Monterey Bay Aquarium Seafood Watch

Environmental sustainability assessment of wild-caught freshwater fish from North America (Lake Ontario) caught using set gillnets and stationary uncovered pound nets

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Species:	Lake whitefish (*Coregonus clupeaformis*), Walleye (*Sander vitreus*), Yellow perch (*Perca flavescens*)
Location:	North America: Inland Waters (Lake Ontario)
Gear:	Set gillnets, Stationary uncovered pound nets
Type:	Wild Caught
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Assessed using Seafood Watch Fisheries Standard v4

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental 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. 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.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.

- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.

- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

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.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered, or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function, or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard.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, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

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

Avoid/Red: Take a pass on these for now; they’re caught or farmed 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

This report provides ratings for lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), and yellow perch (*Perca flavescens*) caught by set gillnet and trap net (categorized as stationary uncovered pound nets) in Lake Ontario by United States and Canadian fisheries. The assessment is divided by management region (Ontario and New York), fishery gear, and species.

The impact of the fisheries (Criterion 1) for lake whitefish is rated Red overall, because abundance is considered a high concern: despite a data-limited assessment indicating that the stock abundance is stable, there are no biologically based reference points and the species is considered highly vulnerable. The impact of the fisheries for walleye is rated Yellow overall. There is moderate concern regarding abundance because data-limited stock assessment reflects that the stock is healthy, but young-of-the-year recruitment has been fluctuating around the reference point in recent years. The impact of the fisheries for yellow perch is rated Red overall, with high concern regarding abundance due to a lack of biologically based reference points for abundance for a species with high vulnerability. For lake whitefish, walleye, and yellow perch from all assessed fisheries, fishing mortality is considered a moderate concern because of uncertainty regarding the appropriateness of the quota, which is not based on biological reference points.

Discard rates are considered to be low in all the assessed fisheries. Bycatch in the New York yellow perch gillnet fishery is considered a high concern because of interactions with lake trout undergoing overfishing (cumulative fishing mortality). In the Canadian fisheries, bycatch is considered a high concern because of interactions with lake trout undergoing overfishing (cumulative fishing mortality) in the gillnet fisheries and with endangered, threatened, and protected (ETP) turtles in the trap net fisheries.

Management is considered moderately effective for all fisheries. Measures are in place to protect species sustainability, including the implementation of license restrictions and commercial quotas developed with a risk-based approach; however, historic fishing and environmental disturbances have resulted in populations at a small proportion of virgin biomass, without a rebuilding plan in place. Management has robust enforcement systems in place and is highly effective in stakeholder inclusion.

Impacts on the habitat and ecosystem are considered a moderate concern for all fisheries. The gillnet and impoundment gear types have a moderate impact on habitat, according to the Seafood Watch Fisheries Standard. Because of the species' ecological roles, detrimental food web impacts are possible; however, spatial and temporal management measures are in place that are appropriate to the scale of the fisheries and the ecology of the stocks and are likely to be effective, with little scientific controversy.

Lake whitefish harvested in Lake Ontario by Canadian (Ontario) gillnet fisheries is rated Red. Yellow perch harvested by Canadian (Ontario) gillnet and trap net fisheries and by United States (New York) gillnet fisheries are rated Red. Walleye harvested in Lake Ontario by Canadian (Ontario) gillnet and trap net fisheries are rated Yellow.

Final Seafood Recommendations

SPECIES | FISHERY	C 1 TARGET SPECIES	C 2 OTHER SPECIES	C 3 MANAGEMENT	C 4 HABITAT	OVERALL	VOLUME (MT) YEAR
Lake whitefish | Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	1.732	1.000	3.000	3.000	**Avoid (1.987)**	Unknown
Walleye | Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	2.644	1.000	3.000	3.000	**Good Alternative (2.209)**	Unknown
Walleye | Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets	2.644	1.732	3.000	3.000	**Good Alternative (2.534)**	Unknown
Yellow perch | Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh	1.732	1.000	3.000	3.000	**Avoid (1.987)**	Unknown
Yellow perch | Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	1.732	3.000	3.000	**Avoid (2.279)**	Unknown
Yellow perch | Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets	1.732	1.000	3.000	3.000	**Avoid (1.987)**	Unknown

null

Summary

Lake whitefish (*Coregonus clupeaformis*) harvested in Lake Ontario by Canadian (Ontario) gillnet fisheries is rated Red.

Walleye (*Sander vitreus*) harvested in Lake Ontario by Canadian (Ontario) trap net (stationary uncovered pound net) and gillnet fisheries are rated Yellow.

Yellow perch (*Perca flavescens*) harvested in Lake Ontario by United States (New York) gillnet fisheries and Canadian (Ontario) gillnet and trap net (stationary uncovered pound net) fisheries are rated Red.

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).

Introduction

Scope of the analysis and ensuing recommendation

This report provides recommendations for lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), and yellow perch (*Perca flavescens*) caught by set gillnets and impoundment gear (trap and/or hoop nets, categorized as stationary uncovered pound nets consistent with FAO definitions) in Lake Ontario by United States and Canadian fisheries. The assessment is divided by management region (Ontario and New York), fishery gear, and species.

Species Overview

Lake whitefish is a temperate (8–14 °C) freshwater and brackish salmonid distributed in North America throughout Canada, and in the United States in Alaska, New England, the Great Lakes, and central Minnesota (depths 8–128 m) (Froese & Pauly 2023a). Lake whitefish can reach 100 cm total length (TL) (commonly 54 cm TL) and 19 kg total weight, and the maximum reported age is 50 years (Froese & Pauly 2023a). It is an annual broadcast spawner in the southern portion of its range but reproduces every 2 to 3 years in the northern sub-Arctic and Arctic regions (Froese & Pauly 2023a). Adults feed on aquatic insect larvae, mollusks, amphipods, fishes, and fish eggs (Froese & Pauly 2023a).

Walleye is a subtropical (1–29 °C) freshwater and brackish perciform fish distributed in North America in the Great Lakes, the Arctic, and the Mississippi River basins, from Quebec and the Northwest Territories in Canada to Alabama and Arkansas in the United States (depths 0–27 m; widely introduced to most U.S. regions) (Froese & Pauly 2023b). Walleye can reach 107 cm TL (commonly 54 cm TL) and 11 kg total weight, and the maximum reported age is 29 years (Froese & Pauly 2023b). It is a broadcast spawner that reaches reproductive maturity at 36–44 cm (Froese & Pauly 2023b). Adults feed primarily on insects and fishes but will consume crayfish, snails, frogs, mudpuppies, and small mammals (Froese & Pauly 2023b).

Yellow perch is a subtropical (0–30 °C) freshwater and brackish perciform fish in North America in the Great Lakes, Atlantic, Arctic, and the Mississippi River basins, from Nova Scotia and the Northwest Territories in Canada to Ohio, Illinois, Nebraska, and Georgia in the United States (depths 0–56 m, typically <9 m) (Froese & Pauly 2023c). Yellow perch can reach 50 cm TL (commonly 19 cm TL) and 1.9 kg total weight, and the maximum reported age is 11 years (Froese & Pauly 2023c). It is an annual nonobligatory plant spawner that reaches reproductive maturity at 19.2 cm TL (Froese & Pauly 2023c). Adults feed on insects, fishes, and fish eggs (Froese & Pauly 2023c).

Lake Ontario is the one of the largest lakes in the world but the smallest of the Great Lakes, with 52% within the Province of Ontario, Canada and 48% within the State of New York, United States (Figure 1) (Stewart et al. 2017). The Lake Ontario drainage basin (70,655 km^2, surface water area 19,477 km^2, average depth 86 m, maximum depth 237 m) was historically the most productive of the deepwater Laurentian Great Lakes for fish (particularly Atlantic salmon, whitefish, lake trout, and burbot) (Morrison 2019). Aquatic community shifts occurred after European colonization from land-use change, dam implementation, overfishing, cultural eutrophication, pollution, and invasive species introduction (Mills et al. 2009). By the 1970s, the abundance of Atlantic salmon, lake trout, burbot, deepwater sculpin, ciscoes, and lake sturgeon had decreased significantly, while invasive alewife, white perch, and rainbow smelt had increased (Stewart et al. 2017). The current commercial fishery in Lake Ontario is concentrated nearshore and in embayments, with a focus on yellow perch, lake whitefish, walleye, brown bullhead, sunfish, and northern pike.

Figure 1: Map of Lake Ontario (Stewart et al. 2017).

Production Statistics

Canada is the exclusive producer of commercially caught walleye, while yellow perch and lake whitefish are harvested commercially in Canada and the United States (Figure 2). The Canadian recreational fishery is the dominant contributor to walleye harvest (78% of the mean annual harvest by weight, 2009–18 (Ontario Ministry of Natural Resources and Forestry 2020)). Compared to the commercial fishery for yellow perch, the recreational fishery in Canada contributes a minor proportion of the harvest (8% in 2017 (Ontario Ministry of Natural Resources and Forestry 2019)). In 2022, the majority of lake whitefish harvest in Canada was from the gillnet fishery (90% by weight), while a small proportion was harvested from the impoundment gear fisheries (10%) (Ontario Ministry of Natural Resources and Forestry 2023).

The total landed value of all species in Lake Ontario in 2022 was $574,204 (315,065 lb) (Ontario Ministry of Natural Resources and Forestry 2023). The 2022 commercial catch of yellow perch in New York, U.S. waters was 32,803 lb ($117,396) (NYSDEC 2022). The lake whitefish commercial harvest in New York is quite low (0–210 lbs annually from 2000 to 2020), so it was not included in the scope of this report (NYSDEC 2022).

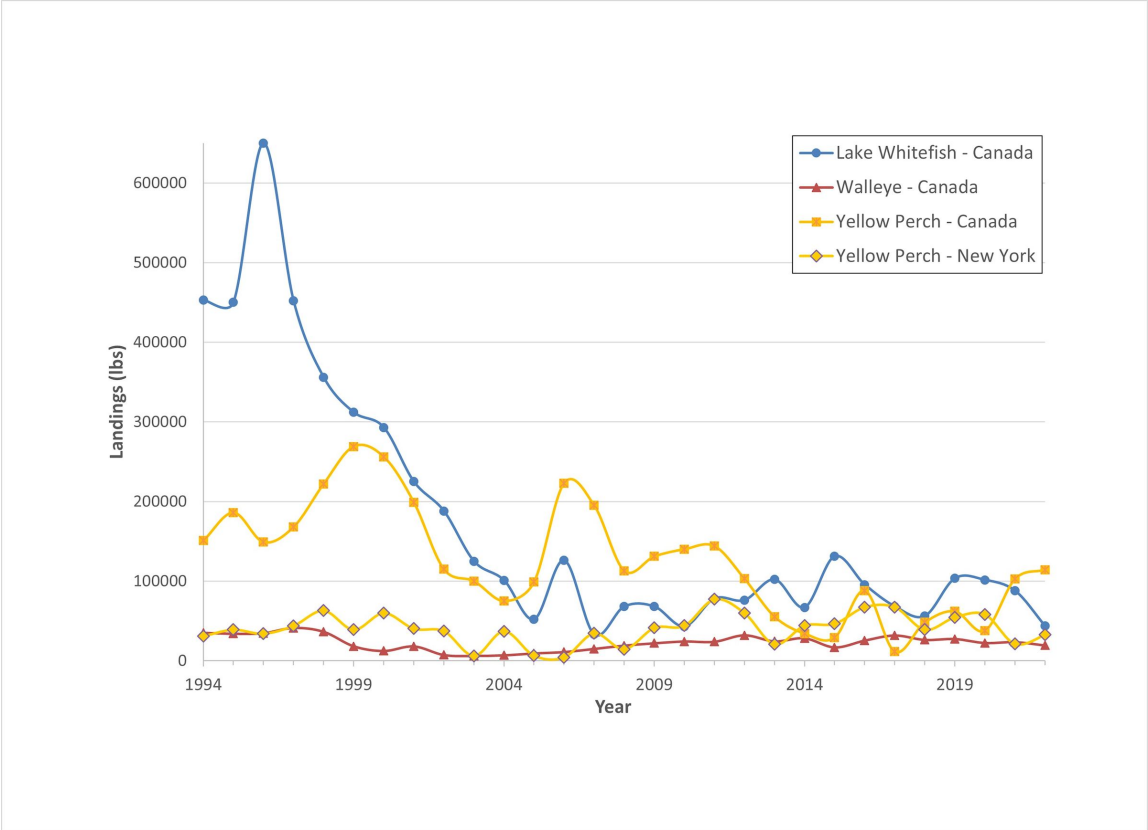

Figure 2: Landings of lake whitefish, walleye, and yellow perch in Lake Ontario from 1994 to 2022. Data sources: (GLFC 2022){NYSDEC 2022)(Ontario Ministry of Natural Resources and Forestry 2022)(Ontario Ministry of Natural Resources and Forestry 2023).

Importance to the US/North American market.

None of the species evaluated in this report is considered important from the perspective of global trade (Jescovitch et al. 2022). The majority of fish harvested in the Great Lakes region is sold to local markets (within 60 mi; i.e., of Canada and the United States) {FAO 2022}, and is insignificant compared to global landings of other fish in other fisheries. Products are sold either as fish (46.5%) or processed products (68%), which may include value-added items such as fillets, smoking, and fish dips {FAO 2022}. Lower proportions of fish harvested in the Great Lakes region are sold regionally (37.9% and 25.4% for fish and processed products, respectively) and nationally (12.7% and 5.1% for fish and processed products, respectively) {FAO 2022}. Only small proportions are sold in international markets (2.9% and 1.5% for fish and processed products, respectively) {FAO 2022}.

Common and market names.

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

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, ring perch, striped perch, jack perch, and redfin.

Primary product forms

Lake whitefish: Fresh and frozen whole (dressed), fillets, steaks, as value-added smoked (head-on and fillets), and roe (Seafood Handbook 2021).

Walleye: Fresh whole (round) headless and dressed, fillets (skinless/skin-on), and frozen individual quick freezing (IQF) fillets and IQF fingers (Seafood Handbook 2021).

Yellow perch: Fresh and frozen skin-on fillets and whole, and as value-added breaded/battered fillets (Seafood Handbook 2021).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. 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.

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

Criterion 1 Summary

LAKE WHITEFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

WALLEYE			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

YELLOW PERCH			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance
Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality
Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

Lake whitefish (Coregonus clupeaformis)

Factor 1.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

High Concern

There are two lake whitefish spawning stocks in Canadian waters of Lake Ontario: the Bay of Quinte "Bay Stock" and the Lake Ontario proper (south shore of Prince Edward County) "Lake Stock" (Ontario Ministry of Natural Resources and Forestry 2020). There is no quantitative stock assessment for lake whitefish stocks; however, management uses the following status/trend indicator to assess the lake whitefish stock: increasing populations of lake whitefish across a range of age groups sufficient to maintain self-sustaining populations and increasing spawning populations in the Bay of Quinte and eastern Lake Ontario (Stewart et al. 2017).

Data to inform the indicator and to examine trends in abundance, age distributions, and length-at-age relationships are based on fishery-dependent (commercial catch sampling) and -independent data (Ontario Ministry of Natural Resources and Forestry 2020). Fishery-independent data are collected through annual gillnet sampling in eastern Lake Ontario and a bottom trawl survey for young-of-the-year in the Bay of Quinte (Ontario Ministry of Natural Resources and Forestry 2020).

The abundance of lake whitefish in Lake Ontario declined severely in the 1990s (attributed to changes to the benthic community and the population collapse of its prey, *Diporeia* spp.), and has been low but considered stable over the past decade (Figure 3) (Ontario Ministry of Natural Resources and Forestry 2020). Young-of-the-year (YOY) catches have varied over the time series without trend and have been low in several years of the last decade for both stocks (Figure 4) (Ontario Ministry of Natural Resources and Forestry 2020). The outlook for increasing abundance of lake whitefish in the near term is considered poor, because *Diporeia* prey species populations have not recovered (O'Gorman 2017). The stocks maintain a range of age distributions, with age classes 5–16 years most commonly encountered (Figure 4) (Ontario Ministry of Natural Resources and Forestry 2020). Since 1990, condition (relative weight) has been assessed using data from summer gillnet surveys in eastern Lake Ontario and from fall commercial catch sampling from both the Bay and Lake Stocks (Figure 5) (Ontario Ministry of Natural Resources and Forestry 2020). Condition was high in the early 1990s, declined in the mid-1990s, and has increased to intermediate levels for summer sampled fish but has remained low for fall sampled fish (Ontario Ministry of Natural Resources and Forestry 2020). Because a data-limited stock assessment indicates population stability but without reference points for abundance, and the stocks are considered highly vulnerable based on a productivity-susceptibility analysis (PSA = 3.6; see Justification), abundance is rated a high concern.

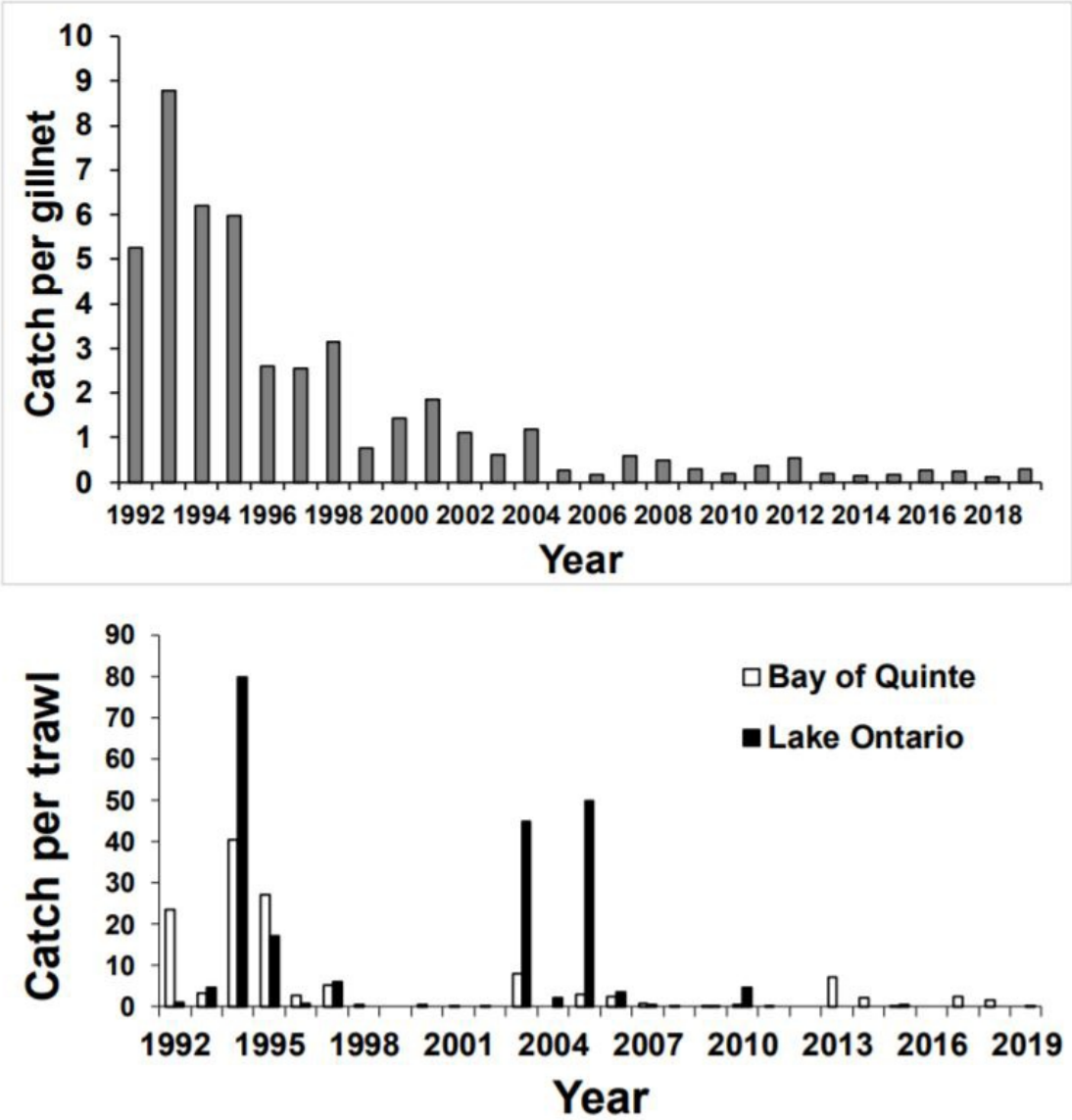

Figure 3: Lake whitefish abundance in eastern Lake Ontario assessment gillnets (1992–2019, sub-adult and adult; upper panel) and bottom trawls (1992–2019, young-of-the-year; lower panel) (Ontario Ministry of Natural Resources and Forestry 2020). Young-of-the-year harvest has been low in the past decade (lower panel).

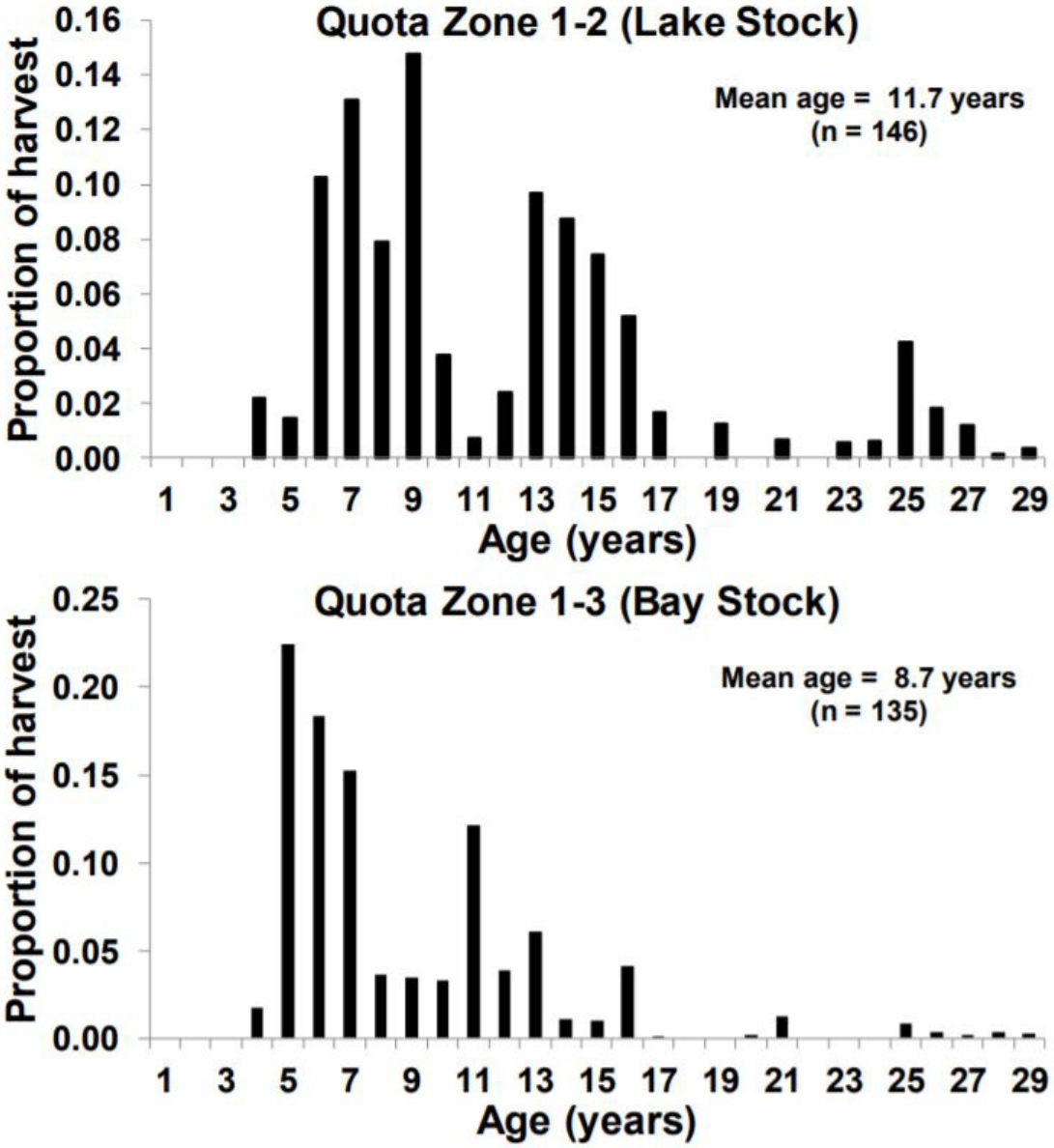

Figure 4: Lake whitefish age distributions (by number) in the 2019 quota zones 1–2 (upper panel) and 1–3 (lower panel) fall commercial fisheries (Ontario Ministry of Natural Resources and Forestry 2020).

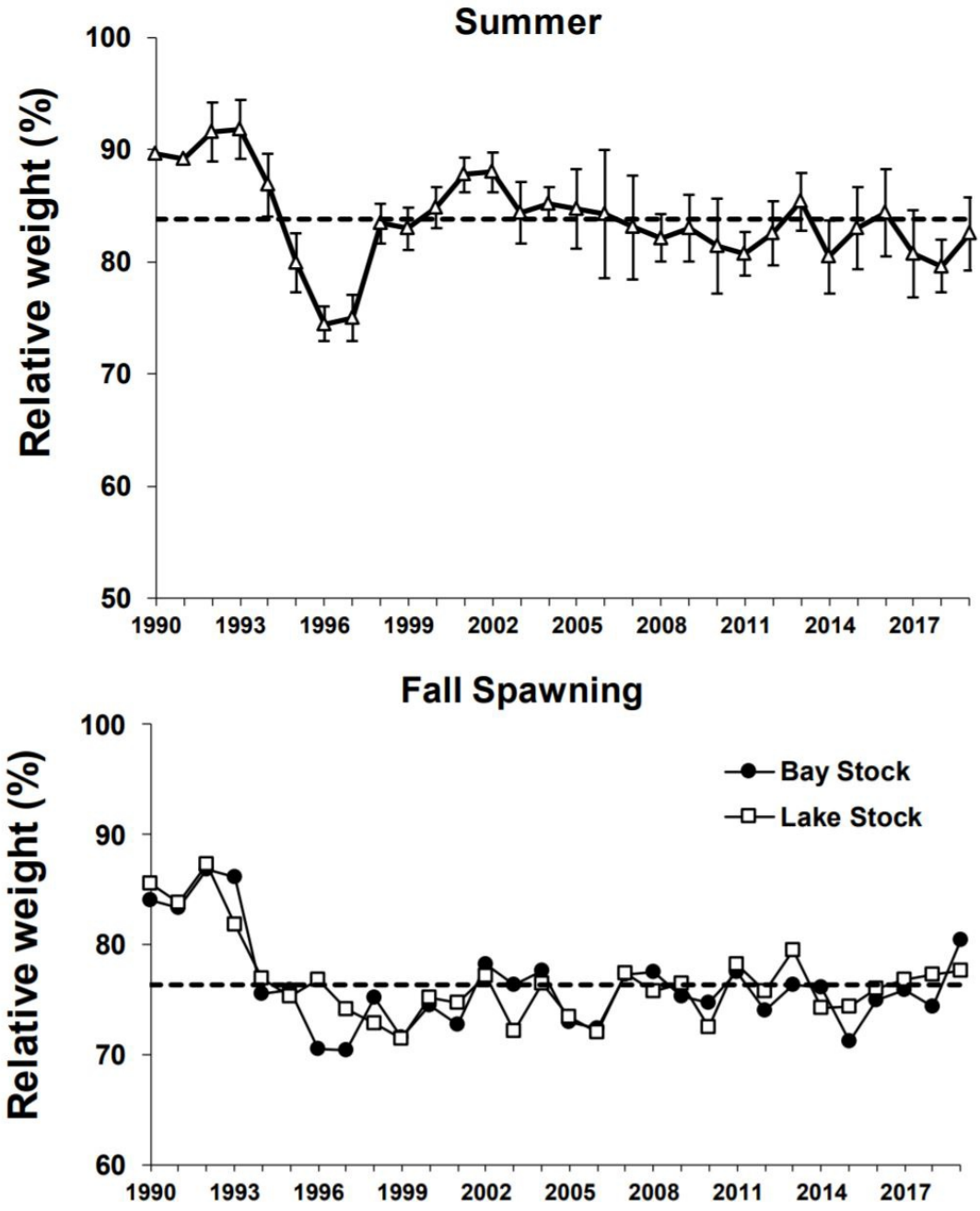

Figure 5: Condition (relative weight) of lake whitefish sampled during summer assessment gillnet surveys in eastern Lake Ontario (upper panel error bars ±2SE) and fall commercial catch sampling (lower panel) in the Bay of Quinte ("Bay Stock") and the south shore Prince Edward County ("Lake Stock"), 1990–2019 (Ontario Ministry of Natural Resources and Forestry 2020).

Productivity-Susceptibility Analysis: This species has a high vulnerability. PSA = 3.6 = $\sqrt{(2^2 + 3^2)}$.

Productivity	Relevant Information	Score
Average age at maturity	3–6 years	2
Von Bertalanffy Growth Coefficient (K)	0.08	3
Fecundity	6,000–120,000 eggs per year	2
Average maximum size	100 cm	2
Average size at maturity	41–54 cm	2
Reproductive strategy	Broadcast spawner	1

P = (2 + 3 + 2 + 2 + 2 + 1) ÷ 6 = 2.0. References for productivity table: (Wang et al. 2008)(Chu & Koops 2007)(Froese & Pauly 2021).

Susceptibility	Relevant Information	Score
Areal overlap	Default score	3
Vertical overlap	Default score	3
Seasonal availability	Year-round fishing	3
Selectivity of fishery	Targeted species; most of the harvest occurs during spawning time, form spawning aggregations	3
Post-capture mortality	Retained species	3

S = (3 + 3 + 3 + 3 + 3 + 3) ÷ 5 = 3.0. Reference for susceptibility table: (Ontario Ministry of Natural Resources and Forestry 2020).

Factor 1.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

Moderate Concern

Annual harvest quotas are in place for the commercial lake whitefish fishery in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2022). Quotas are transferable by commercial fishery quota zone, with 65% (87,918 lb) of the base quota harvested overall in 2021 (Ontario Ministry of Natural Resources and Forestry 2022). The commercial quota and harvest increased from implementation in the mid-1980s, then declined from the mid-1990s to mid-2000s, when it stabilized (Figure 6) (Ontario Ministry of Natural Resources and Forestry 2022). Commercial catches are greatest during the spawning season, November/December (Figure 7) (Ontario Ministry of Natural Resources and Forestry 2022). In 2022, 32% (43,669 lb) of the lake whitefish base quota and 38% of the issued quota were harvested (Ontario Ministry of Natural Resources and Forestry 2023). Management takes a risk-based approach toward development of commercial quotas, with a goal of maintaining stability. The approach considers five factors: the trend in fish population status based on an independent assessment program, the commercial harvest, the commercial fishing effort, harvest and/or catch per unit effort trends from other fisheries if available (recreational and subsistence), and the unique characteristics of the small-scale Lake Ontario fishery. Even though the commercial harvest of lake whitefish has been within the allotted quota since 1984 (see Figure 6) (Ontario Ministry of Natural Resources and Forestry 2020), it is unclear if the quota is appropriate, so fishing mortality is considered a moderate concern.

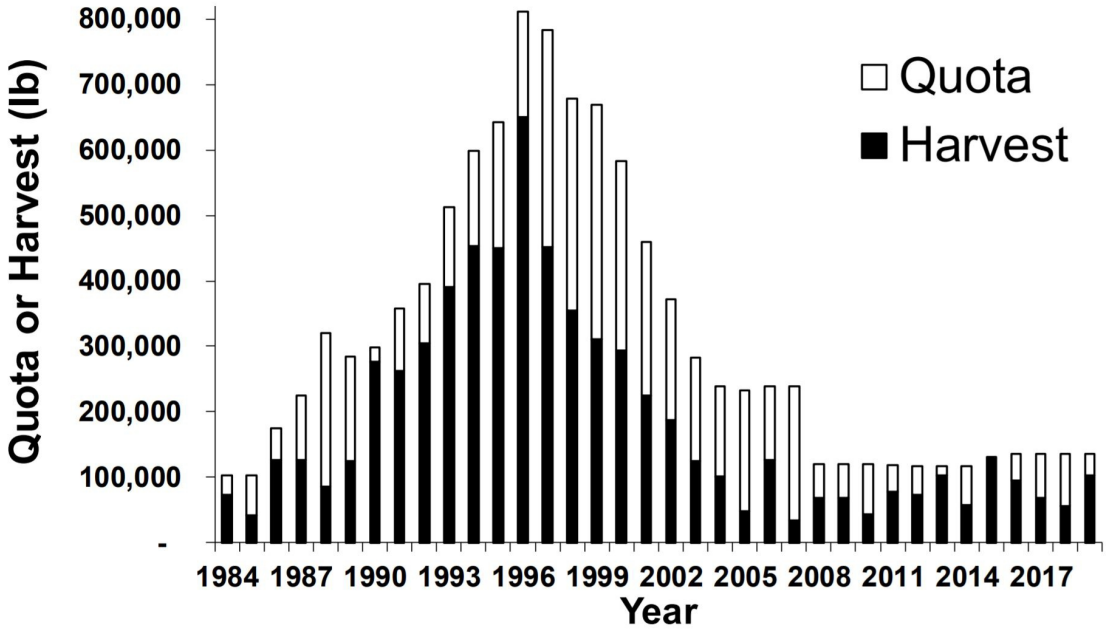

Figure 6: Lake whitefish commercial quota and harvest, 1984–2019 (Ontario Ministry of Natural Resources and Forestry 2020).

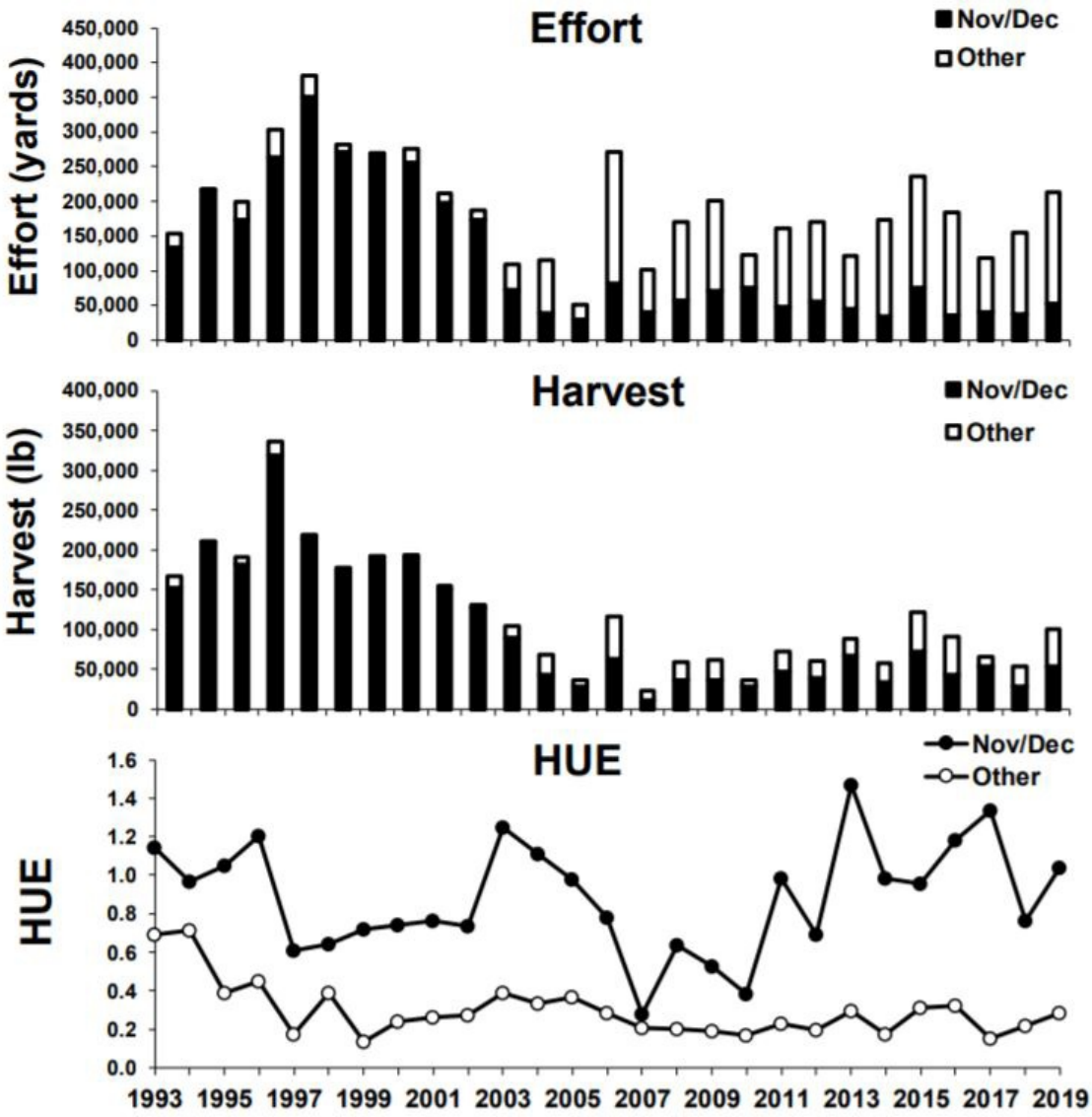

Figure 7: Commercial lake whitefish gillnet fishing effort (top panel), harvest (middle panel), and harvest-per-unit-effort (HUE; bottom panel) in quota zone 1–2, 1993–2019. November/December statistics are reported separately from other times of the year (Ontario Ministry of Natural Resources and Forestry 2020).

Walleye (Sander vitreus)

Factor 1.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Walleye is managed as a single stock in Lake Ontario, and the stock status is considered good by managers (Ontario Ministry of Natural Resources and Forestry 2020). There is no quantitative stock assessment for walleye; however, stock health is assessed by examining trends in abundance, age distributions, length-at-age relationships, and condition (relative weight), based on fishery-dependent and -independent data. Management uses the status/trend indicator of maintaining or increasing fisheries, populations, and recruitment to assess the walleye stock (Stewart et al. 2017).

Fishery-independent surveys for walleye are designed with its migratory life history in mind (Ontario Ministry of Natural Resources and Forestry 2020). Walleye spawns in April in the Bay of Quinte, and mature fish migrate after the spawning season toward eastern Lake Ontario for the summer {Ontario Ministry of Natural Resources and Forestry 2020. Immature walleye remain in the Bay of Quinte year-round {Ontario Ministry of Natural Resources and Forestry 2020. Mature fish return to the Bay of Quinte in the fall to over-winter {Ontario Ministry of Natural Resources and Forestry 2020. To gain information about both juvenile and adult abundance, fishery-independent data are collected through annual summer gillnet sampling that targets juvenile walleye in the Bay of Quinte and adults in eastern Lake Ontario {Ontario Ministry of Natural Resources and Forestry 2020. Bottom trawls are used to assess young-of-the-year (YOY) abundance in the Bay of Quinte {Ontario Ministry of Natural Resources and Forestry 2020.

Abundance is assessed through comparison to the Bay of Quinte Fishery Management Plan target reference points. Targets were established by using catch data from index gillnetting collected during 2002–06, when the walleye population was considered stable (O'Gorman 2017)(Ontario Ministry of Natural Resources and Forestry 2020). The reference point for the number of YOY from the bottom trawling survey is set as at least 5.9 ± 1.0 walleye per standardized bottom trawl for a 5-year period, with no more than two consecutive years of zero catches (O'Gorman 2017)(Ontario Ministry of Natural Resources and Forestry 2020). For juvenile walleye (ages 1–4 years), at least 3.8 ± 0.6 walleye per trapnet should be taken during the fall Nearshore Community Index Surveys in any 5-year period, and at least 33 ± 7 walleye per standardized gillnet (O'Gorman 2017)(Ontario Ministry of Natural Resources and Forestry 2020). For adult walleye (>4 years), at least 11.5 ± 1.5 walleye per standardized gillnet should be captured in the Kingston Basin in any 5-year period (O'Gorman 2017) (Ontario Ministry of Natural Resources and Forestry 2020).

Juvenile abundance has been fluctuating around the Fishery Management Plan (FMP) target, has been stable since 2001 (with an unusually high catch in 2013) (Figure 8), and was just below the FMP target in 2019 (Ontario Ministry of Natural Resources and Forestry 2020). Adult abundance declined sharply in the 1990s (after the establishment of invasive dreissenid mussels), reached a low but stable population size in 2001, and has remained above the FMP target since 2005 (except for an unusually low catch in 2013; see Figure 8) (Ontario Ministry of Natural Resources and Forestry 2020). In the 2018 gillnet survey, ages 3–5 fish were most abundant in the Bay of Quinte while ages 11–12 were the most abundant in Lake Ontario (Figure 9) (Ontario Ministry of Natural Resources and Forestry 2020). Length-at-age has been stable for juvenile age 2 and 3 fish (since 2000) and mature 10-year-old fish with female condition, but decreased in 2013 and 2019 (Figure 10) (Ontario Ministry of Natural Resources and Forestry 2020). Condition (relative weight) has remained stable for juvenile fish in the Bay of Quinte and has been increasing since 2015 (Figure 11) (Ontario Ministry of Natural Resources and Forestry 2020). For adult fish in Lake Ontario, condition showed an increasing trend (1992–2013), decreased sharply in 2014, and has since returned to average levels for the time series (Ontario Ministry of Natural Resources and Forestry 2020). The YOY walleye catch from the bottom trawl survey has fluctuated throughout the time series (Figure 12) (Ontario Ministry of Natural Resources and Forestry 2020). The year class was poor for 2019; however, managers assert that strong recent year classes in 2014, 2015, and 2018 will contribute to continued population stability (Ontario Ministry of Natural Resources and Forestry 2020). There is no expectation that the walleye population will return to the high levels of the 1980s and early 1990s (O'Gorman 2017).

Because there is a data-limited stock assessment reflecting that the stock is healthy, but YOY recruitment is below the reference point for 3 of the past 5 years, abundance is considered a moderate concern.

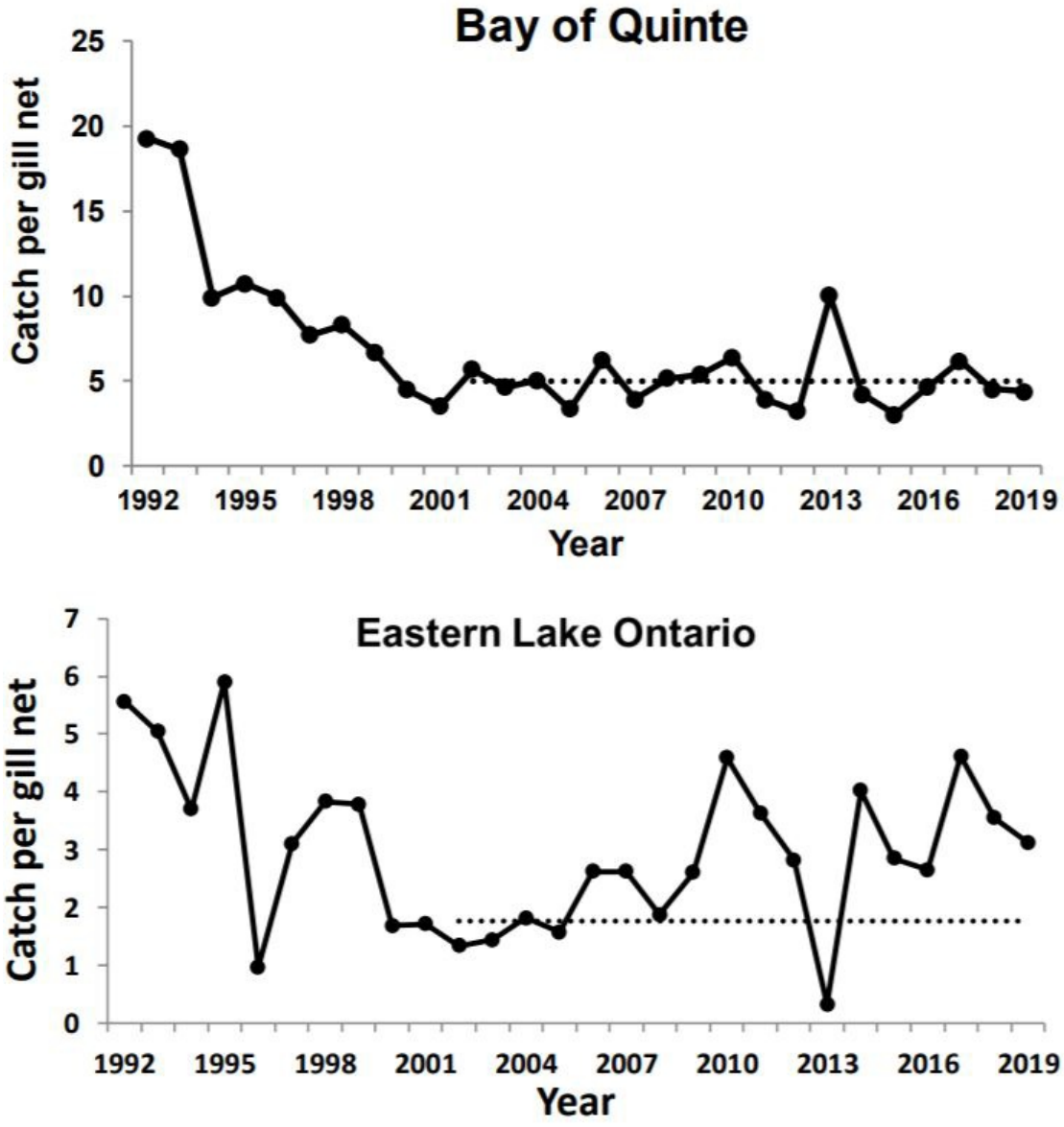

Figure 8: Walleye abundance in summer gillnets in the Bay of Quinte (primarily immature fish) (upper panel) and eastern Lake Ontario (primarily mature fish) (lower panel), 1992–2019 (Ontario Ministry of Natural Resources and Forestry 2020). The dotted line represents the Bay of Quinte FMP (Fisheries Management Plan) target for these two components of the walleye population.

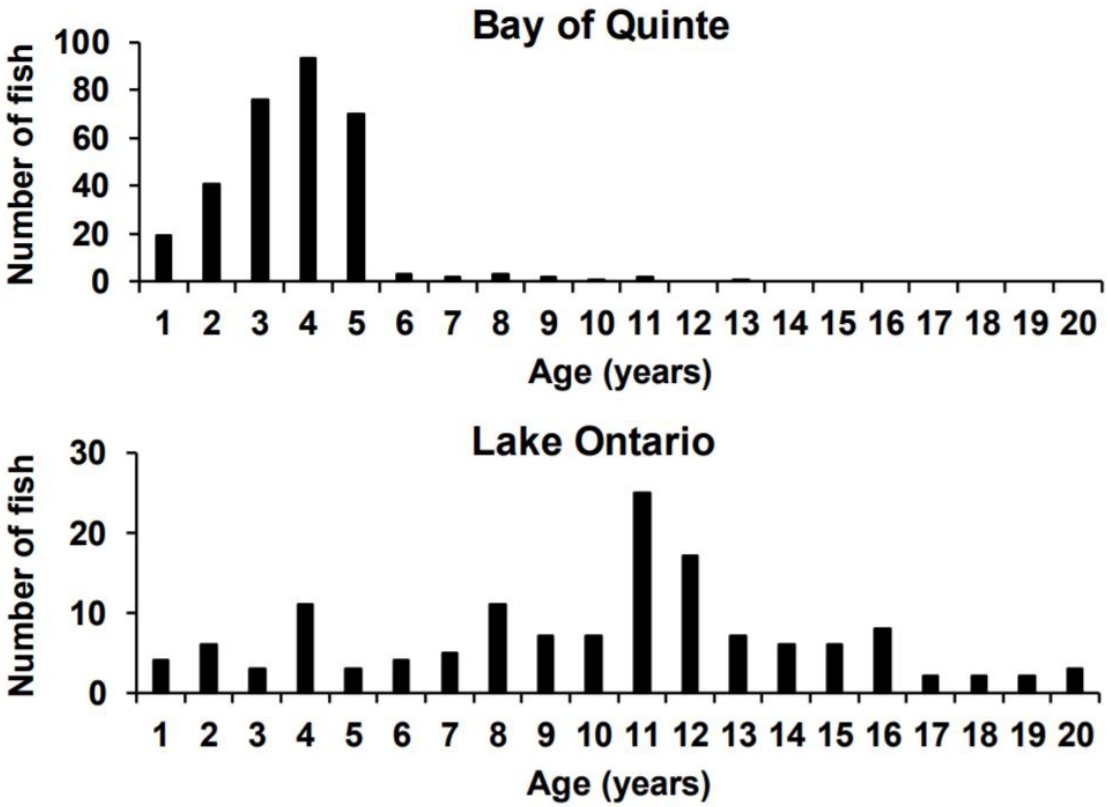

Figure 9: Walleye age distribution in 2018 summer gillnets in the Bay of Quinte (upper panel) and Lake Ontario (lower panel) (Ontario Ministry of Natural Resources and Forestry 2020).

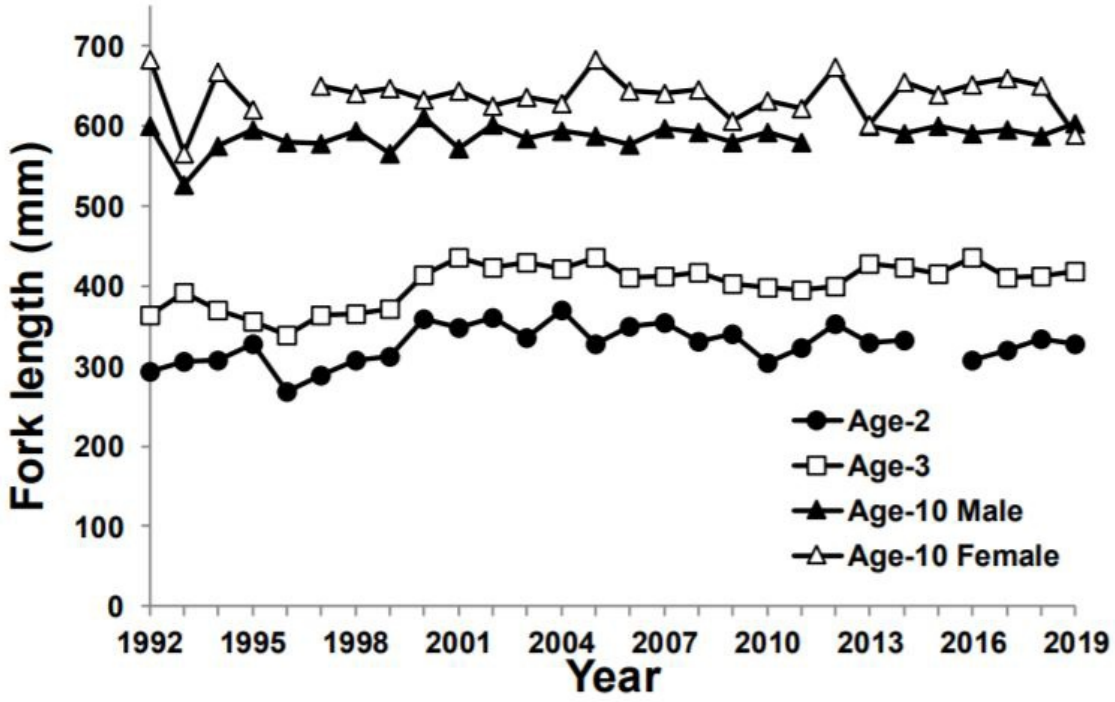

Figure 10: Trends in walleye fork length-at-age for age-2, age-3, age-10 males, and age-10 females caught in summer assessment gillnets, 1992–2019 (Ontario Ministry of Natural Resources and Forestry 2020).

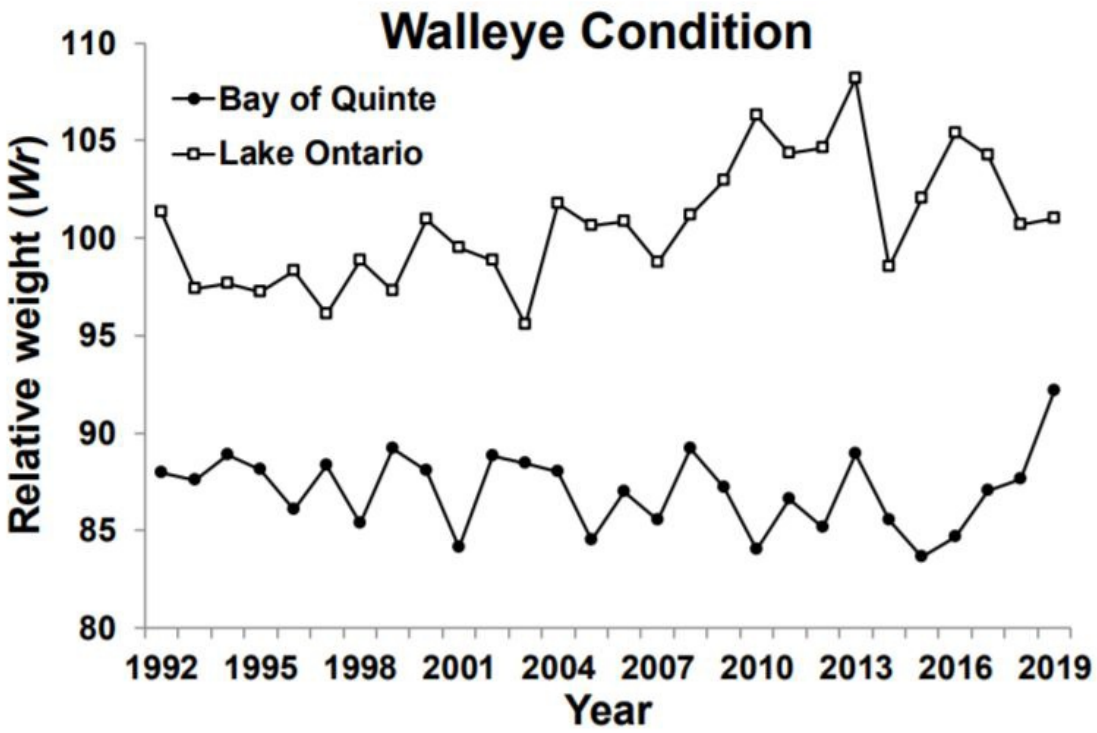

Figure 11: Walleye condition (relative weight) caught in summer assessment gillnets in the Bay of Quinte (immature fish <500 mm fork length) and Lake Ontario (mature fish >500 mm fork length), 1992–2019 (Ontario Ministry of Natural Resources and Forestry 2020).

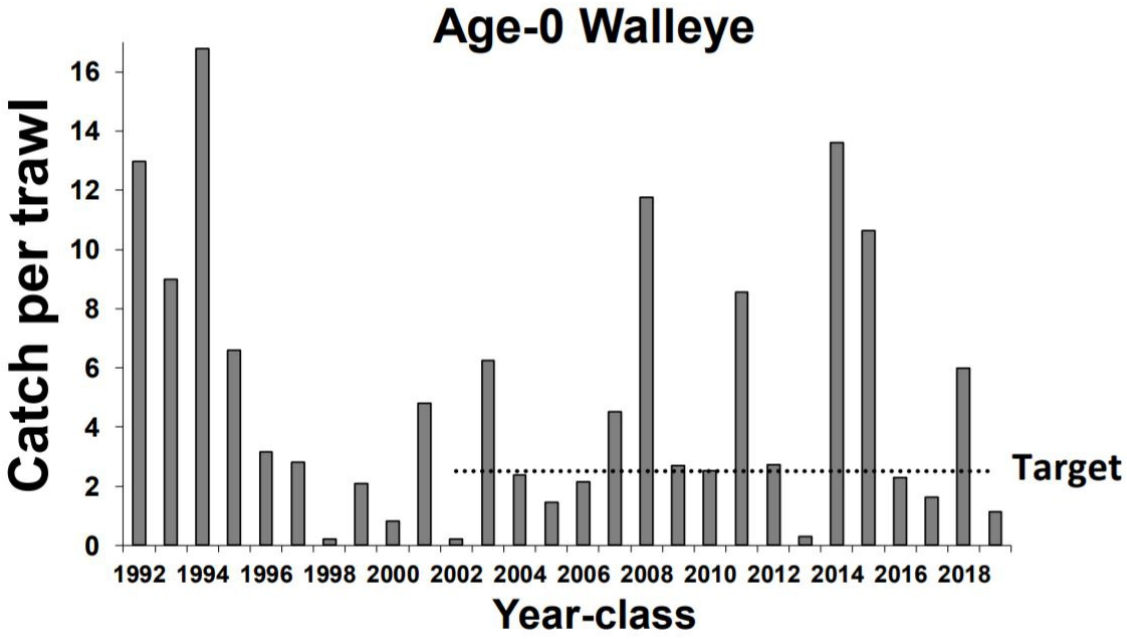

Figure 12: Walleye young-of-the-year (age-0) catch per trawl in the Bay of Quinte, 1992–2019 (Ontario Ministry of Natural Resources and Forestry 2020). The dotted line represents the Bay of Quinte FMP (Fisheries Management Plan) target catch per trawl.

Factor 1.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Annual harvest quotas, which may be transferred among quota zones, are in place for the commercial walleye fishery in Lake Ontario and have not been exceeded since implementation (Figure 13) (Ontario Ministry of Natural Resources and Forestry 2021). In 2021, 49% of the base quota (48,092 lb) was harvested overall, in the lower Bay of Quinte and Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2022). The majority of harvest (96% by weight) in 2021 was landed in the gillnet fishery, with the remaining harvest (4% by weight) taken by the impound fishery (Ontario Ministry of Natural Resources and Forestry 2022). In 2022, 40% (19,205 lb) of the walleye base quota (48,092 lb) and 41% of the issued quota (46,352 lb) was harvested (Ontario Ministry of Natural Resources and Forestry 2023). The commercial quota has remained at what is considered by managers as a relatively moderate level since the early 2000s (Ontario Ministry of Natural Resources and Forestry 2020). The recreational fishery is the dominant contributor to fishery mortality of walleye, harvesting 78% of the mean annual harvest by weight from 2009 to 2018 (Ontario Ministry of Natural Resources and Forestry 2022). Management takes a risk-based approach toward development of commercial quotas, with a goal of maintaining stability (Ontario Ministry of Natural Resources and Forestry 2022). The approach considers five factors: the trend in fish population status based on an independent assessment program, the commercial harvest, the commercial fishing effort, harvest and/or catch per unit effort trends from other fisheries if available (recreational and subsistence), and the unique characteristics of the small-scale Lake Ontario fishery (Ontario Ministry of Natural Resources and

Forestry 2022). Even though the commercial harvest of lake whitefish has been within the allotted quota since 1993 (see Figure 13) (Ontario Ministry of Natural Resources and Forestry 2020), it is unclear if the quota is appropriate, so fishing mortality is considered a moderate concern.

Justification:

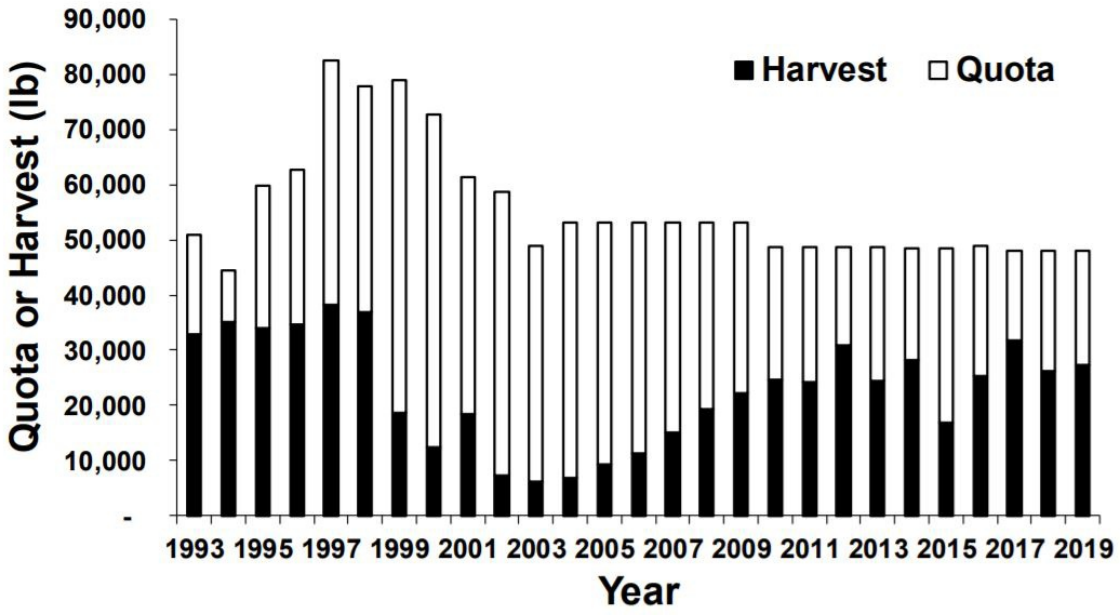

Figure 13: Walleye commercial quota and harvest, 1993–2019 (Ontario Ministry of Natural Resources and Forestry 2020).

Yellow perch (Perca flavescens)

Factor 1.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

High Concern

There is no quantitative stock assessment for yellow perch; however, stock health is assessed by examining trends in abundance using fishery-dependent data as well as fishery-independent data in both Canadian and United States waters of Lake Ontario. In Canada, abundance is informed by index netting programs (Ontario Ministry of Natural Resources and Forestry 2019)(Ontario Ministry of Natural Resources and Forestry 2019). Management uses the status/trend indicator of maintaining or increasing fisheries, populations, and recruitment to assess the yellow perch stock (Stewart et al. 2017). Yellow perch biomass, estimated from gillnet surveys, is below the target values set for the Bay of Quinte and eastern Lake Ontario (Figure 14) (Ontario Ministry of Natural Resources and Forestry 2020). Abundance in the Bay of Quinte has been increasing since 2013 but has remained below the

target level since 2010, while biomass in eastern Lake Ontario has been stable in recent years but has remained below the target level since 2006 (Ontario Ministry of Natural Resources and Forestry 2020). Yellow perch abundance is low relative to historic levels, likely because of a suite of factors including changing ecosystem dynamics, competition with round goby and alewife, and predation by double-crested cormorant and alewife (Hoyle 2015).

In New York waters of Lake Ontario, a fishery-independent Eastern Basin warmwater fish gillnetting survey is conducted annually to monitor relative abundance (catch per unit effort [CPUE] and fish per net night) and to collect life-history data (fish size, age, and maturity) (NYSDEC 2022). Based on abundance indices, the yellow perch stock declined significantly in the 1980s (from mean CPUE of 36.5 from 1980 to 1984 to a low CPUE of 2.2 in 1988), varied from 1993 to 2006 (average CPUE of 6.7; range 2.8 to 9.9), increased in 2007 and 2008 (average CPUE 16.9), and remained stable through 2013 (NYSDEC 2022). Catches declined from 2014 to 2016 to among historic lows (CPUE of 0.8 to 3.1) because of reduced population size and/or distribution shifts potentially attributed to reduced temperatures (NYSDEC 2022). In 2021, yellow perch CPUE (15.3 fish per net night) increased by 68% compared to the previous 10-year average (9.1 fish per net night) (Figure 15) (NYSDEC 2022). The high variability of catch in the time series is also likely attributed to the schooling behavior of yellow perch, adding uncertainty to the dataset (NYSDEC 2022). Further data are collected by the New York State Department of Environmental Conservation (NYSDEC) from recreational angler interviews (since 1985) (Figure 16); however, yellow perch catch and harvest estimates from the survey are highly variable because catch ranges from very low to very high among anglers (NYSDEC 2020).

Because uncertainty exists regarding yellow perch abundance relative to reference points, and yellow perch has a high vulnerability (PSA = 3.26; see Justification), abundance is considered a high concern.

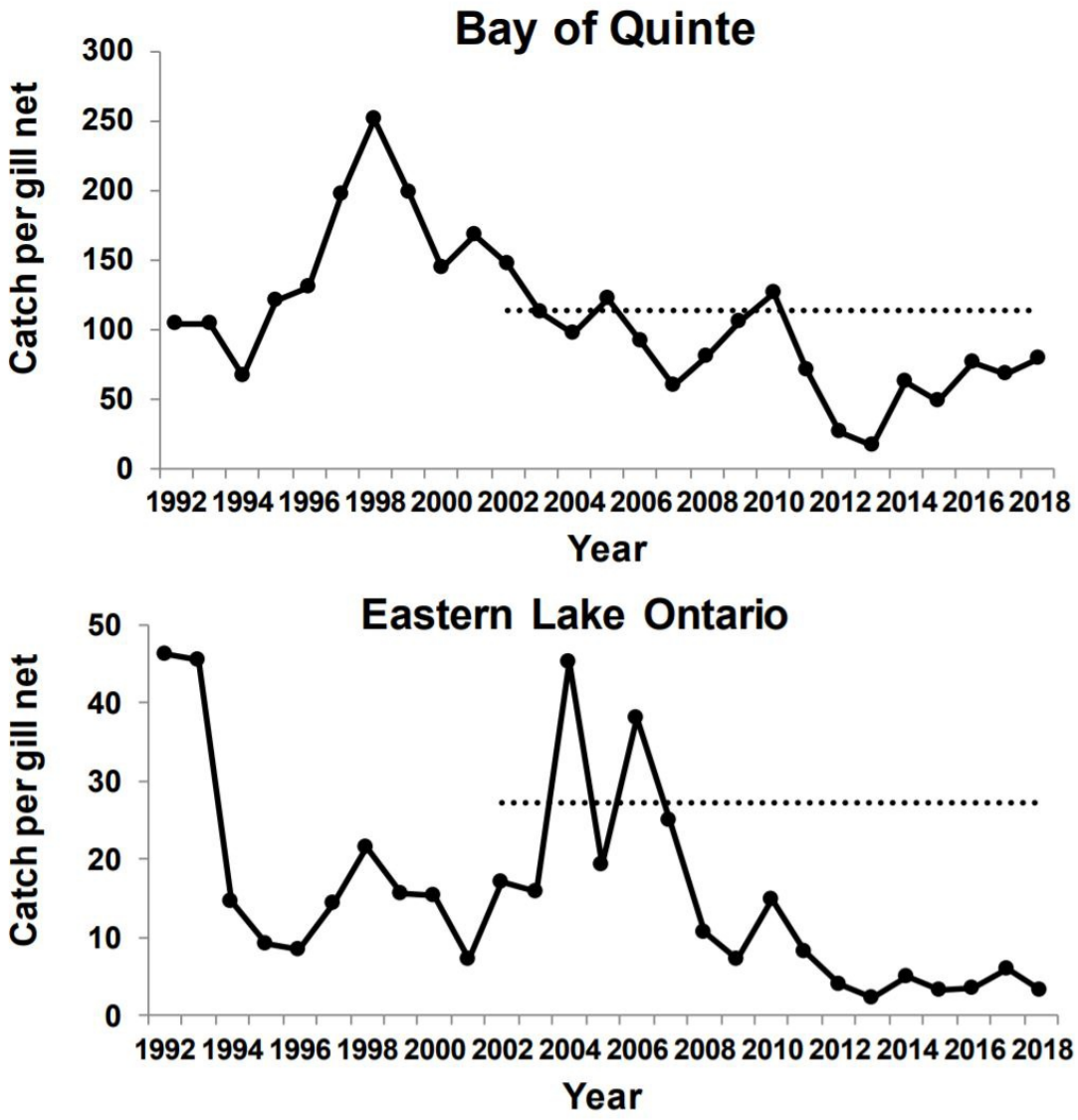

Figure 14: Yellow perch abundance trends in Canadian waters of Lake Ontario (upper panel: Bay of Quinte; lower panel: eastern Lake Ontario), 1992–2018 (Fisheries Management Plan) (Ontario Ministry of Natural Resources and Forestry 2019). Dotted lines represent target abundance levels established in the Bay of Quinte FMP.

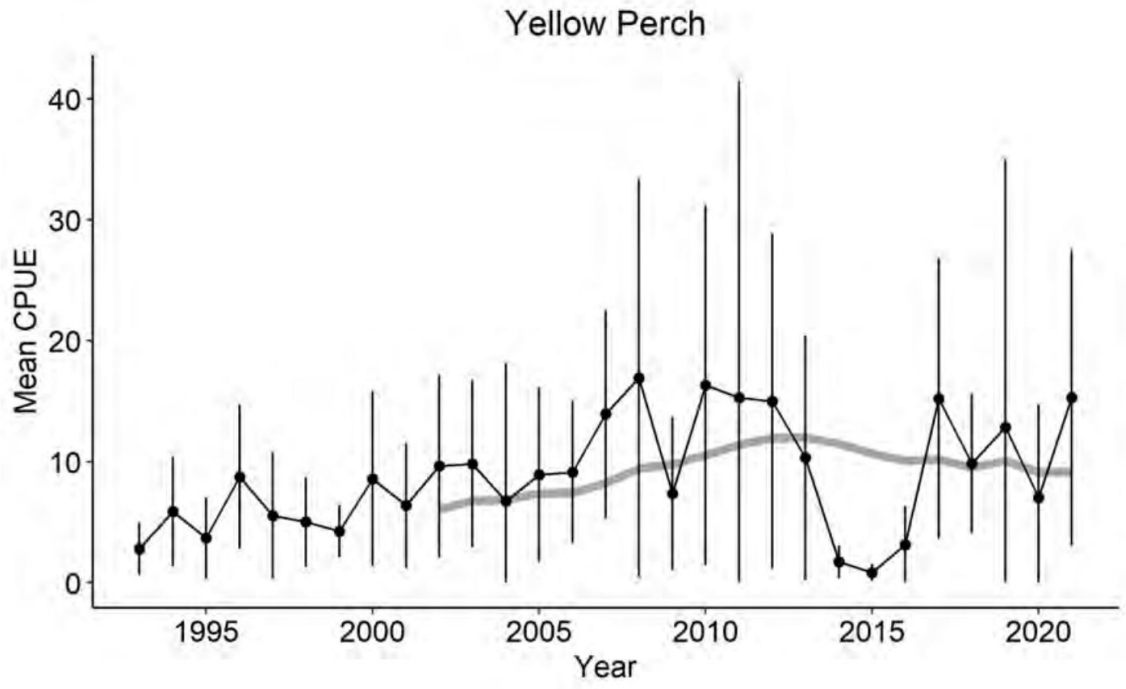

Figure 15: Stratified mean catch per 450-ft gillnet gang (CPUE), 95% confidence intervals, and 10-year moving average (solid grey line) for yellow perch in New York waters of Lake Ontario, 1993–2021 (NYSDEC 2022).

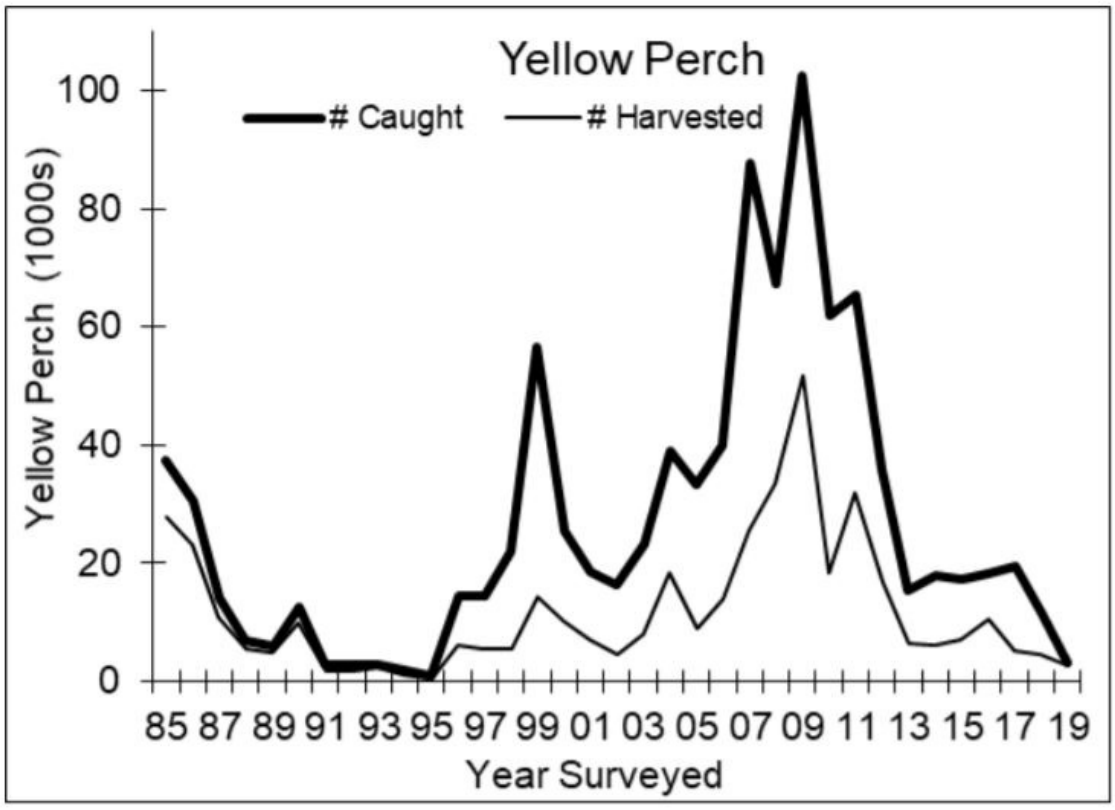

Figure 16: Estimated number of yellow perch caught and harvested by all recreational fishing boats in New York waters of Lake Ontario, April 15 to September 30, 1985–2019 (NYSDEC 2020).

Productivity-Susceptibility Analysis: This species has a high vulnerability. PSA = 3.26 = $\sqrt{(1.67^2 + 2.8^2)}$.

Productivity	Relevant Information	Score
Average age at maturity	1–2 yrs	1
Von Bertalanffy (Brody) growth coefficient (K)	0.1–1.1	3
Fecundity	3,000–61,000 eggs	2
Average maximum size	50 cm	1
Average size at maturity	19.2 cm	1
Reproductive strategy	Nonobligatory plant spawner	2

P = (1 + 3 + 2 + 1 + 1 + 2) ÷ 6 = 1.67. Reference for productivity table: (Froese & Pauly 2021).

Susceptibility	Relevant Information	Score
Areal overlap	Default score	3
Vertical overlap	Default score	3
Seasonal availability	Year-round fishing	3
Selectivity of fishery	Targeted species; conditions under high risk do not apply	2
Post-capture mortality	Retained species	3

S = (3 + 3 + 3 + 2 + 3) ÷ 5 = 2.8.

Factor 1.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Moderate Concern

Since 2001, commercial harvest of yellow perch in Canada has remained well below 50% of the quota (Figure 17) (Ontario Ministry of Natural Resources and Forestry 2019). In 2021, 26% (102,708 lb) of the base quota (392,273 lb, all Canadian regions combined) was harvested overall (Figure 18) (Ontario Ministry of Natural Resources and Forestry 2022). In 2022, 29% (114,300 lb) of the yellow perch base quota (392,273 lb) and 42% of the issued quota (274,935 lb) was harvested (Ontario Ministry of Natural Resources and Forestry 2023). During 2010–19, the commercial fishery for yellow perch in New York was 27.6% of the yellow perch cumulative fishery mortality in Lake Ontario, while the majority (72.4%) was attributed to the fishery in Canadian waters of Lake Ontario (NYSDEC 2020)(Ontario Ministry of Natural Resources and Forestry 2020). In 2021, two of four licensed fishers in New York actively fished commercially for yellow perch in U.S. waters of Lake Ontario and harvested 21,046 lb of yellow perch (NYSDEC 2022). Management takes a risk-based approach toward development of commercial quotas in Canadian waters, with a goal of maintaining stability. The approach considers five factors: the trend in fish population status based on an independent assessment program, the commercial harvest, the commercial fishing effort, harvest and/or catch per unit effort trends from other fisheries if available (recreational and subsistence), and the unique characteristics of the small-scale Lake Ontario fishery. Even though the commercial harvest of lake whitefish has been within the allotted quota since 1993 (see Figure 17) (Ontario Ministry of Natural Resources and Forestry 2020), it is unclear if the quota is appropriate, so fishing mortality is considered a moderate concern.

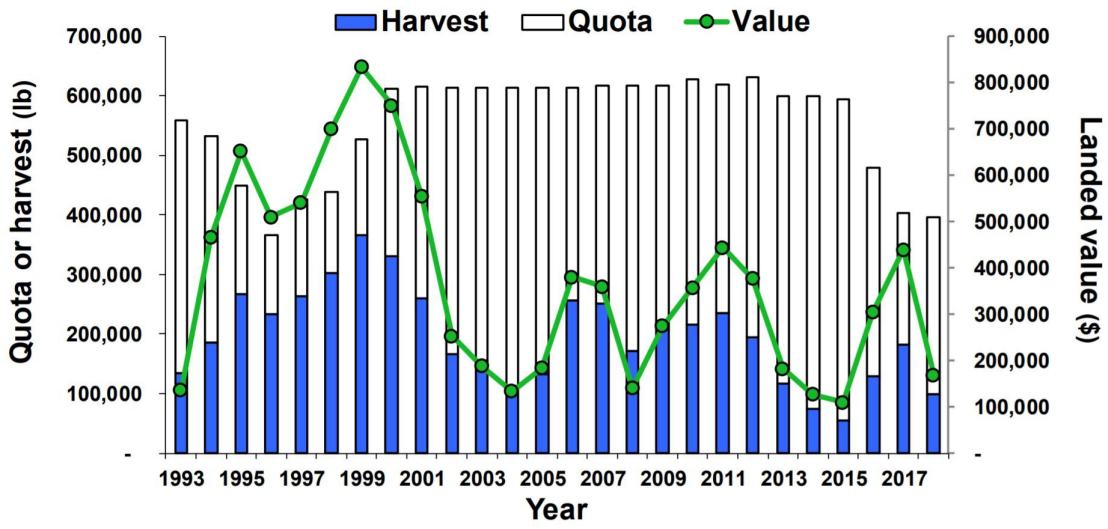

Figure 17: Yellow perch commercial harvest, quota, and landed value trends for Lake Ontario (including east and west) and the St. Lawrence River, 1993–2018 {Ontario Ministry of Natural Resources and Forestry 2019}.

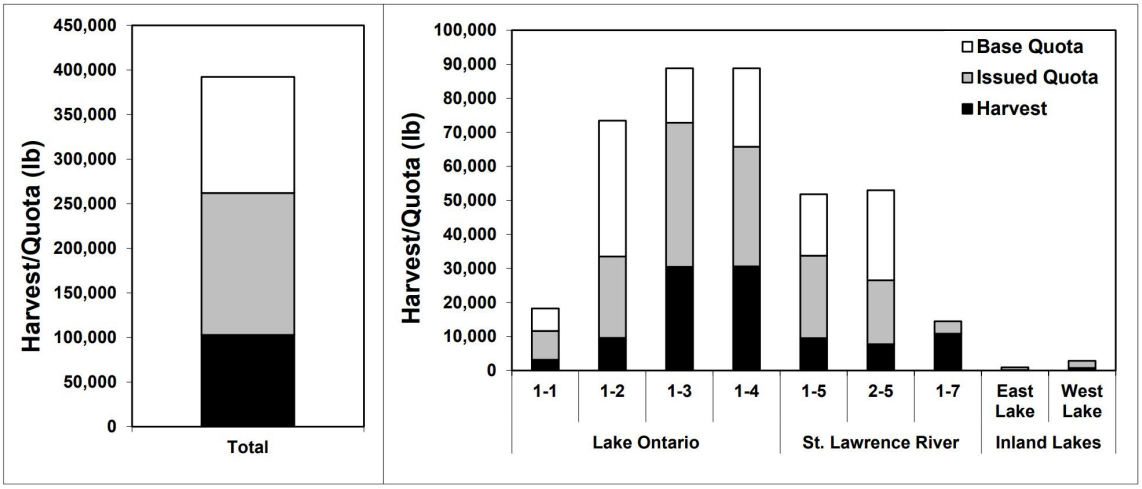

Figure 18: Yellow perch commercial harvest relative to issued and base quotas (total for all quota zones combined; left panel) and by quota zone (right panel), 2021 (Ontario Ministry of Natural Resources and Forestry 2022).

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. 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. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait 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 is Critical if Factor 2.3 (Fishing Mortality) is Crtitical

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

LAKE WHITEFISH			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	1.000	1.000: < 100%	Red (1.000)

WALLEYE			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	1.000	1.000: < 100%	Red (1.000)
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)

YELLOW PERCH			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh	1.000	1.000: < 100%	Red (1.000)
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets	1.000	1.000: < 100%	Red (1.000)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

LAKE ONTARIO | AMERICA, NORTH - INLAND WATERS | CANADA | SET GILLNETS | LARGE MESH			
SUB SCORE: 1.000	DISCARD RATE: 1.000	SCORE: 1.000	
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Lake trout	1.000: High Concern	1.000: High Concern	Red (1.000)
Lake whitefish	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake sturgeon	1.000: High Concern	5.000: Low Concern	Yellow (2.236)

LAKE ONTARIO | AMERICA, NORTH - INLAND WATERS | CANADA | SET GILLNETS | LARGE MESH			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake trout	1.000: High Concern	1.000: High Concern	Red (1.000)
Lake sturgeon	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Freshwater drum	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Walleye	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White bass	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White sucker	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ONTARIO | AMERICA, NORTH - INLAND WATERS | CANADA | SET GILLNETS | SMALL MESH			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake trout	1.000: High Concern	1.000: High Concern	Red (1.000)
Yellow perch	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake sturgeon	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
White perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ONTARIO | AMERICA, NORTH - INLAND WATERS | CANADA | STATIONARY UNCOVERED POUND NETS			
SUB SCORE: 1.732	DISCARD RATE: 1.000	**SCORE: 1.732**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Freshwater turtles	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
American eel	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Freshwater drum	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Walleye	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

LAKE ONTARIO | AMERICA, NORTH - INLAND WATERS | UNITED STATES | NEW YORK | SET GILLNETS			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake trout	1.000: High Concern	1.000: High Concern	Red (1.000)
Yellow perch	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake sturgeon	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
White perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ONTARIO, SAINT LAWRENCE RIVER | AMERICA, NORTH - INLAND WATERS | CANADA | STATIONARY UNCOVERED POUND NETS			
SUB SCORE: 1.732	DISCARD RATE: 1.000	**SCORE: 1.732**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Freshwater turtles	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Yellow perch	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
American eel	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Brown bullhead	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Sunfish (unspecified)	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

In the Canadian Lake Ontario fisheries, catch is self-reported by commercial fishers. Species that compose >5% of the catch (based on unpublished data (Ontario Ministry of Natural Resources and Forestry 2024) averaged over 8 years from 2016 to 2023) were added as main species for Criterion 2. In the Canadian large mesh gillnet lake whitefish fishery, lake whitefish and lake trout were the only species that composed >5% of landings (Ontario Ministry of Natural Resources and Forestry 2024). In the Canadian large mesh gillnet walleye fishery, walleye, freshwater drum, white bass, white sucker, and white perch each made up >5% of catch composition. In the Canadian small mesh gillnet yellow perch fishery, yellow perch and white perch were the only species that composed >5% of landings (Ontario Ministry of Natural Resources and Forestry 2024). In all Canadian gillnet fisheries, lake trout (bycatch based on unpublished data for 2016–23 (Ontario Ministry of Natural Resources and Forestry 2024)) was included as an assessed species for Criterion 2 because it is overfished, with relative abundance remaining below target reference points (Ontario Ministry of Natural Resources and Forestry 2021). The gillnet fisheries interact with lake sturgeon, which was added as a main species because of its threatened status. In the Canadian impoundment gear (hoop and trap nets) yellow perch fisheries, yellow perch, American eel, sunfish (*Lepomis* spp.), and brown bullhead each made up >5% of total landings by weight (based on unpublished data for 2016–23 (Ontario Ministry of Natural Resources and Forestry 2024)). In the Canadian impoundment gear walleye fisheries, walleye and freshwater drum each made up >5% of total catch composition by weight (Ontario Ministry of Natural Resources and Forestry 2024). The impoundment fisheries interact with threatened American eel and freshwater turtles, which were added as main species because some have ETP status. Based on the location and depth of nets, turtles do not interact with the gillnet fishery (pers. comm., Erin Brown MNRF).

In the New York yellow perch commercial fishery, all fishes harvested must be reported (NYSDEC 2023). There were no reported ETP species caught, and in the past 5 years, each species harvested as bycatch (white perch, brown bullhead, and cisco) made up a minor proportion of the catch (<5%) (NYSDEC 2023). The overall bycatch composition is unknown because data on released species were not available. Bycatch composition data from the Canadian yellow perch gillnet fishery were used to inform potential bycatch composition for the New York yellow perch gillnet fishery for Criterion 2.

In the Canadian and United States gillnet fisheries, the Criterion 2 score is limited by interactions with threatened lake trout. In the Canadian impoundment fisheries, the Criterion 2 score is limited by freshwater turtles because there are interactions with some ETP species, with uncertainty in the magnitude of fisheries mortality.

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use
Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

Ratio of bait + discards/landings	Factor 2.3 score
<100%	1
>=100	0.75

American eel (Anguilla rostrata)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

High Concern

The American eel is listed as “Endangered” on the International Union for the Conservation of Nature (IUCN) Red List (Jacoby et al. 2017). It was classified as “Endangered” under Ontario’s Endangered Species Act in 2007, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended it be identified as “Threatened” in 2012 (Ontario Ministry of Natural Resources and Forestry 2020). As part of an effort to restore American eel populations in Lake Ontario, its abundance is assessed using several indices. The abundance of eels observed passing through the various Moses-Saunders Dam eel ladders has declined in recent years, reaching a 13-year low in 2019 (995 eels) (Figure 19) (Ontario Ministry of Natural Resources and Forestry 2020). The reduced use of the eel ladder in 2019 may be attributed to increased water levels and flow (Ontario Ministry of Natural Resources and Forestry 2020). A bottom trawling survey in the Bay of Quinte averaged two eels per trawl from 1972 to 1996; however, no eels were captured in the trawl survey between 2003 and 2011 (Ontario Ministry of Natural Resources and Forestry 2020). In 2019, 6 eels were captured in the survey in 48 bottom trawls. In 2019, nearshore trap-netting survey eel catch rates in Toronto, Upper and Middle/Lower Bay of Quinte were the highest observed in the time series for those regions (Ontario Ministry of Natural Resources and Forestry 2020). The Fish Community Objective for this species—to increase abundance (recruitment and escapement) of naturally produced American eel to levels that support sustainable fisheries—has not been reached (Stewart et al. 2017)(Ontario Ministry of Natural Resources and Forestry 2020). Because the American eel is considered an endangered species, abundance is a high concern.

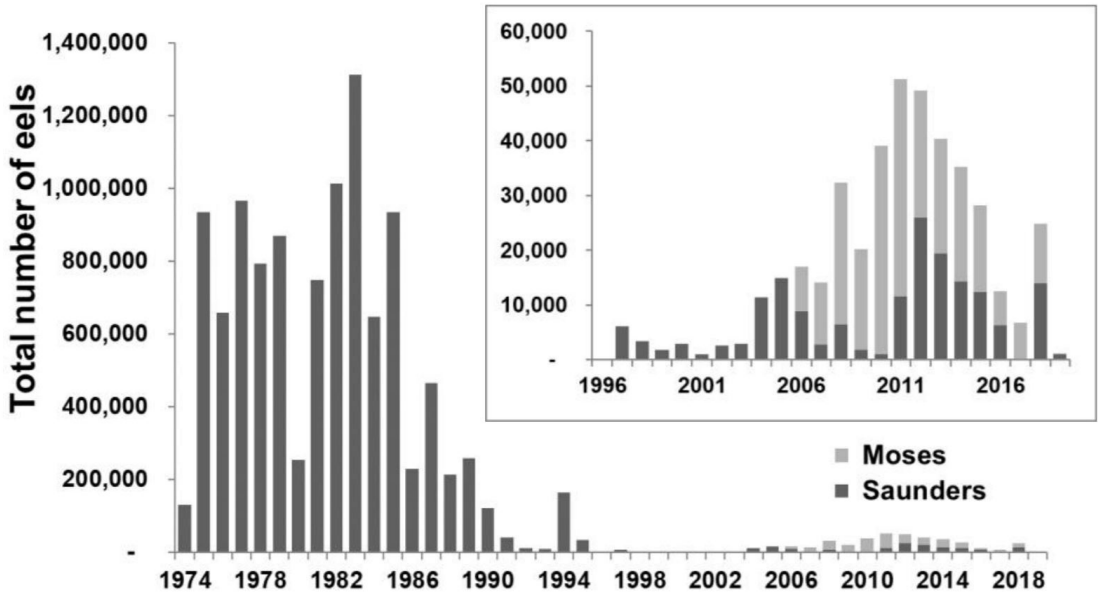

Figure 19: Total number of eels ascending the eel ladders at the Moses-Saunders Dam, Cornwall, Ontario from 1974 to 2019. During 1996, the ladder operated, but no counts were made (Ontario Ministry of Natural Resources and Forestry 2020).

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Low Concern

To facilitate restoration efforts for American eel, directed recreational and commercial fisheries for the species have been closed in Lake Ontario since 2004 (Ontario Ministry of Natural Resources and Forestry 2020). The greatest source of anthropogenic mortality for American eel is currently hydroelectric turbine mortality (MacGregor et al. 2013). In 2008, a trap and transport (T&T) program was developed to facilitate safe passage through dam turbines during the eel migration. Commercial fishers are permitted to retain any caught eel for transport and release below the most downstream dam. This project has reduced the mortality rate of eels migrating downstream and resulted in successful migration (EPRI 2018). In 2021, an annual limit of 7,000 eels was implemented for the T&T program; however, the limit was not reached, and 6,895 eels were transported downstream of the generating station (Ontario Ministry of Natural Resources and Forestry 2022). Post-release mortality for American eel interacting with impoundment gear is considered low, based on a tagging and tracking study (Stahl et al. 2023). Because all American eel caught as bycatch are either released or transferred to the T&T program, and the gillnet and impound fisheries are not substantial contributors to fishing mortality, it is considered a low concern.

Brown bullhead (Ameiurus nebulosus)

Factor 2.1 - Abundance

Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Population abundance trends of brown bullhead are assessed through data obtained from fishery-independent surveys and fish community gillnetting, trawling, and trap-netting monitoring programs (Ontario Ministry of Natural Resources and Forestry 2023). Although there is a relative index for evaluating population trends, there is no formal stock assessment, and no limit reference points are utilized to evaluate abundance of brown bullhead in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2023). Brown bullhead is listed as a species of "Least Concern" by the IUCN Red List (NatureServe 2013). Because data are limited and the species is considered to have medium vulnerability (PSA = 3.10; see Justification), abundance is considered a moderate concern.

Justification:

Productivity-Susceptibility Analysis: This species has medium vulnerability: PSA = 3.10 = $\sqrt{(1.33^2 + 2.80^2)}$.

Productivity	Relevant Information	Score
Average age at maturity	2–3 years	1
Von Bertalanffy growth coefficient (K)	0.47	1
Fecundity	1,050–13,800 eggs	2
Average maximum size	45 cm	1
Average size at maturity	20–33 cm	1
Reproductive Strategy	Nest spawner	2

P = (1 + 1 + 2 + 1 + 1 + 2) ÷ 6 = 1.33. References for productivity table: (Froese & Pauly 2021)(Eakins 2021).

Susceptibility	Relevant Information	Score
Areal overlap	Default score	3
Vertical overlap	Default score	3
Seasonal availability	Default score	3
Selectivity of fishery	Default score	2
Post-capture mortality	Retained species	3

S = (3 + 3 + 3 + 2 + 3) ÷ 5 = 2.80.

Factor 2.2 - Fishing Mortality

Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

There are no quotas for commercial harvest of brown bullhead in Lake Ontario (since 2016 (Ontario Ministry of Natural Resources and Forestry 2022)) and there are no biologically based reference points for fishing mortality. Because fishing mortality is unknown, it is considered a moderate concern.

Freshwater drum (Aplodinotus grunniens)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Population abundance trends of freshwater drum are assessed through data obtained from fishery-independent surveys and fish community gillnetting, trawling, and trap-netting monitoring programs (Ontario Ministry of Natural Resources and Forestry 2023). Although there is a relative index for evaluating population trends, there is no formal stock assessment, and no limit reference points are utilized to evaluate abundance of freshwater drum in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2023). Because freshwater drum is listed as a species of "Least Concern" by the IUCN Red List (NatureServe 2019), abundance is considered a moderate concern.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

There are no quotas for commercial harvest of freshwater drum in Lake Ontario, and there are no biologically based reference points for fishing mortality. Because fishing mortality is unknown, it is considered a moderate concern.

Freshwater turtles (Testudines)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

High Concern

Freshwater turtles that interact with the fishery include Blanding's turtle (Ontario ESA "Threatened" and SARA listed as "Endangered"), snapping turtle (Ontario ESA and SARA listed as "Special Concern"), painted turtle, musk turtle (Ontario ESA and SARA listed as "Special Concern"), and map turtle (Ontario ESA and SARA listed as "Special Concern") (O Reg 230/08 2018)(Government of Canada 2022). Because the fishery interacts with ETP turtle species, abundance is considered a high concern.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Between 2013 and 2020, 3,270 freshwater turtles were caught in impoundment gear, resulting in 26 documented mortalities (Figures 20–21; Lake Ontario Management Unit, MNRF). In 2019, OMNR implemented the requirement of a bycatch reduction device in the form of a float that creates a breathing space for captured turtles; fishers must either use this device or check gear at a minimum of every 24 hours to prevent turtle bycatch mortality (Ontario Ministry of Natural Resources and Forestry 2020). This measure is projected to reduce turtle bycatch mortality; however, methods still need to be fine tuned, because 30% of deployed floats were estimated to be ineffective (Ontario Ministry of Natural Resources and Forestry 2020). Although reported fisheries-induced mortalities of freshwater turtles were low (<1% between 2013 and 2020), the proportion of post-release survivorship is unknown. Because there are no reference points defined and post-release survival is unknown, fishing mortality is considered a moderate concern.

Justification:

Total number of turtles captured (by year and species) for the period 2013 - 2020 . 'Turtles' refer to individuals not identified by species.

SPECIES	2013	2014	2015	2016	2017	2018	2019	2020	Total
blandings	-	-	-	-	-	2	-	3	5
turtles	28	-	-	-	-	10	7	-	45
snapping	59	33	74	64	10	166	24	27	457
painted	166	54	75	47	-	46	50	63	501
musk	173	69	60	84	66	105	54	4	615
map	331	344	164	129	44	206	279	150	1,647
Total	757	500	373	324	120	535	414	247	3,270

Figure 20: Turtle bycatch (captured and released turtles) in impoundment gear 2013–20 (data provided by Lake Ontario Management Unit, MNRF).

Total number of turtle mortalites (all species combined) for the period 2013 - 2020 .

QZ	2013	2014	2015	2016	2017	2018	2019	2020	Total
East L.	4	2	-	-	-	-	-	-	6
West L.	2	-	-	-	-	-	-	-	2
QZ 1-1	-	-	-	-	-	-	-	-	0
QZ 1-2	-	-	-	-	-	-	-	-	0
QZ 1-3	12	-	-	-	-	-	-	3	15
QZ 1-4	-	-	-	-	-	-	-	-	0
QZ 1-5	-	-	3	-	-	-	-	-	3
QZ 2-5	-	-	-	-	-	-	-	-	0
QZ 1-7	-	-	-	-	-	-	-	-	0
Total	18	2	3	0	0	0	0	3	26

Figure 21: Turtle bycatch mortality in impoundment gear 2013–20 (data provided by Lake Ontario Management Unit, MNRF).

Lake sturgeon (Acipenser fulvescens)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

High Concern

The Great Lakes-Upper Saint Lawrence lake sturgeon populations are considered “Endangered” by the Ontario Endangered Species Act, “Threatened” by COSEWIC, and “Threatened” by New York State (COSSARO 2017)(COSEWIC 2017)(NYSDEC 2021). Because of the endangered and threatened status of the species, abundance is considered a high concern.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Low Concern

The Great Lakes-Upper St. Lawrence River lake sturgeon populations have historically been affected by hydroelectric development and commercial overexploitation (COSSARO 2017)(COSEWIC 2017). Targeted fishing for lake sturgeon is no longer permitted in Ontario. The current substantial contributor to mortality is considered to be water quality from industrial pollution (rated medium–low impact by COSEWIC), while agricultural pollution, dams (which alter migration routes), shipping lanes, and fishing and aquatic resources are considered low impact (COSEWIC 2017). Because the gillnet and impound fisheries are not substantial contributors to fishing mortality, it is considered a low concern.

Justification:
Although there are no post-release survival data, the reported bycatch is quite low:

Table 1: Lake sturgeon caught and released in Canadian Lake Ontario commercial fisheries (data provided by Erin Brown & Colin Lake MNRF)

Year	2016	2017	2018	2019	2020	2021	2022
Lake sturgeon bycatch in gillnet fisheries (lb)	27.7	57	43.4	58	66.6	216.5	85
Lake sturgeon bycatch in impound fisheries (lb)	0	1	21.3	0	62.9	151.9	20.3

Lake trout (Salvelinus namaycush)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

High Concern
Lake trout was extirpated from Lake Ontario by the 1950s by overharvest, habitat destruction, and the impacts of invasive species, including predation by sea lamprey (Brenden et al. 2011)(Ontario Ministry of Natural Resources and Forestry 2020). The population has since been undergoing restoration through stocking efforts and is assessed annually, using data-limited assessment based on both fishery-independent and -dependent data. Based on fishery-independent index gillnetting assessment, the population is moderately increasing since 2005 but is low relative to the peak of restoration success in the 1990s (Figure 22) (Ontario Ministry of Natural Resources and Forestry 2022). Lake trout abundance is below the target relative abundance reference point of 1.1 female lake trout (>4,000 g) caught per unit effort per standardized gillnet in the annual Fish Community Index Gill Netting survey (Ontario Ministry of Natural Resources and Forestry 2022). The Lake Trout Management Plan outlines targets for restoration; several of these have yet to be met (Figure 23) (Ontario Ministry of Natural Resources and Forestry 2020). Because a data-limited assessment suggests that the stock is poor relative to target reference points, abundance is considered a high concern.

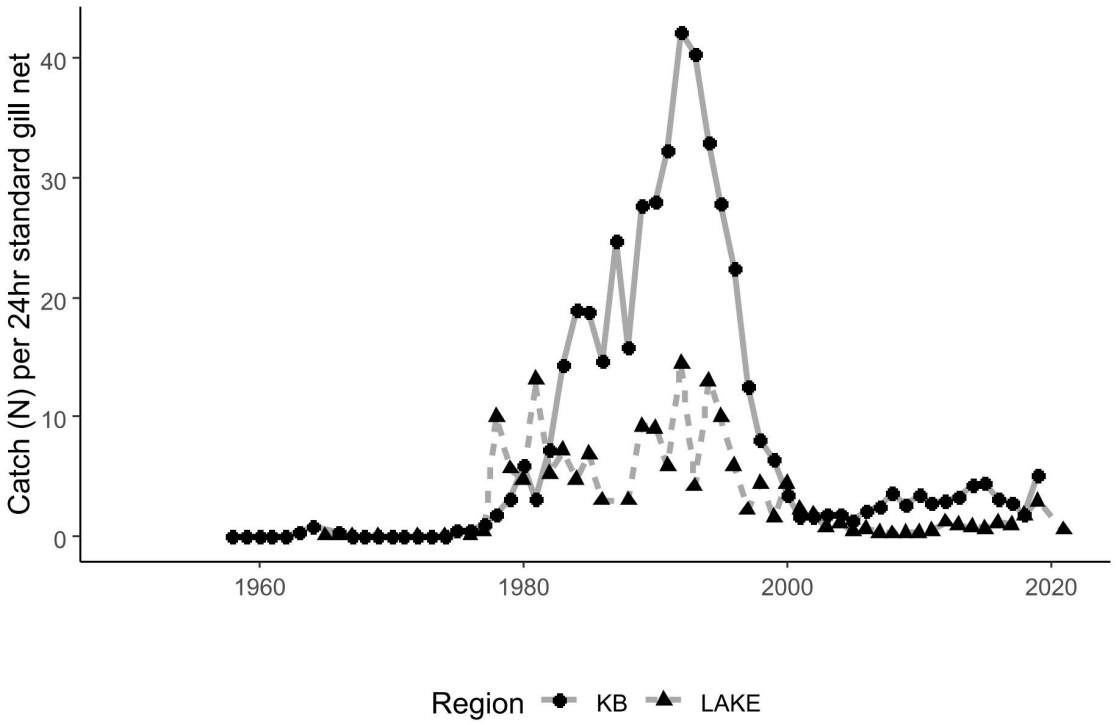

Figure 22: Relative abundance of lake trout captured in the Ontario waters of Lake Ontario from 2021 Fish Community Index Gill Netting in the main basin of Lake Ontario ("LAKE"; indicated by triangles and dashed line) and with the Kingston Basin ("KB"; indicated by circles and solid line) (Ontario Ministry of Natural Resources and Forestry 2022). Points are scaled to lake trout catch (N) per 24-hour standard gillnet set, where the temperature at the net was 15 °C or colder.

Management Strategy	Status	Details
Stock 440,000 spring yearlings per year in Canadian waters	Met	Stocking targets were reduced in 2017 due to concerns over available prey.
Maintain an adjusted catch rate of age-3 fish per standard gill net per 500,000 stocked > 1.5 fish per standard gill net set	Below/Unclear	Historically below target but has shown an increasing trend since 2012 however changes in fish distribution, stocking practices and sampling program confound the interpretation of this index.
A relative abundance greater than a CUE of 1.1 female Lake Trout > 4000g per standardized gill net	Below	Increasing trend but still well below target
Yearly survival of adult fish > 60%	Met	Survival of ages 5 to 15 has averaged 66% since 2016
Maintain the sea lamprey wounding rate in fall gill netting at <2 A1 wounds per 100 lake trout >433mm total length	Met	Target has been consistently met since 1996 although there was a period of high A2 wounding rates between 1995 to 2004.
Maintain annual harvest to <5,000 fish in Canadian waters	Exceeded	Harvest in Lake Ontario Salmon and Trout Angler Survey estimated at 1,349 but does not account for harvest in the Kingston Basin. Kingston Basin has historically been 3.5x higher than reported in Western Lake Ontario suggesting 4703 harvested in the Kingston Basin. Lakewide Ontario harvest is 6055. Harvest estimates do not account for any Lake Trout incidentally killed as commercial by-catch.
Emphasize strains that show the best combination of low post-stocking, juvenile, and adult mortality	Not assessed	In the absence of CWT in stocked lake trout, genetic analysis of all fish would be required in order to determine whether this target is being met. Currently only unclipped fish have tissue collect for genetic analysis.
Emphasize strains that are successfully producing a measurable level of wild recruits	Not reported	DNA samples from unclipped fish are routinely sent for analysis but are not reported here.
Protect naturally produced fish	Unclear	No special measures in place to meet this objective although harvest of all Lake Trout is generally low in Ontario. The percentage of unclipped fish has ranged from 0 to 16% of the observed fish

Figure 23: Status of Ontario targets identified in the Lake Trout Management Plan (Ontario Ministry of Natural Resources and Forestry 2021).

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

High Concern

There are no targeted lake trout commercial fisheries in Lake Ontario. The recreational fishery is considered the primary contributor to fisheries-induced mortality for lake trout (Brenden et al. 2011), with estimates exceeding target reference points (see Figure 23) (Ontario Ministry of Natural Resources and Forestry 2021). The Management Strategy for the Restoration of Lake Trout in Lake Ontario recommends that fishing mortality from all sources should not exceed 5,000 fish annually in Canada and 10,000 fish annually in New York {Lantry et. al 2014}. In 2019, the estimated lake trout harvest from the recreational fishery in Ontario was 6,055 fish, exceeding the target reference point (5,000 fish) (Ontario Ministry of Natural Resources and Forestry 2021). In 2021, the estimated lake trout harvest from the recreational fishery in New York was 11,649 fish, also exceeding the target reference point (10,000 fish) (NYSDEC 2022). Because bycatch post-release survival and fishing mortality from the commercial gillnet fisheries is unknown, with cumulative fishing mortality exceeding target reference points, fishing mortality is considered a high concern.

Justification:

There are several factors that contribute to impeding lake trout restoration in Lake Ontario, and bycatch in the gillnet fisheries is not considered to be among the main contributors to mortality (Brenden et al. 2011){Lantry et. al 2014}. These factors include competing interests with Chinook salmon population maintenance, reduced quantity and quality of prey, issues with egg quality and fry and juvenile survival, habitat alteration, nonnative species, and pollutants (Lantry et al. 2014).

Sunfish (unspecified) (Lepomis spp.)

Factor 2.1 - Abundance

Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Population abundance trends of *Lepomis* spp. are assessed through data obtained from fishery-independent surveys and fish community gillnetting, trawling, and trap-netting monitoring programs (Ontario Ministry of Natural Resources and Forestry 2023). Although there is a relative index to evaluate population trends, there is no formal stock assessment, and no limit reference points are utilized to evaluate abundance in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2023). Pumpkinseed (IUCN Red List “Least Concern”), bluegill (IUCN Red List “Least Concern”), and hybrids are the dominant species that compose *Lepomis* spp. bycatch in the Lake Ontario commercial fisheries (pers. comm., Erin Brown, MNRF)(NatureServe 2013b)(NatureServe 2019b). Because data are limited but the species are considered to be “Least Concern” by the IUCN Red List, abundance is considered a moderate concern.

Factor 2.2 - Fishing Mortality

Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderate Concern

Commercial harvest of *Lepomis* spp. in 2019 remained below the issued quota levels (quota levels have not been exceeded since establishment in 1993 in Zone 1-1, while Zones 1-3 and 1-4 have unlimited quota); however, there are no biologically based reference points for fishing mortality (Figure 24) (Ontario Ministry of Natural Resources and Forestry 2020). Because there are no quotas established in Zones 1-3 and 1-4, and reference points appropriate for the species are unknown, fishing mortality is considered a moderate concern.

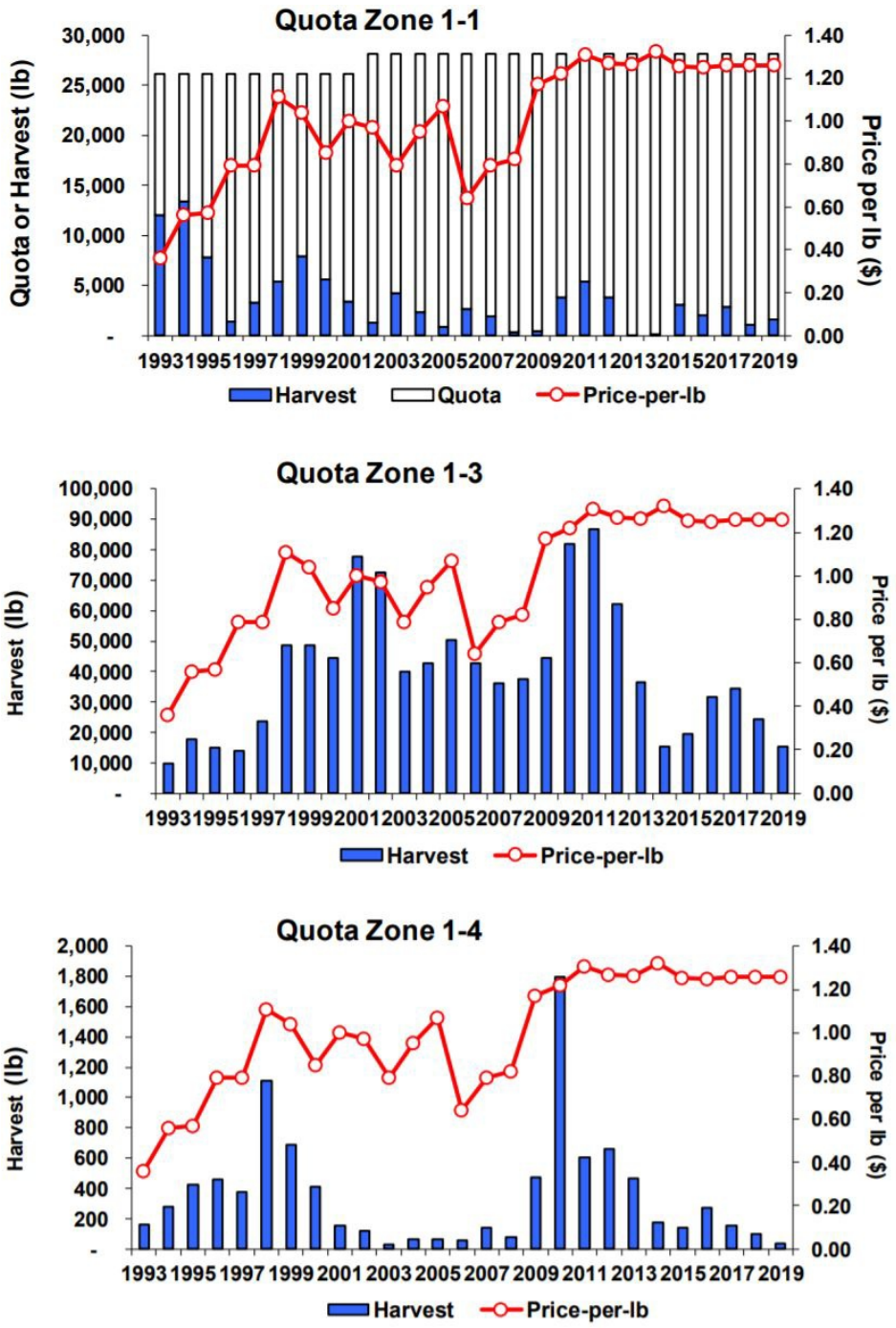

Figure 24: Commercial base quota, harvest, and price-per-lb for *Lepomis* spp. (Ontario Ministry of Natural Resources and Forestry 2020).

White bass (Morone chrysops)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

Moderate Concern

Population abundance trends of white bass are assessed through data obtained from fishery-independent surveys and fish community gillnetting, trawling, and trap-netting monitoring programs (Ontario Ministry of Natural Resources and Forestry 2023). Although there is a relative index for evaluating population trends, there is no quantitative stock assessment, and no limit reference points are utilized to evaluate white bass abundance in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2023). There is no quantitative stock assessment for white bass in Lake Ontario, and it is listed as a species of "Least Concern" by the IUCN Red List (NatureServe 2013d). Because data are limited but the species is considered to have medium vulnerability (PSA = 3.03; see Justification), abundance is considered a moderate concern.

Productivity-Susceptibility Analysis: This species has medium vulnerability: PSA = 3.03 = $\sqrt{(1.17^2 + 2.80^2)}$.

Productivity	Relevant Information	Score
Average age at maturity	2–3 years	1
Von Bertalanffy growth coefficient (K)	0.43–0.45	1
Fecundity	61,700–1,049,207	1
Average maximum size	45 cm	1
Average size at maturity	28 cm	1
Reproductive strategy	Open water/substratum egg scatterers	2

P = (1 + 1 + 1 + 1 + 1 + 2) ÷ 6 = 1.17. Reference for productivity table: (Froese & Pauly 2024).

Susceptibility	Relevant Information	Score
Areal overlap	Default score	3
Vertical overlap	Default score	3
Seasonal availability	Default score	3
Selectivity of fishery	Default score	2
Post-capture mortality	Retained species	3

S = (3 + 3 + 3 + 2 + 3) ÷ 5 = 2.80.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

Moderate Concern

There are no quotas for commercial harvest of white bass in Lake Ontario, and there are no biologically based reference points for fishing mortality. Because fishing mortality is unknown, it is considered a moderate concern.

White perch (Morone americana)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Very Low Concern
Because white perch is nonnative to Lake Ontario {Boileau 1985}, abundance is considered a very low concern.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Low Concern
There are no quotas for commercial harvest of white perch in Lake Ontario, and there are no biologically based reference points for fishing mortality. Because white perch is nonnative to Lake Ontario (Bolieau 1985), fishing mortality is considered a low concern.

White sucker (Catostomus commersonii)

Factor 2.1 - Abundance

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

Moderate Concern
Population abundance trends of white sucker are assessed through data obtained from fishery-independent surveys and fish community gillnetting, trawling, and trap-netting monitoring programs (Ontario Ministry of Natural Resources and Forestry 2023). Although there is a relative index for evaluating population trends, there is no quantitative stock assessment, and no limit reference points are utilized to evaluate white sucker abundance in Lake Ontario (Ontario Ministry of Natural Resources and Forestry 2023). White sucker in Lake Ontario is listed as a species of “Least Concern” by the IUCN Red List (NatureServe 2013c). Because data are limited but the species is considered to have medium vulnerability (PSA = 3.18; see Justification), abundance is considered a moderate concern.

Justification:

Productivity-Susceptibility Analysis: This species has medium vulnerability: PSA = 3.18 = $\sqrt{(1.5^2 + 2.8^2)}$.

Productivity	Relevant Information	Score
Average age at maturity	2 years	1

Von Bertalanffy growth coefficient (K)	0.13–0.15	3
Fecundity	50,000	1
Average maximum size	65 cm	1
Average size at maturity	23 cm	1
Reproductive strategy	Open water/substratum egg scatterers	2

P = (1 + 3 + 1 + 1 + 1 + 2) ÷ 6 = 1.5. Reference for productivity table: (Froese & Pauly 2024b).

Susceptibility	Relevant Information	Score
Areal overlap	Default score	3
Vertical overlap	Default score	3
Seasonal availability	Default score	3
Selectivity of fishery	Default score	2
Post-capture mortality	Retained species	3

S = (3 + 3 + 3 + 2 + 3) ÷ 5 = 2.80.

Factor 2.2 - Fishing Mortality

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh

Moderate Concern

There are no quotas for commercial harvest of white sucker in Lake Ontario, and there are no biologically based reference points for fishing mortality. Because fishing mortality is unknown, it is considered a moderate concern.

Factor 2.3 - Discard Rate/Landings

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

< 100%

Bait is not used in these fisheries, and discards do not exceed landings, so no modifier is applied.

Based on data from 2016 to 2020 provided by Erin Brown in 2021:

Canadian trap nets: 6–9% live-released and <1% dead discards.

Canadian gillnets: 4–6% live-released and 3–7% dead discards.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very LowConcern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (LowConcern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

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 = Red or High Concern***

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	DATA COLLECTION AND ANALYSIS	ENFORCEMENT	INCLUSION	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)

The Great Lakes Fishery Commission (GLFC) is an interjurisdictional agency that comprises eight Commissioners (four from Canada and four from the United States) and one U.S. Alternate Commissioner; it is the main coordinating body of fisheries management for Lake Ontario (GLFC 2023a). In 1981, a Joint Strategic Plan for Management of Great Lakes Fisheries was established to facilitate working relationships among parties (GLFC 2007)(GLFC 2023a)(GLFC 2023b). This cooperative fishery management process is guided by four principles: consensus, accountability, information sharing, and ecosystem-based management (GLFC 2007)(GLFC 2023a)(GLFC 2023b). Specific to each lake, “lake committees” are established that comprise state, provincial, and U.S. tribal agencies and are the primary management jurisdiction on each lake (Figure 29) (GLFC 2007)(GLFC 2023a)(GLFC 2023b). The purpose of the lake committees is to develop strategic management goals called Fish Community Objectives (FCO) and set cooperative harvest levels, management plans, and rehabilitation plans (O'Gorman 2017)(Stewart et al. 2017)(GLFC 2023a)(GLFC 2023b). Each lake committee includes at least one technical committee, which is responsible for collecting data, producing and interpreting science, and making recommendations to the lake committee (GLFC 2023a) (GLFC 2023b).

The Lake Ontario Committee comprises senior staff members from the Ontario Ministry of Natural Resources and Forestry (MNRF) and the New York Department of Environmental Conservation’s (NYSDEC) Division of Fish, Wildlife, and Marine Resources (Ontario Ministry of Natural Resources and Forestry 2021). The Lake Ontario Committee (LOC) is responsible for (1) addressing issues that are pertinent to or have been referred by the Commission, (2) addressing issues of common concern to member management agencies, (3) developing and coordinating joint programs and research projects, and (4) serving as a platform for state, provincial, tribal, and federal agencies to operate (GLFC 2023c).

The Lake Ontario Technical Committee comprises fishery biologists from the New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources and Forestry, Fisheries and Oceans Canada, U.S. Fish and Wildlife Service, and U.S. Geological Survey (GLFC 2023c). The Technical Committee is responsible for (1) conducting work assignments as requested and prioritized by the LOC; (2) coordinating federal, state, provincial, and nongovernmental science-based assessment and research programs focused on topics selected by the LOC; (3) facilitating technical information, sharing, and discussion; (4) creating ad hoc working groups to complete work assignments; (5) reporting to the LOC on findings, technical information, and recommended management actions and research needs; (6) coordinating, organizing, and presenting the LOC report to the GLFC at the annual meeting of the LOC; and (7) on a 5-year cycle, coordinating, organizing, and preparing the “State of the Lake Ontario Report,” inclusive

of updating the status of progress toward achieving the Lake Ontario Fish Community Objectives, for submission to the GLFC (GLFC 2023c).

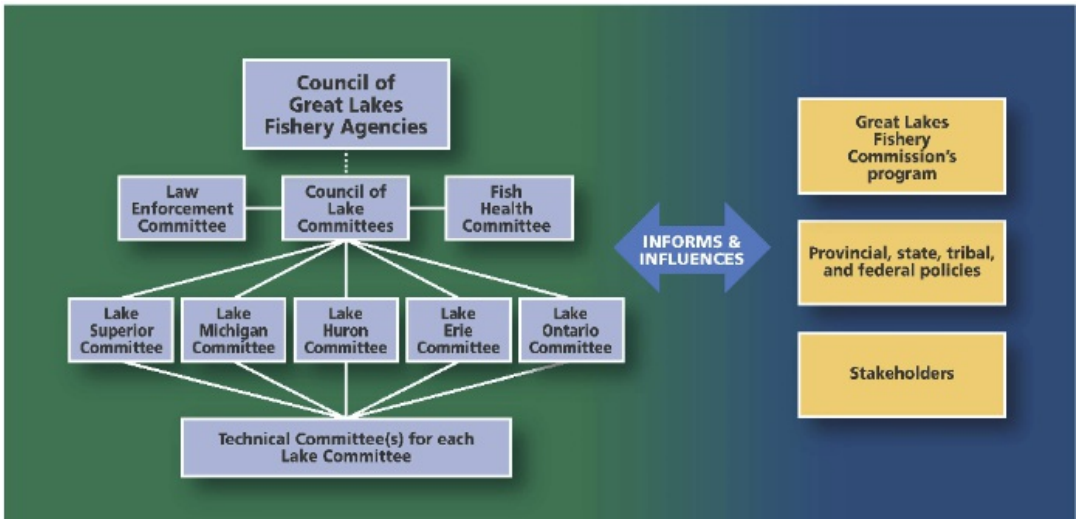

Figure 29: Organizational structure of management bodies in the Great Lakes (GLFC 2023b).

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - 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? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - 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.

Factor 3.5 - 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, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Moderately Effective

Commercial fisheries of Lake Ontario have historically experienced overfishing, and by 1985, to promote sustainability, quota management was introduced for most targeted species (BQFAC 2010). Commercial quotas are set through a risk-based approach that considers the trend in fish population status, based on an independent assessment program, the commercial harvest, the commercial fishing effort, harvest and/or catch per unit effort trends from other fisheries if available (recreational and subsistence), and the unique characteristics of the small-scale Lake Ontario fishery (pers. comm., MNRF).

Stock assessments are conducted by the federal, state, and provincial agencies involved in fisheries research and management; however, intensive stock assessment in Lake Ontario is limited by the relatively low economic value of the small-scale fisheries (pers. comm., MNRF). Although stocks are considered stable by management, populations in all the assessed fisheries are at a small proportion of virgin biomass, and rebuilding plans are not in place (Ontario Ministry of Natural Resources and Forestry 2021)(Ontario Ministry of Natural Resources and Forestry 2022). Fish Community Objectives are outlined by management, and goals toward those objectives are managed through limiting licensing and provisioning annual harvest limits implemented through regional quotas (Stewart et al. 2017). Monitoring programs are in place, including annual fish community index assessments (using both gillnetting and trawling), hydro-acoustic assessments, and commercial catch sampling (Ontario Ministry of Natural Resources and Forestry 2022). 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 (Ontario Ministry of Natural Resources and Forestry 2022). The Lake Ontario Committee uses information from these assessments to propose changes to yearly quotas, which are ultimately set by the management agencies (Ontario Ministry of Natural Resources and Forestry 2022). Quotas are designated by quota zone by the OMNR for Canadian waters of Lake Ontario for all commercially fished species (OMNR 2012). Commercial fishing in New York waters is restricted by number of fishing licenses issued (NYSDEC 2022).

Management strategy is considered moderately effective, because for more than 70% of the fishery's main targeted and retained native species/stocks (by number), management measures in place still exceed those for "Ineffective" or "Critical" management, and management measures are expected to be effective, but harvest control rules are not in place.

Factor 3.2 - Bycatch Strategy

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh

Moderately Effective
In Ontario gillnet fisheries, measures were implemented to reduce overall gear in the water (BQFAC 2010). Buyout programs were implemented by OMNR in the 1980s to purchase gillnet licenses, resulting in the purchase of 50 of 86 gillnet licenses and reducing the quantity of gillnet by 58% (BQFAC 2010). Alternate fishing gear was encouraged through season and quota adjustment incentives (BQFAC 2010). To protect the endangered American eel, the trap and transport (T&T) program was developed in 2008, in which commercial fishers retain eels caught as bycatch and transport them downstream of the furthest dam (near Beauharnois, Quebec) to mitigate mortality in the hydroelectric dam turbines (Ontario Ministry of Natural Resources and Forestry 2021). There are no specific measures in place to mitigate the effects of bycatch on lake trout. Because there are no bycatch mitigation strategies for lake trout and the post-release mortality of lake trout discards is unknown, but with some measures in place to mitigate overall bycatch (buyout programs reducing licensing and the T&T program for American eel), bycatch strategy is considered moderately effective.

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderately Effective
In both the trap net fisheries, measures are in place to minimize bycatch and mortality of other species:

Trap and Transfer Program—To protect the endangered American eel, the Trap and Transport Program was developed in 2008, in which commercial fishers retain eels caught as bycatch and transport them downstream of the furthest dam (near Beauharnois, Quebec) to mitigate mortality in the hydroelectric dam turbines (Ontario Ministry of Natural Resources and Forestry 2021).

Gear modifications—Bycatch reduction devices can mitigate turtle mortality in impoundment gear, which occurs when gear soak times exceed turtle submergence capacity (Midwood et al. 2015). In 2019, new license conditions were implemented to include flotation devices inside hoop and trap nets, to mitigate interactions with turtles (May to September for shallow sets) (Ontario Ministry of Natural Resources and Forestry 2020). This allows turtles to continue to breathe at the surface while captured in the gear until the gear is collected, and if that is not possible, fishers have the option to check the gear more frequently, at a minimum of every 24 hours (Ontario Ministry of Natural Resources and Forestry 2020). There was 85% compliance during surveillance, and of those flotation devices used, 30% were inadequate in providing air spaces—mostly because ineffective flotation prevented surface contact (Ontario Ministry of Natural Resources and Forestry 2020). Water levels in 2019 were higher than average, which may have contributed some difficulty to determining the set depths (Ontario Ministry of Natural Resources and Forestry 2020). No turtles were observed in the commercial fishery gear during surveillance (Ontario Ministry of Natural Resources and Forestry 2020). MNRF intends to collaborate with industry to fine-tune the implementation of the flotation devices and to mitigate turtle bycatch (Ontario Ministry of Natural Resources and Forestry 2020).

Because some species of concern are caught but some bycatch mitigation measures are in place, bycatch strategy is considered moderately effective.

Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Moderately Effective

The gillnet fishery in New York has very low (<5%) retained bycatch, and there is limited licensing (current licenses are only available to two fishers that have held gillnet licenses since 1986, and licenses may not be transferred) (6 NYCRR § 36.2 2023)(Muir 2020). There is no information on total catch composition in the commercial gillnet fishery, with potential for interactions with lake trout, which is undergoing overfishing with the recreational harvest (11,649 fish in 2021) alone exceeding the target reference point of 10,000 fish (NYSDEC 2021)(NYSDEC 2022). Because there are no bycatch mitigation strategies for lake trout and the post-release mortality of lake trout discards is unknown, but there is limited licensing in place, bycatch strategy is considered moderately effective.

Factor 3.3 - Scientific Data Collection and Analysis

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Moderately Effective

The Great Lakes Water Quality Agreement (GLWQA) calls for ecosystem monitoring to be shared among Canadian and U.S. federal agencies, state agencies, and the Province of Ontario (Richardson et al. 2012). The United States–Canada Lake Ontario Lakewide Management Plan (LaMP) and the Great Lakes Fishery Commission's Lake Ontario Lake Committee (LOC) promote collaborative monitoring (U.S.-Canada Lake Ontario Lakewide Management Plan Management Committee 2007). In 2008, the Cooperative Science and Monitoring Initiative (CSMI) was created to coordinate science and monitoring in support of Great Lakes management, with a focus on one of each of the five Great Lakes per year (next in Lake Ontario in 2023).

Both fishery-dependent and fishery-independent monitoring studies are conducted regularly in Lake Ontario, including annual gillnetting, trawling, and hydroacoustics (U.S.-Canada Lake Ontario Lakewide Management Plan Management Committee 2007). The commercial catch is sampled for biological information annually by OMNR. OMNR conducts a fishery-independent annual fish community indexing program, including a bottom trawl survey (established in the 1960s) and gillnet survey (est. 1977) (Ontario Ministry of Natural Resources and Forestry 2021)(U.S.-Canada Lake Ontario Lakewide Management Plan Management Committee 2007). The NYSDEC conducts an annual index gillnetting survey (est. 1976) during summer months to monitor the abundance of warm, cool, and cold water fish species (including lake whitefish, walleye, and yellow perch) in northeastern Lake Ontario and bottom trawl surveys for young-of-the-year fishes (NYSDEC 2020). Annual community index trawling is employed to evaluate younger life stages and smaller fish species. Prey

fishes are surveyed annually in mid-summer, utilizing lake-wide hydroacoustics. Fishery-dependent commercial catch sampling also occurs regularly to obtain biological information. Because long-term (over five decades) datasets exist to monitor ecosystem community dynamics, stock abundance and health, and to maintain stocks and monitor bycatch using appropriate data-limited assessment methods and management strategies, but without robust peer-reviewed assessments, scientific data collection and analysis for Lake Ontario is considered moderately effective.

Factor 3.4 - Enforcement of and Compliance with Management Regulations

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Highly effective

The Great Lakes Law Enforcement Committee was created by the Great Lakes Fishery Commission (GLFC) through the multijurisdictional Joint Strategic Plan for Management of Great Lakes Fisheries (GLFC 2007)(GLFC 2021). The stated intention of the committee is to protect, enhance, and promote the safe and wise use of natural resources in the Great Lakes (GLFC 2007)(GLFC 2021). All states and provinces are represented in the committee through participation by their respective management agencies (GLFC 2007)(GLFC 2021). The committee develops strategies to communicate with stakeholders, provides training sessions for Great Lakes officers, and provides a basin update annually to the GLFC. Law enforcement information is made available for incorporation into fisheries management decision-making (GLFC 2007)(GLFC 2021). Law enforcement engages in covert operations to investigate illegal harvest and invasive species issues (GLFC 2007)(GLFC 2021). Tools for investigation include stakeouts, patrols, tip lines, and forensic fish analysis (GLFC 2007)(GLFC 2021). Commercial fishing vessels are routinely boarded for harvest and gear inspection (GLFC 2007) (GLFC 2021). Portside inspections are used to enforce regulations such as minimum fish sizes, retention of prohibited species, and gear restrictions (GLFC 2007)(GLFC 2021). Deployed gear is randomly inspected to examine gear placement, mesh size, and markings (GLFC 2007)(GLFC 2021). Because regulations are independently verified, with the capacity to control and report compliance at a scale appropriate for the fisheries, enforcement and compliance with management regulations is considered highly effective.

Factor 3.5 - Stakeholder Inclusion

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Highly effective

The Great Lakes Fishery Commission (GLFC) includes stakeholder input in the development of legislation, harvest restrictions, and enforcement regulations. The Lake Ontario and St. Lawrence River Commercial Fishery Liaison Committee (LOLC) acts as a forum for dialogue between the fishing industry and the Ministry of Natural Resources and Forestry (MNRF) and provides advice regarding the commercial fisheries to the Lake Ontario Manager (Ontario Ministry of Natural Resources and Forestry 2020). Ontario Commercial Fishing License holders, the Ontario Commercial Fisheries' Association, and the MNRF are all represented in the LOLC (Ontario Ministry of Natural Resources and Forestry 2020). Each lake committee is required to make regular reports to the Council of Lake Committees (CLC) (Ontario Ministry of Natural Resources and Forestry 2020). These reports generate the development of new legislation, which is made public and provided to local, state, provincial, and federal agencies, who are invited to submit comments and suggestions (GLFC 2007). To develop the Bay of Quinte Fisheries Management Plan, an independent consultant was utilized to design a Community Involvement Framework (CIF); to engage the public and the Bay of Quinte Fisheries Advisory Committee, public input was obtained through a survey, open houses, booths at fishing shows, and through a website (BQFAC 2010). Because the management process is transparent and includes stakeholder input from major user groups, provides forums to address conflict, and encourages participation in the assessment and management process, with a constructive relationship between management, scientists, and fishers, stakeholder inclusion is considered highly effective.

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 (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 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***

Guiding principles

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	FORAGE SPECIES?	SCORE
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate
Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - 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. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - 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.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts
Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management
Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles*

and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.

- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Score: 3

The bottom substrate of Lake Ontario comprises mostly mud (53%) with approximately 25% of hard substrate (Figure 25) (Wang et al. 2015)(USGS & GLAHF 2018). Per the Seafood Watch Standard for Fisheries, the physical impact of fishing gear on the habitat/substrate for gear types such as bottom set gillnets (Figure 26) that are set mostly on soft substrates is given a score of 3.

Justification:

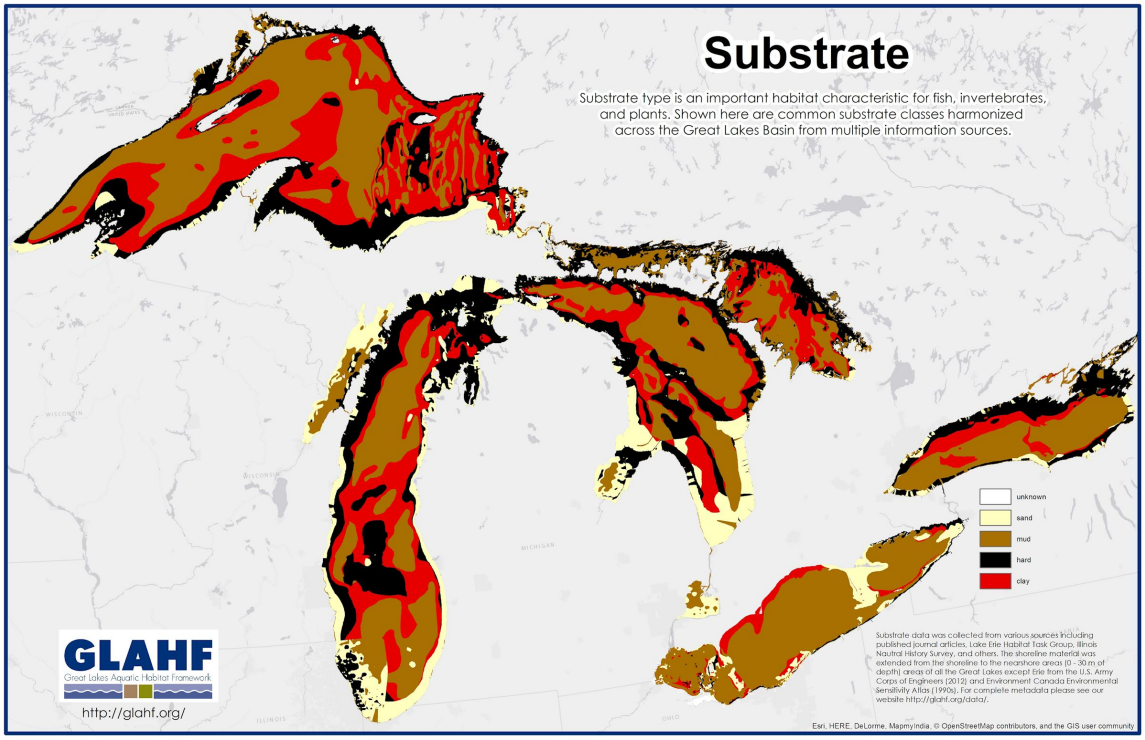

Figure 25: Map of substrate types in the Great Lakes, showing that Lake Ontario comprises mostly mud (USGS & GLAHF 2018).

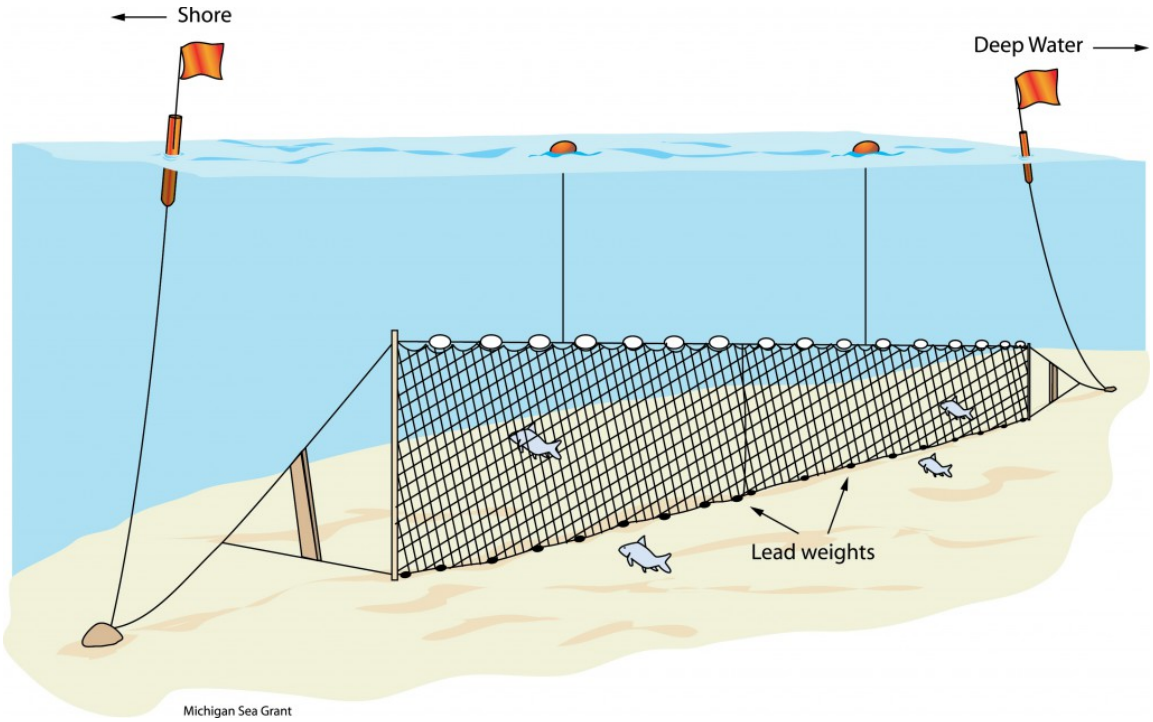

Figure 26: Set gillnets are set perpendicular to shore with floats on the top and weights on the bottom (Michigan Sea Grant 2021).

Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Score: 3

The bottom substrate of Lake Ontario comprises mostly mud (53%) with approximately 25% of hard substrate (see Figure 25) (Wang et al. 2015)(USGS & GLAHF 2018). Per the Seafood Watch Standard for Fisheries, the physical impact of fishing gear on the habitat/substrate for gear types such as trap nets (Figure 27) that are set mostly on soft substrates is given a score of 3.

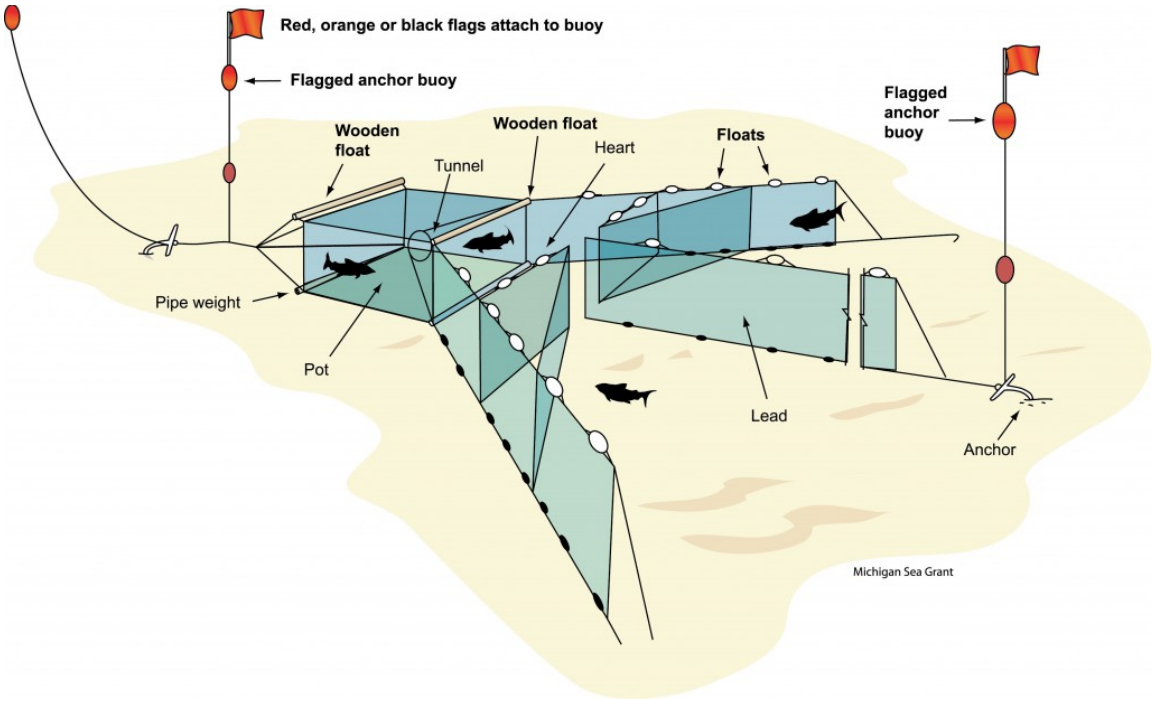

Figure 27: Trap nets divert fishes into an enclosure, through a tunnel into a pot for capture (Michigan SeaGrant 2021).

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Score: 0

The spatial footprint of commercial fishing in Lake Ontario is concentrated to embayments and nearshore open waters of the eastern basin; however, spatial protection is not in place to apply a modifying score for mitigation of gear impacts (Office of National Marine Sanctuaries 2021). There are 135 km of coastal shoreline protected (at various levels) in Lake Ontario (35 km in the United States, 100 km in Canada) (Parker et al. 2017). Although there are no formal in-lake protected areas in Canadian waters of Lake Ontario, some areas are protected through fishing licensing structure (in the Bay of Quinte, fishing licenses for impoundment gear only permit fishing within specific geographically defined areas; see Figure 28, where the licensed areas shown in red represent 44.3% of the region (pers comm, MNRF 2024)). In June 2024, NOAA established a National Marine Sanctuary in New York waters of Lake Ontario (≈1,700 mi^2) with the intention to protect nationally significant shipwrecks (Plunkett 2024)(89 FR 48272 2024). Because it is uncertain what proportion of habitat across all

management regions is completely protected from fishing with gear types that impact the habitat, the modifying factor for the mitigation of gear impacts has been scored as 0.

Justification:

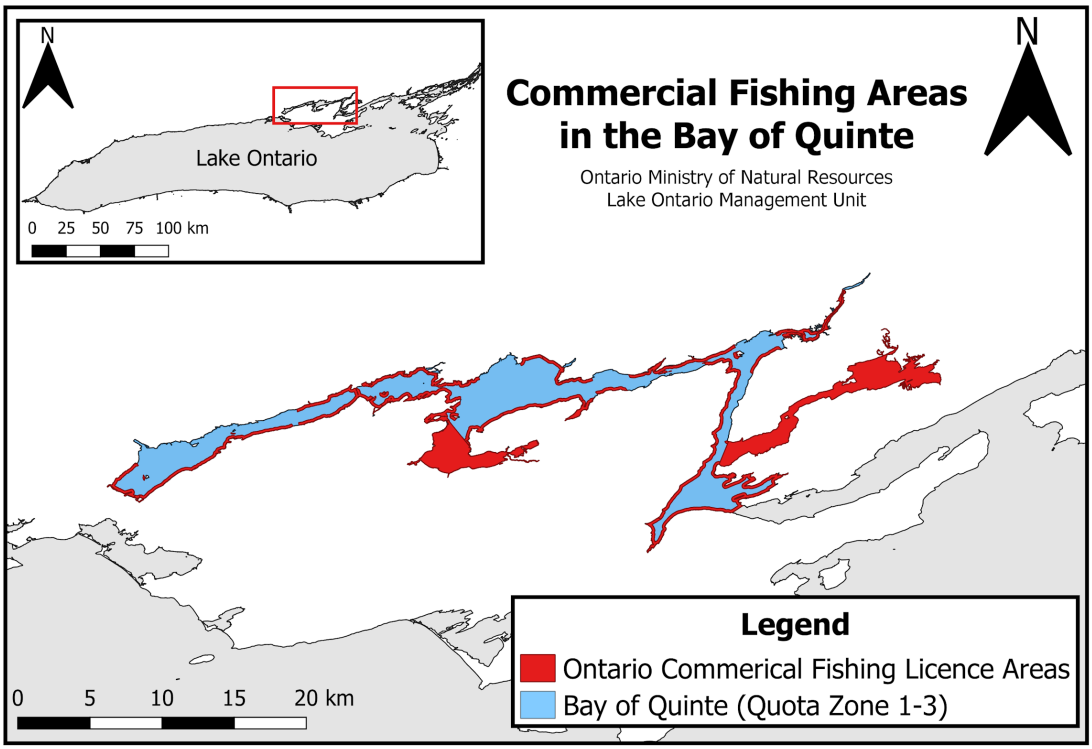

Figure 28: Areas of the Bay of Quinte shown in red indicate areas where impoundment fishing licenses are permitted. The light blue areas of the Bay of Quinte (that lack red highlighting) are currently not fished by commercial fishing licenses {pers. comm., MNRF 2024}.

Factor 4.3 - Ecosystem-based Fisheries Management

Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Large Mesh
Lake Ontario | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | Canada | Set gillnets | Small Mesh
Lake Ontario, Saint Lawrence River | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Ontario | America, North - Inland Waters | United States | New York | Set gillnets

Moderate Concern

The Joint Strategic Plan for Management of the Great Lakes calls for an Ecosystem-Management Strategy in which management agencies address impacts of overlapping activities on fish communities (GLFC 2007). The state of Lake Ontario overall is assessed as fair, driven by concerns regarding invasive species and pollution (Environment and Climate Change Canada and the U.S.

Environmental Protection Agency 2018). Historically, the Lake Ontario ecosystem has been disrupted several times, leading to food web alterations, and this complicates achieving a robust understanding of ecosystem dynamics (Mills et al. 2003)(U.S.-Canada Lake Ontario Lakewide Management Plan Management Committee 2007).

Disruptions influencing the ecosystem include oligotrophication, toxic algal blooms, low phytoplankton biomass, invasive *Dreissena* spp. mussels and round goby, native amphipod *Diporeia* spp. population decline, and increasing populations of piscivorous double-crested cormorant (U.S.-Canada Lake Ontario Lakewide Management Plan Management Committee 2007). There are 122 species of fish (including at least 13 nonnatives, excluding 7 extirpated natives) in the waters of Lake Ontario (NOAA GLERL 2009). Walleye, lake whitefish, and yellow perch are considered dominant species in the food web; however, there are other species that serve in similar trophic roles (NOAA GLERL 2009).

Although restoration measures have had some success, the foodweb of Lake Ontario has been permanently altered by nonnative species (Mills et al. 2009). The lake whitefish population has been negatively affected by the introduction of zebra and quagga mussels (*Dreissena* spp.) because their appearance is correlated with the disappearance of amphipods (*Diopreia* spp.), which are lake whitefish prey (Ebener et al. 2008)(Mills et al. 2009). For sustainable informed fisheries management, it is essential to gain an understanding of the carrying capacity of Lake Ontario, changes in prey and predator species, and mechanisms that influence lower food web productivity. But ongoing ecological disruptions impede a robust understanding. Researchers have cautioned that more conservative Great Lakes management may be required to preserve ecosystem functioning in light of potential projected future anthropogenic and climatic stressors. Based on the species' ecological roles, detrimental food web impacts are possible, but there is spatial and temporal management in place (MNRF 2023) (NYSDEC 2023b) that is appropriate to the scale of the fishery and ecology of the stocks that is likely to be effective with little scientific controversy; hence, ecosystem-based fisheries management is considered a moderate concern.

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Scientific reviewdoes 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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