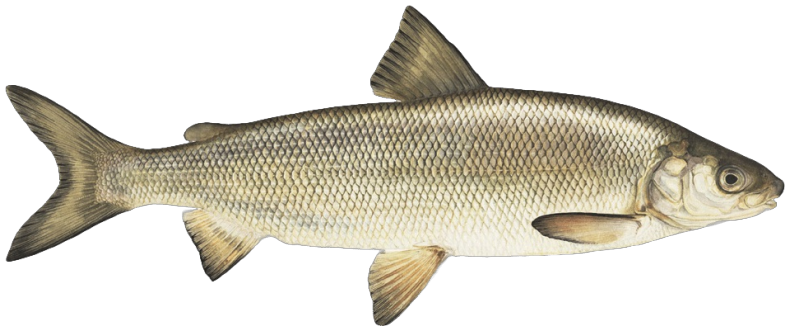
Monterey Bay Aquarium
Seafood Watch

Draft Assessment for Review

July 2024

Freshwater Fish, Lake Erie

Perca flavescens, Coregonus clupeaformis, Sander vitreus, Morone chrysops, Osmerus mordax



North America - Inland Waters

Barriers, fences, weirs, corrals, etc., Set gillnets, Midwater trawls

Report ID 27858

Seafood Watch Standard used in this assessment: 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*), rainbow smelt (*Osmerus mordax*), walleye (*Sander vitreus*), white bass (*Morone chrysops*), white perch (*Morone americana*), and yellow perch (*Perca flavescens*) caught in Lake Erie by United States and Canadian fisheries. The assessment is divided based on management region (Ontario, Canada and Ohio, USA), gear type, including small and large mesh set gillnets, trap nets (also referred to as stationary pound nets), and bottom trawls, and species.

The Ontario trap net fishery harvests yellow perch, white perch, and white bass, and the Ontario set gillnet fishery harvests lake whitefish, walleye, yellow perch, white perch, and white bass. Abundance has been scored a “very low concern” for yellow perch as recent stock assessment abundance estimates display stable population abundance trends, and because biomass is estimated to be above B_{MSY} in all management units and has been since the implementation of the Yellow Perch Management Plan, and fishing mortality has been scored as a “low concern” as it remains at or below the established limit reference points. White perch are considered a non-native species and therefore a score of “very low concern” and “low concern” was awarded for abundance and fishing mortality, respectively. White bass has received a score of “high concern” for abundance, as the population is below the limit reference point. Fishing mortality for white bass is fluctuating around a reference point considered appropriate for the species, and is thus considered a “moderate concern.” Abundance is above the limit reference point for lake whitefish, however, survey indicators show mixed signals and abundance is thus considered a “moderate concern." Fishing mortality for lake whitefish has been scored as “moderate concern,” as F is below the established quota in Ontario, but the appropriateness of the quota is unknown. A stock assessment conducted for walleye indicates that abundance is above the limit reference point, however, management does not have a target reference point, and thus abundance has been scored as a “low concern." Fishing mortality for walleye is considered “low concern,” as fishing mortality is below established the limit reference point. Management strategy and implementation for the Ontario trap net and gillnet fisheries have both been scored as “highly effective,” as more than 70% of the fishery’s main targeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice. Bycatch strategy in the Ontario set gillnet and trap net fisheries is scored as a “moderately effective” as bycatch reduction techniques are used, but there is some uncertainty in bycatch catch composition due to lack of observer coverage. Ecosystem based fisheries management is scored a “moderate concern” for both fisheries to take into account that based on the species' ecological roles, detrimental food web impacts are possible, but spatial and temporal management is in place that is appropriate to the scale of the fishery and ecology of the stocks, that is likely to be effective with little scientific controversy. Taken together, yellow perch, white bass, and white perch in the Ontario trap net fishery received a “yellow” rating. Further, lake whitefish, walleye, yellow perch, white bass, and white perch in the Ontario set gillnet fishery received a “yellow” rating.

The Ohio trap net fishery harvests yellow perch, lake whitefish, white bass, and white perch. Abundance has been scored a “very low concern” for yellow perch as recent quantitative stock assessment abundance estimates display stable population abundance trends, and because biomass is estimated to be above B_{MSY} in all management units and has been since the implementation of the Yellow Perch Management Plan. Fishing mortality for yellow perch has been scored as a “low concern” as it remains at or below the established limit reference points. Abundance is above the limit reference point for lake whitefish, however, survey indicators show mixed signals and abundance is thus considered a “moderate concern." There is no quota for lake whitefish in the Ohio waters of Lake Erie and therefore as F is unknown, fishing mortality is scored a “moderate concern." White bass has received a score of “high concern” for abundance, as the

population is below the limit reference point. Fishing mortality for white bass is fluctuating around a reference point considered appropriate for the species, and is thus rated a “moderate concern.” White perch are considered a non-native species and therefore a score of “very low concern” and “low concern” was awarded for abundance and fishing mortality, respectively. Management strategy and implementation for the Ohio trap net fishery has been scored as “highly effective” as more than 70% of the fishery’s main targeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice. Bycatch strategy in the Ohio trap net fishery is scored as a “moderately effective” as bycatch reduction techniques are used, but there is some uncertainty in bycatch catch composition due to lack of observer coverage. Ecosystem based fisheries management is scored a “moderate concern” to take into account that based on the species' ecological roles, detrimental food web impacts are possible, but spatial and temporal management is in place that is appropriate to the scale of the fishery and ecology of the stocks, that is likely to be effective with little scientific controversy. Taken together, yellow perch, lake whitefish, white bass, and white perch in the Ohio trap net fishery received a “yellow” rating.

The Ontario bottom trawl fishery harvests rainbow smelt which are considered a non-native species, and therefore a score of “very low concern” and “low concern” was awarded for abundance and fishing mortality, respectively. Management strategy and implementation is scored “moderately effective” as rainbow smelt are a non-native species that are not stocked or seeded, and harvesting prevents increases in stock size. Bycatch strategy has been scored as “highly effective” as bycatch is very low and there were very low potential interactions with ETP species. Ecosystem based fisheries management is scored a “moderate concern” to take into account that based on the species' ecological roles, detrimental food web impacts are possible, but spatial and temporal management is in place that is appropriate to the scale of the fishery and ecology of the stocks, that is likely to be effective with little scientific controversy. Taken together, rainbow smelt in the Ontario bottom trawl fishery received a “green” rating.

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 Erie | America, North - Inland Waters | Canada | Set gillnets	2.644	1.732	4.000	3.000	**Good Alternative (2.723)**	Unknown
Lake whitefish | Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	2.644	1.732	4.000	3.000	**Good Alternative (2.723)**	Unknown
Rainbow smelt | Lake Erie | America, North - Inland Waters | Canada | Bottom trawls	5.000	5.000	3.000	2.449	**Best Choice (3.681)**	Unknown
Walleye | Lake Erie | America, North - Inland Waters | Canada | Set gillnets	4.284	1.732	4.000	3.000	**Good Alternative (3.072)**	Unknown
White bass | Lake Erie | America, North - Inland Waters | Canada | Set gillnets	1.732	2.236	4.000	3.000	**Good Alternative (2.611)**	Unknown
White bass | Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	5.000	4.000	3.000	**Good Alternative (3.193)**	Unknown
White bass | Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	1.732	2.644	4.000	3.000	**Good Alternative (2.723)**	Unknown
White perch | Lake Erie | America, North - Inland Waters | Canada | Set gillnets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown
White perch | Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown
White perch | Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown
Yellow perch | Lake Erie | America, North - Inland Waters | Canada | Set gillnets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown
Yellow perch | Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown

Yellow perch | Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	5.000	1.732	4.000	3.000	**Good Alternative (3.193)**	Unknown

Summary

Lake whitefish (*Coregonus clupeaformis*) harvested in Lake Erie by United States (Ohio) trap net and Canadian (Ontario) gillnet fisheries are rated “yellow.”

Rainbow smelt (*Osmerus mordax*) harvested in Lake Erie by the Canadian (Ontario) bottom trawl fishery are rated "green."

Walleye (*Sander vitreus*) harvested in Lake Erie by Canadian (Ontario) gillnet fisheries are rated “yellow.”

White bass (*Morone chrysops*) harvested in Lake Erie by United States (Ohio) and Canadian (Ontario) trap net fisheries and Canadian (Ontario) gillnet fisheries are rated “yellow.”

White perch (*Morone americana)* harvested in Lake Erie by United States (Ohio) trap net and Canadian (Ontario) trap net and gillnet fisheries are rated “yellow.”

Yellow perch (*Perca flavescens*) harvested in Lake Erie by United States (Ohio) trap net and Canadian (Ontario) trap net and gillnet fisheries are rated “yellow.”

Eco-Certification Information

The Lake Erie yellow perch and walleye commercial fisheries in Ontario (small and large mesh gillnet) and yellow perch fishery in Ohio (trap net) are certified by the Marine Stewardship Council {Alderstein et al. 2015}{SAI Global 2019}.

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*), rainbow smelt (*Osmerus mordax*), walleye (*Sander vitreus*), white bass (*Morone chrysops*), white perch (*Morone americana*), and yellow perch (*Perca flavescens*) caught in Lake Erie by United States and Canadian fisheries. The assessment is divided based on management region (Ontario, Canada and Ohio, USA), gear type (small and large mesh set gillnets, trap nets (also referred to as stationary pound nets), and bottom trawls), and species.

Species Overview

Lake whitefish are temperate (8-14°C) freshwater and brackish salmonids distributed in North America throughout Canada, Alaska, New England, the Great Lakes, and central Minnesota, USA (depth 8-128 m) (Froese & Pauly 2021). 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 (ibid). They are annual open water/substratum egg scatterers in the southern portion of their range but reproduce every two to three years in the northern sub-arctic and arctic regions (ibid). As adults they feed on aquatic insect larvae, mollusks, amphipods, fishes and fish eggs (ibid).

Rainbow smelt are temperate (6-14°C) freshwater, brackish and marine osmerid forage fish, present in the North Atlantic drainages from Lake Melville in Newfoundland and Labrador, Canada to Delaware River in Pennsylvania, USA and west through the Great lakes (Froese & Pauly 2021). They occur in Arctic and Pacific drainages from Bathurst Inlet, Northwest Territories to Vancouver Island in British Columbia, Canada and in Pacific drainages of Asia (depth range 0-450 m) (ibid). Rainbow smelt can reach 35 cm TL and 7 years of age (ibid). They spawn in the Great Lakes in tributary rivers and along the shoreline (Fuller et al. 2024) reaching reproductive maturity at 19.5 cm TL (Froese & Pauly 2021). Adults feed on invertebrates and small fishes (ibid). Rainbow smelt are a non-native species that dispersed throughout the Great Lakes after intentional introduction to Crystal Lake, Michigan in 1912 and were first documented in Lake Erie in 1935 (Rooney & Patterson 2009).

Walleye are subtropical (1-29°C) freshwater and brackish perciform fish present in the Great Lakes, Arctic, and Mississippi River basins distributed in North America from Quebec and the Northwest Territories in Canada, to Alabama and Arkansas in the USA (depth 0-27 m, widely introduced to most USA regions) (Froese & Pauly 2021). Walleye can reach 107 cm TL (commonly 57 cm TL) and 11 kg total weight, and the maximum reported age is 29 years (ibid). They are broadcast spawners reaching reproductive maturity at 36-43 cm (ibid). Adults feed primarily on insects and fishes, but will also consume crayfish, snails, frogs, mudpuppies, and small mammals (ibid).

White bass are temperate (12-32°C) freshwater moronid fish present in North America (St. Lawrence-Great Lakes, Hudson Bay and Mississippi River basins) with a northern range from Quebec in Canada south to Louisiana in the USA and to Rio Grande, Texas and New Mexico (Froese & Pauly 2021). White bass can reach 45 cm TL (commonly 32 cm TL) and 3.1 kg total weight, and the maximum reported age is up to 13 years in Lake Erie {Scott et al. 1973}(Froese & Pauly 2021). They are open water/substratum egg scatterers reaching reproductive maturity at 28 cm TL (ibid). Juveniles feed on small invertebrates while adults are piscivorous (Froese & Pauly 2021).

White perch are temperate (10-33°C) freshwater moronid fish present in North America (St. Lawrence-Great

Lakes, Ohio-Missouri-Mississippi River basins and as far west as Colorado, USA) ranging from Quebec, Canada to Georgia, USA (Froese & Pauly 2021). White perch can reach 58 cm TL (commonly 13.5 cm TL) and 2.7 kg total weight, and the maximum reported age is 16 years (ibid). They are open water/substratum egg scatterers reaching reproductive maturity at 2 years of age (ibid). Juveniles and adults feed on small invertebrates and are piscivorous (ibid). White perch are a non-native species to Lake Erie (native to the East Coast of North America) that were first documented in Lake Erie in the 1950s, after first entering Lake Ontario (from the Hudson river by way of the Erie canal) and then dispersing to Lake Erie through Welland Canal, Canada (Schaeffer & Margraf 1986).

Yellow perch are subtropical (0-30°C) freshwater and brackish perciform fish present in Great Lakes, Atlantic, Arctic, and Mississippi River basins in North America from Nova Scotia and the Northwest Territories in Canada, to Ohio, Illinois, Nebraska, and Georgia in the USA (depth 0-56 m, typically < 9m) (Froese & Pauly 2021). Yellow perch can reach 50 cm TL (commonly 19 cm TL) and 1.9 kg total weight, and the maximum reported age in Lake Erie is 14 years {Scott et al. 1973}(Froese & Pauly 2021). They are annual nonobligatory plant spawners reaching reproductive maturity at <150 mm and 1 yr old for males in Lake Erie (ibid). Adults feed on insects, fishes and fish eggs (Froese & Pauly 2021).

Lake Erie is the fourth largest and southernmost of the five Great Lakes, and the 11th largest lake in the world with 50% in Canada and 50% in the USA (see figure 1) (Michigan Sea Grant 2022). The Lake Erie drainage basin (78,063 km^2, surface water area 25,667 km^2, average depth 19 m, max depth 64 m) is the most densely populated of the five lake basins {GLC 2022}. It is the most shallow of the Great Lakes and as such reaches the warmest temperatures (in the spring/summer) and freezes over in winter. There are regular harmful algal blooms (HABs) due to warm temperatures and nutrient-rich agricultural runoff (Michigan Sea Grant 2022). Aquatic community shifts have occurred historically due to overfishing, cultural eutrophication, pollution, and invasive species introduction. Lake Erie has the largest commercial fishery of all the Great Lakes with the majority of catch composed of yellow perch and walleye caught in Canadian waters (ibid).

The Great Lakes fisheries are managed through binational collaboration by the Great Lakes Fishery Commission (GLFC, est. 1954), comprised of commissioners from both Canada and the United States. Fisheries agencies, inclusive of the eight states bordering the Great Lakes, the Province of Ontario, three U.S. intertribal agencies, and several US federal agencies, have committed to cooperate in strategic planning and ecosystem-based management via the Joint Strategic Plan for Management of Great Lakes Fisheries and through lake committees (GLFC 2007). The Lake Erie committee includes membership from the Ontario Ministry of Natural Resources and Forestry, the New York State Department of Environmental Conservation, the Pennsylvania Fish and Boat Commission, the Michigan Department of Natural Resources, and the Ohio Department of Natural Resources (GLFC 2022).

Figure 1: Lake Erie drainage basin, the dotted line represents the division of US and Canadian waters (Michigan Sea Grant 2022).

Production Statistics

Lake Erie commercial fisheries are one of the world's largest freshwater commercial fisheries with the Canadian commercial gillnet fisheries contributing the largest proportion of harvest (Kinnunen 2003).

Lake Whitefish Production Statistics

Lake whitefish harvest in 2022 (170,393 pounds) increased 40% from 2021 but remains low relative to previous decades (Coldwater Task Group 2023). Harvest of lake whitefish was greatest in Ontario (69%), followed by Ohio (31%), New York (<1%), and Pennsylvania (<1%) (see figure 2) (Coldwater Task Group 2023). There was no targeted effort for lake whitefish in 2022. Harvest in Ontario was through bycatch retention in fisheries targeting walleye (85%), rainbow smelt (11%), white bass (3%), white perch (<1%), and yellow perch (<1%) (Coldwater Task Group 2023).

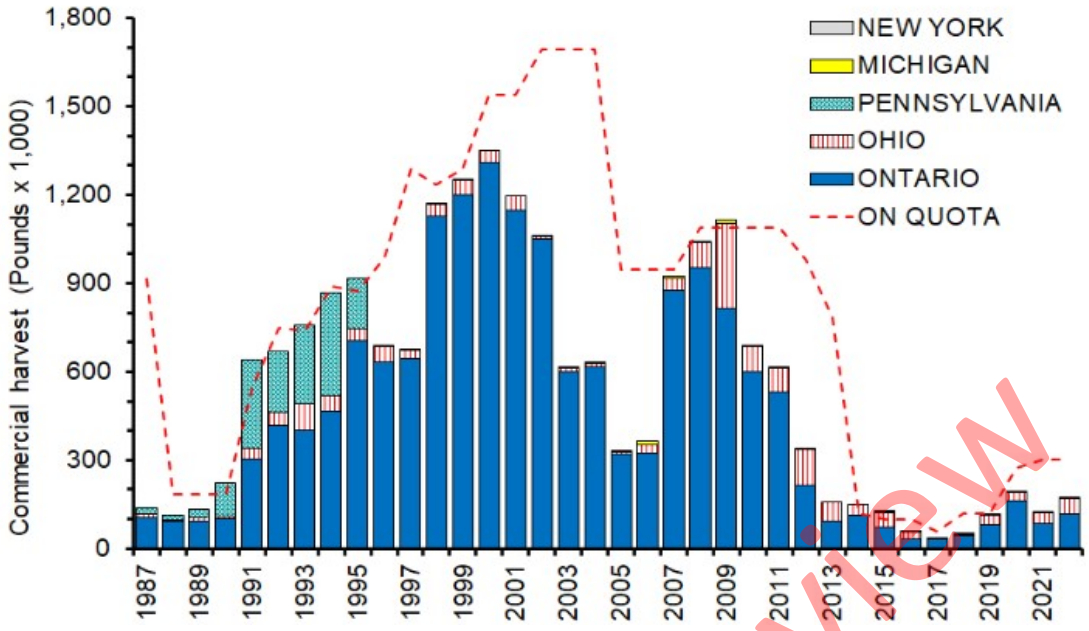

Figure 2: Lake whitefish total harvest from 1987-2022 by jurisdiction in Lake Erie . Pennsylvania ceased gill netting in 1996. Ontario quota is presented as a dashed line. Commercial lake whitefish harvest in Lake Erie remains low relative to previous decades (Coldwater Task Group 2023).

Rainbow Smelt Production Statistics

In 2021, 4.69 million pounds of rainbow smelt were harvested in Lake Erie in Canadian waters, a reduction of 11.5% relative to 2020 (5.30 million pounds, see figure 3) (OCFA 2022).

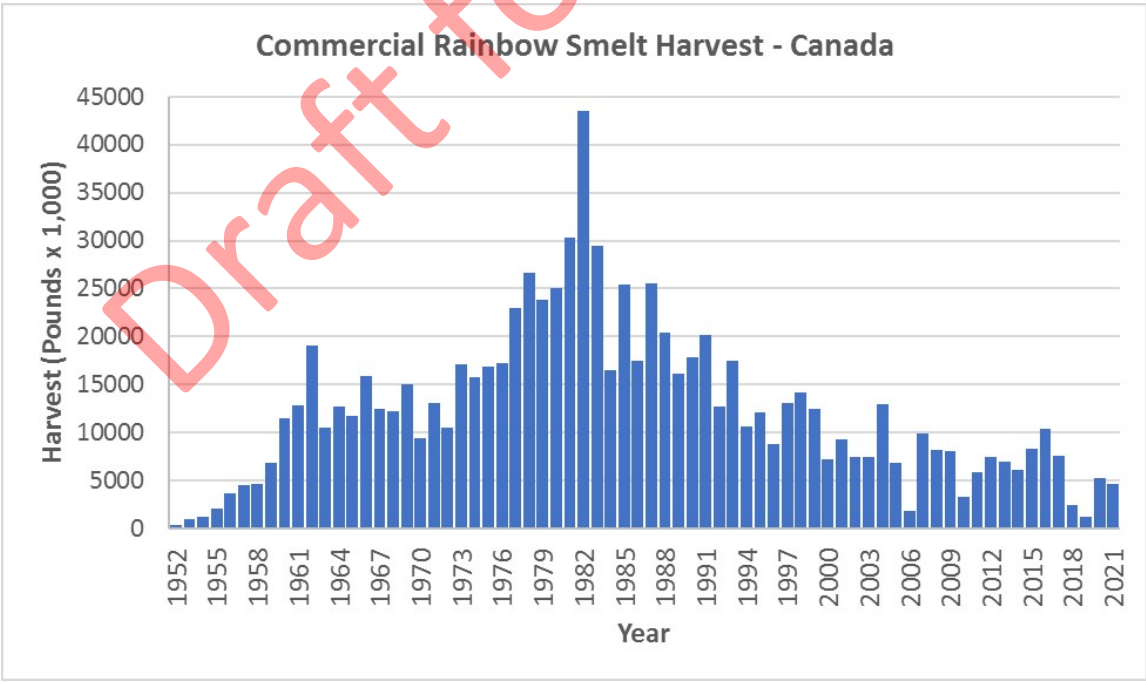

Figure 3: Commercial harvest of rainbow smelt in Lake Erie in Canadian waters (OCFA 2022).

Walleye Production Statistics

In 2022, 9.27 million walleye were harvested in Lake Erie (6.18 million harvested by the commercial fishery and 3.09 million by the sport fishery), a 16% increase relative to 2021 (see figure 4) (Walleye Task Group 2023). The lake-wide Ontario commercial harvest in 2022 (9.269 million fish) was above the long-term average (1976-2021 = 2.205 million walleye) (ibid). From 1999-2018 the mean proportion of harvest from the commercial fishery was 57.2% (+/- 4.4%) and 42.8% (+/- 4.4%) from the sport fishery harvest (SAI Global 2019). Over the last 10 years, about 70% of the walleye harvest has been taken in Management Unit 1 (MU 1), the westernmost management unit (see figure 20) (Global Trust Certification 2022).

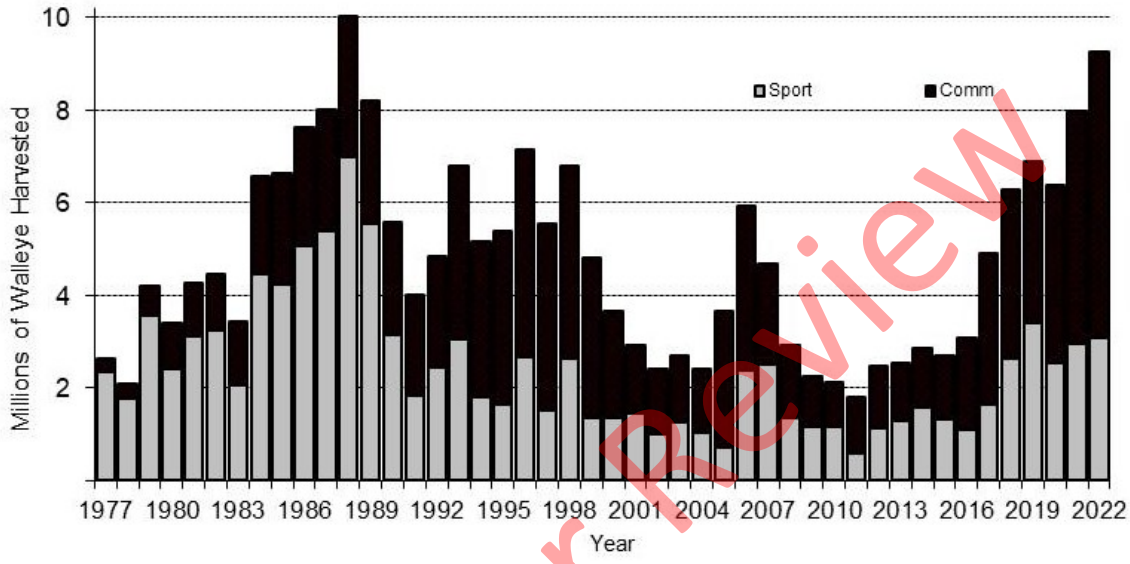

Figure 4: Lake-wide harvest of Lake Erie Walleye by sport and commercial fisheries during 1977-20221 (Walleye Task Group 2023).

White Bass Production Statistics

In 2020, 1.91 million pounds of white bass were harvested by Lake Erie commercial fisheries (see figure 5) (GLFC 2022c). The greatest proportion of harvest was from the Ontario gillnet fishery (see figure below, ibid). Since 2017, harvest has been below average (3.40 million pounds average for 1986-2020) (GLFC 2022).

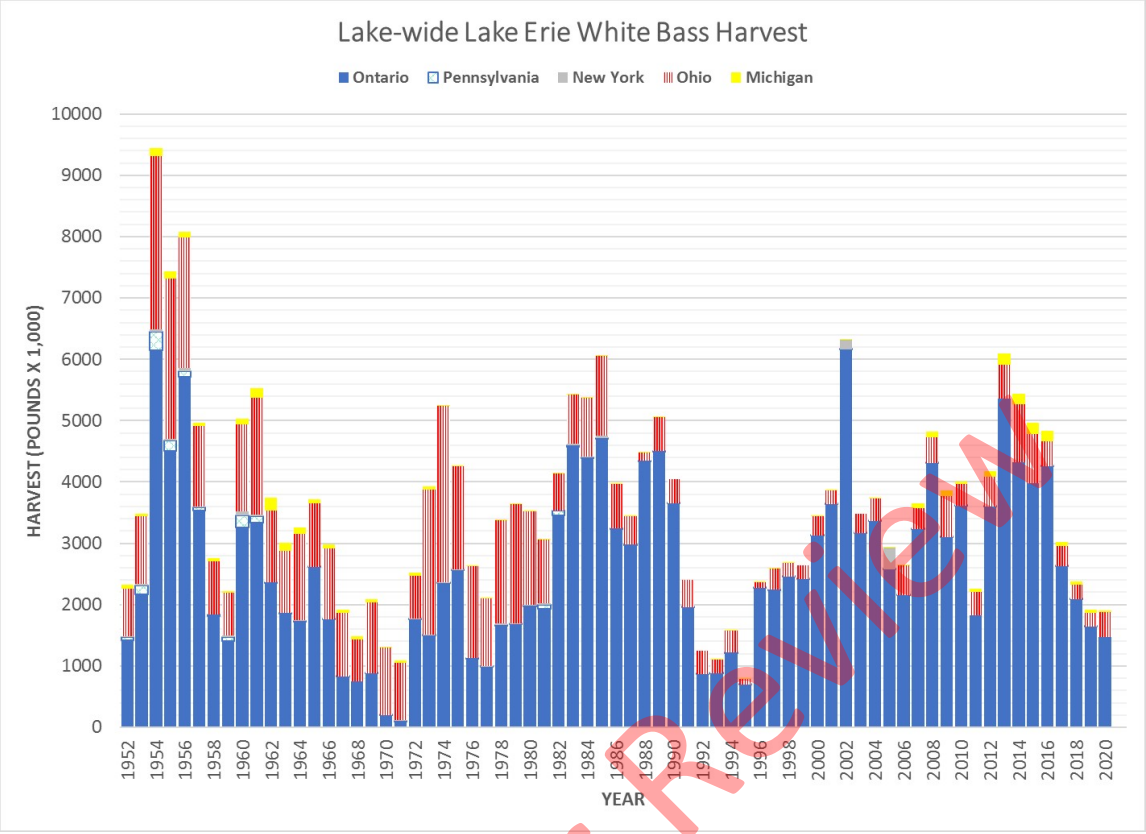

Figure 5: Lake Erie white bass commercial harvest (GLFC 2022c).

White Perch Production Statistics

In 2020, 2.88 million pounds of white perch were harvested by Lake Erie commercial fisheries (see figure 6) (GLFC 2022c). The greatest proportion of harvest was from the Ontario gillnet fishery followed by the Ohio trap net fishery (see figure 6, ibid).

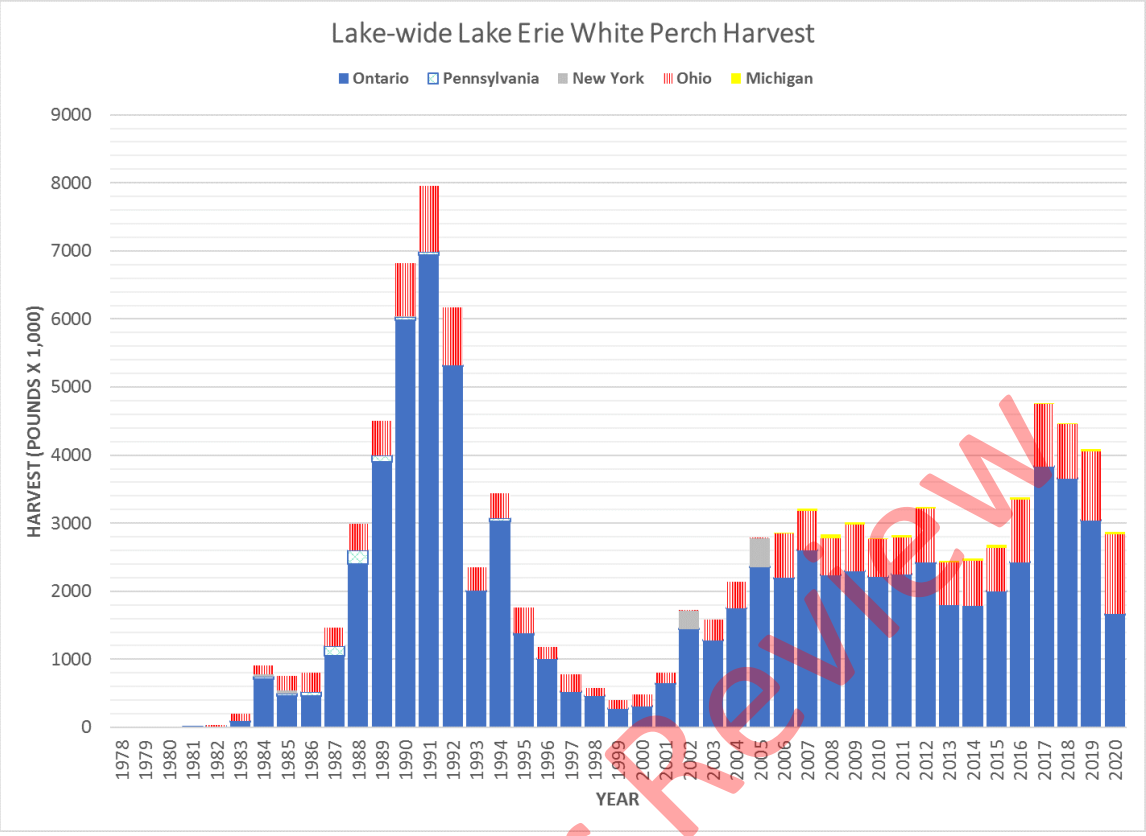

Figure 6: Lake Erie white perch commercial harvest (GLFC 2022c).

Yellow Perch Production Statistics

In 2022, 3.4 million pounds of yellow perch were harvested lake-wide in Lake Erie by commercial fisheries, an increase of 3% relative to 2021 (3.30 million pounds) (see figure 7) (Yellow Perch Task Group 2023). The greatest harvest was from Ontario (65%), followed by Ohio (29%), Michigan (2%), New York (2.5%), and Pennsylvania (1.92%). This is similar to the harvest proportion by region over the long-term average (2011-2020) with greatest harvest from Ontario (65%), followed by Ohio (31%) and small shares of harvest from Michigan (2%), New York (1%) and Pennsylvania (2%) (Global Trust Certification 2022).

The estimated 2021 proportion harvest by gear type lake-wide was 69.7% gillnets, 13.3% in trap nets, and 17% from the sport fishery. The long-term (2011-2020) average harvest proportion by gear type was 61% in small mesh gillnets, 18% in trap nets, 17% in sport fisheries, 4% in large mesh gillnets, and <1% from trawls (Global Trust Certification 2022). Yellow perch fishery commercial harvest peaked in the 1950s-1970s but declined in the mid-1970s attributed to reduced recruitment success and survival leading to reduced TACs (see figure 7). Harvest is greatest in the west and west-central basins of Lake Erie (ibid).

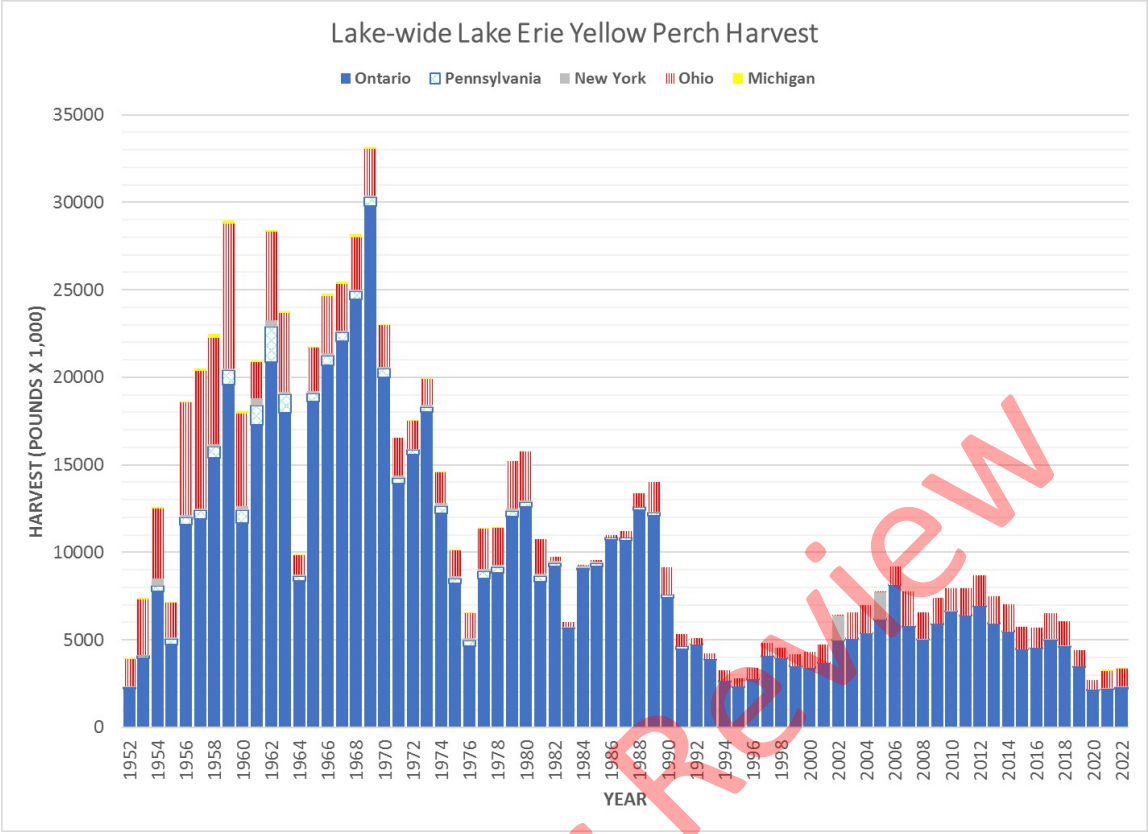

Figure 7: Lake Erie yellow perch commercial harvest (GLFC 2022c)(Yellow Perch Task Group 2022) (Yellow Perch Task Group 2023).

Total Commercial Fisheries Yield in Lake Erie Relative to all Laurentian Great Lakes

Total commercial fisheries yield in Lake Erie is the highest relative to the other Great Lakes (see figure 8) (Brenden et al. 2013). In the early years of the timeseries, the commercial fisheries harvest in Lake Erie was mainly composed of native coregonids (ciscoes and lake whitefish). However, over time due to ecosystem change (including eutrophication, habitat alteration, species introductions, and overfishing), harvest shifted to native percids (blue pike, walleyes, and sauger), and then later to walleyes, rainbow smelt, yellow perch, and white perch (ibid). During 1994–2004, Lake Huron accounted for 57% of the Great Lakes commercial fisheries' yield of lake whitefish, followed by Lake Michigan (28%), Lake Superior (9%), Lake Erie (4%), and Lake Ontario (2%) {Ebener et al. 2008}.

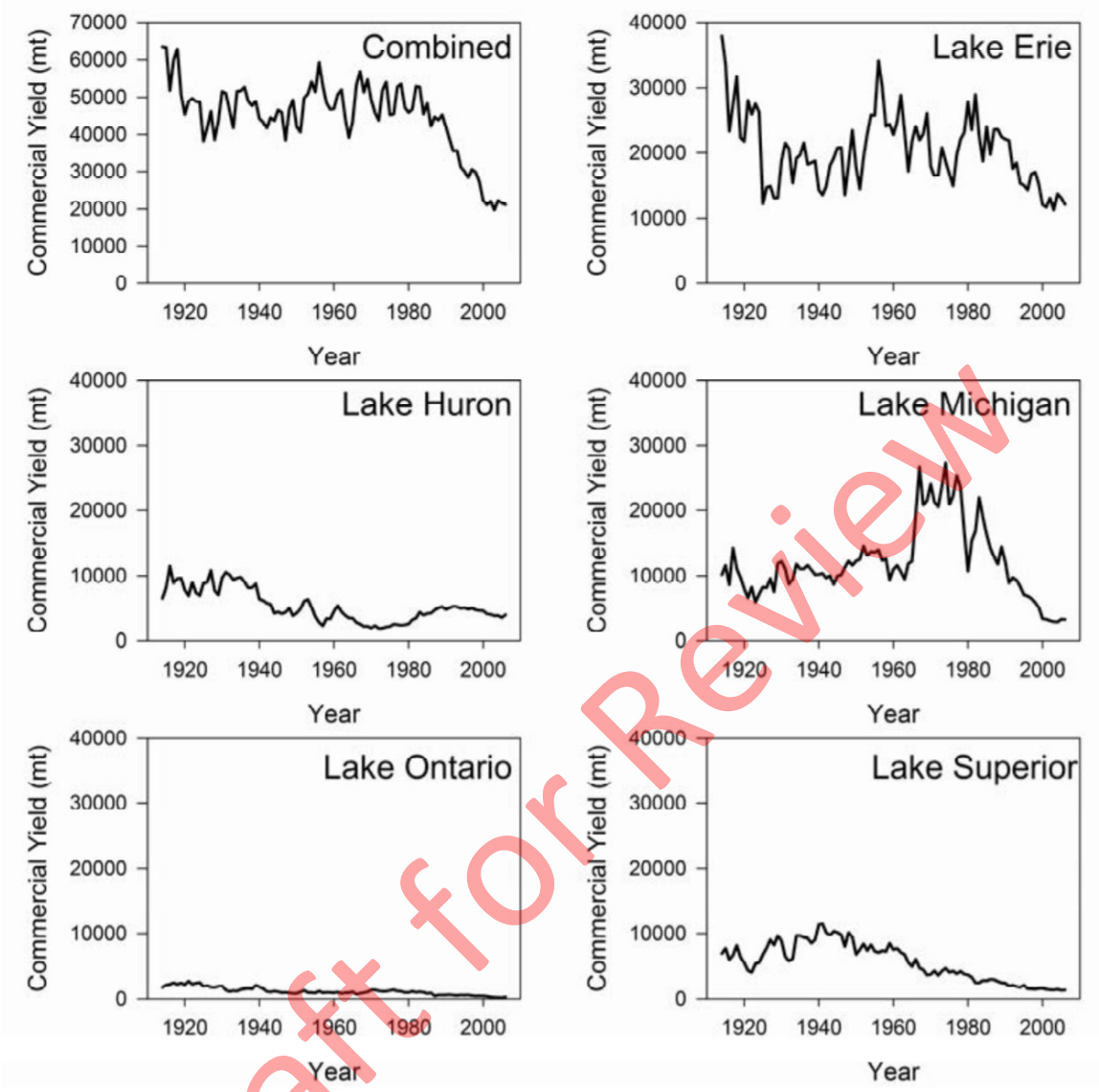

Figure 8: Total commercial yields (mt) of the lakes Erie, Huron, Michigan, Ontario, and Superior commercial fisheries from 1914 to 2006 {Brendan et al. 2013}.

Importance to the US/North American market.

None of the species evaluated in this report are considered important from the perspective of global trade (Jescovitch et al. 2022). Most of the fish produced remains in the region (i.e. from Canada and the United States) (FAO 2022), and is insignificant compared to global landings of other fish in other fisheries. A majority of the fish caught in the Great Lakes region is sold in the local market, either as fish (46.5%), or as a processed product (68%) (ibid). Similarly, a smaller proportion of fish and processed product is sold regionally (37.9% and 25.4% respectively), and nationally (12.7% and 5.1% respectively) (ibid). Only a small proportion, specifically 2.9% for fish and 1.5% for processed product, is sold in international markets (ibid).

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, grande coregone (French).

Rainbow smelt, *Osmerus mordax*, is also known as smelt, American smelt, Atlantic smelt, spirling, freshwater smelt.

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

White bass, *Morone chrysops,*is also known as bass, white lake bass, and silver bass.

White perch, *Morone americana*,is also known as perch.

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, and as value added smoked (head-on; fillets), roe (Seafood Handbook 2022).

Rainbow smelt: Fresh (whole and H&G (headed & gutted)), frozen (H&G) and canned.

Walleye: Fresh whole (round), headless and dressed, fillets (skinless/skin-on) and frozen IQF fillets & IQF fingers.

White bass: Skin on fillets.

White perch: Skin on fillets.

Yellow perch: Fresh and frozen skin-on fillets & whole, and as value added breaded/battered fillets.

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 Erie | America, North - Inland Waters | Canada | Set gillnets	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

RAINBOW SMELT			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

WALLEYE			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	3.670: Low Concern	5.000: Low Concern	Green (4.284)

WHITE BASS			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

WHITE PERCH			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

YELLOW PERCH			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

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 Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Moderate Concern

Lake whitefish are treated as one stock in Lake Erie for management purposes, however, preliminary results from genetic testing indicate there may be reproductively isolated spawning stocks which could lead to regional variation in stock status (Euclide et al. 2022). As such, further sampling is underway to determine stock structure of lake whitefish in Lake Erie. Lake whitefish population abundance is low relative to historic levels as the fishery collapsed in the 1950s due in part to habitat loss, overfishing, and introduction of non-native species with limited recovery in the 1980s due to nutrient shifts, reduced exploitation, and sea lamprey control (Coldwater Task Group 2022). Reduced hatching success from 2004-2013 resulted in record low adult abundance in 2014-2017 (1.2 - 2.1 million kg) (Coldwater Task Group 2022). Management objectives for lake whitefish are to ensure population persistence through maintaining spawning stock biomass (SSB) above the historically low levels seen between 2014 and 2017 and retain a diverse age structure (Francis et al. 2020).

To determine lake whitefish population status in Lake Erie, a two-gear statistical catch-at-age model was used based upon data from Ontario's gillnet fishery and fishery independent data from the Partnership Survey (Ontario Partnership Index Fishing Program Coldwater Assessment Survey) (Coldwater Task Group 2023). The forecasted SSB (2023-2025) was compared with the State of the Lake limit reference point (LRP, based on the range of depressed SSB from 2014-2017) to determine stock status. SSB was projected to remain above the LRP through 2025 provided fisheries harvest remains conservative (see figure 9) (ibid). The Great Lakes Fishery Commission considers the population and fishery to be sustainable due to increasing abundance and evidence of successful hatches during 2016-2020 (GLFC 2022). The catch rates in the Coldwater Assessment Survey standard assessment nets decreased in 2022 (2.73 fish/lift) relative to 2021 (4.30 fish/lift), but increased relative to 2020 (0.87 fish/lift) (Coldwater Task Group 2023). The highest catches were in New York waters (5.9 fish/lift) and Pennsylvania waters (3.0 fish/lift), while catch rates were lowest in Ontario waters (1.6 fish/lift in the east and 0.9 fish/lift in the west) (ibid). The catches of lake whitefish in the offshore nets (n=196, 3.36 fish/lift) exceeded the catch in the standard assessment nets (n = 148) for the second consecutive year (ibid). Trap net catch rates (35 lbs/lift) in Ohio, another indicator of population abundance, were 11% less than in 2021, but exceeded the mean (30 lbs/lift 1996-2021), while catch rates in 2021 were the greatest since 2013 (see figure 11) (ibid). The condition (Condition K) of both male and female lake whitefish in 2022 was above their respective historic means (see figure 12) (ibid). Gill net survey data show diverse age structure (ages 1-32) with dominance of age 7, 12, and 13 fish (38% of the total catch) (ibid). Recruitment of the 2020 cohort (3-year-olds) was forecasted to be moderate based on bottom trawl and gill net survey data (ibid).

The Coldwater Task Group recommends continued conservative management of lake whitefish as the fishery and survey indicators showed mixed status signals in 2022 (Coldwater Task Group 2022)(Coldwater Task Group 2023). As the lake whitefish population in Lake Erie is above the LRP,

but with survey indicators showing mixed signals for 2021 and forecasted low recruitment, population abundance is considered a “moderate concern.”

Justification:

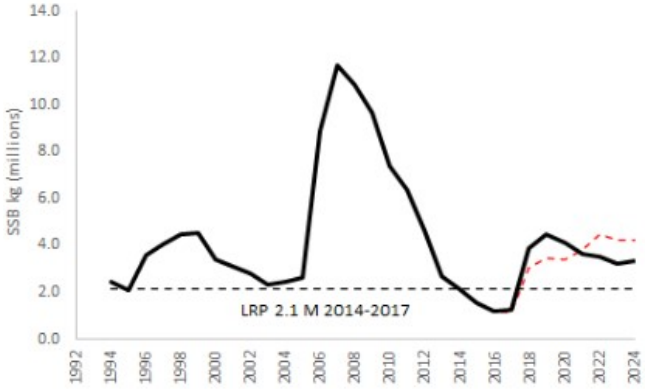

Figure 9: Lake whitefish spawning stock biomass estimates (kg - black line) projected to 2024, assuming constant SCAA survival estimates from 2022 (Coldwater Task Group 2023). Alternate SSB trajectory (PCA alternate) based on recruit indices in PCA-regression for cohorts 2014-2022 (dotted red line). SSB limit reference point was based on low spawning stock biomass 2014-2017 (dashed black line).

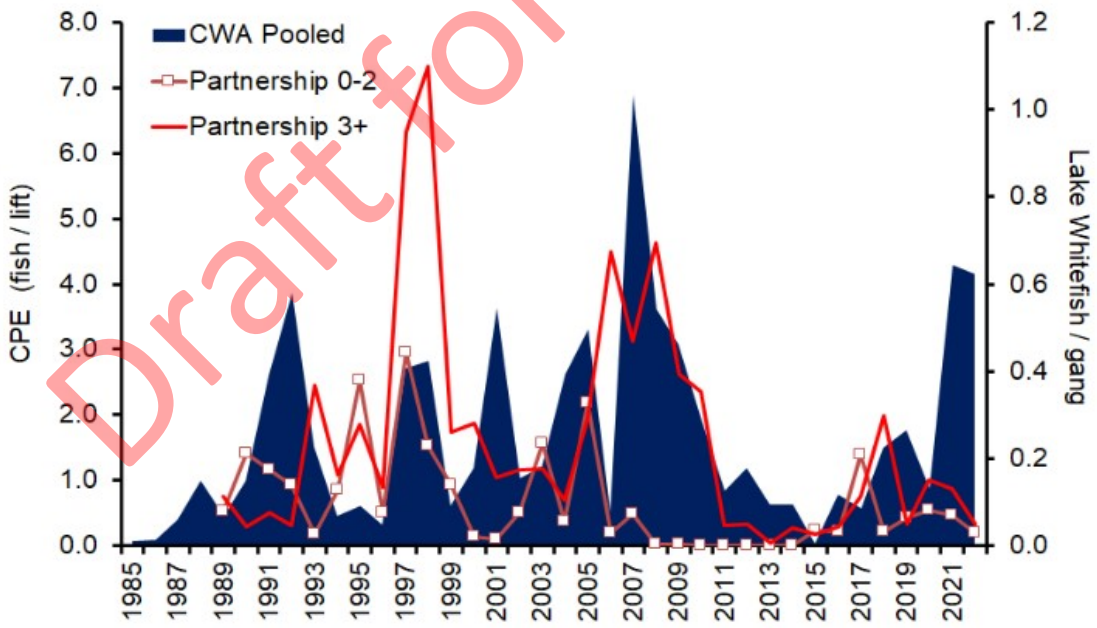

Figure 10: Catch per effort (number fish/lift) of lake whitefish caught in standard coldwater assessment gill nets (CWA) in New York, Pennsylvania, and Ontario waters, weighted by number of lifts (blue area) . Partnership index catch rates (LWF/gang) for ages 0-2 (dots) and ages 3 and older (squares) (second axis)

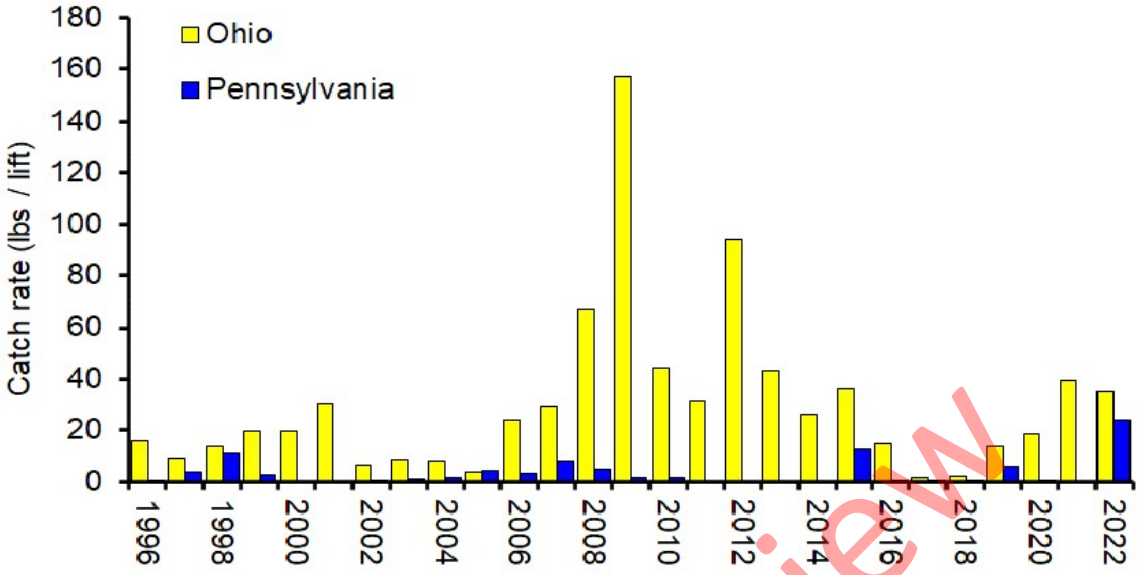

Figure 11: Lake whitefish commercial trap net catch rates in Ohio and Pennsylvania (pounds per lift), 1996-2022 (Coldwater Task Group 2023). Zeroharvest for PA in 2000-2001, 2011-2014 and 2021.

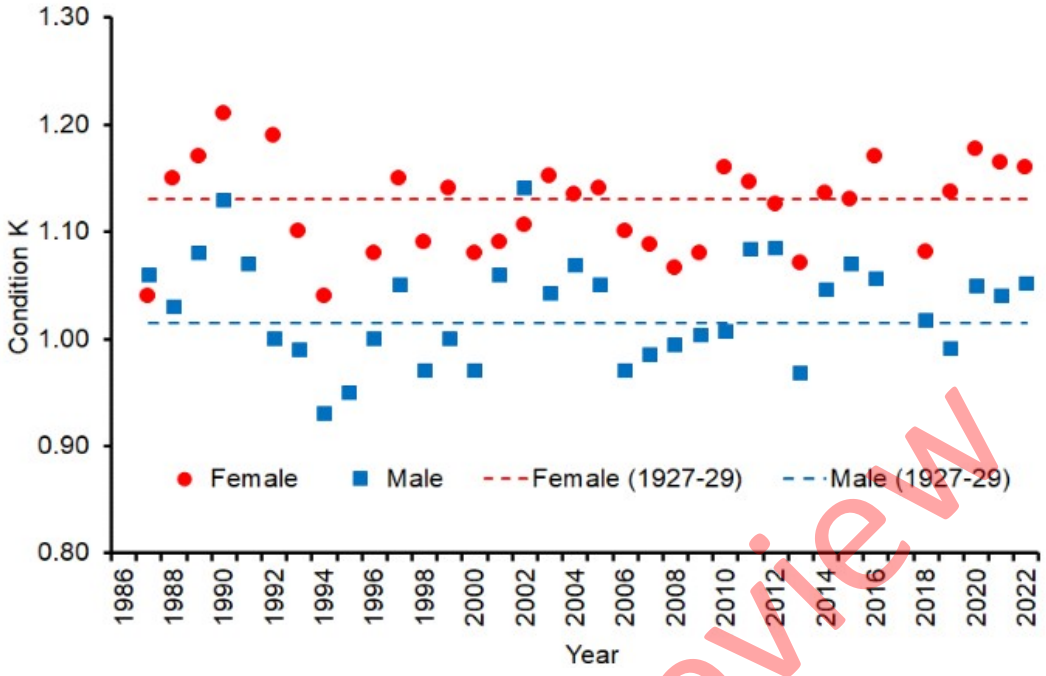

Figure 12: Mean condition factor (K) values of age 4 and older Lake Whitefish obtained from Ontario and Ohio commercial and survey data (Oct-Dec) by sex from 1987-2022 (Coldwater Task Group 2023). Samples sizes in 2022 were: males n=41 and females n=18. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile (1947). Mean condition factor (K) values of age 4 and older lake whitefish obtained from Ontario and Ohio commercial and survey data (Oct-Dec) by sex from 1987-2021 . Samples sizes in 2021 were: males n=17 and females n=25. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile 1947.

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Moderate Concern

In 2022 there was no reported targeted harvest of lake whitefish in Lake Erie (Coldwater Task Group 2023). Lake whitefish harvest in Ontario in 2022 was from bycatch in other fisheries (targeting walleye (85%), rainbow smelt (11%), white bass (3%), white perch (<1%), yellow perch (<1%) (ibid). The total 2022 harvest of lake whitefish in Lake Erie was 170,393 pounds (a 40% increase relative to 2021) with Ontario's incidental harvest representing 39% of the 300,000 pound Ontario quota (see figure 2, ibid). Lake whitefish harvest in the Ohio waters of Lake Erie in 2022 (53,068 pounds) was from commercial trap nets (ibid). There are no harvest control rules to guide management in quota adjustments to the Ontario quota and there is no quota for late whitefish in Ohio (ibid). Harvest has been low for lake whitefish in Lake Erie in the past decade relative to the time series and has been a non-target gillnet fishery in Ontario since 2014 (ibid). Even though the commercial harvest of lake whitefish has been within the allotted quota in Ontario from 1987 to 2022 (see Figure 2)(Coldwater

Task Group 2023), as it is unclear if the quota is appropriate in Ontario, and there is no quota in Ohio, fishing mortality is considered a “moderate concern.”

Rainbow smelt (Osmerus mordax)

Factor 1.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Bottom trawls

Very Low Concern

Rainbow smelt are a non-native species that was introduced into Crystal Lake, Michigan in 1912 and was recorded in Lake Erie in the 1930s (Rooney & Patterson 2009). As a non-native species, abundance of rainbow smelt is considered a “very low concern.”

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Bottom trawls

Low Concern

As rainbow smelt are non-native species (Rooney & Patterson 2009), fishing mortality is considered a “low concern.”

Walleye (Sander vitreus)

Factor 1.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Low Concern

Walleye in Lake Erie are divided into 5 management units (MUs see figure 13) for management purposes, but these are not based on genetic stock structure (Walleye Task Group 2022). Genetic stock structure and migration of walleye in Lake Erie add uncertainty to estimations of population abundance (Chen et al. 2020)(Euclide et al. 2021). There are at least two genetically distinct walleye stocks in Lake Erie (eastern basin stock & west-central basin stock) (ibid). Much of the harvest in the eastern basin comes from the west-central basin stock but there can be considerable variability in the proportion of stock contribution to harvest among years, seasons, and locations (ibid). For stock assessment purposes the walleye population in Lake Erie is currently treated as one genetic stock and abundance is assessed in MUs 1-3 where the majority of fishing occurs, however, research is on-going to develop a mixed-stock model (based on genetics and migratory patterns) particularly in MUs 4-5 (Lake Erie Committee 2015).

The Lake Erie Walleye Task Group uses a statistical catch-at-age model, based on both fishery-independent (gill net surveys in Ontario, Ohio, and Michigan) and fishery-dependent data (Ontario commercial fishery and the Ohio and Michigan sport fisheries), to estimate population abundance of walleye in MUs 1-3 (Walleye Task Group 2022). The 2022 west-central population (MUs 1-3) was

estimated to be 71 million age 2+ walleye (see figure 14) with age 3 as the dominating year class (38%) (Walleye Task Group 2023). The 2023 west-central population was forecasted to be 93.7 million fish (ibid). The spawning stock biomass (SSB) for 2023 was estimated to be 69.057 million kgs and the projected SSB for 2024 was 66.579 million kgs, which are both above the limit reference point ($20\%SSB_O$) of 12.847 million kgs (ibid).

Lake-wide harvest-per-unit effort (HUE) for Lake Erie commercial and sport walleye fisheries and lake-wide mean age from harvest subsampling remain stable (see figures 15 & 16, (Walleye Task Group 2023)). The commercial gill net HUE increased in 2022 and was above the lake-wide average from 1976-2021 (176 walleye/kilometer of net, see figure 15, ibid). Mean length-at-age for age 0 and 1 walleye remains below average based on data from western basin interagency bottom trawl surveys, which is considered by management to be related to increased abundance driving larger than usual year classes that enter the fishery at smaller sizes (see figure 17, ibid). Recruitment success is sporadic and influenced by environmental conditions with strong year classes in recent years (see figure 18) (Global Trust Certification 2022). As there is a quantitative stock assessment estimating abundance to be above the limit reference point, with other indicators also suggesting the stock is healthy, abundance is considered a “low concern.”

Justification:

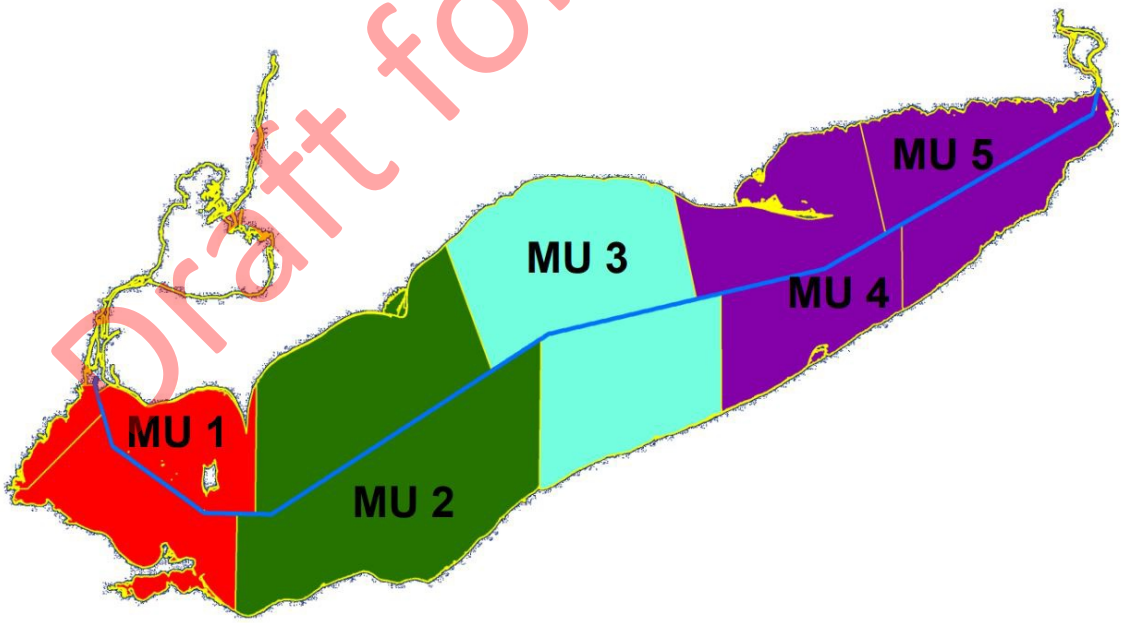

Figure 13: Map of Lake Erie with management units (MU) recognized by the Walleye Task Group for interagency management of Walleye (Walleye Task Group 2022).

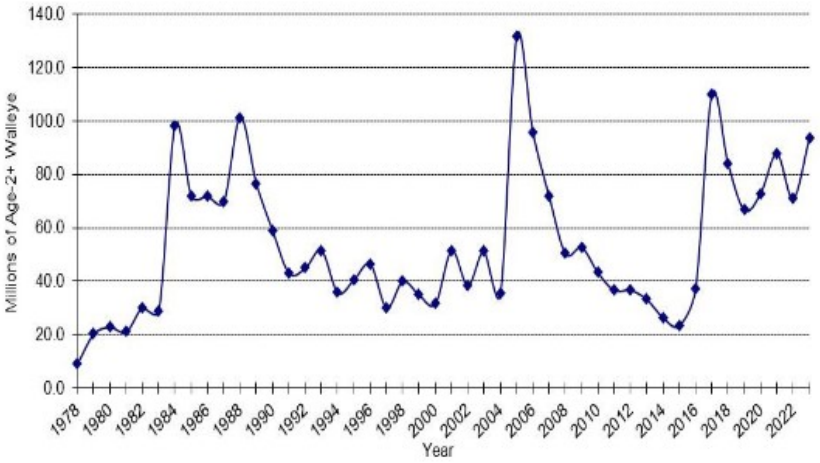

Figure 14: Population estimates of Lake Erie walleye ages 2 and older from 1978 to 2022, and the projection for 2023, from the WTG's SCAA model (Walleye Task Group 2023b).

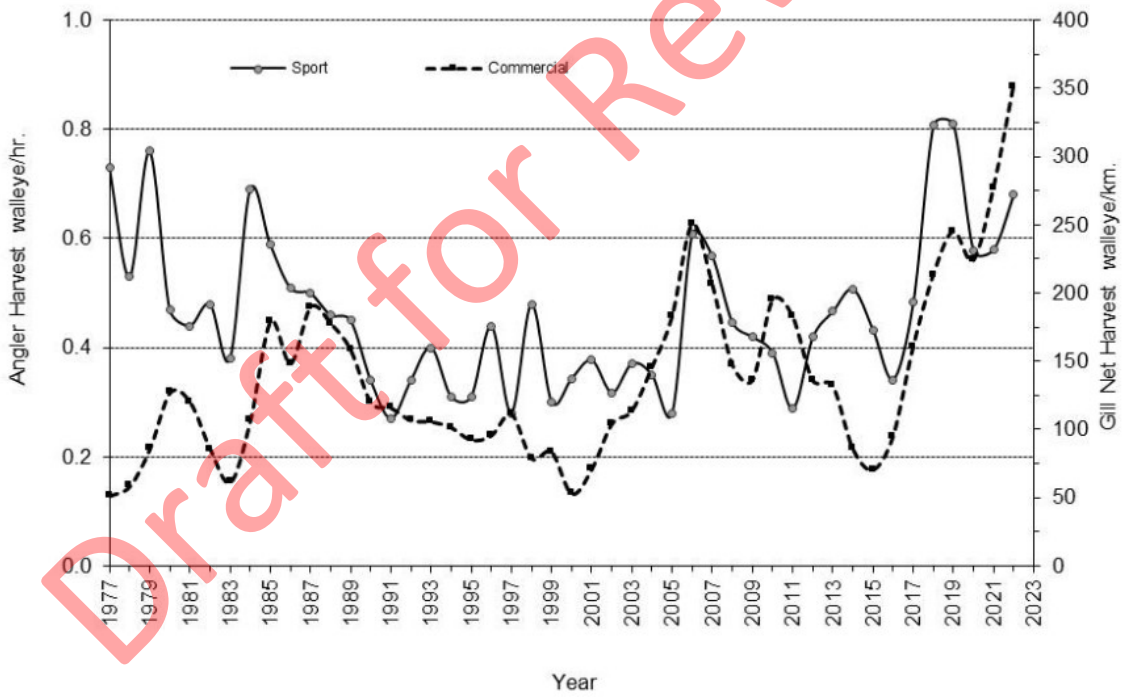

Figure 15: Lake-wide harvest per unit effort (HPE) for Lake Erie sport and commercial walleye fisheries during 1977-2022 (Walleye Task Group 2023).

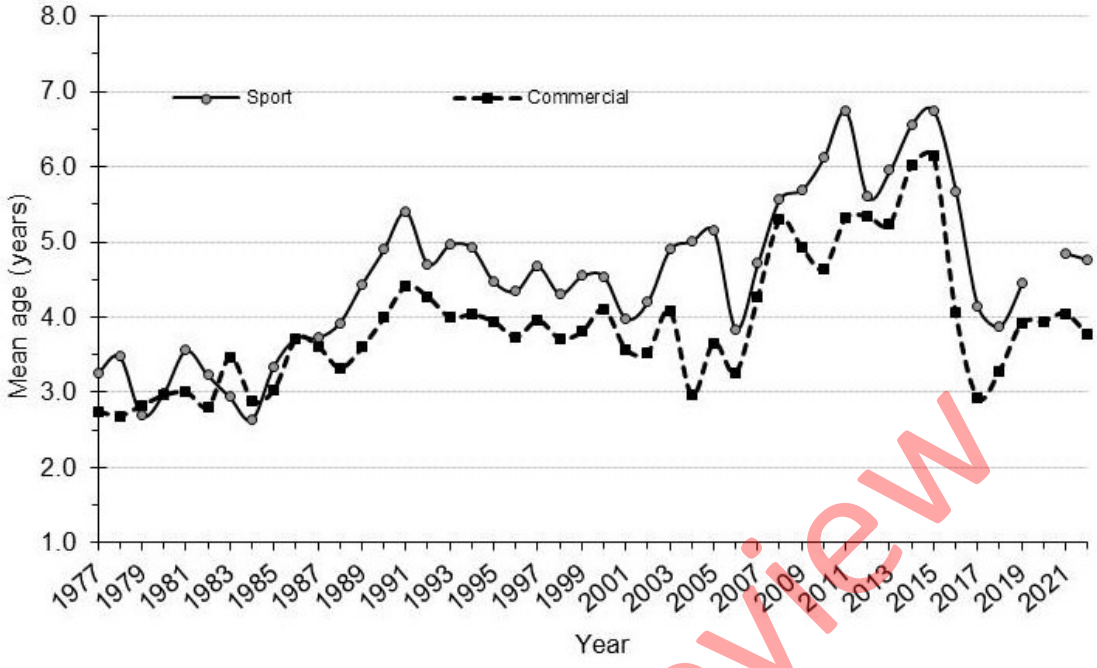

Figure 16: Lake-wide mean age of Lake Erie walleye in sport and commercial harvests during 1977-2022 (Walleye Task Group 2023).

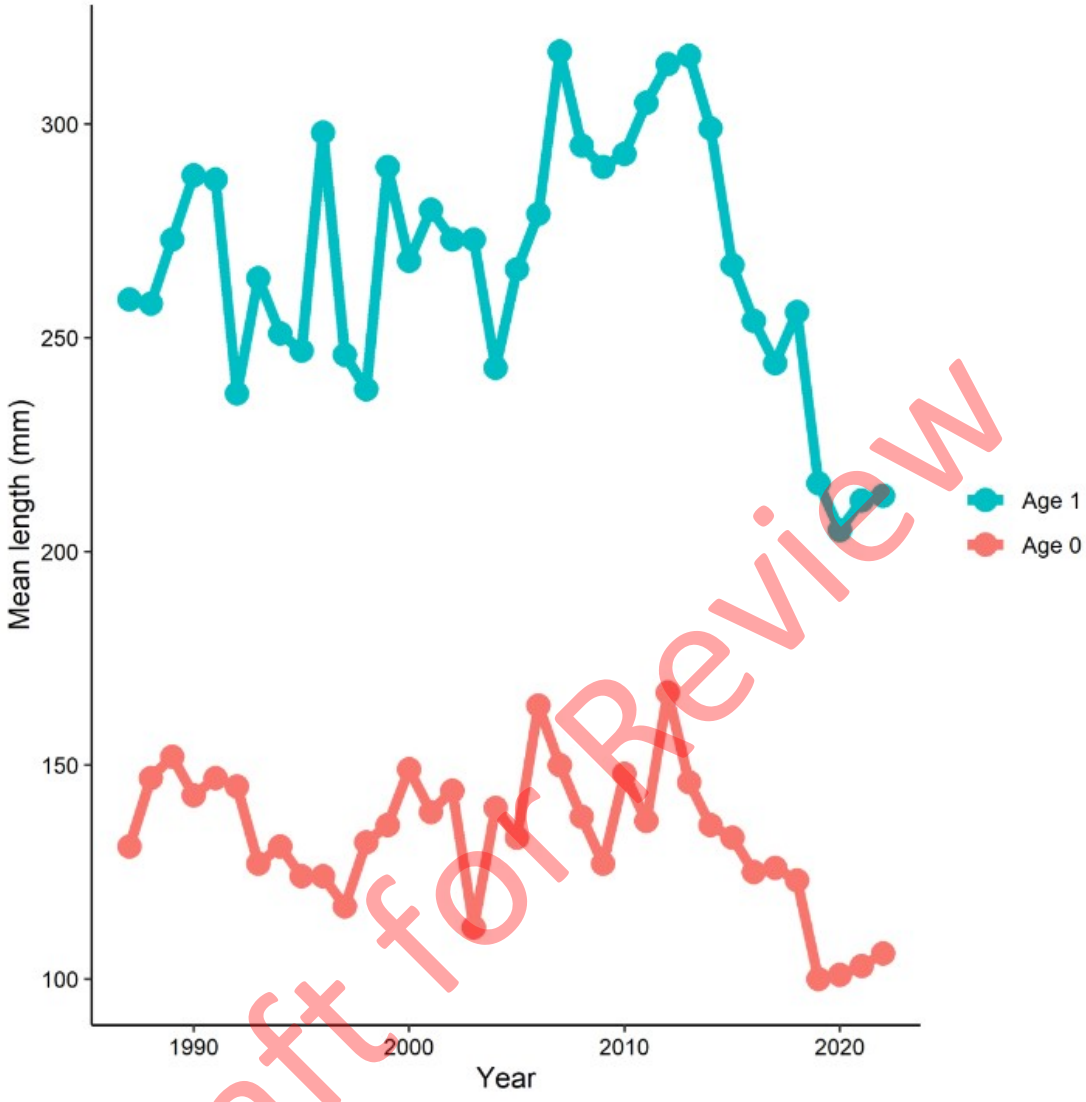

Figure 17: Annual mean total length of age 0 and 1 walleye in Ohio and Ontario waters of western Lake Erie 1987-2022 (Walleye Task Group 2023).

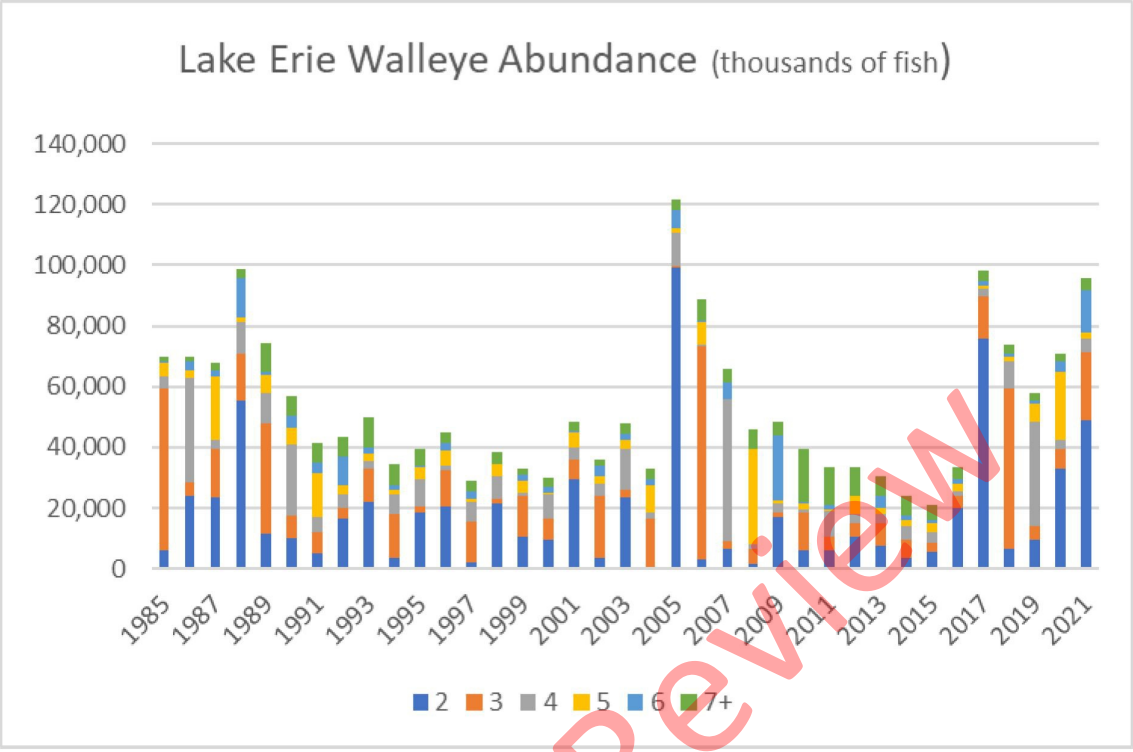

Figure 18: The estimated abundance of Lake Erie walleye by age from 1985 – 2021 . Note strong recruitment of age 2 fish in 1988, 2005, 2018 and 2021 that led to significant peaks in overall abundance of approximately 100 million fish.

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Low Concern

Lake-wide harvest of walleye in Lake Erie in 2022 was 9.269 million walleye with both the commercial fishery (6.180 million fish) and sport fishery harvest (3.089 million walleye) above long term (1975-2021) averages (commercial = 2.205 million fish and sport = 2.311 million fish) (Walleye Task Group 2023). Total harvest in the quota area (MUs 1-3) was 60.2% of the 2022 TAC (see Table 1 for harvest by jurisdiction {Walleye Task Group 2023b). Harvest Control Rules outlined in the Walleye Management Plan (active 2015-2024) include target fishing mortality of 60% of maximum sustainable yield (60%FMSY), a threshold limit reference point of 20% of unfished spawning stock biomass (20%SSBO), and a probabilistic control rule (P-star, P* = 0.05), with a limit on annual TAC change of +/- 20% (Lake Erie Committee 2015).

For 2023, the mean recommended allowable harvest was 13.526 million walleye (range 10.772-16.281 million walleye based on one standard deviation of the mean) (Walleye Task Group 2023). The probability of the projected spawning biomass in 2024 falling below the limit reference point (20%SSBO) with fishing at 60%FMSY in 2023 was estimated to be <5%. The probabilistic control rule was therefore not required to reduce the target fishing rate in 2023. As fishing mortality remains below the limit reference point, and it is probable that fishing mortality from all sources is below a sustainable

level appropriate for walleye, fishing mortality is considered a “low concern.”

Justification:

Table 1: Summary of walleye harvest by jurisdiction in Lake Erie, 2022 (Walleye Task Group 2023b).

In Number of Fish	TAC Area (MU-1, MU-2, and MU-3)				Non-TAC Area (MU-4 and MU-5)				All Areas
	Michigan	Ohio	Ontario	Total	NY	Penn.	Ontario	Total	Total
TAC	847,247	7,427,816	6,257,910	14,533,000	-	-	-	-	14,533,00
TAC % Share	5.83%	51.11%	43.06%	100.00%	-	-	-	-	100.00%
Harvest	114,465	2,581,307	6,047,336	8,743,108	75,774	232,780	271,116	525,670	9,268,777
Harvest %TAC	13.5%	34.8%	96.6%	60.2%	-	-	-	-	-

White bass (Morone chrysops)

Factor 1.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

High Concern

White bass abundance is assessed utilizing a statistical catch-at-age model based on both fishery-independent (the Ontario Partnership Gill net Survey (catch rate, age composition) and the Ohio Gill Net Survey (catch rate, weight-at-age, age composition)) and fishery-dependent data (Ontario commercial gill net (catch, effort, age composition), Ohio trap net (catch, effort), Ohio open-water creel (catch, effort, age composition)) from Ontario and Ohio (SAI Global 2019). In 2022, white bass abundance declined below the reference point (20% of unfished SSB) (see figure 19, (Global Trust Certification 2023)). As white bass abundance is below the limit reference point, abundance is considered a “high concern.”

Justification:

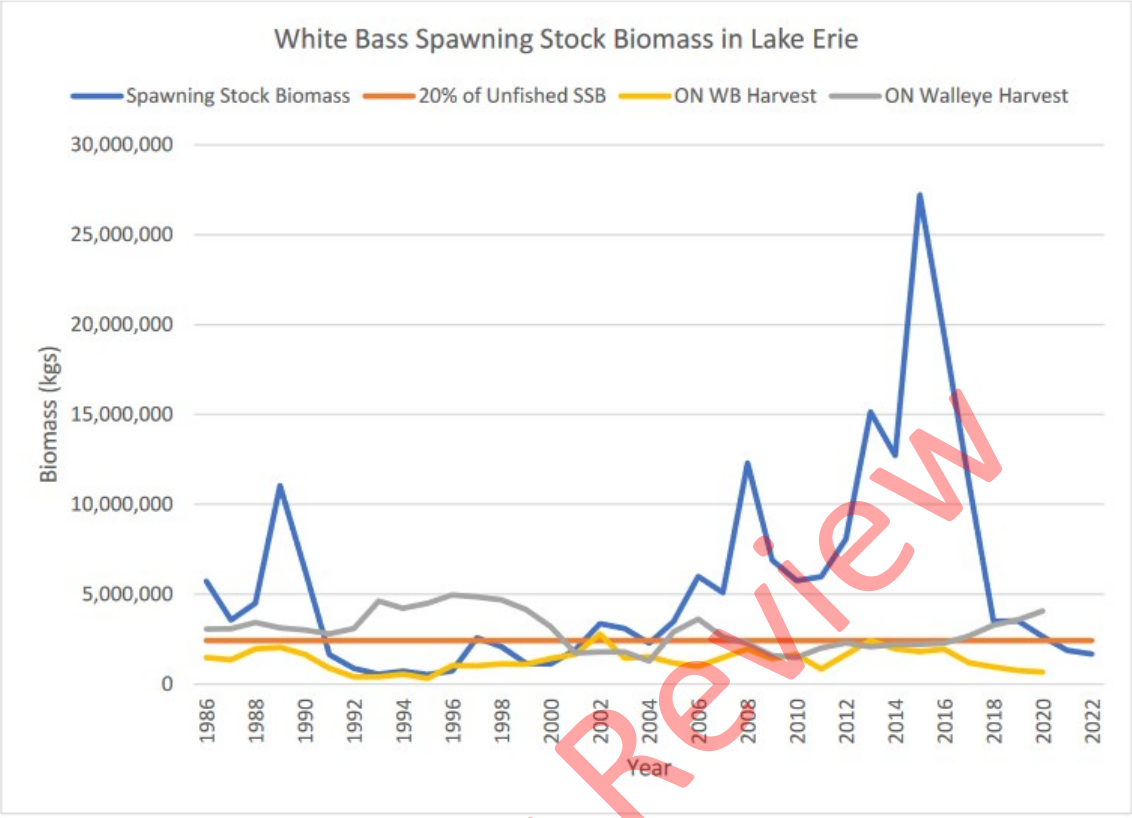

Figure 19: Estimates from the Lake Erie White Bass Statistical Catch at Age model showing white bass spawning stock biomass (SSB) and 20% of the mean unfished SSB (LRP), in the west and central basins of Lake Erie {Global Trust Certification 2023}. Per the original graph reported in Global Trust Certification (2023),

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Moderate Concern

Lake-wide harvest (inclusive of commercial harvest in gillnet, trap net and trawl net gear and sport harvest) has been stable since 1986 (mean = 1.8 million kg, min = 0.5 million kg, max = 3.4 million kg, 1986-2018)(see figure 20) (SAI Global 2020). A surplus production model was used to determine F_{MSY} (0.623) based on lakewide mean biomass per unit effort data from the Partnership Gill Net Index Program and lakewide white bass harvest data (Global Trust Certification 2023). Total fishing mortality, from model estimates, were hindcasted to be below F_{MSY} since 2009 (ibid). When considering all fishing rate scenarios (based on the surplus production model and a catch-at-age model) it is likely that white bass are harvested at a fishing mortality rate approximately equal to F_{MSY} (ibid). As fishing mortality is fluctuating around a reference point considered appropriate for the species, it is considered a “moderate concern.”

Justification:

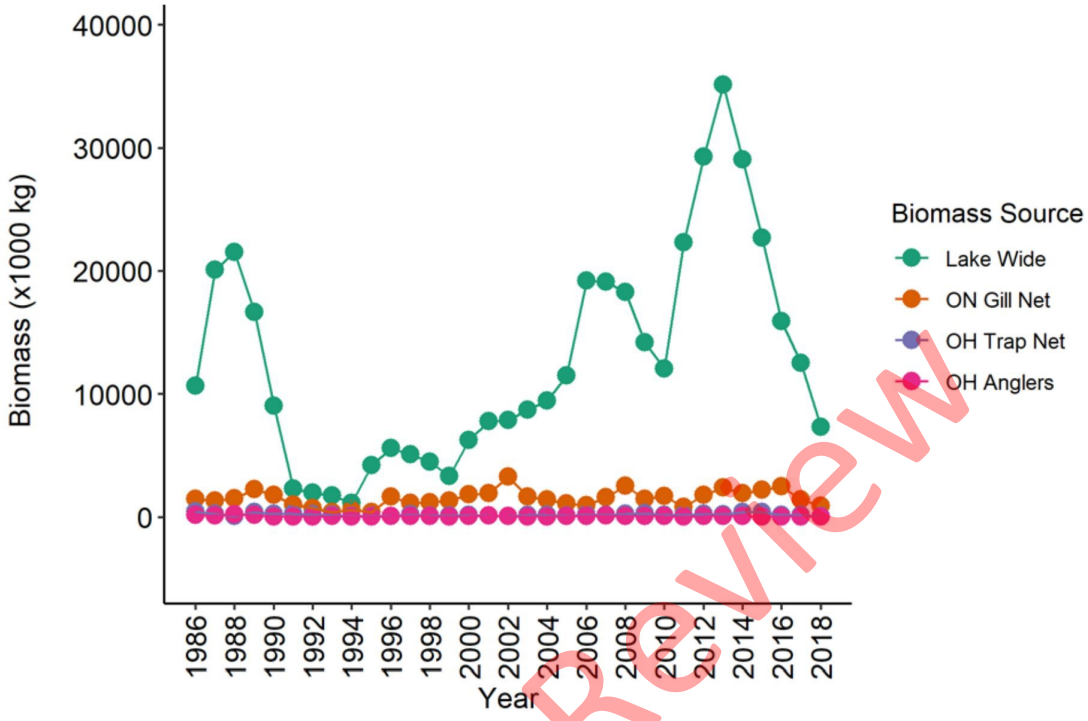

Figure 20: Biomass of white bass in Lake Erie, the Ontario commercial gill net catch, the Ohio commercial trap net catch, and the Ohio open-water recreational harvest (SAI Global 2020).

White perch (Morone americana)

Factor 1.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Very Low Concern

White perch are considered one of the most abundant invasive species to Lake Erie (Schaeffer & Margraf 1986) (SAI Global 2019). As white perch are non-native species in Lake Erie, abundance is considered a “very low concern.”

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Low Concern

White perch are an unlimited catch species in both Ontario and Ohio and in 2021, 3.19 million lbs of white perch were harvested in Lake Erie (OCFA 2022). As white perch are non-native species (Schaeffer & Margraf 1986), fishing mortality is considered a “low concern.”

Yellow perch (Perca flavescens)

Factor 1.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Very Low Concern

Yellow perch in Lake Erie are divided into 4 management units (MUs, see figure 21) based on differences in growth, recruitment, and movement patterns (Lake Erie Committee 2020)(Yellow Perch Task Group 2023). Each management unit stock is assessed annually to estimate population abundance and evaluate fishery performance (Lake Erie Committee 2020). The Lake Erie Yellow Perch Task Group uses a statistical catch-at-age model, based on both fishery-independent (gill net and trawl surveys) and fishery-dependent data (commercial gill net, commercial trap net and recreational fisheries), to estimate population abundance of age 2+ yellow perch (age 2 is considered to be the age at recruitment into the fishery) (Yellow Perch Task Group 2023).

In 2022, stock size was estimated to have decreased relative to the previous year in MUs 1 and 2 and increased in MUs 3 and 4 (see figure 22) (Yellow Perch Task Group 2023). Lake-wide abundance in 2023 was estimated to be 155.251 million fish (ibid). Abundance for age 2+ was forecasted to decline in 2023 relative to 2022 in MU 3 (-17%) and MU 4 (-22%) and increase in MU 1 (+51%) and MU 2 (+16%) (ibid). Abundance for age 3+ fish was forecasted to increase relative to 2022 in MU 1 (+38%), MU 2 (+25%), MU 3 (+10%) and MU 4 (+42%) (ibid). Based on mean weight-at-age data, the projected 2023 age 2+ biomass is expected to increase in all MUs relative to 2022 (see figure 25-28, ibid). The limit reference point (LRP) utilized for abundance evaluation is B_{MSY} (see figure 23, ibid). The SSB in 2023 and projected SSB in 2024 are above the LRP in MUs 1-4 and populations in these regions have not fallen below the LRP since the implementation of the Yellow Perch Management Plan (ibid).

Long-term standardized recruitment indices are developed through data from interagency trawl surveys. Year-class strength for yellow perch can be highly variable, relating to environmental conditions influencing recruitment success, but year classes have been strong overall since 2014 (Figure 24)(SAI Global 2019). Recruitment varies by MU and was weak in MU 2 in 2021 (Figures 25-28) (Global Trust Certification 2022). As recent quantitative stock assessment abundance estimates display stable population abundance trends, and because biomass is estimated to be above B_{MSY} in all management units and has been since the implementation of the Yellow Perch Management Plan, abundance is considered a "very low concern."

Justification:

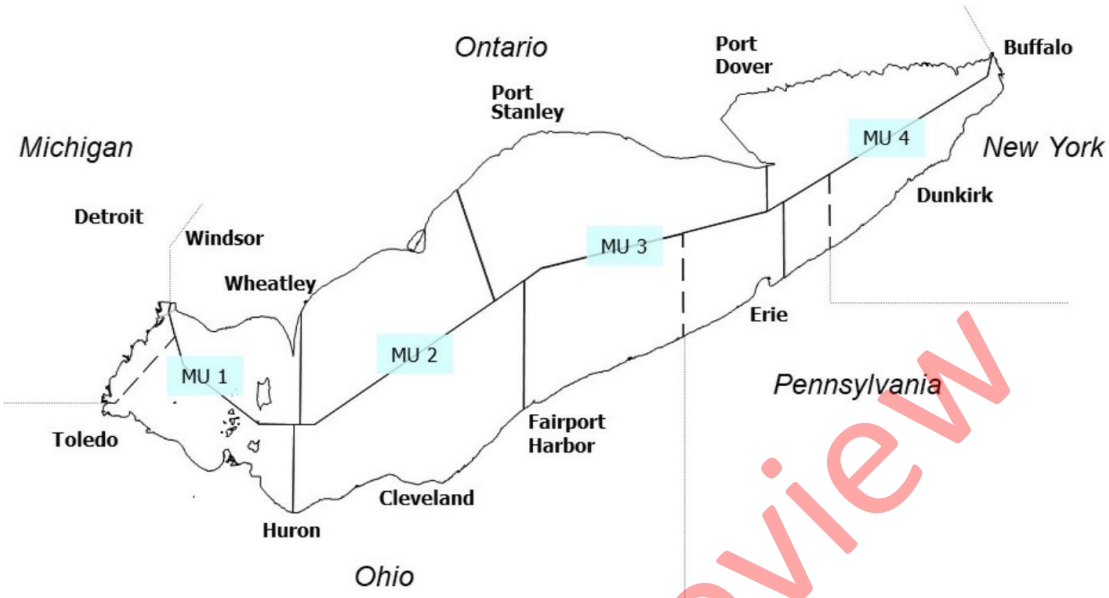

Figure 21: Yellow perch management units in Lake Erie .

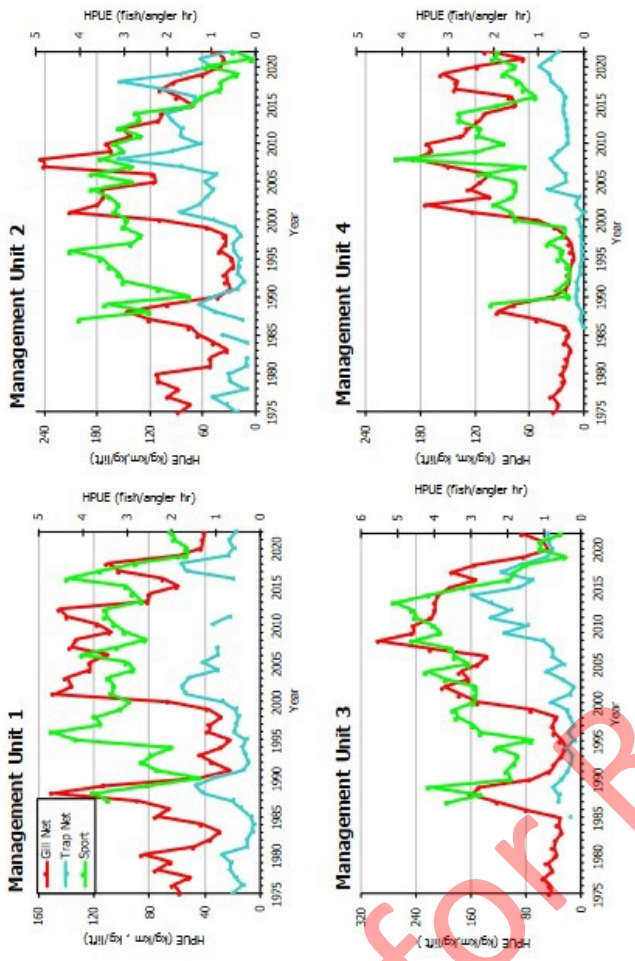

Figure 22: Historic Lake Erie yellow perch harvest per unit effort (HPUE) by management unit and gear type (Yellow Perch Task Group 2023). Note gillnet CPUE for 2001 to 2021 is for small mesh (<3") only.

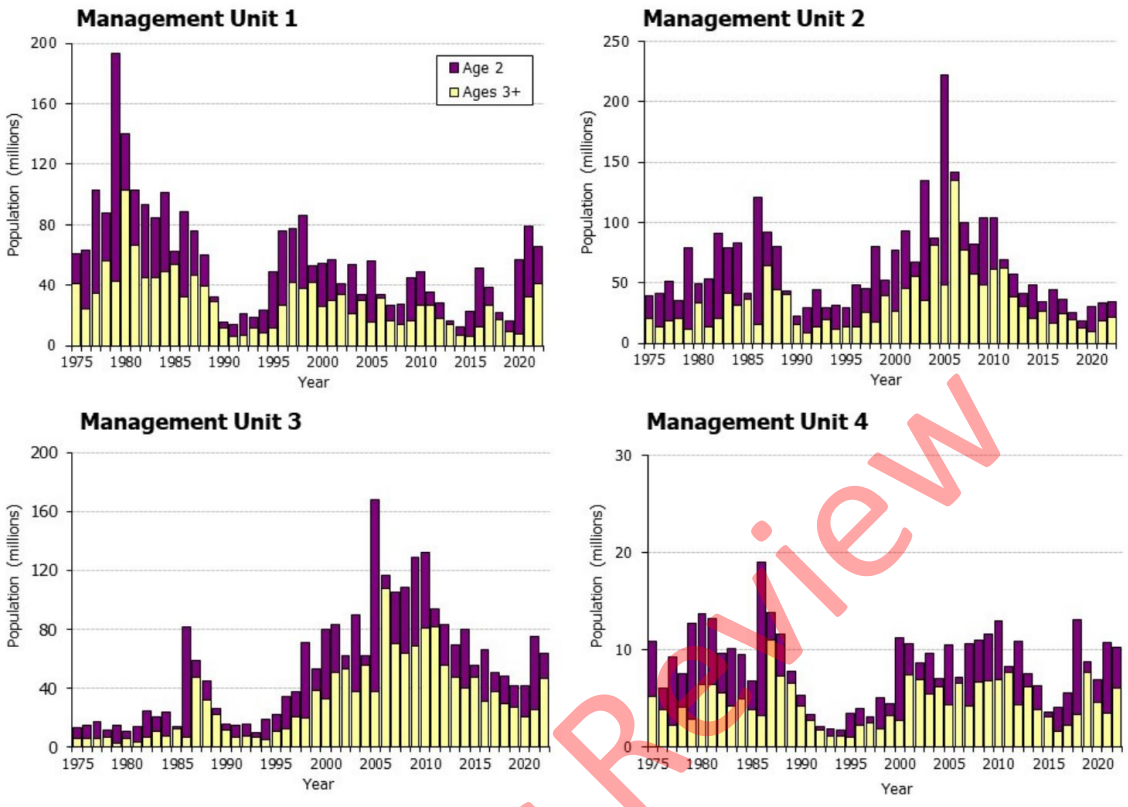

Figure 23: Lake Erie yellow perch population estimates by management unit for age 2 and 3+, 1975-2023 (Yellow Perch Task Group 2023).

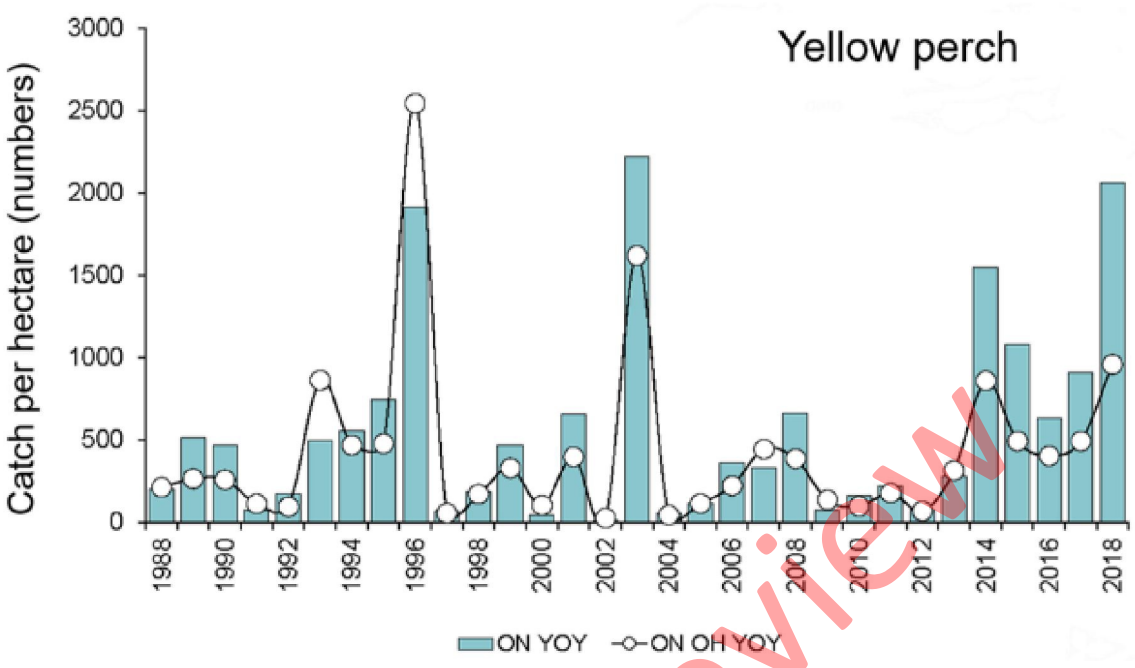

Figure 24: Number of young-of-the-year yellow perch caught per hectare during interagency trawling (1988– 2018) in western Lake Erie. Young-of-the-year catches are provided for Ontario and Ohio, with data from Lake Erie Management Unit, Draft Annual Report 2018 and illustrated from OCFA Annual Convention 2019, OMNRF PowerPoint slide deck .

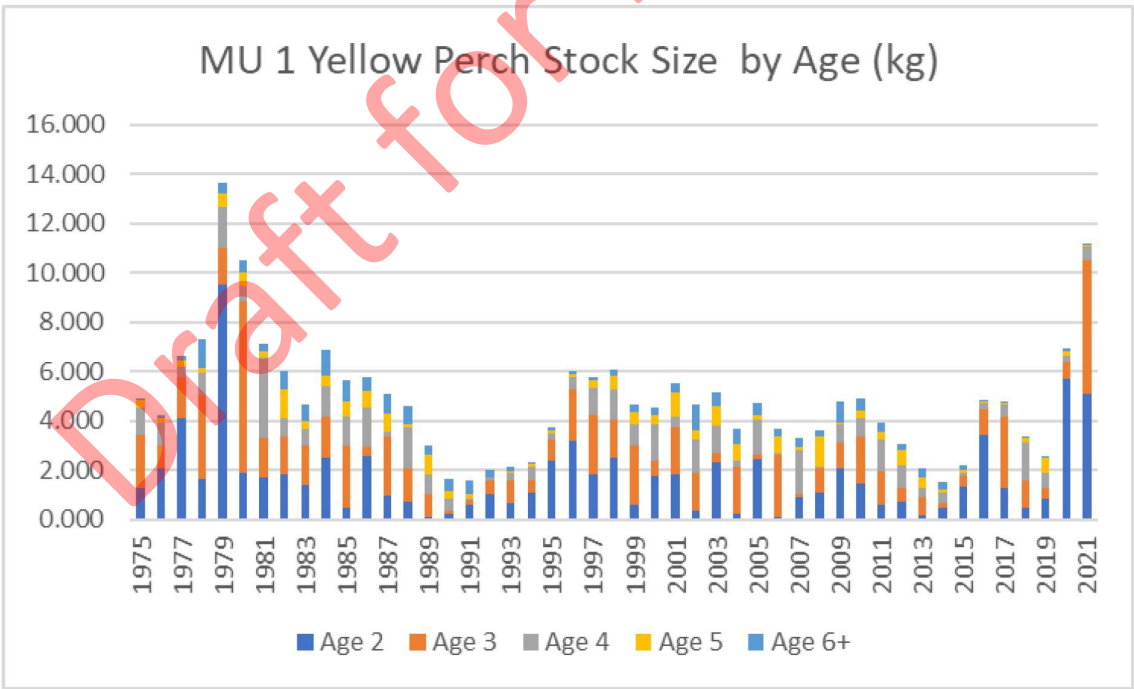

Figure 25: Abundance of yellow perch in Management Unit 1 by age, 1975 – 2021 (kg) . Note strong recruitment of age 2 fish in 1979 and again 2020 and 2021.

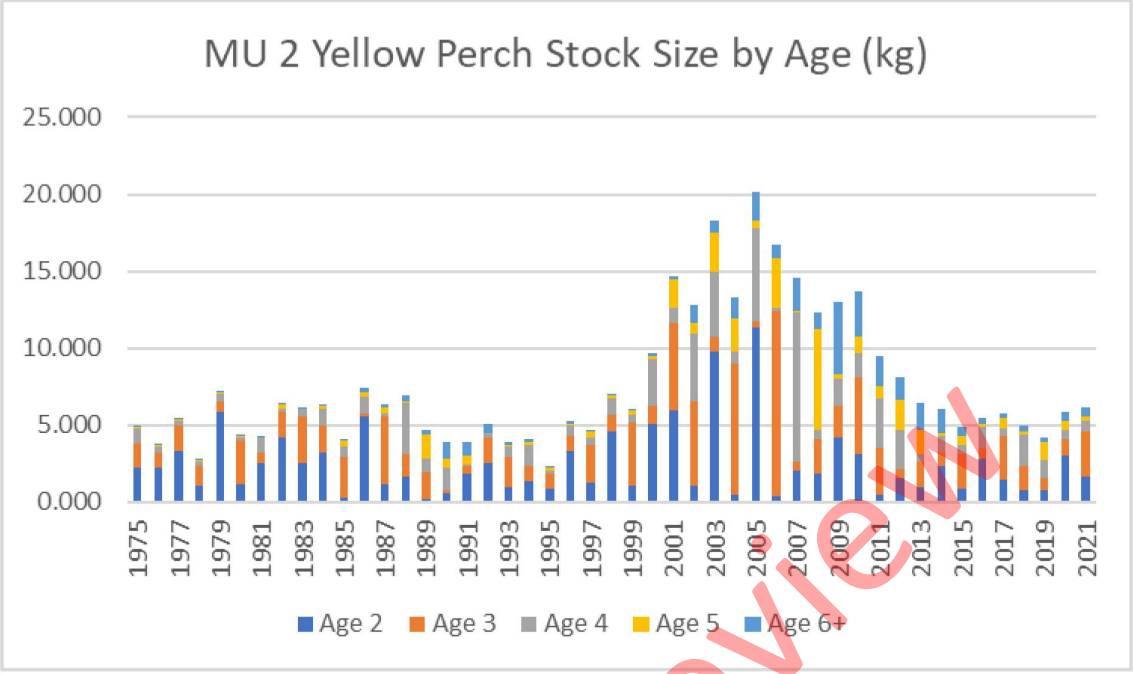

Figure 26: Abundance of yellow perch in Management Unit 2 by age, 1975 to 2021 (kg) . Note strong recruitment in 2003 and 2005, but fairly average recruitment in 1979 and 2020 and weak recruitment in 2021.

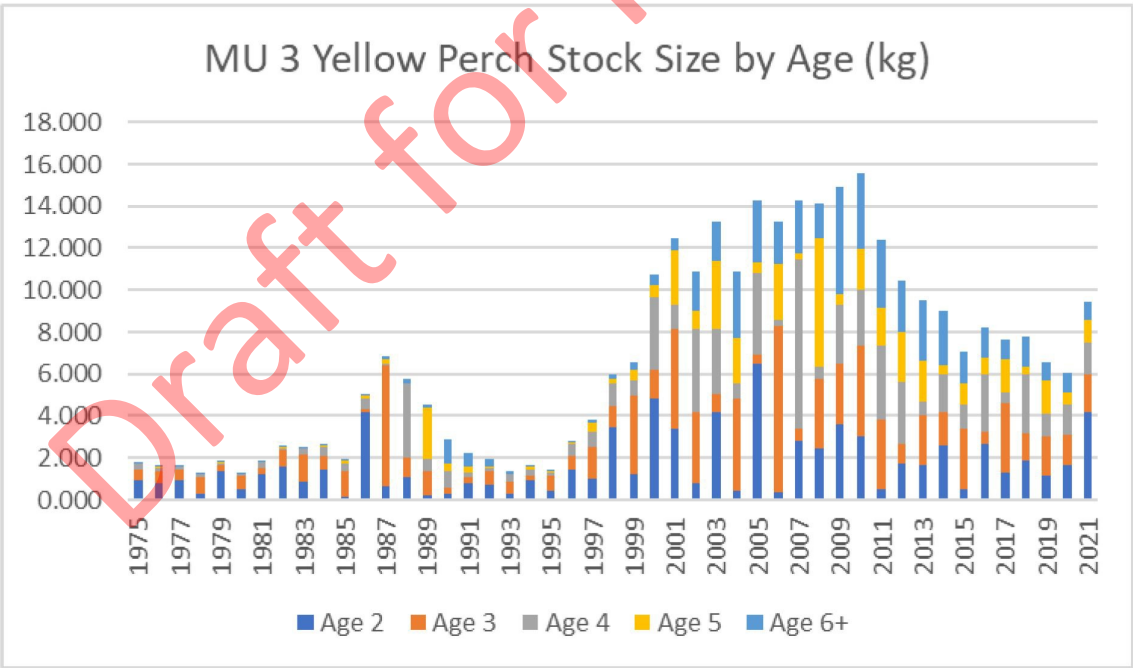

Figure 27: Abundance of yellow perch in Management Unit 3 by age, 1975 – 2021 (kg) . Note high interannual variability in recruitment with strong recruitment of age 2 fish in 1986, in the 2000, 2003, 2005 and 2021.

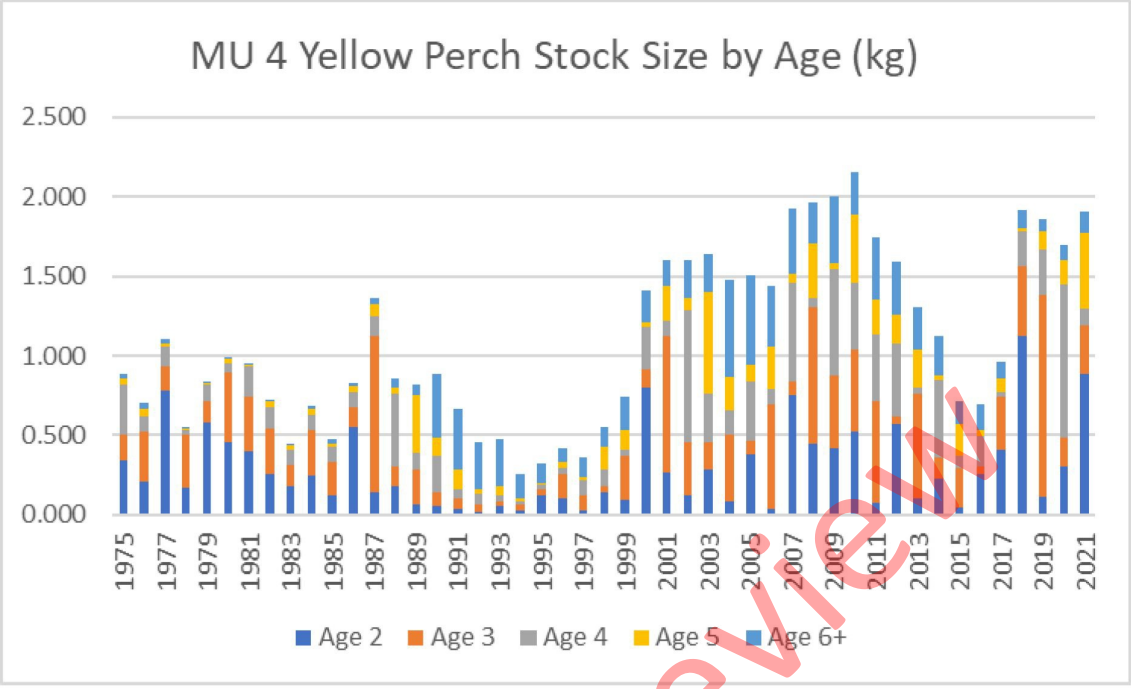

Figure 28: Abundance of yellow perch in Management Unit 4 by age, 1975 – 2021 (kg) . Note high interannual variability in recruitment with recent strong year classes in 2018 and 2021.

Factor 1.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Low Concern

Lake-wide harvest of yellow perch was 3.4 million pounds in 2022 which represents 47% of the 2022 total allowable catch (TAC) and was 3% greater than harvest in 2021 (see Justification section for details on harvest by management area)(Yellow Perch Task Group 2023). Harvest control rules for yellow perch require provision of annual target fishing rates and limit reference points based on data from the statistical catch-at-age model, including target fishing mortality as a percent of fishing mortality at maximum sustainable yield (F_{MSY}, ranging from 28-35%F_{MSY} in 2023), a limit reference point of the biomass at maximum sustainable yield (B_{MSY}), a probabilistic risk tolerance (P* = 0.20), and a limit on the annual change of the total allowable catch (+/- 20% when P(SSB<B_{MSY})< P*) (ibid). See figure 29 for harvest control rule parameters for 2023 (ibid). As fishing mortality remains at or below the limit reference points, and it is probable that fishing mortality from all sources is below a sustainable level appropriate for yellow perch, fishing mortality is considered a “low concern.”

Justification:

MU	Spawning Stock Biomass			Limit Reference Point		Fishing Rate			
	SSB_0	2023	2024 [(a)]	B_{msy}	P	F_{msy}	% F_{msy}	F_{target}	F_{actual} [(b)]
MU1	6,491,579	2,902,510	4,527,930	1,812,720	0.00	1.93	28%	0.540	0.540
MU2	13,901,030	4,083,770	3,917,690	3,871,245	0.49	1.68	35%	0.588	0.106
MU3	13,179,037	6,906,140	5,779,340	3,713,957	0.03	2.00	32%	0.640	0.640
MU4	1,695,040	1,394,620	1,188,450	483,010	0.00	1.64	34%	0.558	0.558

(a) Spawning stock biomass (kg) when population is fished at target fishing rate.
(b) In MU2 fishing at F_{target} exceeds a 0.20 probability (P*) that the projected spawning stock biomass will be equal to or less than the limit reference point (B_{msy}), therefore the fishing rate was reduced until the probability was less than 0.20.

Figure 29: Parameters used in the harvest control rule 2023. F actual may be reduced from F target if P(SSB<Bmsy)= P* (Yellow Perch Task Group 2023).

In 2021 harvest of yellow perch by management area was 1.655 million pounds in MU1 (65% TAC), 0.327 million pounds in MU2 (53% TAC), 0.944 million pounds in MU3 (37% TAC) and 0.371 million pounds in MU4 (71% TAC) (Yellow Perch Task Group 2023). The 2021 harvest of yellow perch in Lake Erie was greatest in Ontario (2.181 million pounds), followed by Ohio (0.967 million pounds), Michigan (0.070 million pounds), New York (0.068 million pounds) and Pennsylvania (0.021 million pounds) (see figure 30 for harvest by jurisdiction and gear type) (ibid).

In Ohio, a minimum of 65% of Ohio's TAC is allocated to the sport fishery and a maximum of 35% of TAC is allocated to the commercial fishery.

MU	Harvest by Jurisdiction (lbs)								Total (lbs)
	Michigan	Ontario	Ohio		Pennsylvania		New York		
	sport	all commercial*	sport	commercial trap net	sport	commercial trap net	sport	commercial trap net	
1	67,667	770,476	470,196	188,739					1,497,078
2		177,919	20,201	97,659					295,779
3		932,682	3,554	207,890	3,207	60,665			1,207,998
4		314,039			533	0	69,486	14,913	398,971
Total	67,667	2,195,116	493,951	494,288	3,740	60,665	69,486	14,913	3,399,826

*Small mesh gill net, large mesh gill net, trap net (MU1), and incidental trawl (MUs 2-4) harvest combined.

Figure 30: Lake Erie Yellow Perch harvest by jurisdiction and gear type for 2022 (Yellow Perch Task Group 2023).

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 Erie | America, North - Inland Waters | Canada | Set gillnets	1.732	1.000: < 100%	Red (1.732)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)

RAINBOW SMELT			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls	5.000	1.000: < 100%	Green (5.000)

WALLEYE			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	1.732	1.000: < 100%	Red (1.732)

WHITE BASS			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	2.236	1.000: < 100%	Yellow (2.236)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	5.000	1.000: < 100%	Green (5.000)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	2.644	1.000: < 100%	Yellow (2.644)

WHITE PERCH			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	1.732	1.000: < 100%	Red (1.732)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)

YELLOW PERCH			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	1.732	1.000: < 100%	Red (1.732)
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	1.732	1.000: < 100%	Red (1.732)

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 ERIE | AMERICA, NORTH - INLAND WATERS | CANADA | BOTTOM TRAWLS			
SUB SCORE: 5.000	DISCARD RATE: 1.000	SCORE: 5.000	
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Rainbow smelt	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ERIE | AMERICA, NORTH - INLAND WATERS | CANADA | SET GILLNETS			
SUB SCORE: 1.732	DISCARD RATE: 1.000	SCORE: 1.732	
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
White bass	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake sturgeon	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Waterbirds	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Lake whitefish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake trout	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Walleye	3.670: Low Concern	5.000: Low Concern	Green (4.284)
White perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Yellow perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ERIE | AMERICA, NORTH - INLAND WATERS | CANADA | STATIONARY UNCOVERED POUND NETS			
SUB SCORE: 5.000	DISCARD RATE: 1.000	SCORE: 5.000	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
White bass	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
White perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Yellow perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

LAKE ERIE | AMERICA, NORTH - INLAND WATERS | UNITED STATES | OHIO | STATIONARY UNCOVERED POUND NETS			
SUB SCORE: 1.732	DISCARD RATE: 1.000	SCORE: 1.732	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
White bass	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Lake whitefish	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)
Yellow perch	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

Commercial fisheries in Lake Erie targeting lake whitefish, rainbow smelt, walleye, white bass, white perch and yellow perch typically catch low amounts of non-target species with no bycatch species comprising >5% of catch composition (Alderstein et al. 2015)(SAI Global 2019). The only fisheries to include additional main species are the Canadian gillnet fisheries in the Ontario waters of Lake Erie targeting lake whitefish, walleye, white bass, white perch and yellow perch.

Canadian Gillnet Commercial Fisheries: No bycatch species comprised >5% of catch composition in the Canadian gillnet commercial fisheries targeting lake whitefish, walleye, white bass, white perch and yellow perch (SAI Global 2019). As there exists potential that interactions with the Ontario gillnet fisheries may significantly contribute to conservation concerns for ETP species including lake sturgeon, waterbirds, and depleted lake trout (in a rehabilitation program) they were each added as main species (Li et al. 2011)(BirdLife International 2018) (SAI Global 2019)(Lake Erie Committee 2021) (ODNR 2022). Suckers are reported in gillnet fishery catch reports, but not to the species level (Alderstein et al. 2015). The white sucker (*Catostomus commersonii*) is the most likely species to comprise the majority of sucker interactions with the fishery and is not an ETP species (SAI Global 2019). Although catch composition of suckers is not identified to the species level, it is considered unlikely for the ETP sucker species (including black redhorse (*Moxostoma duquesnei*, COSEWIC threatened (COSEWIC 2015)), lake chubsucker (*Erimyzon sucetta kennerlyi*, SARA endangered (COSEWIC 2008)) and spotted sucker (*Minytrema melanops*, SARA species of concern (COSEWIC 2005)) to interact with the fisheries as their distribution and habitat is mostly in rivers and shallow wetland areas rather than open waters fished by the commercial fishery and they are not observed in the fishery-independent surveys (ibid). Suckers were not included as a main species due to the low potential for interaction between ETP species and commercial fisheries gear.

Canadian Trap Net Commercial Fisheries: In the Ontario waters of Lake Erie, no bycatch species comprised >5% of total catch composition in trap net fisheries targeting white bass, white perch and yellow perch (Alderstein et al. 2015)(SAI Global 2019). No main species were added for this fishery.

Ohio Trap Net Commercial Fisheries: In the Ohio trap net fishery (targeting lake whitefish, white bass, white perch, yellow perch), management implemented a requirement for accurate estimation and recording of the amount of released fish by species in 2017 in response to the condition implemented by Marine Stewardship Council Certification (Lloyd's Register 2019). In catch composition records, no bycatch species comprised >5% of total catch composition (ibid). No main species were added for this fishery.

Canadian Bottom Trawl Commercial Fishery: In the bottom trawl fishery targeting rainbow smelt no bycatch species comprised >5% of total catch composition records from 2015-2021 (data provided by Ontario Ministry of Natural Resources and Forestry). No main species were added for this fishery.

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

Lake sturgeon (Acipenser fulvescens)

Factor 2.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | 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 endangered by Ohio State (COSSARO 2017)(COSEWIC 2017)(ODNR 2022). Due to endangered and threatened status, abundance is considered a “high concern.”

Factor 2.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Low Concern

The Great Lakes-Upper St. Lawrence River lake sturgeon populations have historically been impacted by hydroelectric development and commercial overexploitation (COSSARO 2017)(COSEWIC 2017). Targeted fishing for lake sturgeon is no longer permitted in Lake Erie but incidental catch occurs in the gillnet fisheries and sturgeon are most commonly released alive. The current main contributor to mortality is considered to be water quality due to industrial pollution (rated medium-low impact by COSEWIC) while agricultural pollution, dams (altering migration routes), shipping lanes and fishing and aquatic resources are considered low impact (COSEWIC 2017). Lake sturgeon catches, typically released alive, were recorded in daily catch records the small mesh gillnet fishery (targeting yellow perch) in quota zone QZ1 (136 and 88 pounds in 2021 and 2020 respectively), in QZ2 (2 pounds in each 2021 and 2020), in QZ3W (3 pounds in 2021) in QZ3E (1 pound in each 2021 and 2020) and in the large mesh gillnet fishery (targeting walleye, 131 and 53 pounds in 2021 and 2020 respectively) (Global Trust Certification 2022). The size and abundance of lake sturgeon caught in the commercial fisheries are not reported. Most lake sturgeon caught in the fishery-independent Partnership Index Survey are juveniles, while adults are rarely caught due to low abundance and low gear selectivity (due to mesh size), raising concern that juvenile mortality may influence recruitment and impede population recovery (Li & Jiao 2011). However, rates of post-release survivorship are unknown in the waters of Lake Erie. Many of the lake sturgeon in the West Basin of Lake Erie are from the St. Clair-Detroit River system which is one of the largest populations in the Great Lakes and considered to be stable (Chiotti et al. 2023). Although there is no information on fisheries-related post-release survival of lake sturgeon from Lake Erie, in Wisconsin waters of Lake Superior, all the lake sturgeon caught as bycatch in commercial fisheries are released alive, and post-release survival is likely to be high, as they are tagged and frequently recaptured (pers. comm. Ray, B. 2024). As it is likely that post-release survival is high in Lake Erie (similarly to Lake Superior in fisheries using similar methods and gear types), the commercial fishery is not considered to be a substantial contributor to fishing mortality, and therefore this factor is considered a “low concern.”

Lake trout (Salvelinus namaycush)

Factor 2.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Moderate Concern

Lake trout were extirpated from Lake Erie by the 1950s due to harvest, habitat destruction, and impacts of invasive species including predation by sea lampreys (Muir et al. 2012). Lake trout have been stocked in Lake Erie since 1969 (commencing in Ontario waters in 2006) to rehabilitate the population and annual stocking is still required to maintain the population (Lake Erie Committee 2021). Lake trout abundance is assessed through fishery-independent surveys. In the Partnership Survey, the abundance in 2022 (0.37 fish/lift) decreased from that in 2021 (0.92 fish/lift) and was below the mean (0.44 fish/lift) (Coldwater Task Group 2023). The abundance of adult (age 5+, an indicator of spawning stock) lake trout in the Coldwater Assessment Survey in 2022 (2.1 fish/lift) increased from 2021 (1.2 fish/ lift) to above the target (2.0 fish/lift) described in the 2021 Lake Management Plan (see figure 31, ibid). Since the survey was redesigned in 2020, the catch per unit effort of lake trout in the Coldwater Assessment Survey has fluctuated around this reference point (above for two years and below for one, ibid). In the absence of biological reference points the stocking reference point is being considered as a de facto indicator of recovery. As lake trout are a species in need of recovery, with recovery success fluctuating around the recovery target set to determine the success of the stocking effort, abundance is considered a “moderate concern.”

Justification:

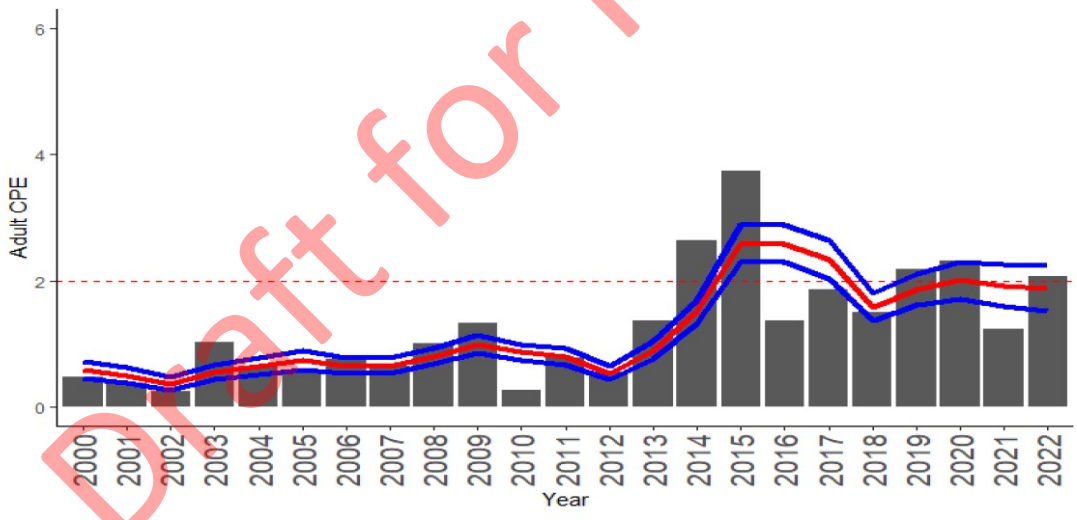

Figure 31: Mean combined CPE (number per lift, weighted by area) for lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 2000-2022 (Coldwater Task Group 2023). Grey bars: annual mean adult (age 5+) lake trout CPE. Red dotted line: targeted adult lake trout CPE (2.0 fish/lift). Red solid line: 3-year running average of adult lake trout CPE. Blue solid lines: bootstrap estimates of the 95% confidence interval

Factor 2.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Low Concern

Lake trout is a non-harvest species in Lake Erie commercial fisheries and are released. In the small mesh gillnet fisheries, the five year average catch of lake trout from 2014-2018 was 41.46 lbs (ranging from 21.4 lbs - 66.9 lbs annually)(SAI Global 2019). In the large mesh gillnet fisheries, the five year average catch of lake trout from 2014-2018 was 112.8 lbs (with peaks in 2014 (246 lbs) and 2015 (316 lbs) and 0-1 lb harvested per year in 2016-2018) (ibid). Lake trout are caught in recreational fisheries in Lake Erie, in New York and Pennsylvania waters, with catch considered to be low overall but increasing in the last decade (Coldwater Task Group 2022). In 2021 an estimated 282 fish were harvested by the recreational fishery lake-wide (ibid). The Coldwater Task Group considers the major factors that impede to rehabilitation success to be degradation of spawning habitat, low survival of early life stages, and low spawner biomass while bycatch mortality is ranked 18th among factors (ibid). As total fishing mortality is very low, with evidence that other sources of mortality impact lake trout, fishing mortality is considered a non-substantial contributor and a “low concern.”

Lake whitefish (Coregonus clupeaformis)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd’s Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

Rainbow smelt (Osmerus mordax)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Bottom trawls

< 100%

Based on daily catch records, discards in the rainbow smelt bottom trawl fishery were <0.1% of the total catch annually from 2015-2021 (data provided by MNRF).

Walleye (Sander vitreus)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd's Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

Waterbirds (Aves)

Factor 2.1 - Abundance

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

High Concern

Ducks (canvasbacks (*Aythya valisineria*), lesser scaup (*Aythya affinis*) and greater scaup (*Aythya marila*) (also known as bluebills), and redheads (*Aythya americana*) - all listed by IUCN as least concern) are the most common bird species to interact with the Lake Erie commercial gill net fishery gear (SAI Global 2019). The only ETP species documented to interact with the fishery is the horned grebe which is considered to be Vulnerable by the IUCN Red List (BirdLife International 2018). The Western population of the horned grebe is estimated to be between 200,000 and 500,000 individuals (Environment and Climate Change Canada 2021). Data are limited regarding interactions with waterbirds. Prior to 2020 uncertainty existed regarding identification of birds to the species level in Daily Catch Records (Global Trust Certification 2022). Since 2020 a program was developed, to meet Marine Stewardship Council certification, that incorporated workshop training for the commercial fishermen and Lake Erie Management Unit staff on waterbird identification. Abundance is considered a "high concern" due to Vulnerable IUCN listing of the horned grebe.

Factor 2.2 - Fishing Mortality

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Low Concern

An average of 81 ducks were discarded per year between 2015-2019 (ranging from 1-217 per year) (SAI Global 2019). The greatest discard year (217 ducks) represents 0.031% of the smallest population (0.7 million ducks each for the canvasback or readhead populations). There has been only one documented interaction of the fishery with the horned grebe (IUCN Vulnerable) resulting in mortality in 2021-2022 (Global Trust Certification 2022). Data availability is limited as monitoring for waterbird interactions with gillnet gear began in 2020 as part of the requirement of Marine Stewardship Council certification (ibid). Horned grebe are migrating while in Lake Erie and although drowning due to interactions with net fisheries in large lakes have been documented for horned grebes

across their range, data are limited. The greatest mortality to horned grebes from fishing interactions was reported in a study in Lake Winnipegosis, Manitoba in 1965 that documented 3,000 grebes and loons netted annually among which horned grebes were ranked third in abundance, however, more recent quantitative data are lacking (COSEWIC 2009). The main threats to horned grebe population sustainability are considered to be habitat degradation due to eutrophication and loss of breeding habitat due to agriculture and development. As the fishery is not considered to be a substantial contributor to waterbird mortality, fishing mortality is considered a “low concern.”

White bass (Morone chrysops)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd’s Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

White perch (Morone americana)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd’s Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

Yellow perch (Perca flavescens)

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd's Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

Factor 2.3 - Discard Rate/Landings

Lake Erie | America, North - Inland Waters | Canada | Bottom trawls

< 100%

Based on daily catch records, discards in the rainbow smelt bottom trawl fishery were <0.1% of the total catch annually from 2015-2021 (data provided by MNRF).

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

< 100%

Based on Daily Catch Records (DCR) discards are <0.1% of the landed catch in the gillnet fisheries targeting walleye and yellow perch as discards of quota species are prohibited and most of the non-target species are also retained (discards reported in DCR since 2011)(SAI Global 2019). Discards from 2015-2021 in the gillnet fishery targeting white bass were 4-17% of the total catch annually from 2015-2021. The Ohio trap net fishery began reporting discards in 2017 as a condition of Marine Stewardship Council certification (Lloyd's Register 2019). Discards represent <5% of the total catch in the Ohio trap net fishery (ibid). Catch records are considered to be accurate by management, however, have yet to be verified by on-board observer coverage (ibid).

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 Erie | America, North - Inland Waters | Canada | Bottom trawls	Moderately Effective	Highly effective	Highly effective	Highly effective	Highly effective	Yellow (3.000)
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	Highly effective	Moderately Effective	Highly effective	Highly effective	Highly effective	Green (4.000)

Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Highly effective	Moderately Effective	Highly effective	Highly effective	Highly effective	**Green (4.000)**
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets	Highly effective	Moderately Effective	Highly effective	Highly effective	Highly effective	**Green (4.000)**

The Great Lakes Fishery Commission (GLFC) is an inter-jurisdictional agency comprising 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 Erie (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 (ibid). Specific to each lake, “lake committees” are established which comprise state, provincial, and U.S. tribal agencies, and are the primary management jurisdiction on each lake (ibid) (Figure 35). 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 (Francis et al. 2020)(GLFC 2023a)(GLFC 2023b). Each lake committee is comprised of 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 Erie Committee comprises senior staff members from Michigan Department of Natural Resources, New York State Department of Environmental Conservation, Ohio Department of Natural Resources, Ontario Ministry of Natural Resources and Forestry, and Pennsylvania Fish and Boat Commission (GLFC 2023c). The Lake Erie Committee (LEC) 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 (ibid).

The Lake Erie Standing Technical Committee (STC), appointed by the LEC, comprises fishery biologists from Michigan Dept. of Natural Resources, New York Dept. Environmental Conservation, Ohio Dept. of Natural Resources, Ontario Ministry of Natural Resources and Forestry, and Pennsylvania Fish and Boat Commission (GLFC 2023c). The Standing Technical Committee is the senior scientific advisory group responsible for organizing and facilitating work from the LEC (ibid). The Coldwater Task Group, Forage Task Group, Habitat Task Group, Walleye Task Group, and Yellow Perch Task Group support the efforts of the STC (ibid). The Task Groups compose annual reports including population assessment and development of TAC recommendations and the walleye and perch groups contribute to development of their respective Fishery Management Plans (FMPs)(Lake Erie Committee 2015)(Lake Erie Committee 2018)(Lake Erie Committee 2020). Data on stock abundance and health are collected and analyzed annually for lake whitefish (by the Coldwater Task Group), rainbow smelt (by the Forage Task Group), yellow perch (by the Yellow Perch Task Group) and walleye (by the Walleye Task Group).

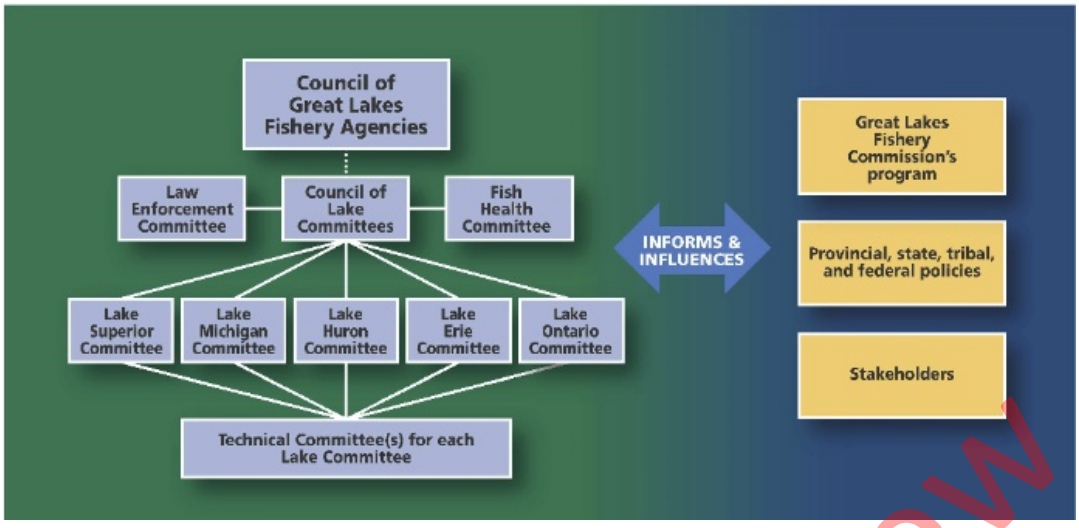

Figure 35: Organizational structure of management bodies in the Great Lakes (GLFC 2023b).

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 followscientific 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? Howsuccessful are these management measures? To achieve a Highly Effective rating, the fishery must have no or lowbycatch, 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: Howmuch 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 howis 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 Erie | America, North - Inland Waters | Canada | Bottom trawls

Moderately Effective

The Ontario bottom trawl fishery retains rainbow smelt, therefore the management strategy and implementation of rainbow smelt is considered here.

Fishes are managed in Lake Erie according to Lake Erie Fish Community Objectives (FCOs) which are developed periodically and in accordance with the Joint Strategic Plan (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). The LEC measures progress towards achieving FCOs at minimum every 5-6 years and discloses this information through State of the Lake Reports (ibid).

The rainbow smelt fishery is managed utilizing a commercial quotas that are reviewed annually and management adjusts the quota when assessment data indicate that a clear change in population status has occurred over a multi-year period as fish assessment data for rainbow smelt has high interannual variability (personal communication MNRF). In response to a decrease in density of rainbow smelt from 2016-2019 in the east basin, management decreased the commercial quotas in 2020 by 20% which has resulted in increased rainbow smelt density in recent years (ibid).

Management strategy is considered “moderately effective” as rainbow smelt are a non-native species that are not stocked or seeded, and harvesting prevents increases in stock size.

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Highly effective

The Ontario set gillnet fishery retains lake whitefish, walleye, white bass, white perch, and yellow perch, therefore, the management strategy and implementation of lake whitefish, walleye, white bass, white perch, and yellow perch is considered here.

Fishes are managed in Lake Erie according to Lake Erie Fish Community Objectives (FCOs) which are developed periodically and in accordance with the Joint Strategic Plan (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). The LEC measures progress towards achieving FCOs at minimum every 5-6 years and discloses this information through State of the Lake Reports (ibid).

Lake whitefish: The lake whitefish stock is managed utilizing a target reference point and TAC that limits harvest (Coldwater Task Group 2023).

Walleye: Walleye quotas have been implemented in Lake Erie since 1976 and have been adjusted using different models and harvest strategies as needed (Lake Erie Committee 2015). In 2005, the Lake Erie Walleye Management Plan was adopted defining fishery objectives and employing components to establish sustainability (ibid). Management intends to review the plan every five years (ibid). A Management Strategy Evaluation in 2011 led to the development and adoption of an updated

assessment model in 2013 and Harvest Control Rule (HCR), developed with internal and external peer-review, which was first applied in 2014 (ibid). The HCR framework is inclusive of limit and target reference points, based on stock assessments, that inform total allowable catch (TAC) that limits harvest (Walleye Task Group 2023).The Walleye Task Group utilizes fishery-independent surveys, fishery-dependent surveys, and population model information to provide recommendations to the LEC regarding sustainable harvest (Walleye Task Group 2022). The LEC considers both scientific advice on recommended allowable harvest and stakeholder input in determining annual walleye TAC (ibid). The recommended HCR sets target fishing mortality at 60% of maximum sustainable yield (F60%MSY), with a threshold limit reference point of 20% of the unfished spawning stock biomass (20%SSBO), includes a probabilistic control rule (P* = 0.05) and a limit on annual change of TAC of +/- 20% (HCR adopted in 2014 (Lake Erie Committee 2015).

White bass: White bass are managed with the objective to maintain the population at approximately 20% or more of the unfished spawning-stock biomass (personal communication MNRF). There are no quotas for white bass in Lake Erie (ibid). The estimated spawning stock biomass is assessed relative to the 20% unfished spawning stock biomass limit reference point to determine if mechanisms can be used to regulate commercial effort and harvest through license conditions (such as season or mesh size restrictions) if the population status is considered impaired (ibid).

White perch: White perch, a non-native species, is an unlimited catch species with no discard requirements or management strategy (SAI Global 2019). This approach is considered by management to be an informal eradication strategy for white perch (ibid).

Yellow perch: The yellow perch fishery is managed utilizing a Harvest Control Rule (HCR) framework inclusive of limit and target reference points, based on stock assessment, that inform total allowable catch (TAC) that limits harvest (Yellow Perch Task Group 2023). The HCRs were developed with internal and external peer-review (ibid). Harvest policies utilizing analytically based limit reference points were implemented in 2019 for the yellow perch fishery (Yellow Perch Task Group 2022). The recommended HCR sets target fishing mortality at a percent of F_{MSY} (target fishing rates set by MU with MU1 = 0.708, MU2 = 0.665, MU3 = 0.685, and MU4 = 0.551), with biomass limit reference points specific to each MU (MU1 = 29%SSB0; MU2 = 28%SSB0; MU3 = 28%SSB0; MU4 = 27%SSB0), including a probabilistic control rule (P* = 0.2) and a limit on annual change of TAC of +/- 20% (ibid).

As more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice, a score of "highly effective" is awarded for management strategy and implementation.

Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Highly effective

The Ontario trap net fishery retains white bass, white perch, and yellow perch, therefore, the management strategy and implementation of white bass, white perch, and yellow perch is considered here.

Fishes are managed in Lake Erie according to Lake Erie Fish Community Objectives (FCOs) which are developed periodically and in accordance with the Joint Strategic Plan (Environment and Climate

Change Canada and the U.S. Environmental Protection Agency 2021). The LEC measures progress towards achieving FCOs at minimum every 5-6 years and discloses this information through State of the Lake Reports (ibid).

White bass: White bass are managed with the objective to maintain the population at approximately 20% or more of the unfished spawning-stock biomass (personal communication MNRF). There are no quotas for white bass in Lake Erie (ibid). The estimated spawning stock biomass is assessed relative to the 20% unfished spawning stock biomass limit reference point to determine if mechanisms can be used to regulate commercial effort and harvest through license conditions (such as season or mesh size restrictions) if the population status is considered impaired (ibid).

White perch: White perch, a non-native species, is an unlimited catch species with no discard requirements or management strategy (SAI Global 2019). This approach is considered by management to be an informal eradication strategy for white perch (ibid).

Yellow perch: Yellow perch are managed under the Lake Erie Yellow Perch Management Plan (2020-2024) (Lake Erie Committee 2020). The yellow perch fishery is managed utilizing a Harvest Control Rule (HCR) framework inclusive of limit and target reference points, based on stock assessments, that inform total allowable catch (TAC) that limits harvest (Yellow Perch Task Group 2023). The HCRs were developed with internal and external peer-review (ibid). Harvest policies utilizing analytically based limit reference points were implemented in 2019 for the yellow perch fishery (Yellow Perch Task Group 2022). The recommended HCR sets target fishing mortality at a percent of F_{MSY} (target fishing rates set by MU with MU1 = 0.708, MU2 = 0.665, MU3 = 0.685, and MU4 = 0.551), with biomass limit reference points specific to each MU (MU1 = 29%SSB0; MU2 = 28%SSB0; MU3 = 28%SSB0; MU4 = 27%SSB0), including a probabilistic control rule (P* = 0.2) and a limit on annual change of TAC of +/- 20% (ibid).

As more than 70% of the fishery's maintargeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice, a score of "highly effective" is awarded for management strategy and implementation.

Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Highly effective

The Ohio trap net fishery retains lake whitefish, white bass, white perch, and yellow perch, therefore, the management strategy and implementation of lake whitefish, white bass, white perch, and yellow perch is considered here.

Fishes are managed in Lake Erie according to Lake Erie Fish Community Objectives (FCOs) which are developed periodically and in accordance with the Joint Strategic Plan (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). The LEC measures progress towards achieving FCOs at minimum every 5-6 years and discloses this information through State of the Lake Reports (ibid).

Lake whitefish: The lake whitefish stock is managed utilizing a target reference point and TAC that

limits harvest (Coldwater Task Group 2023).

White bass: White bass are managed with the objective to maintain the population at approximately 20% or more of the unfished spawning-stock biomass (personal communication MNRF). There are no quotas for white bass in Lake Erie (ibid). The estimated spawning stock biomass is assessed relative to the 20% unfished spawning stock biomass limit reference point to determine if mechanisms can be used to regulate commercial effort and harvest through license conditions (such as season or mesh size restrictions) if the population status is considered impaired (ibid).

White perch: White perch, a non-native species, is an unlimited catch species with no discard requirements or management strategy (SAI Global 2019). This approach is considered by management to be an informal eradication strategy for white perch (ibid).

Yellow perch: Yellow perch are managed under the Lake Erie Yellow Perch Management Plan (2020-2024) (Lake Erie Committee 2020). The yellow perch fishery is managed utilizing a Harvest Control Rule (HCR) framework inclusive of limit and target reference points, based on stock assessment, that inform total allowable catch (TAC) that limits harvest (Yellow Perch Task Group 2023). The HCRs were developed with internal and external peer-review (ibid). Harvest policies utilizing analytically based limit reference points were implemented in 2019 for the yellow perch fishery (Yellow Perch Task Group 2022). The recommended HCR sets target fishing mortality at a percent of F_{MSY} (target fishing rates set by MU with MU1 = 0.708, MU2 = 0.665, MU3 = 0.685, and MU4 = 0.551), with biomass limit reference points specific to each MU (MU1 = 29%SSB0; MU2 = 28%SSB0; MU3 = 28%SSB0; MU4 = 27%SSB0), including a probabilistic control rule (P* = 0.2) and a limit on annual change of TAC of +/- 20% (ibid).

Ohio manages yellow perch quotas within the same management units as the Lake Erie Committee issues TAC with a maximum of 35% of Ohio's TAC allocated to commercial fisheries (Ohio Legislature 2023)(ODNR 2023)(pers. comm. Hartman, T. 2024). Annual TAC is based on the individual trap net license yellow perch harvest shares from 1990 through 2007, population levels, and other pertinent scientific, economic, and social data to set levels that align with LEC harvest policies (ibid). Management may change allocation in response to decreases in population abundance and TAC (ibid). When TACs are high to moderate the Ohio trap net fishery receives 35% of Ohio's share within a management unit, but are adjusted down to 30 or 25% if TACs decline sufficiently (ibid). Commercial quota is allocated to each license based on their share of harvest from 1990 through 2007 (ibid). These frozen shares reduce the incentive to harvest, compared to shares that continue to change based on annual harvest (ibid).

As more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice, a score of "highly effective" is awarded for management strategy and implementation.

Factor 3.2 - Bycatch Strategy

Lake Erie | America, North - Inland Waters | Canada | Bottom trawls

Highly effective

In the Lake Erie, Ontario commercial fisheries, target species have quotas (walleye, yellow perch, lake whitefish and smelt) while eleven bycatch species are permitted to be retained with unlimited catch (channel catfish, white bass, longnose gar, bowfin, alewife, gizard shad, burbot, white perch, rock bass, freshwater drum and crappie) and there are four unlimited catch species groups (suckers excluding black and Bigmouth buffalo, mooneye/goldeye, carp > 56 cm and smaller bullheads, sunfish excluding warmouth) (SAI Global 2019). Harvest is not permitted of any other species (ibid). All live ETP species must be released and dead ETP species must be turned in to management (ibid). There are no on-board observers and therefore no enforcement with respect to reporting bycatch (ibid). Reporting catch and discards is an enforced condition of license and management considers reporting to be accurate but there are no onboard observers or procedures in place for verification (Alderstein et al. 2015)(SAI Global 2019). As the Ontario bottom trawl rainbow smelt fishery has very low bycatch (no species comprises >5% of catch composition) with very low ETP species interactions, bycatch strategy is considered "highly effective."

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Moderately Effective

Current fisheries management in Lake Erie is considered to be successful at minimizing negative harvest effects with exploited fish populations likely predominantly effected by environmental factors relative to fisheries mortality (Zhang et al. 2018). In the Ontario gillnet fisheries, target species have quotas (walleye, yellow perch, lake whitefish and smelt) while eleven bycatch species are permitted to be retained with unlimited catch (channel catfish, white bass, longnose gar, bowfin, alewife, gizard shad, burbot, white perch, rock bass, freshwater drum and crappie) and there are four unlimited catch species groups (suckers excluding black and Bigmouth buffalo, mooneye/goldeye, carp > 56 cm and smaller bullheads, sunfish excluding warmouth) (SAI Global 2019). Harvest is not permitted of any other species (ibid). All live ETP species must be released and dead ETP species must be turned in to management (ibid). Small mesh gill nets are mandated to have a minimum stretch-mesh size of 57 mm (2¼ in) to reduce bycatch of smaller species and immature fishes (ibid). Net height is limited to 36 meshes to ensure more selective harvest based on spatial distribution of fishes (ibid). There are seasonal regulations in the western basin for conducting gill-netting during daylight hours with soak time limited to a few hours (ibid).

Government appointed dockside monitors take sample weights of the catch and compare them to the Daily Catch Reports (DCRs) (SAI Global 2019). If a monitor is not available the capitan files the DCR in a lockbox station before offloading the catch (ibid). There are no on-board observers and therefore no enforcement with respect to reporting released or discarded bycatch (ibid). A low coverage survey in the gillnet fisheries in 2005 utilized on-board observers to quantify retained discard and catch and indicated that they were underreported, however, reporting discards at this time was not an enforced condition of license (Alderstein et al. 2015). As reporting has increased significantly, since 2011 when reporting discards became an enforced condition of license, management considers it to be accurate but there are no procedures in place for verification.

As bycatch reduction techniques are used but as species of concern are caught and there is some uncertainty in bycatch catch composition due to lack of observer coverage, bycatch strategy is

considered “moderately effective.”

Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Moderately Effective

Current fisheries management in Lake Erie is considered to be successful at minimizing negative harvest effects with exploited fish populations likely predominantly effected by environmental factors relative to fisheries mortality (Zhang et al. 2018). In the Lake Erie, Ontario commercial fisheries, target species have quotas (walleye, yellow perch, lake whitefish and smelt) while eleven bycatch species are permitted to be retained with unlimited catch (channel catfish, white bass, longnose gar, bowfin, alewife, gizard shad, burbot, white perch, rock bass, freshwater drum and crappie) and there are four unlimited catch species groups (suckers excluding black and Bigmouth buffalo, mooneye/goldeye, carp > 56 cm and smaller bullheads, sunfish excluding warmouth) (SAI Global 2019). Harvest is not permitted of any other species (ibid). All live ETP species must be released and dead ETP species must be turned in to management (ibid). Government appointed dockside monitors take sample weights of the catch and compare them to the Daily Catch Reports (DCRs) (ibid). If a monitor is not available the captain files the DCR in a lockbox station before offloading the catch (ibid). Bycatch studies have been conducted, however, there are no on-board observers and therefore no enforcement with respect to reporting bycatch (ibid). Reporting catch and discards is an enforced condition of license and management considers reporting to be accurate but there are no onboard observers or procedures in place for verification (Alderstein et al. 2015)(SAI Global 2019). As bycatch reduction techniques are used, but there is some uncertainty in bycatch catch composition due to lack of observer coverage, bycatch strategy is considered “moderately effective.”

Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Moderately Effective

Current fisheries management in Lake Erie is considered to be successful at minimizing negative harvest effects with exploited fish populations likely predominantly effected by environmental factors relative to fisheries mortality (Zhang et al. 2018). In Ohio, trap nets are regulated to be size selective for fishes larger than 8.5 inches total length through implementation of 2¾-in (70-mm) stretch mesh in the back of the trap-net pot allowing for escapement of smaller species (SAI Global 2019). A majority of the fishing occurs in nearshore waters that are less than 20' deep, allowing high survival of released species that are not legal to harvest, and species diversity and abundance of non-targeted fish is much lower in offshore waters of the central basin (pers. comm. Hartman, T. 2024). There is a requirement to lift the nets at minimum every 5 days to minimize bycatch (ibid). The catch is subject to port inspection (ibid). Undersized fishes must be released minimizing injury as much as possible (ibid). All catch must be reported by electronic catch reporting system but there are no on-board observers and therefore no enforcement with respect to reporting bycatch (ibid). As bycatch reduction techniques are used, but there is some uncertainty in bycatch catch composition due to lack of observer coverage, bycatch strategy is considered “moderately effective.”

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Highly effective

The Great Lakes Water Quality Agreement (GLWQA) calls for ecosystem monitoring shared among Canadian and US Federal agencies, state agencies and the province of Ontario (Richardson et al. 2012). The U.S.-Canada Lake Erie Lakewide Management Plan (LaMP) and the Great Lakes Fishery Commission's Lake Erie Lake Committee (LEC) promote collaborative monitoring (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). 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 is Lake Erie in 2024). The bi-national Lake Erie Millennium Network (LEMN) employs binational collaboration in summarizing the status of the Lake Erie ecosystem, documenting research and management needs, and developing a research network that ensures coordinated bi-national data collection and dissemination to address research and management priorities (ibid).

In Lake Erie coordination to develop research projects occurs among the Michigan Department of Natural Resources, New York State Department of Environmental Conservation, Ohio Department of Natural Resources, Ontario Ministry of Natural Resources and Forestry, and Pennsylvania Fish and Boat Commission. Research and monitoring priorities include obtaining a better understanding of nutrient loading and cycling within Lake Erie, monitoring and understanding food web dynamics, and in tracking contaminant loading and cycling (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). Data are collected regularly from both fishery-independent and fishery-dependent monitoring (Daily Catch Reports, DCRs, and commercial catch sampling) in Lake Erie including gillnetting, trawling and hydroacoustic surveys (Coldwater Task Group 2022) (Forage Task Group 2023). There are two annual fishery-independent gill net surveys providing harvest, effort, and age data in the eastern basin: the interagency August Coldwater Assessment (a.k.a. the Coldwater Assessment Survey conducted in US waters) and the Ontario Partnership Index Fishing Program (a.k.a. the Partnership Survey conducted in Ontario waters). Annual trawl and hydroacoustic surveys are conducted in each basin to estimate densities of forage fishes {Forage Fish Task Group 2022}. In Ontario, DCRs are required and inclusive of reporting retained, released, and discarded species (SAI Global 2019). Dock-side monitoring also occurs in which sample weights are taken and matched to the DCR (SAI Global 2019). In Ohio, all trap net vessels are required to have a vessel monitoring system and keep a daily catch record on an electronic catch reporting system with data reported immediately after each net is lifted (SAI Global 2019). Quantitative stock assessments are developed for lake whitefish, walleye, white bass, and yellow perch stocks, however, there is no formal stock assessment for rainbow smelt (SAI Global 2019)(Forage Task Group 2023) (Yellow Perch Task Group 2023) (Coldwater Task Group 2023)(Walleye Task Group 2023). Rainbow Smelt status is evaluated annually in Lake Erie using data derived from a variety of fishery-dependent and -independent assessment methods (personal communication MNRF). Empirical population biomass estimates for rainbow smelt are derived from a lake wide hydroacoustic survey conducted as a collaboration between U.S. and Canadian agencies (Forage Task Group 2023).

As data are collected and analyzed to monitor and maintain stock abundance and health using appropriate strategies, data collection and analysis is considered “highly effective.”

Factor 3.4 - Enforcement of and Compliance with Management Regulations

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Highly effective

The Great Lakes Law Enforcement Committee was created by the Great Lakes Fishery Commission (GLFC) through the multi-jurisdictional Joint Strategic Plan for Management of Great Lakes Fisheries 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. The committee develops strategies to communicate with stakeholders, provides training sessions for Great Lakes officers, and provides a basin update annually to the GLFC (ibid). Law enforcement information is made available for incorporation into fisheries management decision-making. Law enforcement engages in covert operations to investigate illegal harvest and invasive species issues (ibid). Tools for investigation include stake-outs, patrols, tip lines, and forensic fish analysis (ibid). Commercial fishing vessels are routinely boarded for harvest and gear inspection. Portside inspections are used to enforce regulations such as minimum fish sizes, retention of prohibited species, and gear restrictions (ibid). Deployed gear is randomly inspected to examine gear placement, mesh size, and markings (ibid). As 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 Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Highly effective

The Great Lakes Fishery Commission (GLFC) includes stakeholder input in the development of legislation, harvest restrictions, and enforcement regulations. Each lake has a representative committee required to make regular reports to the Council of Lake Committees (CLC). These reports

generate the development of new legislation, which is made public and local, state, provincial, and federal agencies are also invited to submit comments and suggestions (GLFC 2007).

Historically, comments were solicited from stakeholders at annual Lake Erie Committee (LEC) meetings, but there was concern among stakeholders that these comments were not being effectively incorporated into management decision-making as they occurred at a late stage in TAC development (Lake Erie Committee 2020). In 2010, the LEC partnered with Michigan State University's Quantitative Fisheries Center (QFC) and created a formalized more structured process to engage stakeholders in management decisions for the walleye and yellow perch fisheries (ibid). This led to development of the Lake Erie Percid Management Advisory Group (LEPMAG) which employs a structured decision-making process facilitated by the QFC and a senior Research Biologist from the GLFC and engages stakeholders (inclusive of commercial fishers, fish processors, recreational fishers and charter captains) in development of recommendations to the LEC (Lake Erie Committee 2015).

As 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 Erie | America, North - Inland Waters | Canada | Bottom trawls	Score: 2	Score: 0	Moderate Concern		**Yellow (2.449)**
Lake Erie | America, North - Inland Waters | Canada | Set gillnets	Score: 3	Score: 0	Moderate Concern		**Yellow (3.000)**
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets	Score: 3	Score: 0	Moderate Concern		**Yellow (3.000)**
Lake Erie | America, North - Inland Waters | United States | Ohio | 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 Erie | America, North - Inland Waters | Canada | Bottom trawls

Score: 2

The bottom substrate of Lake Erie comprises of mostly mud (60%) and sand (26%) with approximately no hard substrate (Wang et al. 2015) (USGS & GLAHF 2018)(see map in Figure 32). Per the Seafood Watch Standard for Fisheries, the physical impact of fishing gear on the habitat/substrate for gear types such as bottom trawls (see Figure 36) that are set mostly on soft substrates is given a score of "3".

Justification:

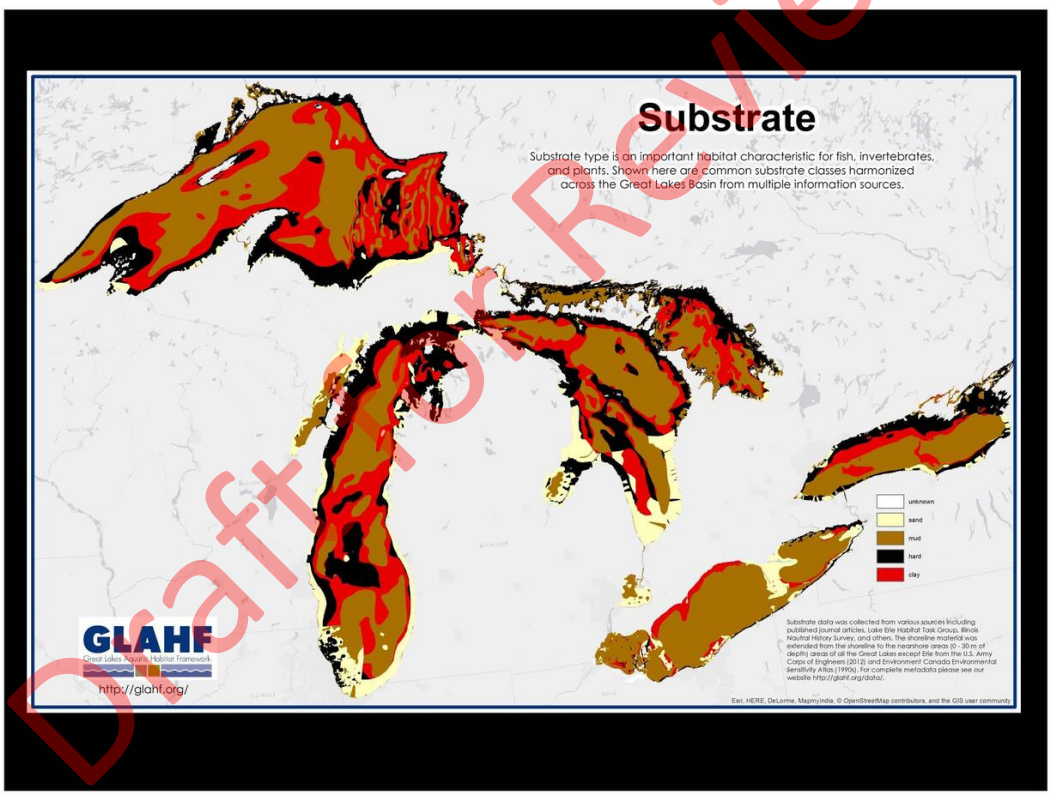

Figure 32: Map of substrate types in the Great Lakes, showing that Lake Erie comprises mostly of mud (USGS & GLAHF 2018).

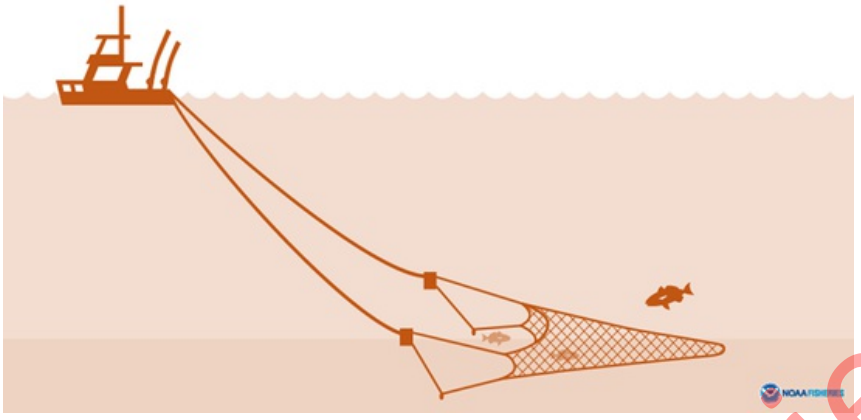

Figure 36: Bottom trawling is a fishing practice that herds and captures the target species by towing a net along the ocean floor (NOAA Fisheries 2023).

Lake Erie | America, North - Inland Waters | Canada | Set gillnets

Score: 3

The bottom substrate of Lake Erie comprises of mostly mud (60%) and sand (26%) with approximately no hard substrate (Wang et al. 2015) (USGS & GLAHF 2018)(see map in Figure 32). The gillnet fisheries use small mesh bottom-set gillnets when targeting yellow perch and large-mesh mid-water gillnets when targeting walleye. 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 (see Figure 33) that are set mostly on soft substrates is given a score of “3”.

Justification:

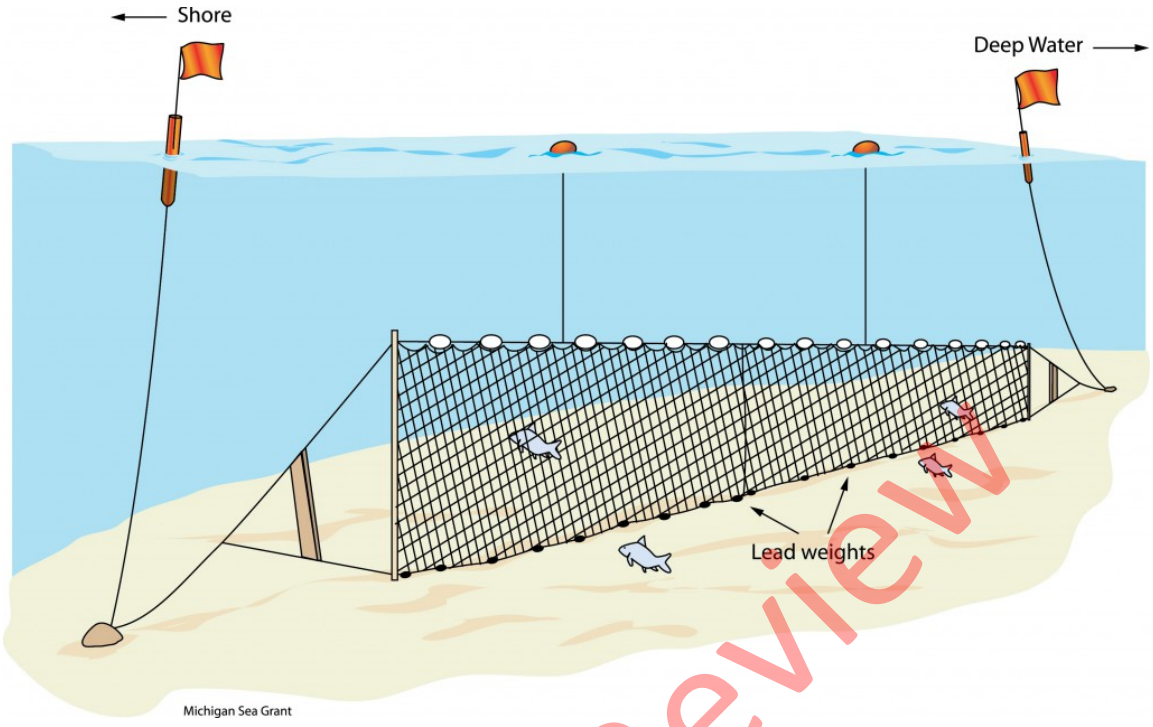

Figure 33: Set gill nets are set perpendicular to shore with floats on the top and weights on the bottom (Michigan Sea Grant 2021).

Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets

Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Score: 3

The bottom substrate of Lake Erie comprises of mostly mud (60%) and sand (26%) with approximately no hard substrate (Wang et al. 2015) (USGS & GLAHF 2018)(see map in Figure 32). Per the Seafood Watch Standard for Fisheries, the physical impact of fishing gear on the habitat/substrate for gear types such as trap nets (see Figure 34) that are set mostly on soft substrates is given a score of “3”.

Justification:

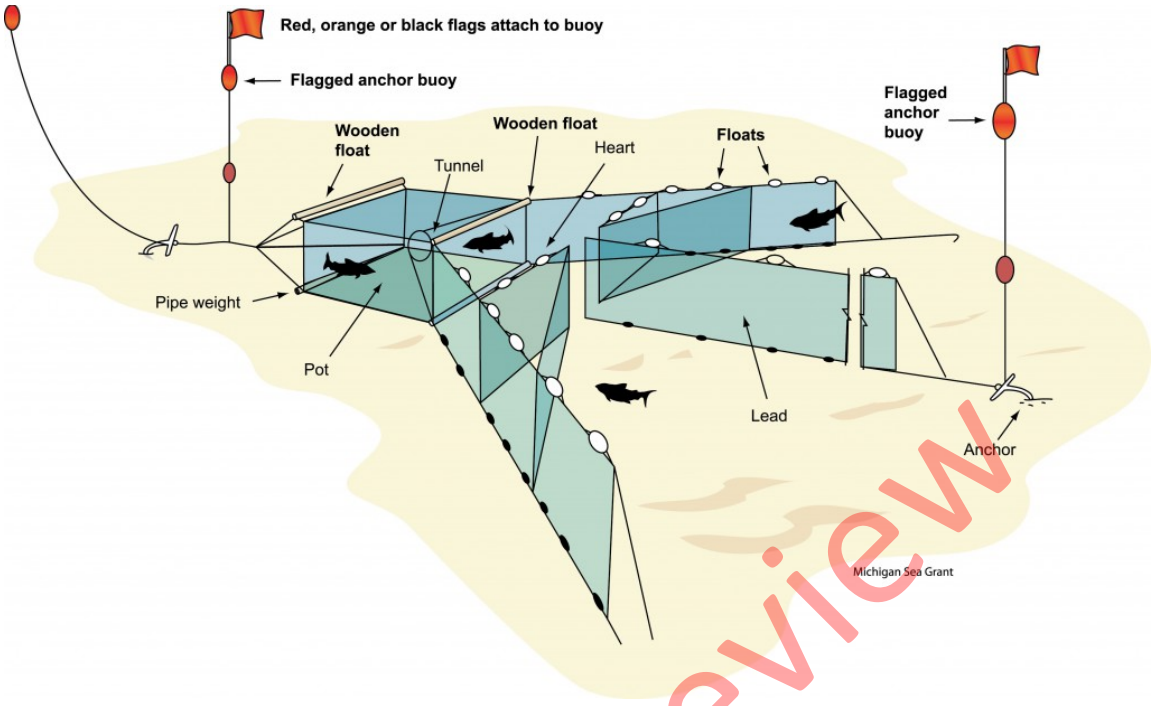

Figure 34: Trap nets divert fishes into an enclosure, through a tunnel into a pot for capture (Michigan Sea Grant 2021).

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound nets
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

Score: 0

There are 947 km of coastal shoreline protected (at various levels) in Lake Erie (233 km in the US, 714 km in Canada)(Parker et al. 2017). In Ohio, the nearshore and reef zones are closed to fishing (SAI Global 2019). Less than 2% of in-lake US waters in Lake Erie are protected areas and there are no in-lake protected areas in Canadian waters of Lake Erie (Parker et al. 2017). Spatial protections do not meet the requirements to apply a modifying score for mitigation of gear impacts.

Factor 4.3 - Ecosystem-based Fisheries Management

Lake Erie | America, North - Inland Waters | Canada | Set gillnets
Lake Erie | America, North - Inland Waters | United States | Ohio | Stationary uncovered pound

nets
Lake Erie | America, North - Inland Waters | Canada | Bottom trawls
Lake Erie | America, North - Inland Waters | Canada | Stationary uncovered pound nets

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). Fish community objectives are developed by the Lake Erie Committee to facilitate a functional food web and healthy ecosystem in Lake Erie with progress evaluations at minimum every 5 years (Francis et al. 2020). The Lake Erie Partnership has identified five priority threats to the Lake Erie ecosystem: nutrient and bacterial pollution, chemical contaminant pollution, loss of habitat and native species, invasive species, and climate trend impacts (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). The Lake Erie Biodiversity Conservation Strategy developed goals of increasing food web stability with self-sustaining populations of native predators and at least 50% prey biomass comprised of native fishes by 2030 (Pearsall et al. 2012).

During the industrial revolution in the 19th century, due to the addition of industrial pollutants and nutrients, Lake Erie underwent eutrophication causing increased occurrence of algal blooms and hypoxic conditions (Munawar et al. 2002). After phosphorus abatement strategies were implemented in the 1980s, levels decreased (~50% decrease relative to peak concentrations) and Lake Erie shifted towards a mesotrophic-oligotrophic state (Munawar et al. 2002)(International Joint Commission United States & Canada 1987). However, hypoxic events still occur frequently in the central basin (Munawar et al. 2002)(International Joint Commission United States & Canada 1987). In the late 1990s, the western basin and nearshore areas of the central and eastern basins experienced re-eutrophication leading to harmful algal blooms particularly in the western basin in the late summer (Watson et al. 2016). It is an environmental priority of the Lake Erie Committee to achieve mesotrophic conditions that favor percid fish productivity (GLFC 2022). Currently, the central basin is within target levels, the west basin has been above the target for several years, while the east basin is below the target (ibid).

Several historic ecosystem disruptions in Lake Erie have occurred from invasive species with over 140 aquatic and terrestrial non-native species identified in the Lake Erie basin over the past 200 years (32% of which have had moderate to high environmental impacts) (Environment and Climate Change Canada and the U.S. Environmental Protection Agency 2021). Species with the greatest environmental impact include the zebra and quagga mussels (*Dreissena* spp. mussels), alewife, and sea lamprey (ibid).

Walleye are piscivorous top predators in Lake Erie while yellow perch, lake whitefish, and rainbow smelt are prey fishes and lower-level predators (Hartman 2009)(Francis et al. 2020). Although there are other fishes in Lake Erie in each of these trophic levels that also facilitate energy processing through predator-prey interactions, each of the assessed species serve an important role in the ecosystem. Walleye are considered the primary coupler among habitats and basins in Lake Erie and influence fish community structure through selective piscivory (Ives et al. 2019). For non-native rainbow smelt, it is unclear what the effect of policies to manage the fishery have on native species due to the complex nature of the dynamically changing food web and ecosystem (Francis et al. 2020). Based on the species' ecological roles, detrimental food web impacts are possible. Ecosystem based fisheries management is considered a “moderate concern” as there is spatial and temporal management in

place appropriate to the scale of the fishery and ecology of the stocks that is likely to be effective with little scientific controversy.

Acknowledgements

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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