Lake whitefish, Walleye, Yellow perch

Image © New York State Department of Environmental Conservation

Lake Ontario

Bottom gillnet, Trap net

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Bailey Keeler, Consulting researcher

Disclaimer

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About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught.

Avoid/Red: Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

1 "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

Summary

The following Seafood Watch report provides recommendations for lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and rainbow smelt (*Osmerus mordax*) caught throughout the Great Lakes of North America by U.S., Canadian, and tribal fisheries. Since commercial fishing began in the Great Lakes in the 1800s, the profile of commercially targeted and caught species has undergone dramatic changes in response to a suite of anthropogenic pressures. Particularly substantial declines in target species biomass occurred during the first half of the 20th century due to a combination of overfishing, habitat loss, chemical contamination, and the proliferation of invasive species that followed urban, agricultural, and industrial expansion throughout the Great Lakes region. In response to these dramatic declines, new management and assessment regimes were put into place in the mid-20th century, and these have continued to evolve and expand. Because of these efforts, the Great Lakes fishery now more closely resembles the fishery of the early 1900s than in the past 75 years. Today's commercial fisheries are a mixture of recovered native species that have been mainstays of the Great Lakes (e.g., lake trout, yellow perch, walleye, and lake whitefish) and non-native forage species (e.g., rainbow smelt).

1. Lake trout (*Salvelinus namaycush*): This long-lived species was once the top predator in all the Great Lakes, and a main target of the commercial fishery. Although it is moderately resilient to fishing pressure, the combined stress of overfishing and high levels of predation by the exotic sea lamprey drove lake trout populations into steep decline during the mid-20th century. By 1960, lake trout populations were nearly obliterated in all lakes except Lake Superior. At present, only Lake Superior has self-sustaining populations able to support a targeted commercial fishery for wild-caught lake trout. Restoration of lake trout populations remains a major management goal throughout the Great Lakes.

In Lake Erie, lake trout is not allowed to be harvested by commercial fishermen, and any lake trout that shows up at a market is not allowed to be sold. Furthermore, commercial fisheries that do accidentally catch lake trout are required to return them to the lake alive, though this number is unreported.

In Lake Huron, stock status is considered poor, but rehabilitation efforts are in place and ongoing. Spawning and recruitment have been somewhat successful, and the abundance of spawning adults is increasing. Lake trout from Lake Huron is considered a "**Good Alternative**."

Lake trout in Michigan waters of Lake Superior is a "**Good Alternative**" because populations are in recovery. Lake trout in Wisconsin waters of Lake Superior is "**Avoid**" primarily due to lack of available data. Lake trout in Minnesota waters of Lake Superior is a "**Best Choice**" because of stable populations and well-managed harvest. Lake trout in Canadian waters of Lake Superior is a "**Good Alternative**" because of unlicensed fishing in a portion of those waters.

Lake trout populations in Lake Ontario hit a low point in 2005 after a significant decline in the 1990s. Mainly due to hatchery stocking program problems, lake trout populations have seen only some increases in recent years. There is no commercial fishery for lake trout in Lake Ontario.

Lake trout in Lake Michigan waters is considered a "**Good Alternative**." Lake trout populations throughout the lake are still heavily maintained through stocking, with little natural reproduction evident.

2. Walleye (*Sander vitreus*): This dominant near-shore predator has been a target of Great Lakes commercial fisheries since the late 19th century. It is resilient to fishing pressure and tolerant of a variety of environmental conditions. This has allowed walleye populations to recover quickly from environmental degradation, and the species has remained dominant in the commercial fishery.

The walleye recommendation for Lake Superior in Canada and Michigan is "**Good Alternative**" because populations are in recovery. In Wisconsin it is "**Avoid**" primarily due to lack of data.

The recommendation for Lake Huron is "**Good Alternative**." Commercial harvest of walleye is restricted throughout much of the lake in an effort to aid in stock recovery.

Today, walleye harvested by commercial fisheries are caught only in Canadian waters using gillnets. Walleye populations began to recover in Lake Erie as soon as nutrient abatement programs went into effect in the 1970s; however, after a period of recovery from the 1970s to 1990s, walleye populations underwent a second period of decline in the 1990s due to highly variable recruitment. At present, populations are still recovering and a better understanding is needed of what species-specific and environmental characteristics affect year-class strength. Primarily due to this poor recruitment, walleye is recommended as a "**Good Alternative**."

There is a small gillnet and trapnet fishery for walleye in Canadian waters of Lake Ontario. This comprised 8% of the total commercial catch in 2012, and both are given "**Good Alternative**" recommendations because impacts of the fishery on the target stock is very low, effective management is in place, and impacts on other species is moderate to low.

The walleye recommendation for Lake Michigan is "**Good Alternative**." Walleye in Lake Michigan is still in recovery following a dramatic decline during the 1990s.

3. Yellow perch (*Perca flavescens*): This near-shore species has an intermediate position in the aquatic food web and is often found in the same environments as walleye. It is broadly distributed in the Great Lakes and resilient to fishing pressure. Yellow perch abundance has been highly variable since the mid-20th century due to the effects of habitat loss, interactions with invasive species, and overfishing, but has recovered quickly when stresses have been removed. The 1980s were a period of record productivity for the yellow perch fisheries throughout the Great Lakes, including Lake Michigan's Green

Bay, but yellow perch entered a new period of decline in the 1990s. Currently, yellow perch population status is widely uncertain and variable, and populations are not at levels seen before their decline.

Lake Erie has the largest fishery for yellow perch of all the Great Lakes. In recent years, the yellow perch commercial harvest has been showing a generally increasing trend. Overall, increasing populations (as evidenced by increased catch per unit effort throughout most of Lake Erie), an effective management regime, and inherently resilient life history characteristics make yellow perch caught in Lake Erie a "**Best Choice**" if caught in trapnets within Pennsylvania or New York waters and "**Good Alternativ**e" if caught in trapnets within Ohio waters or gillnets within Ontario waters.

In Lake Superior Canadian waters, yellow perch was over-harvested and the fishery was closed in 2004. Yellow perch is currently in recovery but has the recommendation of "**Good Alternative**" because of restrictions to harvest that allow for recovery. Yellow perch from Lake Superior Michigan waters is a "**Good Alternative**" because of stable populations and low harvest.

Yellow perch has a "**Good Alternative**" recommendation for Lake Huron. Yellow perch populations are still in a state of recovery following lake-wide declines in the 1980s to 1990s. Additionally, several years of poor year-class strength and recruitment have resulted in uncertain population status for yellow perch in U.S. waters.

In Canadian waters of Lake Ontario, yellow perch is one of the two main targeted species, along with lake whitefish. Yellow perch in Canadian waters for both gillnet and trap net fisheries receive a "**Good Alternative**" because the fishery impacts on stocks, impacts on other species, and effects on habitats and ecosystems are all moderate to low. Furthermore, effective management is in place.

In New York waters of Lake Ontario, yellow perch is the main target species with a catch of 27.21 MT. In New York waters yellow perch received a "**Best Choice**" ranking because it is a small fishery and yellow perch have made up >95% of the fishery since 2004, so its impacts on other species is minimal. In addition, effective management is in place, and the fishery impacts on habitat, the target stock, and other species is low to moderate.

In Lake Michigan, the yellow perch recommendation is "**Good Alternative**" because stocks are still in a period of recovery following dramatic declines in harvest yield.

4. Lake whitefish (*Coregonnus clupeaformis*): Lake whitefish has been a longtime target of the Great Lakes commercial fishery. As an epibenthic fish, this species occupies deep, cold waters rather than near-shore environments. Lake whitefish is a schooling fish caught primarily from Lake Michigan and Lake Huron, and the patchy distribution of its intermingling stocks complicates stock assessment and management. Like other deepwater fish, lake whitefish underwent substantial population declines in the mid-19th century, but was able to recover quickly after nutrient abatement and sea lamprey control measures were put in place in the 1970s. Stocks in Lake Huron and Lake Superior are deemed moderate or low concern. Lake whitefish is currently the dominant deepwater benthic fish in the Great Lakes, because other native fish, such as the cisco, have not recovered as successfully. Their condition, growth,

and catch rates became highly variable in the 1990s when their preferred prey, the amphipod *Diporeia*, disappeared in many lake areas in an apparent response to the proliferation of invasive zebra mussels. Lake whitefish have adjusted to these food web changes, first by changing their distribution to areas where *Diporeia* persisted, and more recently by changing their diets and consuming alternate prey, including zebra mussels. In spite of decreased conditions and changing catch rates, populations remain large, management is effective, and impacts of bycatch are low due to effort, placement, and size restrictions on gear.

In Lake Erie, there is no evidence of young-of-year or yearling whitefish in 2012 lake-wide surveys and assessments. Recruitment appears to be sparse, which is thought to lead to continuing population declines. The recommendation for lake whitefish from Lake Erie is "**Good Alternative**."

Lake Ontario lake whitefish is a "**Good Alternative**." Lake whitefish is only targeted in Canadian waters of Lake Ontario where it is a main target species. Impacts on other species, mainly lake trout, are the main concern.

Lake whitefish in Lake Huron is also given a "**Good Alternative**" recommendation. Lake whitefish represents the largest and most valuable fishery in Lake Huron, but concerns about bycatch (mainly lake trout, and potentially lake sturgeon) result in the score awarded.

The lake whitefish recommendation is "**Good Alternative**" for Lake Superior Michigan waters because of historically stable populations. Lake whitefish in Lake Superior Wisconsin waters is **"Avoid**" primarily due to a lack of available data. Lake whitefish in Canadian waters in Lake Superior is a "**Good Alternative**" because of unlicensed fishing in portions of their waters.

With the exception of individuals harvest with trapnets from Wisconsin waters, the lake whitefish recommendations for Lake Michigan are "**Good Alternative**." Lake whitefish taken with trapnets from Wisconsin waters is considered a "**Best Choice**."

5. Rainbow smelt (*Osmerus mordax*): This non-native forage species first arrived in the Great Lakes in the 1930s, and was seen as a nuisance because it had no commercial value, clogged nets, and competed with native species. In the mid-1960s, salmonine stocking programs were instituted with a number of motivations: to control non-native species such as rainbow smelt and alewife, to support increased recreational fishing, and to aid in the recovery of lake trout populations. The first two goals were met successfully, but resulted in complications for rainbow smelt management: introduced predators were now successfully controlling forage fish populations, but this forage was essential for feeding the predator community that now supports highly lucrative recreational fisheries. Also, smelt had become a favored prey of recovering native predators such as lake trout, and smelt began to support a substantial commercial fishery. In the latter 20th century, rainbow smelt stocks entered a period of highly variable recruitment, possibly in response to excessive predation pressure and the reduction of food availability in the water column associated with the proliferation of zebra and quagga mussels. However, rainbow smelt is an invasive species that has negative impacts on native forage fish by competing for food and preying on juvenile fish.

Currently, the outlook for rainbow smelt stocks is unclear, though management recognizes the inherent difficulty and complicated nature of managing rainbow smelt populations. This results in high uncertainty about stock status and fishery impacts. Overall, management recognizes that restoring the native predator-prey balance to the Great Lakes is important, but the recreational fisheries that are made possible in part by rainbow smelt presence in the Great Lakes are also highly valued.

In Lake Erie, rainbow smelt has become an important forage species, and in recent years, surveys are performed to determine their abundance. Rainbow smelt abundances reached their historic highs in 2012. In Lake Erie, the only fishery that targets rainbow smelt is a trawling fishery located in Ontario waters. The recommendation for rainbow smelt in Lake Erie is "**Best Choice**."

Rainbow smelt is a "**Good Alternative**" in Michigan waters of Lake Superior because it is an invasive species. In Lake Superior Wisconsin waters it is a "**Good Alternative**" because of a lack of available data. In Canadian waters of Lake Superior it is considered a "**Good Alternative**" because of unlicensed fishing in a portion of their waters. It is a **"Best Choice**" in Minnesota because they are invasive and have minimal impacts on other species.

Rainbow smelt in Lake Huron is deemed a **"Good Alternative**," primarily due to concerns with bycatch. However, rainbow smelt is not a targeted species and has little commercial value.

There are no rainbow smelt commercial fisheries in Lake Ontario or Lake Michigan.

Table of Conservation Concerns and Overall Recommendations

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Yellow perch Canada Lake Ontario - Gillnet, Bottom	Yellow (2.64)	Yellow (2.71)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.967)**
Yellow perch New York Lake Ontario - Gillnet, Bottom	Yellow (2.64)	Green (5.00)	Yellow (3.00)	Green (3.61)	**Best Choice (3.458)**
Yellow perch Canada Lake Ontario - Trap net	Yellow (2.64)	Yellow (2.64)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.949)**
Lake whitefish Canada Lake Ontario - Gillnet, Bottom	Green (3.32)	Yellow (2.64)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.121)**
Walleye Canada Lake Ontario - Gillnet, Bottom	Green (3.32)	Yellow (2.64)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.121)**
Walleye Canada Lake Ontario - Trap net	Green (3.32)	Yellow (2.64)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.121)**

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, **and** no Red Criteria, **and** no Critical scores

- **Good Alternative/Yellow** = Final score >2.2-3.2, **and** neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern[2], **and** no more than one Red Criterion, **and** no Critical scores
- **Avoid/Red** = Final Score <=2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern **or** two or more Red Criteria, **or** one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

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Introduction

Scope of the analysis and ensuing recommendation

This report evaluated the commercial harvest of lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), and rainbow smelt (*Osmerus mordax*) in the Laurentian Great Lakes.

Fishing gears examined in this region include gillnets and trapnets utilized by commercially licensed fishermen from Michigan, Wisconsin, Minnesota, Illinois, Indiana, Ohio, Pennsylvania, New York, the Canadian Province of Ontario, and tribal fishermen.

Overview of the species and management bodies

Lake trout are found in the northern parts of North America, principally in Canada, throughout Alaska, and in the Laurentian Great Lakes, preferring cool water temperatures of 45–55°F (Froese & Pauly 2012). During the spring and fall, lake trout may be found at depths of 10 to 15 ft. but move to depths of 100–200 ft. waters during the summer and winter. Lake trout are the largest of the charr (a sub-grouping within Salmonidae), reaching lengths of 50 inches, and typically weighing 15 to 40 lbs. (Froese & Pauly 2012). Lake trout was once the dominant predator in Lake Huron, but introduction of the sea lamprey, habitat alterations, and overfishing have resulted in dramatic declines of this once economically valuable fish.

Lake whitefish (member of the family Salmonidae) are found in inland lakes throughout Canada, Alaska, and the northern part of the United States. Lake whitefish are schooling fish, which prefer cool waters at depths of up to 200 ft. Lake whitefish typically achieve lengths of 20–30 inches and weigh 20 lbs. or more. Lake whitefish represent the highest commercial yield of any fishery in the Great Lakes (Froese & Pauly 2012).

Yellow perch are found throughout freshwater lakes in North America. Yellow perch are utilized as both a food fish and a game fish, making them a source of great value. Yellow perch prefer water temperatures of 66–70°F and are generally taken at depths of > 45 ft. (Froese & Pauly 2012). They average 4–10 inches in length and achieve weights of 4–10 oz. (Froese & Pauly 2012).

Walleye (the largest member of the perch family) are also utilized as both a food fish and a game fish. They are found throughout most of Canada and the northern United States. Walleye are voracious nearshore predators, reaching lengths of 20–30 inches and weighing up to 20 lbs. They prefer temperatures of 55–68°F and are seldom found at depths >50 ft. (Froese & Pauly 2012).

Rainbow smelt are native to the Atlantic Coast and throughout the northern portions of the Atlantic Ocean and Arctic Ocean. They were introduced into inland lakes, escaped, and made their way into the Great Lakes in the early 1900s. The rainbow smelt is slender and cylindrical, achieving lengths of 7 to 9 inches and weights of ~3 oz. The commercial fishery for rainbow smelt has greatly declined in Lake

Huron where they are now currently caught only as bycatch with other, more valuable species (Froese & Pauly 2012).

The early Lake Ontario fishery was focused on lake trout, lake whitefish, Atlantic salmon, lake herring, and deepwater ciscoes. Overfishing, particularly of “discrete” (highly localized) stocks, such as lake herring and lake whitefish, caused both local and lake wide declines in the seine net fisheries of the 19th century. Atlantic salmon stocks had collapsed by 1840 and were extirpated in the lake by 1890. Deepwater cisco populations were reduced by the 1860s, coinciding with the colonization of alewife. Though deepwater ciscoes had recovered somewhat by 1900, lake whitefish, lake trout, and burbot (a nuisance incidental catch of the trout fishery) had become scarce. Lake trout was the most valuable and widely sought species, with the bulk of the catches coming from eastern Canadian waters. However, population trends were similar throughout the lake; favorable environmental conditions allowed whitefish, trout, and burbot populations to increase briefly in the 1920s, but they declined again by the 1930s. Lake herring populations also declined during this time. The following decades saw an acceleration in the changes in species composition, with lake trout, burbot, herring, and deepwater cisco populations all collapsing in the 1940s during the proliferation of rainbow smelt; walleye rising in dominance in the 1950s; and white bass, blue pike, and deepwater sculpin all disappearing. The collapse of lake trout is thought to have been initiated by overfishing during the early part of the 20th century, which made the population especially vulnerable to increasing predation by sea lamprey through the 1950s. Lake whitefish were for many years the mainstay of the Lake Ontario fishery, particularly because it persisted after lake trout and deepwater ciscoes were no longer available to the fishery. However, sea lamprey predation also affected whitefish abundance, particularly in the 1950s after the collapse of lake trout had removed the lamprey’s favored prey. The decline of the lake whitefish caused a further shift in fishery effort to yellow perch and white perch, where available. Yellow perch had been a minor, but continuous, target of the commercial fishery. During the latter half of the 20th century the lake began to reflect increasing eutrophication, with algal blooms and lower oxygen conditions affecting spawning success for some species during the 1970s, and an increase in the population of yellow perch in the open waters of Lake Ontario. By this time alewife represented the greatest biomass in the lake, and the fishery had moved from capturing a small number of relatively large, valuable fish to depending on a large number of smaller, lower value fishes. (Information from previous Seafood Watch report.)

The Great Lakes Fishery Commission (GLFC) under the Joint Strategic Plan manages the fisheries targeting the species mentioned above, which was originally enacted in 1981. It was reviewed in 1986 and amended in 1997 in an effort to adopt practices to better coordinate fishery and environmental management issues. During this time tribal fishermen (CORA and GLIFWC) and U.S. Geological Survey (USGS) representatives were offered seats on the Council of Lake Committees (GLFC 2007).

Production Statistics

None of the species evaluated in this report are considered important on a global scale. Most of the harvest remains on the continent and is insignificant compared to global landings of other fish in other fisheries. Lake whitefish yields are the largest with an estimated 9,494 MT reported as harvested globally (FAO 2014).

In 2012, the total reported commercial harvest in New York waters of Lake Ontario was 61,286 lbs. (27.8 tons) (NYSDEC 2012, section20), of which 59,989 lbs. were yellow perch and 18 lbs. were whitefish. In Canadian waters, the total reported commercial catch was 401,014 lbs. (181.9 tons) with 206,988 lbs. of this being whitefish, yellow perch, and walleye (OMNR 2012, section 4). Yellow perch and whitefish are the targeted species in this fishery.

In 2013 in Canadian waters, the commercial catch of yellow perch dropped by ~50% to 55,437 lbs. and whitefish catch increased from 73,379 lbs. to 102,005 lbs. (OMNR 2012, 2013). In New York waters, yellow perch has remained the major target fishery since at least 2000 and represents the vast majority of total catch (NYSDEC 2012, section 20).

Table 1. Reported commercial fish catch in pounds from the New York waters of Eastern Lake Ontario, 2000-2012, taken from (NYSDEC 2012).

	# Lic.	YP	BBH	WP	RB	SF	CRP	WTF	CAT	DRM	CSCO
2000	7	59,928	5,709	383	280	3,571	308	-	-	-	-
2001	6	40,323	5,875	442	15	16	-	-	-	-	-
2002	6	37,223	4,435	-	-	-	-	-	-	-	-
2003	6	6,153	5,815	-	-	-	-	-	-	-	-
2004	3	37,066	1,200	-	-	-	-	-	-	-	-
2005	3	6,354	1,040	-	-	-	-	-	-	-	-
2006	3	4,274	500	-	-	-	-	-	-	-	-
2007	3	34,343	535	-	-	-	-	-	-	-	-
2008	3	14,428	735	-	-	-	-	-	-	-	-
2009	3	41,338	31	-	20	-	-	-	-	-	347**
2010	2	44,008	75	546	-	-	-	16	-	-	465
2011	3	77,238	105	3,736	-	-	-	-	-	-	613
2012	3	59,989	105	1,130	-	-	-	18	-	-	44

*does not include documented illegal and/or unreported harvest
**known harvest in previous years was not reported

# Lic. = number of active licenses
YP = Yellow Perch
BBH = Brown Bullhead
WP = White Perch
RB = Rock Bass
SF = sunfish (Pumpkinseed, Bluegill)
CRP = Black Crappie
WTF = Whitefish
CAT = Channel Catfish
DRM = Freshwater Drum
CSCO= Lake Herring

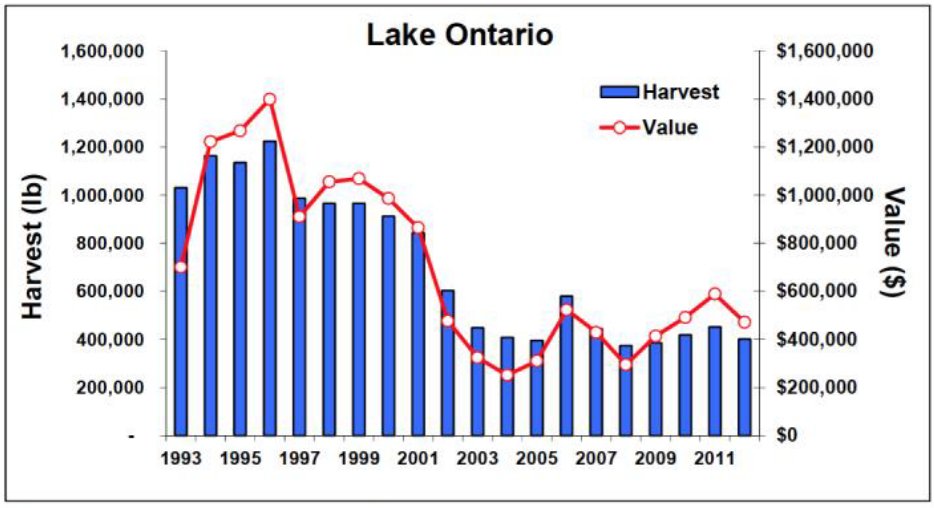

Figure 1. Total commercial fishery harvest and value for Lake Ontario (Quota Zones 1-1, 1-2, 1-3, 1-4 and 1-8) 1993-2012, Graph taken from (OMNR 2012).

Table 2. Summary of landing statistics (MT) for Canadian and New York waters of Lake Ontario. 2012–2013.

Lake	Species	Landing (tonnes)	Gear Type
Lake Ontario **(NY)** 2012	Yellow Perch	27.211	Gillnet
Lake Ontario **(NY)** 2012	Whitefish	18lbs	Gillnet
Lake Ontario **(Canada)** 2012	Yellow Perch	46.584	Gillnet/trapnet
Lake Ontario **(Canada)** 2012	Whitefish	33.28	gillnet
Lake Ontario **(Canada)** 2012	Walleye	14.024	gillnet
Lake Ontario **(Canada)** 2013	Yellow Perch	25.146	Gillnet/trapnet
Lake Ontario **(Canada)** 2013	Whitefish	46.269	Gillnet
Lake Ontario **(Canada)** 2013	Walleye	24385	gillnet

Importance to the US/North American market

Commercial fisheries for lake trout in the Great Lakes are generally small and restricted for the most part to Lake Superior, Lake Huron, and Lake Michigan. Although some lake trout are caught in Canadian waters of Lake Superior and Lake Ontario, this species is not a primary freshwater export for Canada.

The majority of walleye sold in the US comes from Canadian sources, primarily from Lake Erie. Walleye is one of Canada's largest freshwater fish exports, together with yellow perch and lake whitefish, and is recently the most valuable in terms of price per pound.

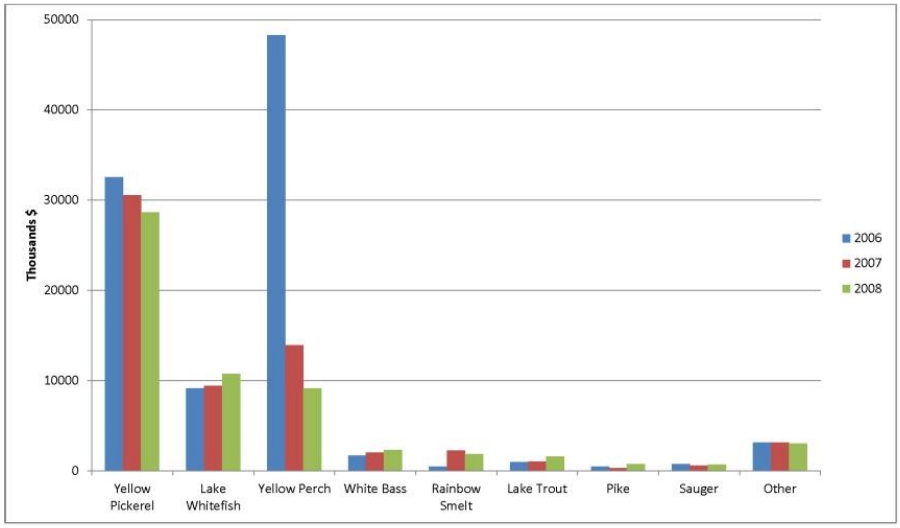

Figure 2. Commercial landing values of Canadian Freshwater Fisheries.

The United States imports about 6.6 million pounds of fresh and frozen walleye annually from Canada, primarily as frozen fillets, but also as fresh whole fish, fresh fillets, and frozen block (DFO 2011). Approximately 90% is from Great Lakes sources, with about 87% coming from Lake Erie and about 3% from Lake Huron.

The largest market for yellow perch in the United States is in the Great Lakes region, where fresh perch fillets attain the highest price per pound. Demand in the United States for yellow perch makes it one of Canada's largest and most valuable freshwater fishery exports, together with walleye and lake whitefish.

The demand for yellow perch in the Great Lakes region has been estimated to reach about 50–100 million pounds annually (Hinshaw 2006). Currently, close to 2 million pounds are commercially harvested within the United States, primarily from Ohio waters of Lake Erie. Nearly twice that, just under 4 million pounds, is imported, nearly all of it from Canadian commercial Great Lakes fisheries operating in Ontario (Hinshaw 2006, Baldwin et al. 2009, DFO 2011).

The largest exports of whitefish from Canada are from the Northwest Territories, Manitoba, Saskatchewan, and Alberta. Great Lakes catches traditionally focused on domestic wholesale markets, but competition from Canadian wholesalers from northwest regions of Canada are influencing prices and increasing competition with Great Lakes fish. Partly as a result of this competition and also because of declining quota and the need to get greater return from less available product, the lake whitefish market is currently exploring better branding and value-added products. Lake whitefish is one of the

three largest freshwater exports, by both weight and value, from Canada. These fish are primarily sold in US markets.

Great Lakes rainbow smelt are the fifth largest Canadian freshwater fish export by value. The majority of Canadian-caught freshwater smelt are exported frozen to Japan, with some going to the United States. A portion of the Lake Erie catch is also exported fresh to the United States.

Common and market names

Lake trout, *Salvelinus namaycush*, is also known as Great Lakes trout, laker, namaycush, togue, grey trout, mountain trout, mackinaw, lake char/charr, touladi, and salmon trout.

Walleye, *Sander vitreus*, is also known as yellow pickerel, pickerel (Canada), yellow pike, yellow walleye, and dore (France, Canada).

Yellow perch, *Perca flavescens*, is also known as lake perch, ringed perch, raccoon perch, ned, yellow ned, redfin, and redfin perch.

Lake whitefish, *Coregonnus clupeaformis*, is also known as common whitefish, Sault whitefish, whitefish, eastern whitefish, Great Lakes whitefish, inland whitefish, gizzard fish, grande coregone (French), and Attikumaig (Chippewa).

Rainbow smelt, *Osmerus mordax*, is also known as American smelt, leefish, freshwater smelt, and frost fish.

Primary product forms

Lake trout may be marketed fresh, frozen, or smoked. Though “smoked lake trout” is typically siscowet, or oily lake trout, a substantial portion of the larger lean lake trout sold is also smoked. Smaller fish are primarily marketed fresh or frozen, as whole dressed fish.

Walleye is available fresh as whole fish (head on or off, dressed) or fillets (skin on or off), and frozen as fillets or fingers (7–12 cm strips).

Yellow perch can be found fresh or frozen, sold primarily as scaled, skin-on fillets.

Whitefish is available fresh or frozen as whole dressed fish or fillets. New value-added products growing in market share include frozen vacuum-packed fillets and prepared foods such as spreads. Lake whitefish roe is also successfully marketed as “golden caviar.” Canadian whitefish catches from outside the Great Lakes are marketed by the Freshwater Fish Marketing Corporation (FFMC), which produces three main whitefish products: minced block, whole fresh, and whole frozen whitefish.

Rainbow smelt can be found on the US market as fresh or frozen whole fish.

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at http://www.seafoodwatch.org.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown.

The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Criterion 1 Summary

LAKE WHITEFISH				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Canada Lake Ontario Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	**Green (3.318)**

WALLEYE				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Canada Lake Ontario Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	**Green (3.318)**
Canada Lake Ontario Trap net	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	**Green (3.318)**

YELLOW PERCH				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Canada Lake Ontario Gillnet, Bottom	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**
Canada Lake Ontario Trap net	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**
New York Lake Ontario Gillnet, Bottom	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**

Overall, the commercial fisheries for Lake Ontario are small, especially the ones in New York waters. Other impacts such as habitat change, invasive/non-native species, predation, and sports fishing have more substantial impacts on the fish populations than the commercial fisheries themselves.

However, target reference points are absent for estimating biomass and species abundance in Lake Ontario. Alternatively, catch per unit effort (CPUE) and catch-age models are used as an indication of abundance and stock status. Thus, in some cases, it is not certain how much the commercial fishery is impacting a stock. This is the reasoning for any rankings of "Moderate Concern" in Criteria 1. Commercial fisheries in Canadian waters of Lake Ontario are required to submit "Daily Catch Reports (DCRs)," and biological sampling of catch is also preformed to gain size and age-specific information about the harvest. Age-specific data from the harvest is used in catch-age modeling to estimate population size and mortality schedule (OMNR, 2012). These catch-age models and trends in CPUE are used to make management decisions for the commercial fisheries in Lake Ontario. Commercial fishing efforts in New York waters are small. For example, in 2012 only five licensed commercial fishermen existed, but only four actively fished on three licenses. Indeed, the commercial harvest of yellow perch peaked in 2011 at 38.62 tons. Recreational fisheries dominate New York waters, and as a result population assessments focus on these efforts and not on commercial efforts (NYSDEC 2012).

Rainbow smelt are not included in the Lake Ontario report because there is no commercial fishery. Rainbow smelt do exist in Lake Ontario however and are considered an invasive species. Furthermore, there is not any significant non-targeted catch; due to their small size, they are not vulnerable to the gear types used on Lake Ontario. Due to the soft substrate composition of the lake bottom, both bottom gillnet and trapnet fishery effects on habitat and ecosystem are minimal.

Inherent vulnerability scores are derived from the "vulnerability" score provided on FishBase, which is based on several inherent biological characteristics of the species (e.g., age at maturity, maximum age, fecundity, etc.). The FishBase vulnerability score is derived from Cheung et al. (2005) and is found at www.fishbase.org on the species' page. This score is used to determine a risk-based score for Factor 1.2 (abundance of the stock) only in cases where the abundance is otherwise unknown. Attributes that affect susceptibility of the species to the fishery, e.g., its attraction to fishing gear and spatial overlap with the fishery, are germane to the degree of fishing mortality experienced by the species and therefore are considered under Factor 1.3 (fishing mortality) in cases where fishing mortality is unknown and a risk-based score is needed.

Criterion 1 Assessment

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low— FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.*
- *Medium— FishBase vulnerability score for species 36-55 OR life history characteristics that*

make it neither particularly vulnerable nor resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.

- *High— FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.*

Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g. schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Factor 1.2 - Abundance

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*

- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

LAKE WHITEFISH

Factor 1.1 - Inherent Vulnerability

Canada Lake Ontario, Gillnet, Bottom

Medium

The lake whitefish, a member of the family Salmonidae, has long been the mainstay of the commercial catch in the Great Lakes. This schooling, planktivorous fish can live >25 years, and reaches sexual maturity at ~ 2 years of age. Lake whitefish are characteristic broadcast spawners.

The FishBase vulnerability score for lake whitefish is 48 (Froese & Pauly 2012).

Lake whitefish are given an inherent vulnerability score of **"Medium"** based on their FishBase vulnerability score and their biological attributes.

Factor 1.2 - Abundance

Canada Lake Ontario, Gillnet, Bottom

Moderate Concern

Lake whitefish abundance remains low compared to that of the early 1990s, but stable (OMNR 2013, Section 2.2). Lake whitefish recruitment is highly variable (OMNR 2013, Section 2.3) but many age-classes (ages 1–21 yo) are present in the population (Section 2.2) and the commercial fishery (OMNR 2013, Section 4.2).

By 1997 lake whitefish had declined severely and this decline is attributed to the collapse of Diporeia spp. populations, which were a preferred and main prey for lake whitefish in Lake Ontario. After the collapse of Diporeia spp., lake whitefish had to shift geographic and bathymetric distribution, and seek out alternative prey. Alternative prey species were lower in lipid content and contributed to a decrease in lake whitefish body condition at that time. This decline was not attributed to fishing practices or overfishing of lake whitefish (Owens et al 2005). Lake whitefish body condition is up from the late 1990s and stable (see Figure 2.2.6 from OMNR 2013).

As just stated, lake whitefish body condition is up from the late 1990s and has been stable since ~2000 (see figure below, Whitefish Body Condition). Relative weight of lake whitefish declined from 90 to ~75 in the late 90s, but has been stabilizing around 85 since ~2000. This decline in the 1990s in population and body condition was likely due to loss of diporeia and the resulting shifts in the Lake Ontario food web (OMNR 2013). Catch per unit effort (CPUE) is the primary evidence of stock status, and CPUE data have been collected annually for several decades with no major change in technology (OMNR 2013). The stock is not officially classified by management as either over- or under-fished (OMNR 2013).

This fishery is given a score of **"Moderate Concern"** because there is no evidence to suggest that stock is either above or below reference points (reference points unavailable); unknown and stock inherent vulnerability is low.

Rationale:

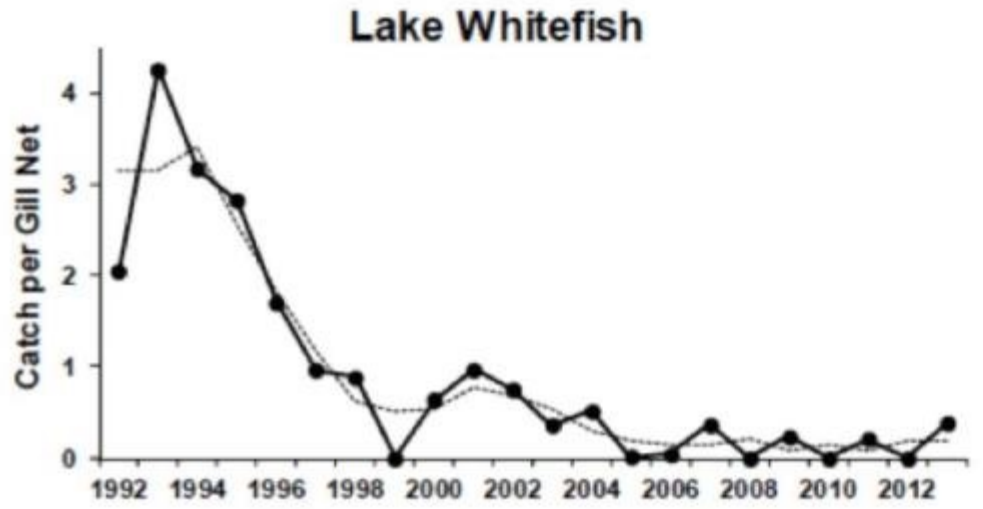

FIG 2.2.2 Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in north eastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton). Annual catch per gillnet values are arithmetic means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

Figure 3. CPUE of Lake Whitefish in Lake Ontario, 1992 to 2012. From OMNR 2013 Lake Ontario report.

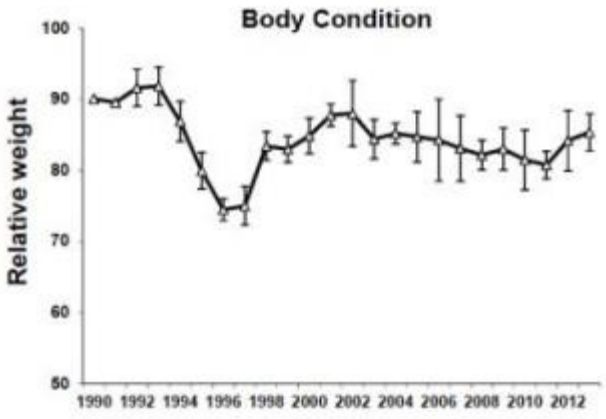

FIG. 2.2.6. Lake Whitefish relative weight (see Rennie and Verdon, 2008) for fish, greater than 4-years-old, caught in summer index gillnets, 1990-2013. Error bars are +-2 SE.

Rennie, M.D. and R. Verdon. 2008. Development and evaluation of condition indices for the lake whitefish. N. Amer. J. Fish. Manage. 28:1270-1293.

Figure 4. Lake Whitefish relative weight for fish, greater than 4 yo, caught in summer index gillnets, 1990-2013. Taken from OMNR 2013 Annual Report.

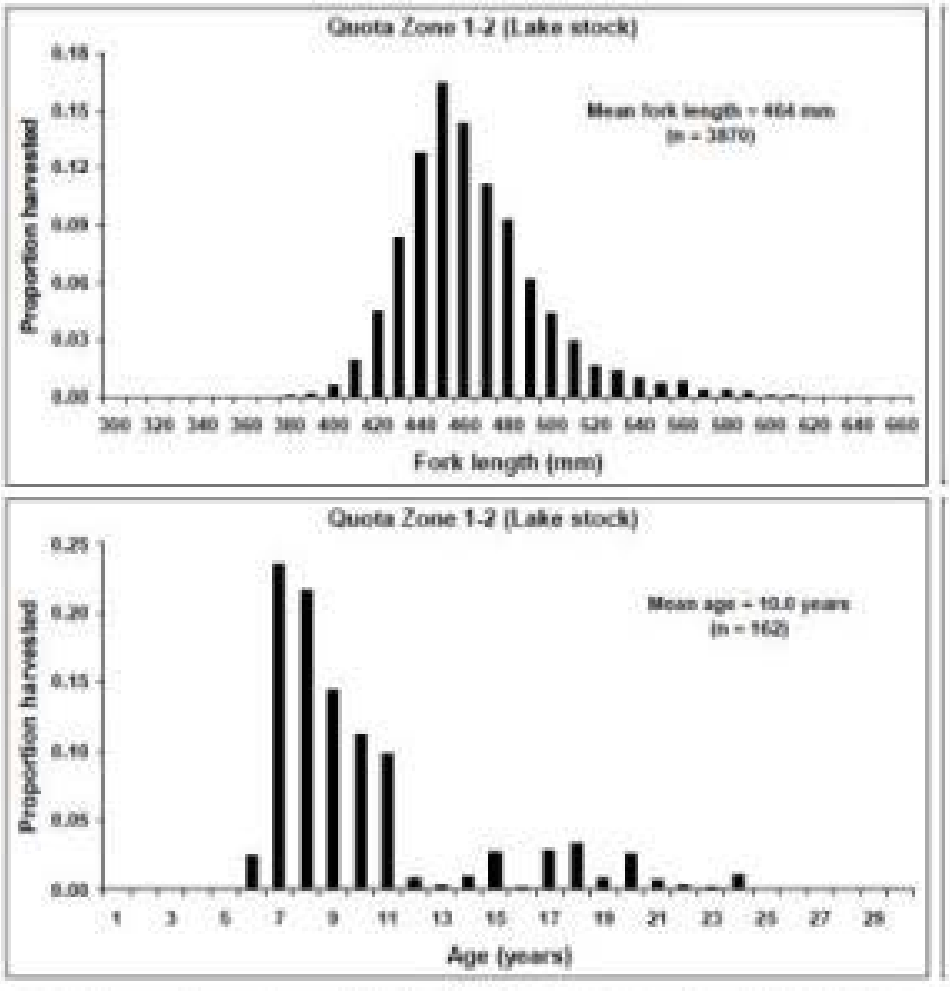

Figure 5. Size and age distribution of lake whitefish in Canadian waters of Lake Ontario. Sampled during 2012 commercial catch sampling program (OMNR 2012, pg 88).

Factor 1.3 - Fishing Mortality

Canada Lake Ontario, Gillnet, Bottom

Low Concern

Commercial catches in Ontario, Canada waters have been under the quota since 2008 ranging from 36%-87% of quota. At the same time, body condition has been stable since 1996 ([OMNR 2013), 94), species abundance has stabilized since ~2006 ([OMNR 2013), 14), and a wide range of ages were found in commercial catch surveys ([OMNR 2013), 93). These three factors are common indicators that a fish population is stable.

Quotas are determined using trends in catch per unit effort (CPUE) and age-specific modeling based off of biological data obtained by sampling commercial harvests (OMNR 2012).

The lake whitefish fishery in Canadian waters is ranked as **"Low Concern"** because it is probable that fishing mortality is at or below a sustainable level that will allow the population to maintain its current level or rebuild if depleted, but with some uncertainty. Uncertainty is due to the fact that there are no reference points based on a biomass reference point, however, the catch is consistently under quota, the population is stable, and quotas are set based on robust scientific research.

WALLEYE

Factor 1.1 - Inherent Vulnerability

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Medium

The walleye is the largest member of the perch family, and is considered the dominant nearshore predator. Walleye can live >25 years with males maturing at age 2–4 and females maturing at age 3–6. In the spring, walleye migrate to tributary streams to lay eggs over gravel and rocks.

The FishBase vulnerability score for walleye is 40 (Froese & Pauly 2012).

Walleye in Lake Ontario waters are given an inherent vulnerability score of **"Medium"** based on their FishBase vulnerability score and biological attributes.

Factor 1.2 - Abundance

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Moderate Concern

Assessments indicate that walleye stock has been stable for at least the last decade. These assessments include community index gill netting and trawling, lake-wide hydroacoustics, and a volunteer angler diary program. Furthermore, current walleye recruitment objectives were met or exceeded over the last 10 years, although there was a poor year class in 2013 (OMNR 2013).

In the "State of the Great Lakes 2009" report, habitat change, environmental factors, and invasive/non-natives species were cited as main "pressures" on walleye population health. Walleye has seen

improved recruitment in 2003–2007 year classes, and alewife population declines are thought to be a main contributing factor to this success based on recent research in Lake Huron. Changing fisheries is also reported under potential causes of walleye declines in the Great Lakes through the early 2000s, but research is lacking to show which factors actually contributed and to what degree to the decline (Kayle 2009).

This stock is given a **"Moderate"** concern ranking because target reference points based on biomass are lacking, and walleye status as over- or under-fished is not clearly defined in the literature by management. Thus, overall population abundance status is uncertain, but studies conducted have indicated that walleye have met management goals for the past decade. Also, stock inherent vulnerability is moderate.

Rationale:

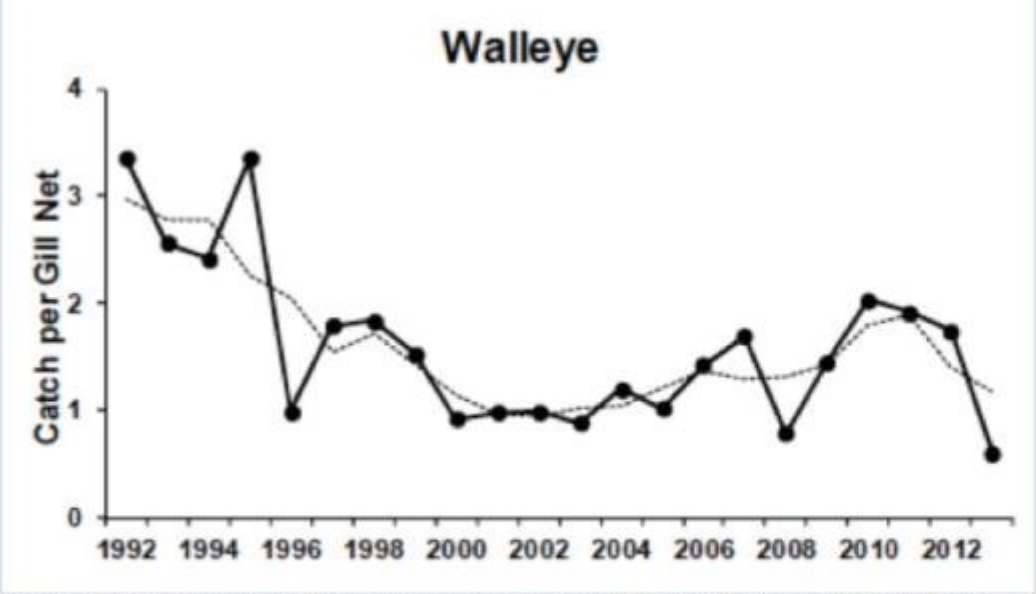

FIG 2.2.2 Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in north eastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton). Annual catch per gillnet values are arithmetic means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

Figure 6. Trends in catch per unit effort for walleye in Lake Ontario from 1992-2012. From OMNR 2013 Lake Ontario report.

Factor 1.3 - Fishing Mortality

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Low Concern

Walleye are targeted in the Lake Ontario commercial fisheries, but much less than the two main target species: whitefish and yellow perch. Walleye was 8% of the 2012 annual harvest (OMNR 2012, 79). Commercial catches (gill and trap net) of walleye were below allowable issued quotas (~50% of quota harvested) from 2008–2013 while population stocks have been deemed very stable for the past decade by the Ontario Ministry of Natural Resources (OMNR 2013). See image below.

CPUE assessments and commercial catch sampling have indicated stability and fishing at or under a sustainable rate. Furthermore, walleye recruitment goals have been met or exceeded for the past decade. Quotas have remained constant since the early 2000s (OMNR 2013). However, F_{smy} does not exist for this fishery, which is a source of uncertainty. CPUE and age-specific models using commercial catch sampled data are used to analyze trends and make management decisions such as setting quota.

Fish mortality is classified as **"Low Concern"** because it is probable that fishing mortality is at or below a sustainable level that will allow populations to maintain current levels or rebuild if depleted, but some uncertainty remains. Population stocks have been evaluated, but target reference points are lacking and CPUE is the main metric used in assessment. Also, this fishery is much smaller than the other commercial fisheries in the lake, and commercial fishing impacts are considered minimal.

Rationale:

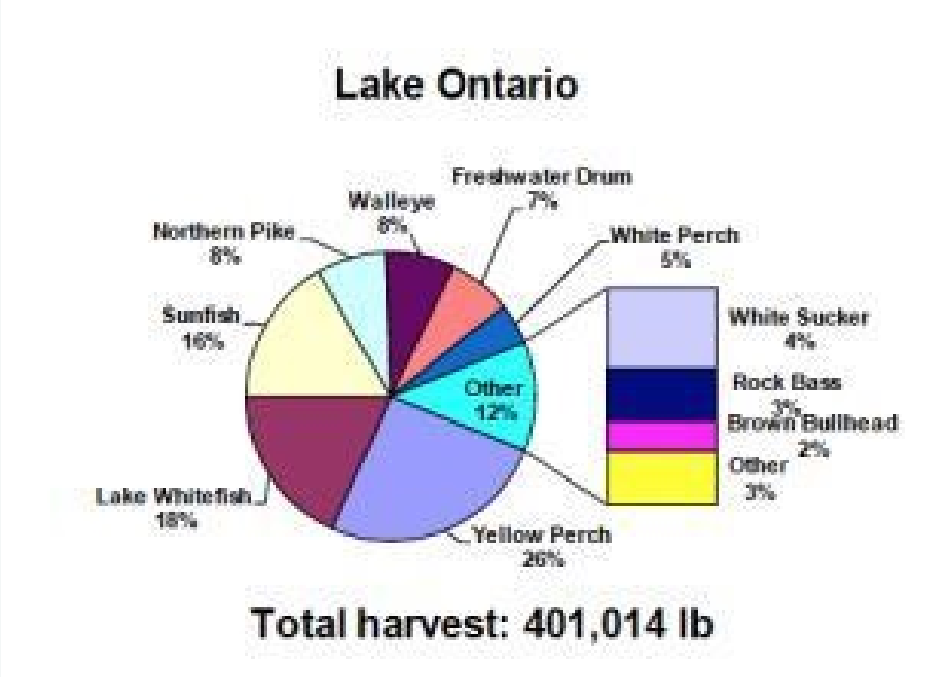

Figure 7. Canadian total commercial harvest composition for 2012.

YELLOW PERCH

Factor 1.1 - Inherent Vulnerability

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

New York Lake Ontario, Gillnet, Bottom

Low

The yellow perch inhabits shallow, nearshore areas where they dine primarily on immature insects, larger invertebrates (such as crayfish), and the eggs and young of other fish. Male perch reach sexual maturity at 3 years of age while females mature at age 4. Yellow perch often live 9–10 years. Yellow perch spawn in the spring, laying eggs in gelatinous strings over dense vegetation, roots, and fallen trees.

The FishBase vulnerability score for yellow perch is 31 (Froese & Pauly 2012).

Yellow perch in Lake Ontario are given an inherent vulnerability score of **"Low"** based on their FishBase vulnerability score and their biological attributes.

Factor 1.2 - Abundance

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Moderate Concern

Based on fish community index gill netting assessments, yellow perch abundance has declined in many areas of the lake and is currently low ([OMNR 2013], 1). See figure below. Yellow perch, along with other species in the nearshore zone, are cited by the OMNR (Ontario Ministry of Natural Resources) as being "at moderate abundance levels" (OMNR 2013). Given the absence of target reference points, stock status is uncertain, but there is no indication that recruitment is impaired, and the stock is not listed by management bodies as overfished, depleted, or a species of concern.

This stock is given a **"Moderate Concern"** because there is no evidence to suggest that stock is either above or below reference points; unknown **and** stock inherent vulnerability is moderate or low.

Rationale:

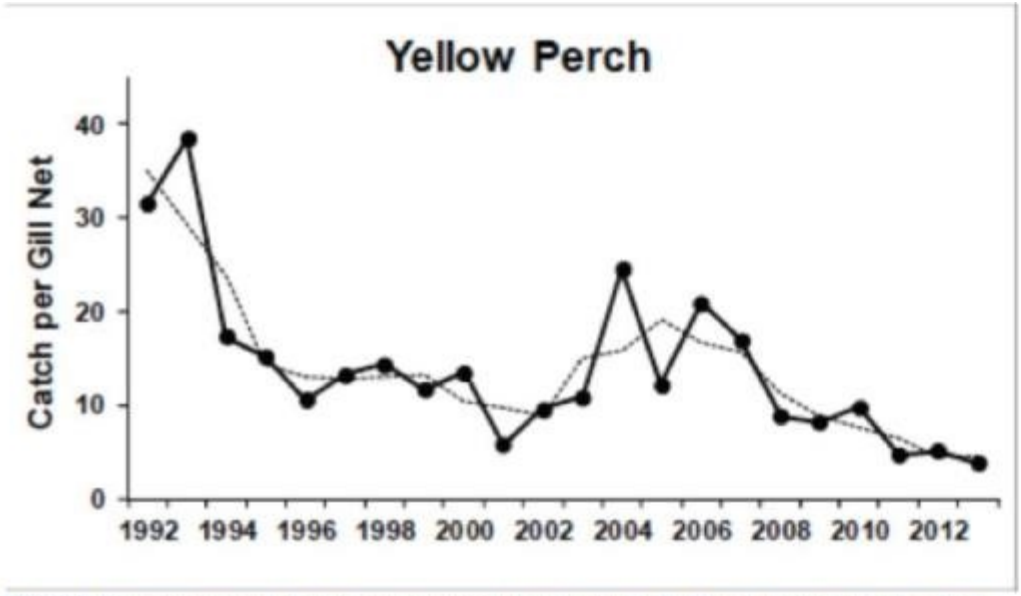

FIG 2.2.2 Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in north eastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton). Annual catch per gillnet values are arithmetic means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

Figure 8. Trend in catch per unit effort for yellow perch in Lake Ontario from 1992–2012. From OMNR 2013 Lake Ontario report.

New York Lake Ontario, Gillnet, Bottom

Moderate Concern

An estimate of biomass relative to reference points is not available, but quantitative analyses conducted by fishery scientists under transparent guidelines indicate sufficient stock as detailed below; however, there is uncertainty.

CPUE is used in the absence of an estimate of biomass relative to reference points, and meets criteria as a reliable quantitative analyses based on the following information. There have been no major changes in technology because only gillnets of various types have been used throughout (NYSDEC 2012). Trends in size structure are available and by comparing yearly reported statistics in the NYSDEC annual reports on yellow perch lengths and weights, the fishery is not reducing stock productivity by depleting the relative proportion of large individuals. CPUE comes from “A standardized, stratified random design gillnetting assessment conducted annually from 1976 through 2012 in the New York waters of Lake Ontario’s eastern basin to assess the warmwater fish community.” (NYSDEC 2012)

Stock abundance for yellow perch in New York waters of Lake Ontario is given a status of **“Moderate Concern”** because stocks are below historic highs and have remained low since a significant decline in the mid-1980s. Stocks have increased in recent years but it is it is unknown whether the population is at

levels above which recruitment is impaired.

Rationale:
There has been no trend in average yellow perch lengths or weights since 2008, which indicates that the population is stable: average lengths between 2008–2012 range from 8.8 in to 9.1 in, and average weights range from 5.6 oz.–6.5 oz. with no declining trend over the years. The percentage of yellow perch caught with lengths over 9 in has been increasing since 2009 from 36% to 53% of catch (NYSDEC 2012).

Yellow perch CPUE has increased and stabilized since 2008 after a previous decrease attributed in part to double-crested cormorant predation (O'Gorman and Burnett 2001 via NYSDEC 2013 report). In 2008, yellow perch CPUE increased to the highest level since 1984 and 2012 CPUE was comparable to highs observed in recent years. Management occurring since the early 2000s has been in place to control the double-crested cormorant populations, and both number of cormorant feeding days and number of fish consumed have decreased (Johnson et al. 2010 via 2013 NYSDEC 2013 report). Over the same time period, round goby abundance has also increased, which further reduced predation pressure on yellow perch (Johnson et al. 2013 via 2013 NYSDEC 2013 report). Furthermore, "Data collected during the Lake Ontario fishing boat survey corroborates continued, higher yellow perch abundances in recent years" (Lantry and Eckert 2013 via NYSDEC 2012 report).

However, CPUE prior to 1984 was significantly higher than recent CPUE, so uncertainty exists concerning whether populations are at levels below which recruitment is impaired. (See graph below).
The variability of catch in gillnets is high, but is likely attributable to the schooling nature of perch (NYSDEC 2012).

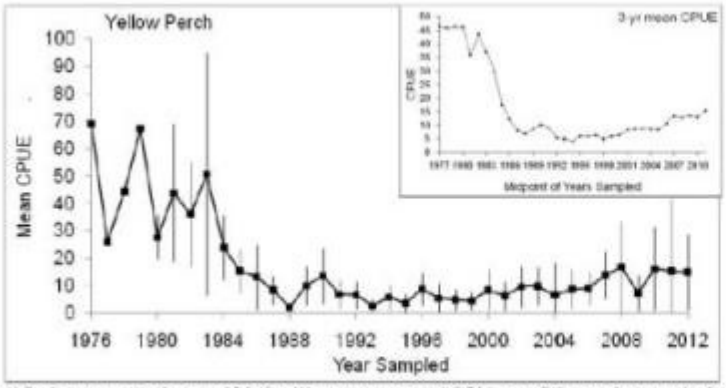

Figure 4. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for yellow perch, 1976-2012.

Figure 9. Yellow perch CPUE from New York Waters of Lake Ontario from 1976–2012. Taken from the NYSDEC 2012 annual report on Lake Ontario.

Factor 1.3 - Fishing Mortality

- **Canada Lake Ontario, Gillnet, Bottom**

  Canada Lake Ontario, Trap net

  Moderate Concern

  "Quota has remained more or less constant since 2000 except in quota zone 1–7 where quota has increased significantly and allowed for increased harvest." ([OMNR 2013], 83). However, the F_{msy} in commercial fisheries targeting yellow perch in Canadian waters of Lake Ontario is small; the commercial fishery comprises 2–3 licenses/year. Yellow perch was 16% of the Lake Ontario total harvest in 2013 at 55,437 lbs. ([OMNR 2013], 84). This harvest is over a 50% decrease from 2008–2012 harvests. In 2008–2013, perch harvests were over 100,000 lbs./yr., and harvests were over 140,000 lbs./yr. in 2010 and 2011 (OMNR 2013). Based on fish community index gillnetting assessments, "Yellow perch abundance has declined in many areas of the lake and is currently low" ([OMNR 2013], 1). (See figure below.) However, there is no indication that yellow perch is being overfished in Lake Ontario, or that these decreases are a result of fishing pressure. Stocks had decreased in the early 2000s, but their fall and later stabilization is attributed in part to double-crested cormorant predation (NYSDEC 2012). However, uncertainty does exist on the extent of the fishery's contribution to fish mortality.

  Effective management includes fish population and community assessments, commercial fishery surveying and monitoring, and the creation of the Lake Ontario Fish Community Objectives, which "provide bi-national fisheries management direction to protect and restore native species and to maintain sustainable fisheries" ([OMNR 2012], v). Lake Ontario fisheries are managed by MNR in partnership with New York State within the Lake Ontario Committee under the Great Lakes Fishery Commission (OMNR 2012).

  Fishing mortality for yellow perch from Canadian waters of Lake Ontario is given a **"Moderate Concern"** because F is unknown and population assessments have been showing a decline in catch in recent years. Although the fishery would appear underexploited because catch is significantly lower than set quotas and effective management is in place, uncertainty and recent declines shown in assessments give this fishery a **"Moderate Concern."**

  New York Lake Ontario, Gillnet, Bottom

  Moderate Concern

  Fishing mortality for yellow perch in New York waters by gillnet is given a **"Moderate Concern"** ranking. F is unknown but management of the yellow perch stock is in place. The fishery appears to be underexploiting the stock and there is no evidence that cumulative fishing mortality has significant impacts on the populations. Yet because F is unknown, uncertainty exists concerning the fisheries' impact on populations. Furthermore, population trends are stable in recent years but not increasing.

Rationale:
Yellow perch is targeted by the fishery, but cumulative commercial fishing mortality has little to no impact on population.

The New York commercial fishery for yellow perch is relatively small: in 2012, only four licensed commercial fishermen actively fished on three licenses out of a total of five licenses granted. Catch amounts since 2008 are as follows: 2008 —14,428 lbs., 2009 — 41,338 lbs., 2010 — 44,008 lbs., 2011 — 77,238 lbs., 2012 — 59,989 lbs. (LaPan, 2013 via NYSDEC 2012). As detailed in the stock status criteria, yellow perch stocks in New York waters have been stable in recent years based on CPUE gillnetting assessments. Stocks decreased in the early 2000s, but their fall and later stabilization is attributed in part to double-crested cormorant predation (NYSDEC 2012), and there is no evidence of fishing pressure affecting yellow perch populations. However, uncertainty exists.

Criterion 2: Impacts on other species

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing.

To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical.

Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix B.

Lake whitefish: Canada Lake Ontario, Gillnet, Bottom

Subscore:: 2.644 **Discard Rate: 1.00** **C2 Rate: 2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
YELLOW PERCH	Low	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
LAKE TROUT	High	2.00: High Concern	3.67: Low Concern	**2.709**
LAKE WHITEFISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WALLEYE	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WHITE PERCH	High	5.00: Very Low Concern	5.00: Very Low Concern	**5.000**

Walleye: Canada Lake Ontario, Gillnet, Bottom

Subscore:: 2.644 **Discard Rate: 1.00** **C2 Rate: 2.644**

Species	Inherent	Stock Status	Fishing	Subscore

	Vulnerability		Mortality	
YELLOW PERCH	Low	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
LAKE TROUT	High	2.00: High Concern	3.67: Low Concern	**2.709**
LAKE WHITEFISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WALLEYE	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WHITE PERCH	High	5.00: Very Low Concern	5.00: Very Low Concern	**5.000**

Walleye: Canada Lake Ontario, Trap net

Subscore:: **2.644** **Discard Rate:** **1.00** **C2 Rate:** **2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
FRESHWATER DRUM	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
NORTHERN PIKE	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
SUNFISH (UNSPECIFIED)	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
YELLOW PERCH	Low	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
WALLEYE	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
LAKE WHITEFISH	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Yellow perch: Canada Lake Ontario, Gillnet, Bottom

Subscore:: **2.709** **Discard Rate:** **1.00** **C2 Rate:** **2.709**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
YELLOW PERCH	Low	3.00: Moderate	2.33: Moderate	**2.644**

		Concern	Concern	
LAKE TROUT	High	2.00: High Concern	3.67: Low Concern	**2.709**
LAKE WHITEFISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WALLEYE	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
WHITE PERCH	High	5.00: Very Low Concern	5.00: Very Low Concern	**5.000**

Yellow perch: Canada Lake Ontario, Trap net

Subscore:: **2.644** **Discard Rate:** **1.00** **C2 Rate:** **2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
FRESHWATER DRUM	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
NORTHERN PIKE	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
SUNFISH (UNSPECIFIED)	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
YELLOW PERCH	Low	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
WALLEYE	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
LAKE WHITEFISH	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Yellow perch: New York Lake Ontario, Gillnet, Bottom

Subscore:: **5.000** **Discard Rate:** **1.00** **C2 Rate:** **5.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
YELLOW PERCH	Low	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**

Species included in Criteria 2 include all species composing 5% or more of the total catch by that fishery. Catch composition was determined from data provided by the New York State Department of Environmental Conservation in their annual report on commercial fisheries in New York waters of Lake Ontario, and raw catch data provided by Jim Hoyle of the Ontario Ministry of Natural Resources for species caught in Canadian waters of Lake Ontario. In New York waters, yellow perch is the main species reported, and catch amounts are not separated by gear type. Gear types mentioned with catch data for New York waters included gillnets, trapnets, and hoop nets, but only gillnets were used in 2012.

In Lake Ontario Canadian trapnet catches, Lepomis was between 13-33% of total catch, but this includes all sunfish and does not specify how many of each sunfish species were caught.

The bycatch species in this report have commercial value and are thus kept and sold portside. The only exception is lake trout, which are listed as threatened and cannot be sold portside, but these catches are low and most are released alive rather than discarded dead.

Lake sturgeon landings are prohibited throughout the Great Lakes, but they are occasionally incidentally captured in gillnets. However, there is a general consensus throughout the fishery community (scientists and fishermen) that gillnets most often do not harm lake sturgeon. Fishing methods utilized in Lake Ontario (gillnets and trapnets) are not believed to have significant impacts on lake sturgeon, and most fish that are incidentally caught with such gears are returned to the water alive (Threader and Broussaeu 1986, Hayes and Caroffino 2012, pers. comm. MDNR).

The capture rates of lake sturgeon in both these fisheries are also extremely low. Lake sturgeon are neither targeted nor landed by Canadian commercial fisheries in Lake Ontario (OMNR 2013). Any lake sturgeon caught incidentally by Canadian commercial fisheries (both trap and gill net for all targeted species) in Lake Ontario were reported as released by commercial fishers on their daily catch reports, and these numbers are small: less than 70 lbs./year since 2004 (Jim Hoyle 2014). Lake sturgeon are not targeted by the New York commercial fisheries. No catch of lake sturgeon has been reported landed since at least 2000 (NYSDEC 2012). Therefore, these fisheries are deemed not to impact the lake sturgeon populations, and lake sturgeon were not included in this assessment.

Criterion 2 Assessment

FRESHWATER DRUM

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Canada Lake Ontario, Trap net
Medium

Freshwater drum inhabit medium to large rivers and lakes. Adults feed on aquatic insects and smaller fish like shad and young drum. Juveniles feed on zooplankton. They are marked as “least concern” for their IUCN Red List Status. They serve as a forage fish for larger piscivores when young. As adults, their main threat is recreational fishing.

The FishBase vulnerability score for freshwater drum is 37 (moderate).

Given its FishBase vulnerability score and biological attributes, freshwater drum is given an inherent vulnerability of “medium.”

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

Canada Lake Ontario, Trap net

Moderate Concern

There is no evidence to suggest that stock is either above or below reference points;
Unknown **and** stock inherent vulnerability is moderate according to its vulnerability score on FishBase, so freshwater drum in Lake Ontario Canadian trapnet fisheries is given an abundance score of **“Moderate.”**

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Canada Lake Ontario, Trap net

Moderate Concern

Freshwater drum in Lake Ontario is not assessed as a species, so it is unknown whether fishing mortality is at a sustainable level. There is no set quota for freshwater drum in Canadian waters of Lake Ontario. Freshwater drum constitute a small percentage of overall commercial harvests in the lake. Indeed, they were only 7% of the total Lake Ontario commercial harvest (gillnet and trapnet) in 2012, and made up 13.3% of the trapnet total catch. This was the largest percentage of freshwater drum trapnet catch since 2004.

Freshwater drum in Canadian waters of Lake Ontario is given a fishing mortality score of **“Moderate”** because the species is not assessed and it is unknown whether fishing mortality is at a sustainable level.

Factor 2.4 - Discard Rate

Canada Lake Ontario, Trap net

< 20%

Trapnets do not use bait. Reported discards from Canadian trapnets in Lake Ontario are extremely low and do not appear to have any notable effects on any one species. Most non-target species caught in trapnets are released alive or landed rather than discarded. In this data set, catches are recorded as either landed (kept), discarded (died), or released (alive). (Jim Hoyle 2014.)

Discard rates have been 0.004%, 2.5%, and .23% in 2010, 2011, and 2012, respectively (Jim Hoyle 2014).

Rationale:
Below are statistics for the commercial fishery in Canadian waters of Lake Ontario using impound (trapnet) for whitefish, yellow perch, and walleye targeted fisheries (pers. comm., [Jim Hoyle 2014]). See attached reference with spreadsheet for data. Below is the discards/landings calculation for 2012, 2011, and 2010. Trapnets are very selective gear and any unwanted catches can easily be released. The vast majority of catches were landed (well below 20%). Bait is not used in trapnets.

2012:
Total Landings: 130313 lbs.
Total Discards: 6 lbs.
Total Released: 576 lbs. (assuming 50% mortality: 288 lbs.)

Discards/landings = 294/130313 = 0.23%

2011:
Total Landings: 138682 lbs.
Total Discards: 3427 lbs.
Total Released: 14 lbs. (assuming 50% mortality: 7 lbs.)

Discards/landings = 3434/138682 = 2.5%

2010:
Total Landings: 111,316 lbs.
Total Discards: 0 lbs.
Total Released: 10 lbs. (assuming 50% mortality: 5 lbs.)

Discards/landings = 5/111,316 = 0.004%

NORTHERN PIKE

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Canada Lake Ontario, Trap net

Medium

Northern pike is a popular sport and food fish inhabiting freshwaters in the northern hemisphere including the Great Lakes basin. They become sexually mature at 3–4 years of age and live 10–12 years on average, though some individuals older than this have been found. They are solitary and ambush predators. Their diet changes from small invertebrates when they are juveniles to a broad carnivorous diet as adults that include amphibians but is mostly smaller fish. In North America they reach a maximum size of ~100 cm, and are 20–40cm at maturity. They have a high fecundity, with females laying up to 100,000 eggs on vegetation. (Alexander J.P. Raat 1988)(Michigan DNR 2014)(Minnesota DNR 2014)

Their FishBase score is 69 (high).

Age at maturity, life span, reproductive strategy, fecundity, maximum size, and size at maturity are factors used on the Seafood Watch inherent vulnerability table and result in an average score of 2.4 or **"Moderate Inherent Vulnerability."**

Northern pike are given an inherent vulnerability score of **"Moderate"** based on their biological attributes and their Seafood Watch inherent vulnerability score.

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

Canada Lake Ontario, Trap net

Moderate Concern

Northern pike are common in many embayment and nearshore areas of Lake Ontario although their abundance trend is showing a long term decline (OMNR 2012).

Northern pike in the Canadian trapnet fishery is given an abundance score of **"Moderate"** because there is no evidence to suggest that stock is either above or below reference points; unknown **and** stock inherent vulnerability is moderate.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Canada Lake Ontario, Trap net

Moderate Concern

Northern pike have been caught in this fishery at >5% of total catch since 2007 and have averaged ~11% of the catch since then. Declines in northern pike abundance are attributed to a recruitment problem, and there is no indication that fishing mortality contributes substantially to this species' population abundance. However, they are not assessed in relation to the commercial fishery so it is unknown whether fishing mortality is at or below a sustainable level.

Northern pike in the Lake Ontario Canadian trapnet fishery are given a fishing mortality score of **"Moderate Concern"** because it is probable (>50% chance) that fishing mortality is at or below a sustainable level that will allow the population to maintain its current level or rebuild if depleted, but there remains some uncertainty.

Factor 2.4 - Discard Rate

Canada Lake Ontario, Trap net

< 20%

Trapnets do not use bait. Reported discards from Canadian trapnets in Lake Ontario are extremely low and do not appear to have any notable effects on any one species. Most non-target species caught in trapnets are released alive or landed rather than discarded. In this data set, catches are recorded as either landed (kept), discarded (died), or released (alive). (Jim Hoyle 2014.)

Discard rates have been 0.004%, 2.5%, and .23% in 2010, 2011, and 2012, respectively (Jim Hoyle 2014).

Rationale:
Below are statistics for the commercial fishery in Canadian waters of Lake Ontario using impound (trapnet) for whitefish, yellow perch, and walleye targeted fisheries (pers. comm., Jim Hoyle 2014). See the attached reference with spreadsheet for data. Below is the discards/landings calculation for 2012, 2011, and 2010. Trapnets are very selective gear and any unwanted catches can easily be released. The vast majority of catches were landed (well below 20%). Bait is not used in trapnets.

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Total Landings: 111,316 lbs.
Total Discards: 0 lbs.
Total Released: 10 lbs. (assuming 50% mortality: 5 lbs.)

Discards/landings = 5/111,316 = 0.004%

SUNFISH (UNSPECIFIED)

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Canada Lake Ontario, Trap net

Medium

Lepomis (sunfishes) are native to the Great Lakes basin. They prefer vegetated areas in lakes, ponds, and small rivers. They feed on small fishes, other vertebrates, and fish eggs. They reach sexual maturity between 2–3 years and the males will prepare and guard nests of eggs. This genus includes bluegill, warmouth, pumpkinseed, and green sunfish. This genus could possibly include the introduced species orangespotted sunfish, but this species will not be evaluated due to its non-native status. The only Lepomis sunfish in the region with a threatened status (threatened status in NY via NYSDEC) is the northern longear sunfish, which are not caught in this fishery because they no longer have a range overlapping with Ontario fisheries. They are only currently found in a small river system to the south east of Lake Ontario (NY Dept. Environ. Conservation 2014).

Based on the species caught, the FishBase vulnerability score for Lepomis range from low to moderate: pumpkinseed is given a score of 39 or moderate vulnerability. Bluegill is given a score of 33 or low-moderate vulnerability. Warmouth is given a score of 18 or low vulnerability. Green sunfish is given a

score of 31 or low to moderate.

Based on their biological attributes and their FishBase score range of 18–39 (low to moderate), Lepomis are given an inherent vulnerability score of **"Medium."**

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

Canada Lake Ontario, Trap net

Moderate Concern

Trends provided in the Ontario Ministry of Natural Resource's annual reports include data on harvest amounts and % quota, but this data does not appear to show any trend since 1993. (OMNR 2012)

Individual species of Lepomis sunfish are not specified in the catch data for this fishery. Lepomis sunfish include the pumpkinseed, green sunfish, bluegill, and warmouth. The only Lepomis sunfish that is listed as **"Threatened"** is the longear sunfish (*Lepomis megalotis*), which originally was found in the western drainage basin of Lake Ontario, but is now only currently found in New York's Tonawanda Creek. Biologists site siltation, water quality deterioration, and hybridization with pumpkinseed and green sunfish as factors leading to its shrinking geographic range (NY Dept. Environ. Conservation 2014). Since this species' geographic range no longer overlaps with the fishery, it is not considered in this report.

Sunfish in the Lake Ontario Canadian trapnet fishery is given an abundance score of **"Moderate Concern"** because it is not assessed and it's unknown whether abundance is at or above the level that would lead to impaired productivity.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Canada Lake Ontario, Trap net

Moderate Concern

Individual species of Lepomis sunfish are not specified in the catch data for this fishery. Lepomis sunfish include the pumpkinseed, green sunfish, bluegill, and warmouth. The only Lepomis sunfish that is listed as **"Threatened"** is the longear sunfish (*Lepomis megalotis*), which originally was found in the western drainage basin of Lake Ontario, but is now only currently found in New York's Tonawanda Creek. Biologists site siltation, water quality deterioration, and hybridization with pumpkinseed and green

sunfish as factors leading to its shrinking geographic range (NY Dept. Environ. Conservation 2014). Since this species' geographic range no longer overlaps with the fishery, it is not considered in this report.

Sunfish in the Lake Ontario Canadian trapnet fishery are given a fishing mortality score of **"Moderate Concern"** because this species is not assessed in relation to fishing mortality sustainability.

Factor 2.4 - Discard Rate

Canada Lake Ontario, Trap net

< 20%

Trapnets do not use bait. Reported discards from Canadian trapnets in Lake Ontario are extremely low and do not appear to have any notable effects on any one species. Most non-target species caught in trapnets are released alive and landed rather than discarded. In this data set, catches are recorded as either landed (kept), discarded (died), or released (alive). (Jim Hoyle 2014.)

Discard rates have been 0.004%, 2.5%, and .23% in 2010, 2011, and 2012, respectively (Jim Hoyle 2014).

Rationale:
Below are statistics for the commercial fishery in Canadian waters of Lake Ontario using impound (trapnet) for whitefish, yellow perch, and walleye targeted fisheries (pers. comm., Jim Hoyle 2014). See the attached reference with spreadsheet for data. Below is the discards/landings calculation for 2012, 2011, and 2010. Trapnets are very selective gear and any unwanted catches can easily be released. The vast majority of catches were landed (well below 20%). Bait is not used in trapnets.

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Discards/landings = 3434/138682 = 2.5%

2010:
Total Landings: 111,316 lbs.
Total Discards: 0 lbs.
Total Released: 10 lbs. (assuming 50% mortality: 5 lbs.)

Discards/landings = 5/111,316 = 0.004%

WHITE PERCH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Canada Lake Ontario, Gillnet, Bottom

High

White perch are part of the bass family. Fish eggs are an important component of their diet as well as zooplankton. They prey on walleye eggs, white bass eggs, and their own eggs, especially in spring months. Native to the East Coast, they were introduced to the Great Lakes basin in the 1950s following construction of the Erie Canal.

White perch is given a FishBase inherent vulnerability score of 68/100, which indicates a **"High Vulnerability."**

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

Canada Lake Ontario, Gillnet, Bottom

Very Low Concern

White perch is non-native to the Great Lakes Basin, so they are given a score of **"Very Low Concern"** for stock abundance.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Canada Lake Ontario, Gillnet, Bottom

Very Low Concern

White perch is given a score of **"Very Low Concern"** because they are non-native to the Great Lakes basin.

Factor 2.4 - Discard Rate

Canada Lake Ontario, Gillnet, Bottom

< 20%

Gillnets do not use bait. Reported discards from Canadian gillnets in Lake Ontario are low and do not appear to have any notable effects on any one species. The Canadian gillnet fishery in Lake Ontario primarily targets lake whitefish and utilize strategies to minimize unwanted catch. Indeed, bottom gillnets in Canadian waters of Lake Ontario are fairly selective and are largely a seasonal effort for lake whitefish. Incidental catch of lake trout in gillnets occurs in summer months, but the majority of gillnetting for lake whitefish occurs in fall and winter months when the fishery is able to more selectively target lake whitefish via knowledge of spawning behaviors. Incidental catch is thus mitigated ([OMNR 2008][OMNR 2009][OMNR 2010][OMNR 2011][OMNR 2012] tables 4.2.1). Gillnet catches in this fishery have shown discard rates of 3.89%, 4.31%, and 7.76% in 2010, 2011, and 2012 respectively (Jim Hoyle 2014)

Rationale:
By analyzing raw catch data provided by Jim Hoyle of the OMNR, the statistics below were calculated on discards over landings for gillnet fisheries in Canadian waters of Lake Ontario targeting lake whitefish, yellow perch, and walleye in 2012, 2011, and 2010. Data for earlier years can be seen on the spreadsheet connected to the reference: (Jim Hoyle 2014).

2012:
Landings: 153151 lbs.
Discards: 9448 lbs.
Releases: 4860 lbs. (assuming 50% mortality: 2430 lbs.)
Discards/landings: 11878/153151 = 7.76%

2011:
Landings: 172743
Discards: 5114 lbs.
Releases: 4676 lbs. (assuming 50% mortality: 2338 lbs.)
Discards/landings: 7452/172743 = 4.31%

2010:
Landings: 152755 lbs.
Discards: 3354 lbs.
Releases: 5175 lbs. (assuming 50% mortality: 2587.5 lbs.)
Discards/landings: 5941.5/152755 = 3.89%

Criterion 3: Management effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*

Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Criterion 3 Summary

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
Canada Lake Ontario Gillnet, Bottom	3.000	All Species Retained	Yellow(3.000)
Canada Lake Ontario Trap net	3.000	All Species Retained	Yellow(3.000)
New York Lake Ontario Gillnet, Bottom	3.000	All Species Retained	Yellow(3.000)

Factor 3.1: Harvest Strategy

Scoring Guidelines

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'

- *5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered.*
- *4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*

- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective.'*
- *0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.*

Factor 3.1 Summary

Factor 3.1: Management of fishing impacts on retained species							
Region / Method	**Strategy**	**Recovery**	**Research**	**Advice**	**Enforce**	**Track**	**Inclusion**
Canada Lake Ontario Gillnet, Bottom	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada Lake Ontario Trap net	Moderately Effective	N/A	Highly Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
New York Lake Ontario Gillnet, Bottom	Moderately Effective	N/A	Highly Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective

Subfactor 3.1.1 – Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

New York Lake Ontario, Gillnet, Bottom

Moderately Effective

The Great Lakes span jurisdictions in two countries, several states, one province, and a number of tribal lands, thus management of the shared fishery resources is complex and dynamic. The main coordinating body of fishery management in the region is the Great Lakes Fishery Commission (GLFC), an inter-jurisdictional agency established in 1954 by the governments of the United States and Canada (Beamish 2001). The Commission consists of four Canadian and four American commissioners, who are appointed by their respective governments and supported by a secretariat in Ann Arbor, Michigan. Within the Great Lakes Fishery Commission, each lake has a Lake Committee that undertakes research and makes

recommendations on sea lamprey control (the original motivation for the Commission), lake trout rehabilitation, stocking events, and other lake-specific management actions for each of the Great Lakes. Lake Committees comprise members of the actual management bodies for each lake. However, the GLFC and the Lake Committees do not manage the lakes, but rather act as a platform organization to help bring together the multiple management agencies involved in Great Lakes fisheries to coordinate research, enforcement, stocking, quota, and other management issues. The Lake Ontario Committee's stated purposes are to: consider issues pertinent to, or referred by, the Great Lakes Fishery Commission; consider issues and problems of common concern to member agencies; develop and coordinate joint programs and research projects; and serve as a forum for state, provincial, tribal, and federal agencies (GLFC 2014). Lake Ontario management agencies include the New York Department of Environmental Conservation's (NYSDEC) Division of Fish, Wildlife, and Marine Resources and the Ontario Ministry of Natural Resources (OMNR). Some fish stock surveys and water quality monitoring in the Great Lakes region are undertaken by the US Geological Service's Great Lakes Science Center, NOAA's Great Lakes Environmental Research Laboratory (GLERL), and the US Environmental Protection Agency (EPA). Furthermore, fisheries-independent research conducted by local agencies and universities are also undertaken. There are no tribal fisheries in Lake Ontario. Stock assessments are conducted by the federal, state, and provincial agencies involved in fisheries research and management within each lake. Fish community index assessments are carried out regularly using both gill netting and trawling, and hydro-acoustic assessments are also used, as well as commercial catch sampling. Furthermore, there is a volunteer angler diary program in Ontario waters. Daily catch reports, annual CPUE and harvest trends, and stock condition trends (length to weight ratios, size at maturity, and size at harvest) are all monitored and evaluated by these survey methods, and shared with LTCs. Again, information from management agencies, research institutions, local agencies, and universities are evaluated. The Lake Ontario Committee uses the information from these assessments to propose changes to yearly quotas, which are ultimately set by the management agencies. Quotas are given by the OMNR for Canadian waters of Lake Ontario for all commercially fished species (OMNR 2012). These are designated by quota zone in these waters. Commercial fishing in New York waters is restricted by number of fishing licenses issued. For example, only four fishermen actively fished on three licenses of the five total licenses issued in 2012. Catch amounts since 2000 were similar to or less than that caught in 2012 (NYSDEC 2012). Furthermore, there is a "Fish Community Objectives for Lake Ontario" plan, which confirms commitment to "A Joint Strategic Plan for the Management of Great Lakes Fisheries" ([Stewart, Todd, LaPan 2013], 3), and gives updated goals and objectives for management of the Lake Ontario fish community (4). Gear types utilized in Lake Ontario waters are gillnets and trapnets, but gillnetting is prohibited in the US state-licensed fishery. Specific fishery management strategies include fingerling stocking (Trout and Salmon), quotas, and fishing licenses.

Management and Implementation in Canadian and New York waters of Lake Ontario are given a **"Moderately Effective"** score because management agencies and plans exist for Lake Ontario fisheries and fish communities. However, commercial fisheries-focused research has room for improvement, and biomass target reference points for the fisheries are absent.

Subfactor 3.1.2 – Recovery of Species of Concern

Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.

Canada Lake Ontario, Gillnet, Bottom

Moderately Effective

Lake trout is not a target fishery. Some lake trout are caught in the summer as bycatch in the Canadian whitefish targeted fishery. Summer catches are unable to target whitefish as selectively because they are no longer spawning. Thus, lake trout are caught with whitefish, but not in large numbers. For example, in all commercial fisheries (gillnet and trapnet), the lake trout bycatch was only 4,073 lbs. in 2012, and 71.8% of this was released alive. Catches in this data set are recorded as either "landed," "discarded," or "released (alive)" (Jim Hoyle 2014). This is the largest bycatch of trout since 2004. No lake trout have been landed or discarded from trapnets since 2004, and numbers released have not exceeded 39 lbs.

"The Province of Ontario purposefully limits commercial fishing for lake whitefish to the fall spawning period in the Kingston Basin and eastern Ontario waters of Lake Ontario because their bycatch is considerably greater during other seasons of the year." ([Ebner et al. 2008], pg 112).

Management is in place to protect and increase wild lake trout populations. Lake trout were extirpated in Lake Ontario in the 1950s (OMNR 2012, 110). Rehabilitation efforts such as sea lamprey control and stocking of hatchery fish have been ongoing since the 1970s, have included joint US-Canadian efforts since 1983, and have increased significantly since 1997 ([OMNR 2013], pg 118). Poor early survival of stocked fish, and occurrence of wild fish are key issues. Indeed, poor survival of juvenile lake trout is a significant factor in lake trout population declines in the 1990s and early 2000s. Sea lamprey are cited as a major contributor to lake trout mortality ([OMNR 2013], pg 121) whereas commercial fishing is not cited as a major contributing factor. On the other hand, since 2005, lake trout adult populations have been gradually increasing ([OMNR 2013], pg 118). However, there are no clear indicators that lake trout populations will reach a recovered status on a reasonable timeline as set in management goals.

Canadian gillnet fisheries in Lake Ontario are given a score of **"Moderately Effective"** because lake trout (a species of concern) is occasionally caught and discarded. Because lake trout are not targeted, discard rates are hence very low. Effective management is in place governing the recovery of this species, but the population has declined since the 1990s, and there are no clear indicators that lake trout population status/recovery will reach management goals in the near future.

Since 2004, most lake trout caught are released (alive) instead of discarded (mortality) (Jim Hoyle 2014). Furthermore, though lake trout are not targeted or retained in the Lake Ontario commercial fisheries, there are recovery plans in place via the Lake Ontario Committee and their Fish Community Objective for Lake Ontario.
(NYSDEC 2012)(OMNR 2013)(Stewart, Todd, LaPan 2013)

Canada Lake Ontario, Trap net

N/A

There are currently no overfished, depleted, endangered or threatened species targeted or retained in the fishery.

(NYSDEC 2012)(OMNR 2013)(Stewart, Todd, LaPan 2013)

Rationale:
Lake sturgeon are neither targeted nor landed by Canadian or New York commercial fisheries in Lake Ontario (OMNR 2013). Any lake sturgeon caught incidentally by commercial fisheries (both trap and gillnet for all targeted species) in Lake Ontario were reported as released by commercial fishers on their daily catch reports, and these numbers are small: less than 70 lbs./year since 2004 (Jim Hoyle 2014).

Lake trout is not a target fishery. In all Canadian commercial fisheries (gillnet and trapnet), the lake trout gillnet bycatch was only 4,073 lbs. in 2012, and only 24 lbs. were caught but then released (alive) by trapnets. Catches in this data set are recorded as “landed,” “discarded,” or “released (alive)” (Jim Hoyle 2014). Furthermore, this was the largest bycatch of lake trout since 2004; no lake trout have been landed or discarded from trapnets since 2004, and numbers released (alive) have not exceeded 39 lbs. “The Province of Ontario purposefully limits commercial fishing for lake whitefish to the fall spawning period in the Kingston Basin and eastern Ontario waters of Lake Ontario because their bycatch is considerably greater during other seasons of the year.” ([Ebner et al 2008], pg 112).

Management is in place to protect and increase wild lake trout populations. Rehabilitation efforts such as sea lamprey control and stocking of hatchery fish have been ongoing since the 1970s, have included joint US-Canadian efforts since 1983, and have increased significantly since 1997 ([OMNR 2013], pg 118). Sea lampreys are cited as a major contributor to lake trout mortality ([OMNR 2013], pg 121). Also, poor survival of juvenile lake trout is a significant factor in lake trout population declines in the 1990s and early 2000s. Commercial fishing is not cited as a major contributing factor. Furthermore, since 2005, lake trout adult populations have been gradually increasing ([OMNR 2013], pg 118).

New York Lake Ontario, Gillnet, Bottom

N/A

New York gillnet fisheries in Lake Ontario are given a score of "N/A" because there are currently no overfished, depleted, endangered or threatened species targeted or retained in the fishery

Subfactor 3.1.3 – Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

Various index assessments are carried out regularly, including annual gillnetting, trawling, and hydro-acoustics. Annual index gillnetting fieldwork occurs during summer months to monitor the abundance of a variety of warm, cool, and cold water fish species in eastern Lake Ontario. Species sampled include lake whitefish, lake trout, and yellow perch, as well as species not targeted in commercial fisheries, like salmon (OMNR 2013). Community index trawling is done to evaluate small fish species and young fish from larger bodied species including lake trout, yellow perch, and whitefish. Lake wide hydro-acoustics are done annually in mid-summer to assess prey fish like rainbow smelt, and alewife (OMNR 2013, section 2.2). Commercial catch samplings have occurred in 2013 and 2012 for whitefish and lake herring, in 2011 for lake whitefish, and in 2010–2008 for lake whitefish and northern pike. (OMNR 2012)

There are no non-native target species (e.g., rainbow smelt or alewife).

Biodiversity monitoring and species rehabilitation and restoration efforts are being implemented or planned for numerous species including lake trout. Measures include stocking programs and sea lamprey control measures ([OMNR 2013] section 8.1). There are international inter-agency goals and commitments for management and restoration of fish communities in Lake Ontario via the Fish Community Objectives Plan, 2013 (Stewart, Todd, and LaPan 2013). Both US and Canadian agencies are involved including the New York State Department of Environmental Conservation (NYSDEC) and the Ontario Ministry of Natural Resources (OMNR). Fish Community Objective Plans are reviewed and pertinent data is presented at annual Lake Committee meetings.

Scientific research and monitoring for Lake Ontario is given the score of **"Highly Effective"** because the

management process uses independent and up-to-date scientific stock assessments and analyses, and these are conducted regularly and are complete and robust.

These assessments mainly use CPUE as an indicator of biomass or stock abundance, and target reference points are absent. However, these assessments are long term and robust and are coupled with species body-condition and age/weight assessments. There is a good probability that they are good indicators of stock status and fish community health.

New York Lake Ontario, Gillnet, Bottom

Highly Effective

The management process uses independent and up-to-date scientific stock assessments and analyses, and these are conducted regularly and are complete and robust.

These assessments mainly use CPUE as an indicator of biomass or stock abundance, and target reference points are absent. However, these assessments are long-term and robust, and are coupled with species body-condition and age/weight assessments. There is a good probability that they are good indicators of stock status and fish community health.

Rationale:
Annually, the New York State Department of Environmental Conservation (NYSDEC) assesses the warmwater fish community in New York waters of the Eastern Basin of Lake Ontario. This assessment was started in 1976 with emphasis on smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and white perch (*Morone americana*) to create abundance indices for warmwater fish in these waters (NYSDEC 2012).

There are no non-native target species. Yellow perch is the primary target species. Brown bullhead have been targeted and sold prior to 2010, but only ~100 lbs. or less has been landed and sold in recent years. White perch has been landed and sold in 2010 (546 lbs.), 2011 (3,736 lbs.), and 2012 (1,130 lbs.). Lake herring have been landed since 2000, but not reported until 2009 in numbers up to 613 lbs. These numbers are all insignificant compared to yellow perch landings (59,989 lbs. in 2012) (NYSDEC 2012).

There are international inter-agency goals and commitments for management and restoration of fish communities in Lake Ontario via the Fish Community Objectives Plan, 2013 (Stewart, Todd, and LaPan 2013). Biodiversity monitoring and species rehabilitation and restoration efforts are being implemented or planned in accordance with the goals and objectives set by the Lake Ontario Committee, which will continue with programs to protect and restore native species with an emphasis on lake trout, Atlantic salmon, American eel, lake sturgeon, lake cisco, round whitefish, deepwater sculpin, and deepwater ciscoes (Stewart, Todd, LaPan 2013). Other non-native fish communities such as alewife and round goby are being monitored and maintained in order to support important sports fisheries including salmon and

trout in accordance with stakeholder wishes (Stewart, Todd, and LaPan 2013).

Subfactor 3.1.4 – Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

The Great Lakes Fishery Commission takes scientific advice into account when setting quotas and developing management strategies throughout the Great Lakes. With the enactment of the Joint Strategic Plan for Management of Great Lakes Fisheries, quotas and stock assessments are evaluated by representatives of both state and provincial agencies, and assessed based on proposed ecological impacts to the fishery and surrounding ecosystems. Additionally, scientific advice is elicited to help determine stock status on most of the species listed in this report. Serving on each lake technical committee and present at the lake committee technical hearings are representatives from the research divisions of DNR and OMNR agencies whose sole propose is to provide information on projected stock status, discuss potential adverse trends afflicting stocks of interest (including spread of VHS and lamprey control efforts), and to advise on future directions. The Great Lakes Fishery Commission is implementing scientific advice on a regular basis (pers. comm. DNR and OMNR officials). Independent research conducted by universities throughout the Great Lakes is routinely included in these meetings and significant results are discussed. Because of the fragile nature of the Great Lakes fishery, which appears to only recently be recovering from a period of low yield and decreased stock abundances, scientific advice is relied upon heavily to ensure the fishery continues to recover.

Lake Ontario fisheries use of scientific advice is given a score of **“Highly Effective”** because management is very closely tied with scientific advice and research. The current management plans, goals, and objectives for fish communities and fisheries in the Canadian waters of Lake Ontario are based on scientific research and advice. In annual reports published by the Ontario Ministry of Natural Resources, scientific assessments, data, and findings are sited when management goals are outlined. Furthermore, Canadian management is committed to the “Lake Committee Objectives for Lake Ontario,” which is a joint effort with US management agencies and follows scientific advice and assessments in its goals and objectives (OMNR 2013)(Stewart, Todd, LaPan 2013).

New York Lake Ontario, Gillnet, Bottom

Highly Effective

Management is very closely tied with scientific advice and research. The current management plans, goals, and objectives for fish communities and fisheries in the US waters of Lake Ontario are based on scientific research and advice. In annual reports published by the New York State Department of Environmental Conservation, scientific assessments, data, and findings are cited when management goals are outlined. Furthermore, New York management is committed to the "Lake Committee Objectives for Lake Ontario," which is a joint effort with US management agencies and follows scientific advice and assessments in its goals and objectives (Stewart, Todd, and LaPan 2013).

Subfactor 3.1.5 – Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

The Great Lakes Fishery Commission (GLFC) created the Great Lakes Law Enforcement Committee with the goal to "protect, enhance and promote the safe and wise use of the natural resources in the Great Lakes for present and future generations" (GLFC Website 2014). This committee comprises representatives from the fishery management agencies representing all states and provinces bordering the Great Lakes. These management agencies include State Departments of Natural Resources (DNR), the Department of Environmental Conservation in New York (NYSDEC), the Pennsylvania Fish and Boat Commission, the Ontario Ministry of Natural Resources (OMNR), the United States Coast Guard, and the tribal/first nation authorities Chippewa Ottawa Resource Authority (CORA) and the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) when applicable. CORA and GLIFWC are not applicable to Lake Ontario because there are no tribal fisheries in the lake. Specialists from the coast guard and both the Ontario Ministry of Natural Resources (OMNR) and DNR routinely board commercial fishing vessels to inspect harvest and fishing gear to ensure that fisherman are following the required guidelines. Portside inspections are carried out by DNR, which enforces fisheries legislation including minimum landing sizes, retention of prohibited species, gear restriction, etc. The coast guard also randomly inspects deployed gears and conservation officers of the DNR to ensure that gears are properly marked, placed in authorized areas, and are utilizing legal mesh sizes (DNR Website 2005). The US coast guard and the conservation officers of the DNRE carry out patrols and monitoring of illegal fishing. Actions of the Great Lakes Law Enforcement Committee are guided by policies and recommendations enacted by the governing Council of Lake Committees. These include supporting investigations crossing jurisdiction lines, supporting development and dissemination of information on fisheries forensic sciences, sharing

of law enforcement intelligence information, and enforcing quota and harvest regulations (GLFC Website 2014). Furthermore, fisheries in Lake Ontario do not overshoot quotas or TACs. Harvested catches have been below quota amounts in Canadian Waters since at least 2008 ([OMNR 2008][OMNR 2009][OMNR 2010][OMNR 2011][OMNR 2012][OMNR 2013], sections 4.1)

Enforcement for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Highly Effective"** because regulations and agreed voluntary arrangements are regularly enforced and independently verified.

New York Lake Ontario, Gillnet, Bottom

Highly Effective

The GLFC created the International Great Lakes Fishery Law Enforcement Committee with the goal to "protect, enhance and promote the safe and wise use of the natural resources in the Great Lakes for present and future generations" (GLFC-website 2014). This committee comprises representatives from resource enforcement agencies (OMNR, DNR) from all states and provinces bordering the lakes, the United States Coast Guard, and tribal/first nation authorities (CORA, GLIFWC). Specialists from the coast guard and both the Ontario Ministry of Natural Resources (OMNR) and the state's Department of Natural Resources (DNR) routinely board commercial fishing vessels to inspect harvest and fishing gear to ensure that fisherman are following the required guidelines. Portside inspections are carried out by DNR and tribal authorities, which enforce fisheries legislation including minimum landing sizes, retention of prohibited species, gear restriction, etc. The coast guard also randomly inspects deployed gears and conservation officers of the DNR to ensure that gears are properly marked, placed in authorized areas, and are utilizing legal mesh sizes (DNR website 2005). The US coast guard, conservation officers of the DNR, and tribal authorities carry out patrols and monitoring of illegal fishing. An agreement was reached between CORA and the US coast guard (the memorandums of agreement) that allows the coast guard to inspect and prosecute tribal fishermen in tribal waters of the Great Lakes (Pickering 2010). Additionally, the Tribal Fisheries Consent Decree of 2000 between the United States and CORA allows DNR officials to inspect portside take from tribal fishermen (DNR website 2005). Actions of the Law Enforcement Committee are guided by policies and recommendations enacted by the governing Council of Lake Committees. These include supporting investigations crossing jurisdiction lines, supporting development and dissemination of information on fisheries forensic sciences, sharing of law enforcement intelligence information, and enforcing quota and harvest regulations (GLFC Website 2014).

There is a documented case of under reporting of lake herring incidental catches prior to 2009, but fishers were promptly reminded (within the year of discovery of under reporting) of reporting requirements in order to ensure greater awareness and adherence to reporting requirements (NYSDEC 2012, section 20). Enforcement for gillnet fisheries in New York waters of Lake Ontario is given a score of **"Highly Effective"** because regulations and agreed voluntary arrangements are regularly enforced

and independently verified, and fishing efforts do not overshoot established quotas.

Subfactor 3.1.6 – Management Track Record

Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels? A Highly Effective rating is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

New York Lake Ontario, Gillnet, Bottom

Moderately Effective

The fish stocks in the Great Lakes have been subject to fishing pressures for centuries. Historic overfishing, the introduction of non-native species (sea lamprey, alewifes, zebra mussels, etc.), and habitat alteration and destruction have resulted in many of the fish stocks becoming greatly diminished or depleted. Comprehensive management of the Great Lakes began during the middle of the 20th century with the formation of the Great Lakes Fishery Commission (GLFC), after many of the commercially important stocks were already decimated. Implementation of legislation to promote improved conditions throughout the Great Lakes (Great Lake Water Quality Agreement 1972), as well as the development of more effective invasive control efforts, has resulted in the increased stock abundance of many target species. State (DNR), provincial (OMNR), and tribal (CORA) management agencies have made substantial progress in rehabilitation, restoration, and prevention efforts. However, stocks of once commercially valuable lake trout and lake sturgeon are still far below historic levels (though improving) even after rigorous re-stocking and rehabilitation attempts over the last several decades. Additionally, systemic issues that occur between agencies (difference in regional priorities and interests, jurisdictional disputes, etc.) can impede or delay action and response to new threats or obstacles to the fishery. Such delays in action may interfere with current restoration attempts, as new threats such as invasive species and productivity changes continue to plague the fishery. While current management strategies have proven effective in halting and in some cases reversing the downward trends in abundance of many stocks throughout the Great Lakes, it is too early to determine whether this management system will prevail in the face of mounting ecological pressures. (OMNR 2013)(Stewart, Todd, LaPan 2013)

The track record for gillnet fisheries in the waters of Lake Ontario is given the score of **"Moderately Effective"** because it is uncertain/mixed.

Subfactor 3.1.7 – Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent and includes stakeholder input.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

Agencies at the state, federal, and provincial level work with local stakeholders since they are the managing agencies with the delegated authority to invoke management actions (e.g., harvest restrictions, size limits, stocking, etc.). For example, Ontario has formed a provincial system of Fisheries Management Zone councils composed almost entirely of mixed user groups. These groups meet regularly to hear from Ontario Ministry of Natural Resources (OMNR), research elements, and provide feedback for proposed management decisions. This ground level engagement is conducted by individual managing agencies, which include US state and federal agencies and Canadian provincial agencies. Bringing together these managing agencies in the Great Lakes region is the Great Lakes Fishery Commission (GLFC). The GLFC comprises representatives from all parties that have a stake in the commercial fishery, including US state and federal agencies, Canadian agencies, and tribal/first nation representatives. The GLFC has a good track record of including stakeholders in the development of legislation, harvest restrictions, and enforcement regulations throughout the Great Lakes fisheries since there are representatives participating from managing agencies that reach out to their local stakeholders regularly. Furthermore, stakeholders representing recreational fishery interests are also present at local lake committee meetings. The US fishery is largely managed for the benefit of the recreational fishing industry, and as such their interests are acknowledged and incorporated in Great Lakes management ([DesJardine et al. 1995], [Riley 2013]). Each lake committee is required to make regular reports to the Council of Lake Committees (CLC). These reports generate the development of new legislation, which is made public and to local, state, provincial, and federal agencies who are invited to submit comments and suggestions. Findings, reports, and suggested management strategies are made public and opened to criticism, which shows transparency of the process (GLFC 2007). Stakeholder Inclusion for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Highly Effective"** because the management process is transparent and includes stakeholder input.

New York Lake Ontario, Gillnet, Bottom

Highly Effective

In the Lake Community Objectives (LCOs) for Lake Ontario (a joint management plan with commitment from both the Ministry of Natural Resources in Ontario, Canada, the New York State Department of Environmental Conservation, and other organizations) public consultation occurred when creating objectives and stakeholder input influenced management plans and objectives (Stewart, Todd, LaPan 2013). Furthermore, it stated that deviations from policies outlined in the LCOs report will, "...only be considered based on mutual agreement by NYSDEC and OMNR in consultation with stakeholders." ([Stewart, Todd, LaPan 2013], pg 11). The LCO's for Lake Ontario is a public document available online. Taken from text in the LCOs for Lake Ontario 2013:

“Public consultation very clearly indicates that stakeholders greatly value both the diversity of Lake Ontario’s salmon and trout fisheries and an abundance of trophy-sized fish. In addition to the strong interest in maintenance of the salmon and trout fishery, many stakeholders support protection and restoration of native species, including expansion of their ranges, and achieving an increased role for wild fish. Alewife is required in sufficient abundance to provide food for salmon and trout, especially Chinook Salmon, but as previously noted, abundant Alewife suppress production of many native fish species.”([Stewart, Todd, LaPan 2013], pg 11).

Stakeholder inclusion for gillnet fisheries in New York waters of Lake Ontario is given a score of **“Highly Effective”** because the management process is transparent and includes stakeholder input.

Bycatch Strategy

Factor 3.2: Management of fishing impacts on bycatch species						
Region / Method	**All Kept**	**Critical**	**Strategy**	**Research**	**Advice**	**Enforce**
Canada Lake Ontario Gillnet, Bottom	Yes	No	Highly Effective	Highly Effective	Highly Effective	Highly Effective
Canada Lake Ontario Trap net	Yes	No	Highly Effective	Highly Effective	Highly Effective	Highly Effective
New York Lake Ontario Gillnet, Bottom	Yes					

Subfactor 3.2.1 – Management Strategy and Implementation

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures? To achieve a Highly Effective rating, the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g., catch limits, use of proven mitigation measures, etc.).

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

Bycatch management strategy received a score of **"Highly Effective"** since most species harvested have commercial value (even if they are not a targeted species) and are thus kept and sold portside. The main exception is lake trout in Canadian fisheries, but lake trout bycatch rates are low and most are released (alive). Lake sturgeon catch is prohibited in both US and Canadian waters of Lake Ontario. No sturgeon were reported as bycatch by either country. Both New York State Department of Environmental Conservation and the Ontario Ministry of Natural resources have committed to restoring lake sturgeon populations in Lake Ontario via Objective 1.2 in the Lake Ontario Fish Community Objectives. This objective specifically states the goal of restoring lake sturgeon populations by establishing at least 4 spawning populations with at least 750 sexually mature lake sturgeon ([Stewart, Todd, LaPan 2013], 13). A recovery strategy plan has been developed by OMNR detailing management and restoration plans for lake sturgeon, but this is still currently under review. Thus no specific management plans are currently in place in Canadian waters of Lake Ontario to restore the species (Golder Associates Ltd 2011). However, the recovery goal is to maintain existing populations and to restore, rehabilitate, or reestablish self-sustaining populations where feasible while maintaining ecosystem health and function ([Golder Associates Ltd 2011], iv). Under the Ontario Endangered Species Act (ESA) and Canadian Species at Risk Act (SARA), lake sturgeon are designated as threatened, but its SARA designation is still pending ([OMNR 2013], pg 111).

Subfactor 3.2.2 – Scientific Research and Monitoring

Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species? To achieve a Highly Effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

Various research projects are being carried out to further study lake sturgeon population dynamics, habitat needs, and other factors to aid in a management/recovery plan (OMNR 2013). No sturgeon bycatch by gill and trapnet in Canadian waters have been reported (Hoyle). Conclusive evidence of bycatch impacts on lake sturgeon populations have not been established, but impacts are believed to be low. Furthermore, though lake sturgeon are not targeted or retained in the Lake Ontario commercial fisheries, there are recovery plans in place via the Lake Ontario Committee and their Fish Community

Objective for Lake Ontario.

Lake trout are the only other species of concern landed or discarded from commercial fisheries but these numbers are low and there are recovery plans and management strategies in place. Furthermore, various research projects listed in 3.1.3 are underway to assess lake trout population status for use in determining whether Lake Committee Objectives are being met. Research is done by both US and Canadian agencies, data is shared, and joint efforts are agreed upon for fishery management plans. These agencies include the New York State Department of Environmental Conservation (NYSDEC) and Ontario Ministry of Natural Resources (OMNR). (GLFC 2007)(Jim Hoyle 2014)(NYSDEC 2012)(OMNR 2012)

This section receives a score of "Highly Effective" because research and monitoring associated with lake sturgeon and lake trout is extensive, well-coordinated, and aimed at improving and rehabilitating populations. Data collection and analysis is sufficient to determine whether goals are being met.

Subfactor 3.2.3 – Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

Scientific advice for bycatch species is followed the same as for target species. Thus, this fishery is given the score of "Highly Effective." See answers in factor 3.1 for rational/details.

Subfactor 3.2.4 – Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

Highly Effective

This fishery is given the score of **"Highly Effective"** because enforcement follows the same strategies and has the same status for bycatch species as for target species. See details and rational in factor 3.1 for explanation.

Criterion 4: Impacts on the habitat and ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.

The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management score. The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Overall Recomm.
Canada Lake Ontario Gillnet, Bottom	3.00:Low Concern	0.25:Minimal Mitigation	4.00:Low Concern	**Green (3.606)**
Canada Lake Ontario Trap net	3.00:Low Concern	0.25:Minimal Mitigation	4.00:Low Concern	**Green (3.606)**
New York Lake Ontario Gillnet, Bottom	3.00:Low Concern	0.25:Minimal Mitigation	4.00:Low Concern	**Green (3.606)**

Justification of Ranking

Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate

Scoring Guidelines

- *5 (None)—Fishing gear does not contact the bottom*
- *4 (Very Low)—Vertical line gear*
- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*

- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Canada Lake Ontario, Gillnet, Bottom

Low Concern

Bottom gillnets on Lake Ontario do not encounter rocky reefs or coral and thus qualify as a low concern. Gillnets are the primary gear type used in Canadian waters of Lake Ontario where whitefish is the primary fishery. The greatest negative impacts from bottom gillnet gear is due to destruction of substrate habitat and incidental bycatch (Chuenpagdee et al 2003). Both of these factors are low in Lake Ontario.

Between 2008 and 2013, on average, 92.5% of commercial lake whitefish targeted harvest was taken by gillnets in the Canadian waters of Lake Ontario with a range of 88% to 97%. The remaining catch was with impoundment gear. Furthermore, on average over this same time period, 97.9% of gillnet catch was in quota zones 1-1 and 1-2, which consist of the open lake portions of eastern Lake Ontario, where gillnet impacts on substrate will be smallest due to soft (sandy substrate). No gillnet catch came from the Bay of Quinte (OMNR 2013).

Effects of gear type on substrate for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Low Concern"** because bottom set gillnets are used, which always have at least partial contact with the bottom substrate, but do not come into contact with corals or reef/boulder topography.

Rationale:

Image of typical gillnet used in Great Lakes:

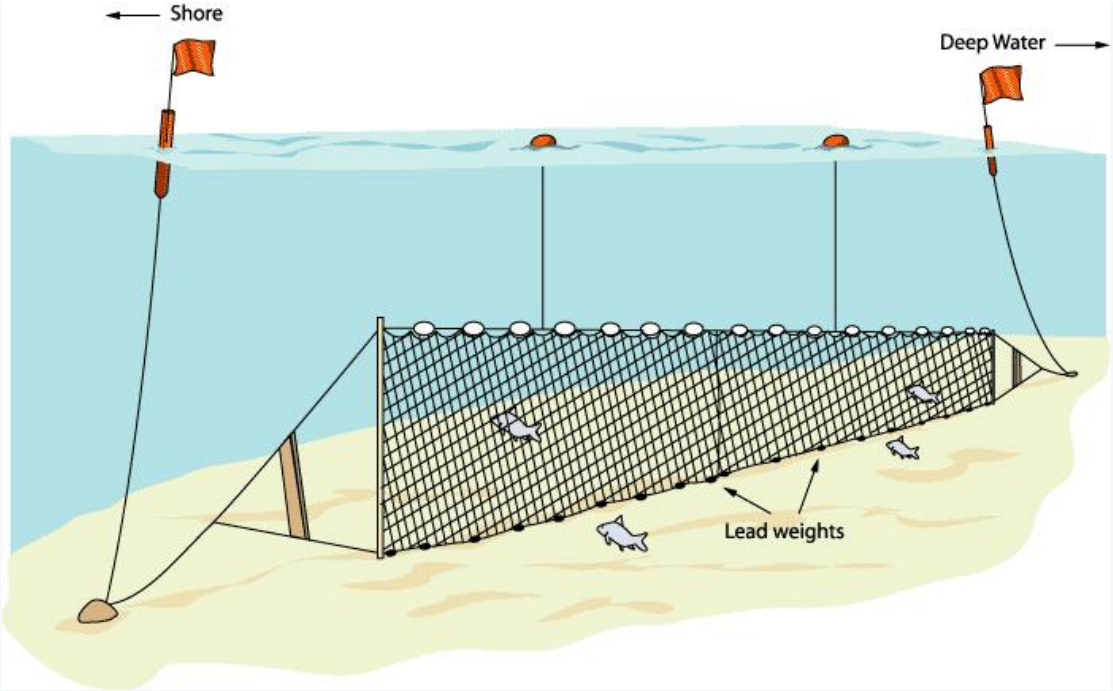

Figure 10. Description of typical gillnet used in Great Lakes. Image from Michigan Seagrant.

Canada Lake Ontario, Trap net

Low Concern

Trapnets are used lake wide in US, tribal, and Canadian waters. Trapnet impacts on benthic substrate in Canadian waters is not assessed. However, their impacts are considered negligible in areas where they are utilized; trapnets come into contact with bottom substrate but are stationary (pers. comm. {GLFC 2014]). Bottom substrate in Lake Ontario is soft (mostly sandy).

Effects of gear type on substrate for trapnets in Canadian waters of Lake Ontario is given a score of "**Low Concern"** because they do come into contact with bottom substrate. However, they do not come into contact with coral or reef/boulder topology and their impacts on the bottom substrate are considered negligible.

Rationale:

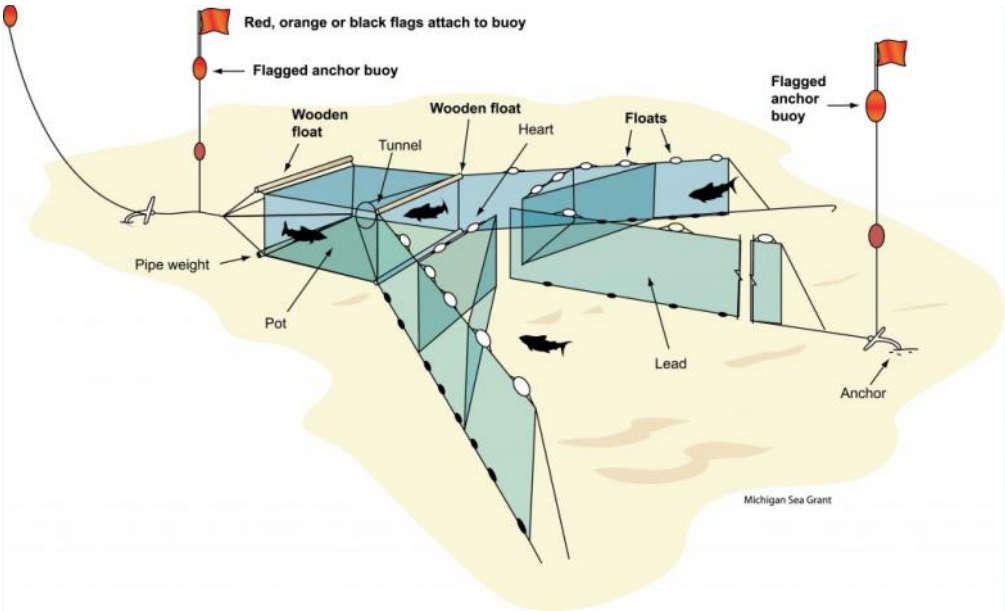

Figure 11. Description of a typical Great Lakes trapnet. Image from Michigan Seagrant.

New York Lake Ontario, Gillnet, Bottom

Low Concern

The floor of Lake Ontario is primarily soft/sandy substrate. Gillnets are the primary gear type used in New York waters of Lake Ontario where yellow perch is the primary fishery (NYSDEC 2012).

The greatest potential negative impacts from bottom gillnet gear is due to destruction of substrate habitat and incidental bycatch (Chuenpagdee et al. 2003)—both of which are very low in Lake Ontario due to the sandy/muddy nature of the substrate.

Effects of gear type on substrate for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Low Concern"** because bottom set gillnets are used, which have at least partial contact with bottom substrate, but they do not come into contact with corals or reef/boulder topography.

Factor 4.2 – Mitigation of Gear Impacts

Scoring Guidelines

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.*

- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced.*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats.*

Canada Lake Ontario, Gillnet, Bottom

Minimal Mitigation

Impacts of commercial fishing gear on benthic substrate have not been fully assessed in Lake Ontario. However, gears utilized in Lake Ontario are not believed to significantly impact benthic substrate. The benthic substrate of Lake Ontario is generally soft and devoid of hard structures that may be damaged by gear placement. In areas considered spawning or nursery areas (where hard substrate may exist) fishing gear is rarely, if ever placed, as such areas are recognized as vital to commercially valuable species such as lake whitefish or lake sturgeon.

Mitigation of gear impacts for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Minimal Mitigation"** because fishing effort or intensity is effectively controlled, but is not actively being reduced.

Canada Lake Ontario, Trap net

Minimal Mitigation

Impacts of commercial fishing gear on benthic substrate has not been fully assessed in Lake Ontario. However, gears utilized in Lake Ontario are not believed to significantly impact benthic substrate and as such, mitigation strategies for negative impacts are non-existent. The benthic substrate of Lake Ontario is generally soft and devoid of hard structure that may be damaged by gear placement. In areas deemed spawning or nursery areas (where such hard substrate may exist) fishing gear is rarely, if ever placed, as such areas are recognized as vital to commercially valuable species such as lake whitefish (pers. comm. OMNR).

Mitigation of gear impacts for gillnet fisheries in Canadian waters of Lake Ontario is given a score of **"Minimal Mitigation"** because fishing effort or intensity is effectively controlled, but is not actively being reduced.

New York Lake Ontario, Gillnet, Bottom

Minimal Mitigation

Impacts of commercial fishing gear on benthic substrate have not been fully assessed in Lake Ontario. However, gears utilized in Lake Ontario are not believed to significantly impact benthic substrate. Thus, mitigation strategies for negative impacts are non-existent. The benthic substrate of Lake Ontario is generally soft substrate and devoid of hard structures that may be damaged by gear placement. In areas considered spawning or nursery areas (where hard substrate may exist) fishing gear is rarely, if ever placed, as such areas are recognized as vital to commercially valuable species such as lake whitefish and lake sturgeon.

Mitigation of gear impacts for gillnet fisheries in New York waters of Lake Ontario is given a score of **"Minimal Mitigation"** because fishing effort or intensity is effectively controlled, but is not actively being reduced.

Factor 4.3 – Ecosystem-Based Fisheries Management

Scoring Guidelines

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators).*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts.*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

Canada Lake Ontario, Gillnet, Bottom

Canada Lake Ontario, Trap net

New York Lake Ontario, Gillnet, Bottom

Low Concern

The GLFC currently implements an Ecosystem Based Fisheries Management (EBFM) strategy (GLFC 2007). The Joint Strategic Plan for Management of the Great Lakes explicitly calls for an Ecosystem-Management Strategy as one of four agreed upon strategies recognized by the GLFC. The policy was adopted for two reasons: 1) Fisheries managers realize that the Great Lakes are all intimately connected and if something negatively impacts one there is a high likelihood that it will affect the others, 2) the Great Lakes commercial fishing industry comprises multi-species of interests with each currently existing in a different state of conservation concern and requiring different management efforts to recovery. As such, targeted fish stocks and status are continually monitored and recommendations on harvest restrictions are made to reflect current stock conditions. These restrictions include harvest limits or quotas, seasonal fishing restrictions, and size restrictions (Stewart, Todd, and LaPan 2013), (OMNR 2013). Shifts in community structure, as well as trends in abundance of prey and forage fish are also closely monitored. For example, alewife populations are being monitored and controlled to fit with fishery objectives for Lake Ontario: alewife serve as an important forage fish for lake trout and pacific salmon stocks (Honeyfield et al. 2005). While consumption of alewife has been shown to increase early mortality syndrome in lake trout, they are still the preferred prey species, and reduction in stock sizes could result in reduced catch and harvest of desired fisheries. Managers of Lake Ontario recognize that efforts to support alewife populations can interfere with objectives to support healthy native fish populations, and this is taken into consideration when management plans are put into place (Stewart, Todd, and LaPan 2013). Lake trout, an “exceptional species” in Lake Ontario as a top predator, is also closely monitored and the ecological interactions existing between lake trout and its surrounding ecosystem are a subject of great concern and consideration for managers throughout the Great Lakes. A basin-wide rehabilitation effort is currently underway that attempts to fully understand the lake trout ecological role in an effort to help restore the stocks. In New York waters of Lake Ontario, these rehabilitation efforts include the stocking of lake trout in designated stock zones, annual assessment surveys conducted by NYSDEC and USGS, and monitoring for sea lamprey predation ([NYSDEC 2011], section 5). These are joint efforts coordinated through the Lake Ontario Committee of the GLFC and including the New York and Ontario agencies such as the New York State Department of Environmental Conservation (NYSDEC) and Ontario Ministry of Natural Resources (OMNR). Together they developed the Joint Plan for Rehabilitation of lake trout in Lake Ontario (Schneider et al. 1997) with the main goal of restoring a naturally reproducing population of lake trout ([NYSDEC 2011] section 5). The US Geological Survey (USGS) and US Fish and Wildlife Service (USFWS) are important partners helping to carry out LOC initiatives and goals. In Canadian waters of Lake Ontario these rehabilitation efforts include stocking and hatchery programs, sea lamprey control and predation monitoring, and assessment and tracking of current stocks. Strains of stocked lake trout are primarily taken from existing populations in Lake Huron in an effort to reduce the introduction of non-native strains and maintain the genetic

integrity of the existing stocks ([Ebner et al 2008], [OMNR 2012]). A management strategy for Lake Ontario was developed in 2013 and is currently under review ([OMNR 2013], section 8.5). There is also a basin wide effort to manage commercial lake whitefish throughout the Great Lakes (Ebner et al. 2008). The EBFM for trap and gillnet fisheries in Canadian waters, and gillnet fisheries in New York waters of Lake Ontario are given a score of **"Low Concern"** because scientific assessment and management efforts to account for ecological roles are underway. The fishery catches one "exceptional species," lake trout, and policies are in place to protect ecosystem functioning. For fisheries with hatchery supplementation, practices are designed to minimize or mitigate any potential negative ecological and/or genetic impacts, where applicable (i.e., lake trout). There are no fisheries for non-native species.

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Appendix B

LAKE TROUT

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Canada Lake Ontario, Gillnet, Bottom

High

Fishbase vulnerability score is 72 out of 100 (Froese & Pauly 2012).The lake trout is the largest trout native to the Great lakes and other Michigan lake waters, where they are considered the top native predator. They have relatively long lives (>25 years) and become sexually mature at 6 or 7 years of age. Like many members of Salmonidae, lake trout are broadcast spawners and return each fall to use the same spawning beds annualy although some straying does occur.
Lake trout are given an inherent vulnerability score of 'high' based on their 'Fishbase' vulnerability score and their biological attributes.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Canada Lake Ontario, Gillnet, Bottom

High Concern

Beginning in the 1990's, Lake Trout abundance experienced a period of significant decline that reached a low point in 2005. Sea Lamprey predation, reduced stocking levels, and decreased early survival all contributed to this decline. There has been a gradual increase since 2005 but the populations are still well below historical highs. Community index gillnetting is used to keep track of Lake Trout populations.Community index gillnetting occurs annually during summer months based on fish movement/migration patterns, fish growth patterns, and logistical considerations. Fixed, single-depth sites and depth-stratified sampling areas are included in the design. Within a specified time-frame, each site is visited 1-3 times using 2, 3, or 8 replicate gill net gangs (OMNR 2013). CPUE has increased slightly, but this is largely due to increased catch of stocked(hatchery origin) rather than wild Lake Trout. (OMNR 2013, 118-119).

Management is working toward creating a self-sustaining Lake Trout population, but community index gillnetting efforts are dominated by stocked fish. Some wild young-of year have been caught in the Community Index bottom trawls, and this could be a potential indicator toward the goal of a self-sustaining lake trout popultions. However, as of yet, the population is of stocked origin. ([OMNR 2013),

1).
Lake Trout in Canadian waters is given the stock status of 'High Concern' because it is probable that stock is below the point where recruitment is impaired.

Rationale:

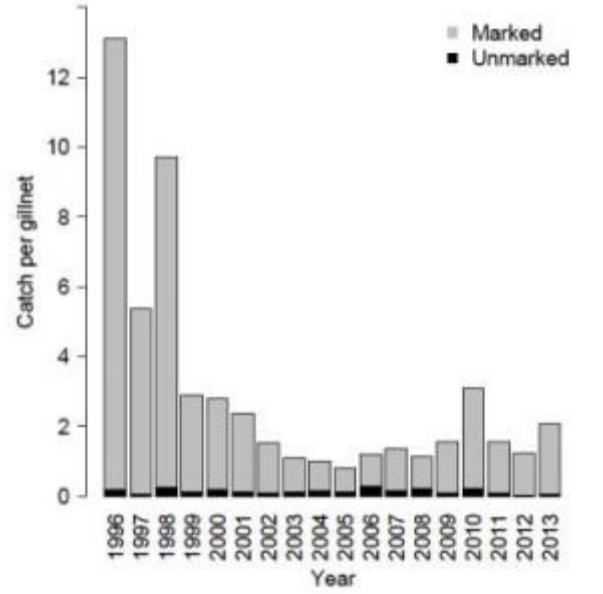

FIG. 8.5.2. Catch per unit effort of marked (hatchery) and un-marked (wild) Lake Trout in the Community Index Gillnetting (Section 2.2).

Figure 12. Catch per unit effort of marked (hatchery) and un-marked (wild) Lake Trout in the Community Index Gillnetting (Section 2.2). (OMNR 2013 Annual Report, pg 119)

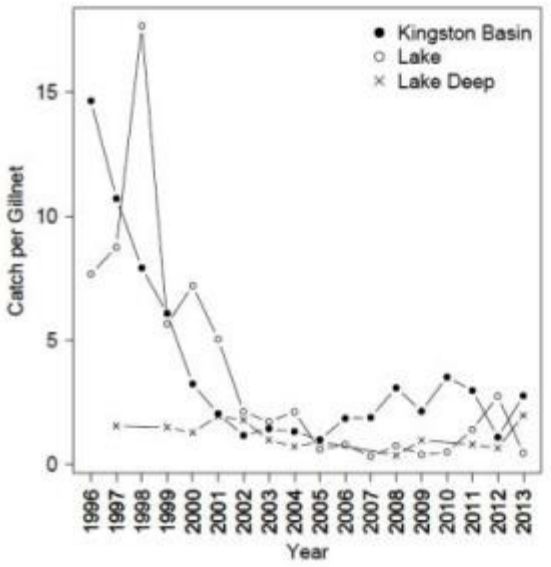

FIG. 8.5.1 Catch per unit effort (# fish per set-night) of adult lake trout in bottom-set gillnets in three areas of eastern Lake Ontario. Deep sets off Rocky Point were not fished in 2006, 2007, and 2010.

Figure 13. Catch per unit effort (# fish per set-night) of adult lake trout in bottom-set gillnets in three areas of eastern Lake Ontario. Deep sets off Rocky Point were not fished in 2006, 2007, and 2010. (OMNR 2013 Annual Report, pg 118)

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Canada Lake Ontario, Gillnet, Bottom

Low Concern

Total degree of fishery contribution is unknown, but lake trout is not a target fishery. Some Lake Trout are caught in the summer as bycatch in the Canadian Whitefish targeted fishery. Summer catches are unable to target whitefish as selectively because they are no longer spawning. Thus, Lake Trout get caught with Whitefish, but not in large numbers. For example, in all commercial fisheries (gillnet and trap-net), the Lake Trout gillnet by-catch was only 4,073 lbs in 2012 or 2.4% of total catch. 99.9% of this catch was by gillnet, and 71.7% was released (alive). Catches in this data set are recorded as either 'Landed', 'Discarded', or 'Released (alive)'. (Jim Hoyle 2014) This is the largest bycatch of Trout since 2004. Furthermore, no Lake Trout have been landed or discarded from trapnets since 2004, and numbers released have not exceeded 39 lbs.
-"The Province of Ontario pur-posefully limits commercial fishing for lake whitefish to the fall spawning period in the Kingston Basin and eastern Ontario waters of Lake Ontario because their bycatch is consid-erably greater during other seasons of the year." ([Ebner et al 2008), pg 112).

Management is in place to protect and increase wild Lake Trout populations. Rehabilitation efforts such

as sea lamprey control and stocking of hatchery fish have been ongoing since the 1970s, have included joint US-Canadian efforts since 1983, and have increased significantly since 1997 ([OMNR 2013), pg 118). Sea Lamprey are cited as a major contributor to Lake Trout mortality ([OMNR 2013), pg 121). Also, poor survival of juvenile Lake Trout is a significant factor in Lake Trout population declines in the 1990s and early 2000s. Commercial fishing is not cited as a major contributing factor. Furthermore, since 2005, Lake Trout adult populations have been gradually increasing (See Trout Abundance/status figures in Detailed Rational) ([OMNR 2013), pg 118).

Fishing Mortality for Lake Trout gillnet fishery is given a 'Low Concern' because it is probably that fishing mortality is at or below a sustainable level that will allow population to maintain current level or rebuild if depleted, but there is some uncertainty.

Rationale:

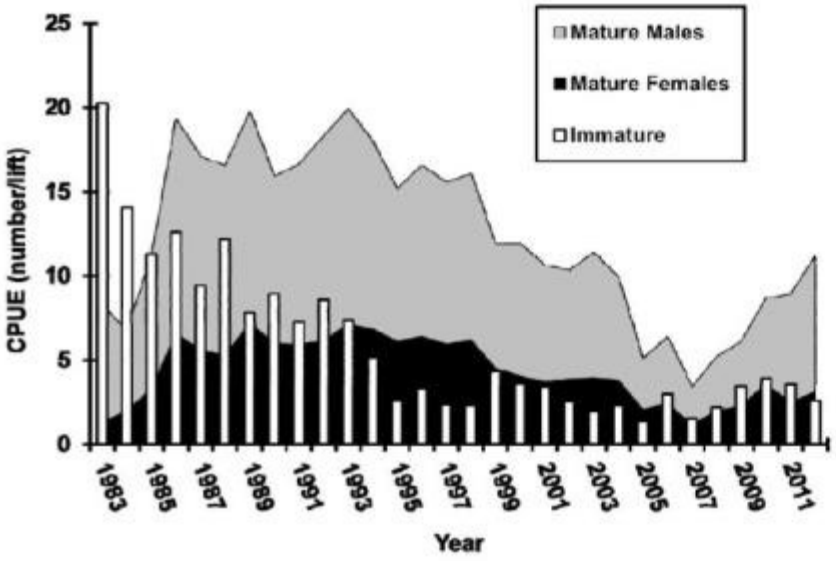

Figure 3. Abundance of mature and immature (sexes combined) lake trout calculated from catches made with gill nets set in U.S. waters of Lake Ontario, during September 1983-2012. CPUE (number/lift) was calculated based on four strata representing net position in relation to depth of the sets.

Figure 14. Abundance of mature and immature (sexes combined) lake trout calculated from catches made with gill nets in US waters fo Lake Ontario 1983-2012

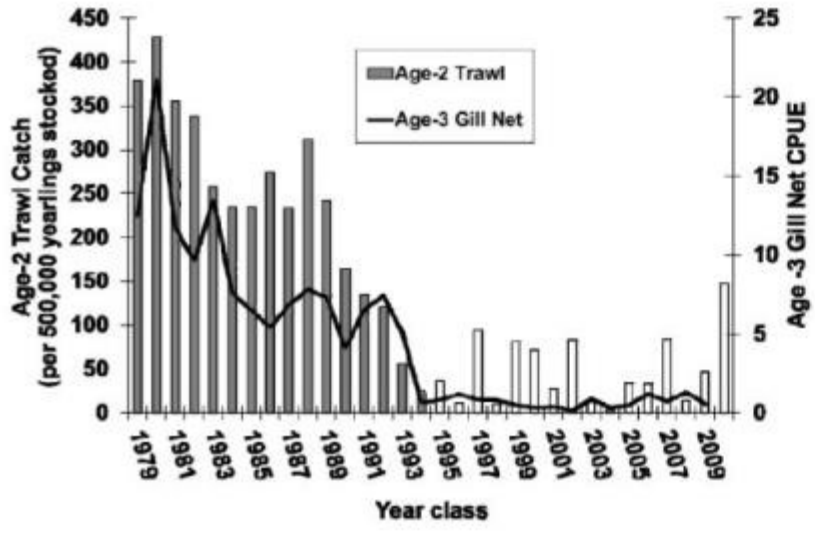

Figure 2. Survival indices for age-2 lake trout stocked in U.S. waters of Lake Ontario in 1980 – 2011. Survival was indexed at age 2 as the total catch from bottom trawls (BTR) fished in July-August per 500,000 fish stocked (Note: White bars represent data collected with a new trawl configuration which employed roller gear on the footrope and did not fish as hard on the lake bottom as the old trawl).

Figure 15. Graph of survival indices for age 2 and age 3 lake trout in US waters of Lake Ontatio caught in gill net bottom trawls.

Factor 2.4 - Discard Rate

Canada Lake Ontario, Gillnet, Bottom

< 20%

Gillnets do not use bait. Reported discards from Canadian gillnets in Lake Ontario are low and do not appear to have any notable effects on any one species. The Canadian gillnet fishery in Lake Ontario primarily targets Lake Whitefish and utilize strategies to minimize unwanted catch. Indeed, bottom gillnets in Canadian waters of Lake Ontario are fairly selective and are largely a seasonal effort for Lake Whitefish. Incidental catch of Lake Trout in gillnets occurs in summer months, but the majority of gillnetting occurs for Lake Whitefish in Fall and Winter months when the fishery is able to more selectively target Lake Whitefish via knowledge of spawning behaviors and thus mitigate incidental catch ([OMNR 2008)(OMNR 2009)(OMNR 2010)(OMNR 2011)(OMNR 2012) tables 4.2.1).Gillnet catches in this fishery have shown discard rates of 3.89%, 4.31%, and 7.76% in 2010, 2011, and 2012 respectively (Jim Hoyle 2014)

Rationale:
By analyzing raw catch data provided by Jim Hoyle of the OMNR the below statistics were calculated on discards over landings for gillnet fisheries in Canadian waters of Lake Ontario targeting Lake Whitefish, Yellow Perch, and Walleye in 2012, 2011, and 2010. Data for earlier years can be seen on the

spreadsheet connected to the reference: (Jim Hoyle 2014)

2012:
Landings: 153151 lbs
Discards: 9448 lbs
Releases: 4860 lbs (assuming 50% mortality: 2430lbs)
Discards/landings: 11878/153151 = 7.76%

2011:
Landings: 172743
Discards: 5114 lbs
Releases: 4676 lbs (assuming 50% mortality: 2338 lbs)
Discards/landings:7452/172743 = 4.31%

2010:
Landings: 152755 lbs
Discards: 3354 lbs
Releases: 5175 lbs (assuming 50% mortality: 2587.5 lbs)
Discards/landings: 5941.5/152755 = 3.89%