St. Marys River Area of Concern
Canadian Section

# Status Assessment of the *Restrictions on Fish and Wildlife Consumption* Beneficial Use Impairment

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## Executive Summary

The purpose of this report is to assess the current status of the *Restrictions on Fish and Wildlife Consumption* beneficial use impairment (BUI), for the St. Marys River Canadian Area of Concern (AOC). For this AOC, only fish consumption is identified as impaired. This assessment report includes:

i) An overview of the history behind the original impairment designation;
ii) Review of the established BUI delisting criteria and a summary of the tiered assessment framework for the fish portion of the BUI;
iii) Review of the Community Fish Consumption Survey results and its use in the BUI assessment; and
iv) Conclusions and recommendations regarding BUI redesignation.

Upon the St. Marys River being designated an Area of Concern under the Canada-U.S. Great Lakes Water Quality Agreement in 1987, the Stage 1 Remedial Action Plan (RAP) report released in 1992 identified *Restrictions on Fish and Wildlife Consumption* as one of the impaired BUIs for the AOC. At the time, the reason for the impaired status was mercury concentrations in larger sizes of longnose sucker, white sucker, walleye, northern pike and lake trout. With the 2002 release of the Stage 2 RAP report, this was expanded to include both mercury and polychlorinated biphenyls (PCBs) as driving fish consumption advisories within the AOC. The wildlife component was included in the original BUI impaired status, but there were no specific concerns identified for the St. Marys River AOC apart from the Ontario government advising people not to eat kidneys and liver from large game (which was and continues to be an Ontario-wide advisory). The Stage 2 RAP report (2002) changed the status of the wildlife component of the BUI to *not impaired* status due to there being no AOC-specific advisories in effect. The focus of this BUI assessment is therefore only on the fish component, which was upheld as impaired in the Stage 2 RAP report.

As mentioned, historical reasons for this impairment were two major contaminants of concern affecting fish consumption advisories: mercury and PCBs. Dioxins/furans and polyfluoroalkyl substances (PFAS) are also evaluated in this updated BUI status assessment, even though they were not identified in the Stage 1 and Stage 2 RAP reports, because Ontario's Fish Contaminant Monitoring Program includes these chemicals when evaluating and issuing consumption advisories for St. Marys River fish. Current advisories within the AOC are mainly due to these four contaminants, which are also responsible for restrictions on eating fish from other areas of Lake Superior and Lake Huron. As a result, restrictions in fish consumption from these four substances are not unique or specific to the St. Marys River AOC, instead, they reflect a lake-wide phenomenon.

The delisting criteria for this beneficial use impairment states that it will no longer be impaired when: **"*the fish consumption advisories in the Area of Concern are no more restrictive than the advisories for the same contaminants in suitable reference sites. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events".***

Results from an initial assessment of the BUI were published in March 2020 in the Journal of Great Lakes Research co-authored by the University of Toronto and the Ministry of the Environment, Conservation and Parks (Gandhi et al. 2020 – Appendix B). The results suggested that levels of mercury, PCBs, and dioxins/furans in fish from the St. Marys River have declined to an extent that the BUI can be considered "not impaired". It was found that the safety of eating fish from within the AOC are generally similar to or better than other regions of the Great Lakes. A second assessment was also completed using published advisories (ie. non-simulated) from the Guide to Eating Ontario Fish for 2017-2018 and again for 2023-2024.

In the initial 2020 assessment (Gandhi et al.), the journal article asserted that 8+ meals per month can be considered a "non-restrictive" diet of fish. To verify this, the authors recommended that a community fish consumption survey, to determine types of fish and how often they are being consumed, be conducted to test this critical assumption in order to help complete a BUI status assessment. Furthermore, results from the 2020 assessment also concluded fish consumption advisories for the St. Marys River AOC are similar to those in Lake Superior and Lake Huron, with one exception - Chinook salmon. That fish was considered a *partial restriction* with an advisory of 1-4 meals per month depending on the size of the fish. Therefore, the community fish consumption survey also sought to gain further insight into the consumption of this particular fish.

The St. Marys River AOC Community Fish Consumption Survey ran from May 2021 – November 2023 with a total of 673 surveys collected during the survey period. Results of the survey support the assertion used by Gandhi et al. (2020) that 8+ meals per month can be considered a "non-restrictive" diet of fish.

A second assessment was completed using the tiered assessment framework. This assessment utilized published advisories (ie. non-simulated) from the Guide to Eating Ontario Fish for 2017-2018 and again for 2023-2024. Tier 1 assessed whether monthly meal limits issued for species in the St. Marys River AOC were considered non-restrictive. The 2017-2018 advisories showed four species with consumption advisories that were more restrictive than a meal allowance benchmark of 8+ meals per month. In 2023-24 improvements were seen, however, Chinook Salmon and Longnose Sucker still had consumption advisories that were considered restrictive.

Based on the tiered assessment framework, a Tier 2 analysis is required. Tier 2 assessed whether advisories within the AOC were comparable to reference sites. The results of the Tier 2 analysis indicate that three species had advisories considered more restrictive than reference sites in Lakes Superior and Huron. However, the advisories either still constitute a non-restrictive diet of fish (8+ meals per month) from the AOC or a low community desire to eat more than advisories allow. Therefore, this does not result in impairment. The Tier 2 analysis supports the rationale for redesignating the BUI to "not impaired" status for the Canadian side of the St. Marys River AOC.

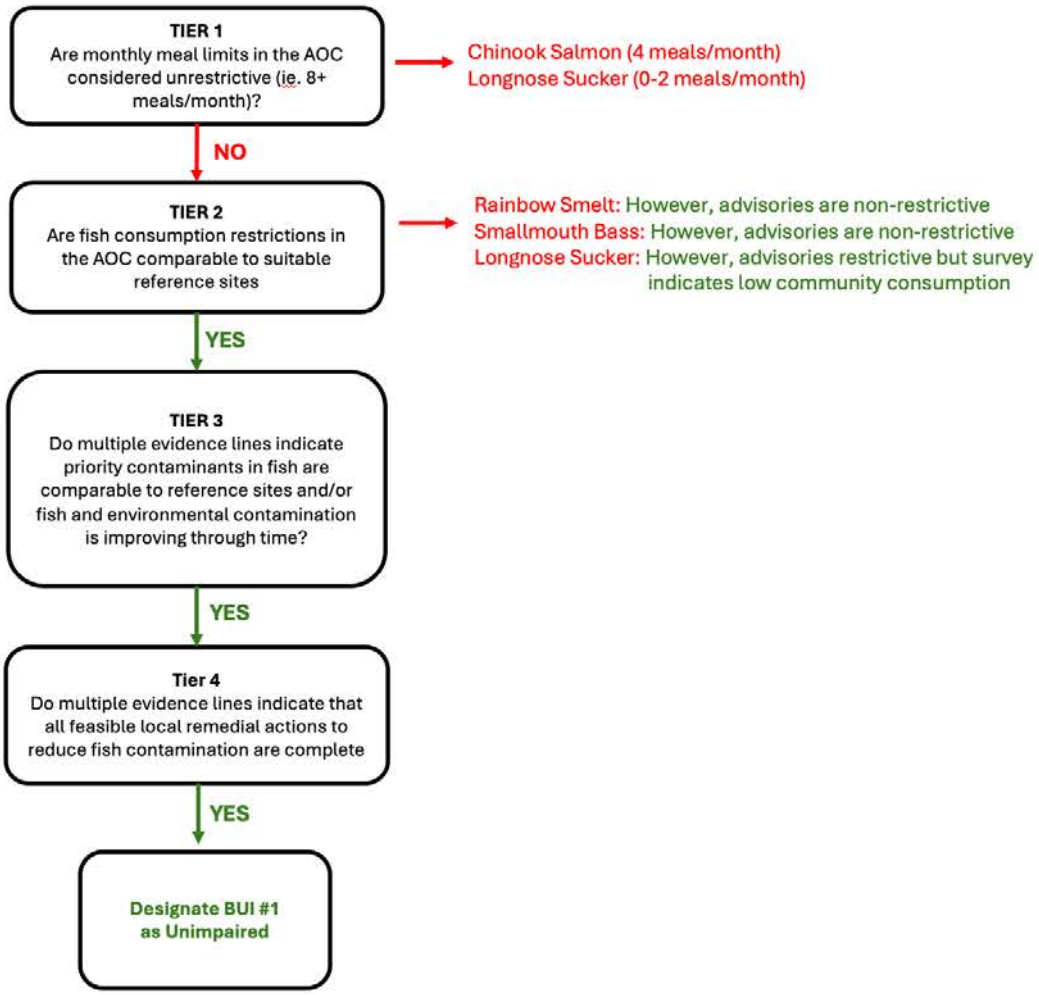


***Figure 1: Results of tiered assessment framework applied to the St. Marys River AOC.***

This report outlines how the delisting criteria have been met, and provides a recommendation to change the *Restrictions on Fish and Wildlife Consumption* BUI to not impaired.

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# 1.0 Introduction

## 1.1 The St. Marys River Area of Concern

The St. Marys River is a connecting channel between Lake Superior and Lake Huron. In 1987, it was identified as an Area of Concern (AOC) under the Canada-U.S. Great Lakes Water Quality Agreement due in large part to high levels of point source contamination from local industries and municipalities. An AOC is a location within the Great Lakes which has experienced historically significant environmental impairment resulting from human activities at the local level.

The St. Marys River AOC is a 125 km stretch of water that separates the twin cities of Sault Ste. Marie, Ontario and Sault Ste. Marie, Michigan. The river originates in Whitefish Bay on Lake Superior between Point Iroquois, Michigan and Gros Cap, Ontario and divides into two channels around St. Joseph Island to the east (Figure 1).

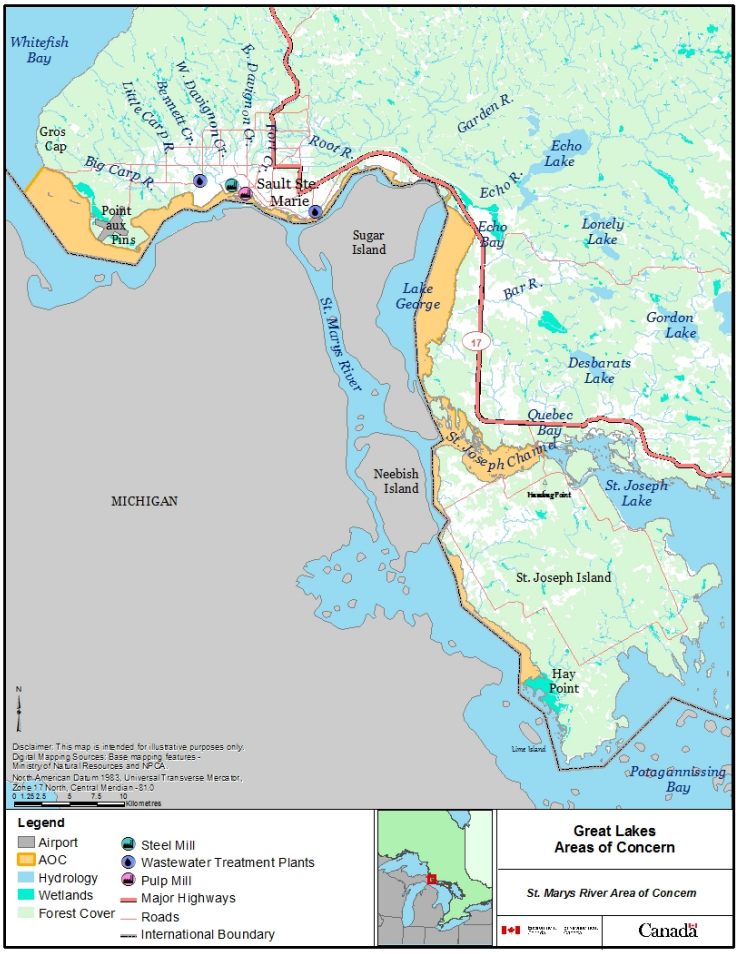


***Figure 2: St. Marys River Area of Concern (AOC) - Canadian Section.***

### 1.2 Reason for Beneficial Use Impairment (BUI)

The *Restrictions on Fish and Wildlife Consumption* BUI was listed as impaired in the Stage 1 Remedial Action Plan (RAP) report (1992). This designation occurred as result of fish consumption advisories triggered by mercury levels in fish within the St. Marys River. Levels of mercury exceeded the trigger level of 0.5 mg/kg in fish captured in Ontario waters downstream of the rapids. As a result, restricted consumption advisories were put in effect for larger sizes of longnose sucker, white sucker, walleye, northern pike and lake trout (Table 1).

***Table 1: St. Marys River fish consumption advisories in effect in 1991 due to mercury contamination.***

| Location | Species | Length | Advisory |
|---|---|---|---|
| Below Rapids | Longnose sucker | 30-45 cm | 0.2 kg/week |
| | White sucker | 45-55 cm | 0.2 kg/week |
| | Walleye | 45-65cm | 0.2 kg/week |
| Lake George | Northern pike | 65-75 cm | 0.2 kg/week |
| | Lake trout | 55-65 cm | 0.2 kg/week |
| | Walleye | 45-55 cm | 0.2 kg/week |
| | Walleye | 55-65 cm | 0.1 kg/week |
| St. Joseph Channel | Northern pike | >75 cm | 0.2 kg/week |

Polychlorinated biphenyls (PCBs) were added as a second contaminant of concern in the Stage 2 RAP report (2002) as they are considered one of the main causes for fish consumption advisories.

The Ontario Ministry of Environment, Conservation and Parks (MECP) collects data through its Fish Contaminant Monitoring Program and uses it to advise the public on safe fish consumption practices through the *Guide to Eating Ontario Fish*[1]. The Stage 2 RAP Report (2002) found fish consumption restrictions to be higher than normal due to contaminant loadings from local industrial and municipal discharges.

[1] Available online: www.ontario.ca/page/guide-eating-ontario-fish

### 1.3 Contaminants of Concern

In addition to mercury and PCBs, dioxins/furans and polyfluoroalkyl substances (PFAS) are evaluated in this updated BUI status assessment, even though they were not identified as a concern for fish consumption advisories in the Stage 1 and Stage 2 RAP reports. They were added to the assessment since they are present in the St. Marys River and assessed as part of Ontario's Fish Contaminant Monitoring Program.

All four of these contaminants may lead to negative human health effects if consumed at a higher rate than the Ontario guide recommends.

***Table 2: Contaminants of concern in the St. Marys River AOC.***

| | |
|---|---|
| **Mercury:** | Can be absorbed by a fish either from water passing over its gills or it is ingested with its diet. Since fish eliminate mercury at a very slow rate, concentrations of this substance gradually increase. Fish at the top of the food web usually have the highest mercury levels. |
| **Polychlorinated biphenyls (PCBs):** | A group of chlorinated organic compounds banned in the 1970s. They persist for decades in the natural environment and readily accumulate in the aquatic ecosystem. |
| **Dioxins/Furans:** | Unintentional by-products of several industrial processes with 17 of the 210 different dioxins and furans being toxic enough to be of concern. |
| **Polyfluoroalkyl substances (PFAS):** | A family of chemicals that make materials repellent to water, stain and oil. They have been in a wide array of consumer products since the 1950s and do not break down easily. |

For the wildlife portion of this BUI, the Ontario Ministry of Natural Resources (MNR) advised against the consumption of kidneys and livers in large game animals during the time of the Stage 1 RAP report due to high cadmium levels and was identified as impaired. However, since this advisory existed for the entire province, and not just within the St. Marys River AOC, the wildlife portion of the *Restriction on Fish and Wildlife Consumption* was deemed not impaired in the Stage 2 report.

### 1.4 BUI Delisting Criteria

Delisting criteria, which are measurable environmental targets that need to be achieved before the BUI can be considered not impaired, help guide the development of remedial actions and direct monitoring efforts in the AOC. They are tailored to each AOC and are derived locally through a collaborative effort between the RAP Coordinating Committee, local government agencies, Indigenous communities and the public as represented by public advisory councils/committees. Additionally, since the St. Marys River is an international waterway, the AOC has a Binational Public Advisory Council (BPAC).

In order for an "impaired' BUI to be redesignated to "not impaired", the delisting criteria developed specifically for the BUI must be met. The initial suite of BUI delisting criteria for the St. Marys River AOC were developed in 2002 for the Stage 2 RAP report. Although the wildlife component of the BUI was changed to not impaired in that report, the BUI delisting criteria was for both parts of the *Restrictions on Fish and Wildlife Consumption BUI*, and stated: "*This BUI will no longer be impaired when there are no locally derived fish and wildlife consumption advisories as determined by the most stringent standards, objectives or guidelines*".

Starting in 2010, the suite of delisting criteria for the St. Marys River RAP underwent updates on the Canadian side of the AOC, following a similar process that had concluded on the U.S. side a few years earlier. This was done to reflect current science and use indicators that measure ecosystem health. The revised delisting criteria were endorsed by BPAC in February 2015. For the *Restrictions on Fish and Wildlife Consumption* BUI, the established delisting criteria states:

***"This BUI will no longer be impaired when the fish consumption advisories in the AOC are no more restrictive than the advisories in suitable reference sites. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events".***

The wildlife portion of the BUI was deemed not impaired at the time of the Stage 2 report because advisories for large game animals were not AOC-specific but province-wide. Therefore, the delisting criteria only address fish consumption.

## 2.0 Ontario Fish Consumption Advisories

The MECP issues fish consumption advisories for the Canadian side of the St. Marys River, which encompasses the AOC from Lake Superior to the St. Joseph Channel. Consumption advisories are issued in tables with data indicating the maximum number of meals per month recommended for various fish species and size ranges (Table 2). The consumption advice is generated using a standard body size and meal portion (227 g or half a pound per meal)

combined with contaminant-specific fish consumption advisory benchmarks generally based on health protection guidelines from Health Canada. These benchmarks are subject to periodic revision and updating when new scientific information becomes available. Most often such updates result in more stringent advice being issued for a given level of contamination.

Meal advice for the general population are issued as 0, 1, 2, 4, 8, 12, 16 or 32 meals/month. For the sensitive population, which consists of children under 15 years of age and women who are pregnant or may become pregnant, meal advice is issued as 0, 4, 8, 12, 16 and 32 meals/month.

*Table 3: Example fish consumption advisory table.*

| **Length (cm)** | 15–20 | 20–25 | 25–30 | 30–35 | 35–40 | 40–45 | 45–50 |
|---|---|---|---|---|---|---|---|
| **Length (in)** | 6–8 | 8–10 | 10–12 | 12–14 | 14–16 | 16–18 | 18–20 |
| **General population** | N/A | N/A | N/A | 8 | 4 | 4 | 4 |
| **Sensitive population*** | N/A | N/A | N/A | 4 | 0 | 0 | 0 |

Note: An angler catches a 33 cm (13 in) Walleye from Lake and wants to determine how many meals of fish they can eat in a month. Using the length of the fish across the top of the table, the advice given for Walleye in the 30-35 cm (12–14 in) is 8 for the general population and 4 for the sensitive population indicating that no more than 8 meals per month of that fish can be safely eaten by the general population and no more than 4 meals per month for the sensitive population. You may need to use the scroll bar at the bottom of the table to find the correct length range for the fish.

## 3.0 A Tiered Assessment Framework

An assessment of the *Restrictions on Fish and Wildlife Consumption* BUI is based on advisories issued by the MECP for fish consumption. These advisories are impacted by changes to local fish contaminant levels as well as advisory benchmarks. The benchmarks undergo periodic updating as new scientific information becomes available. Oftentimes these updates result in more stringent advice being issued. In order to calculate fish consumption advisories, data recorded in Ontario's fish contaminant database are utilized. These records could be from different time periods and locations within the river based on the number of records available for a particular species. These changes to benchmarks and availability of data records can complicate the assessment of the *restrictions on fish consumption*. There may be certain situations where contaminants in fish are declining within the AOC, however, with more stringent benchmarks coming into play, fish consumption advisories may remain constant or potentially increase. As

such, in addition to assessing the delisting criteria for this BUI, a tiered assessment framework was also used to assess the recovery of the *restrictions on fish consumption*.

This tiered framework is based on a hierarchical process where each tier is assessed and could possibly lead to a "not impaired" status without needing to move further throughout the framework (Figure 2). Tier 1 examines fish consumption advisories in the AOC, looking at whether advisories for the AOC allow for desired fish consumption of 8+ meals/month. Tier 2 calls for a reference comparison where advisories for the AOC are compared to suitable non-AOC reference sites. Tier 3 is a lines of evidence analysis to assess contaminant trends. Tier 4 is sometimes added to determine whether all restoration actions are complete and whether multiple evidence lines indicate environmental recovery is occurring and, if so, is this recovery likely to further reduce fish contamination and intensity of fish consumption advice (Bhavsar *et al*. 2018).

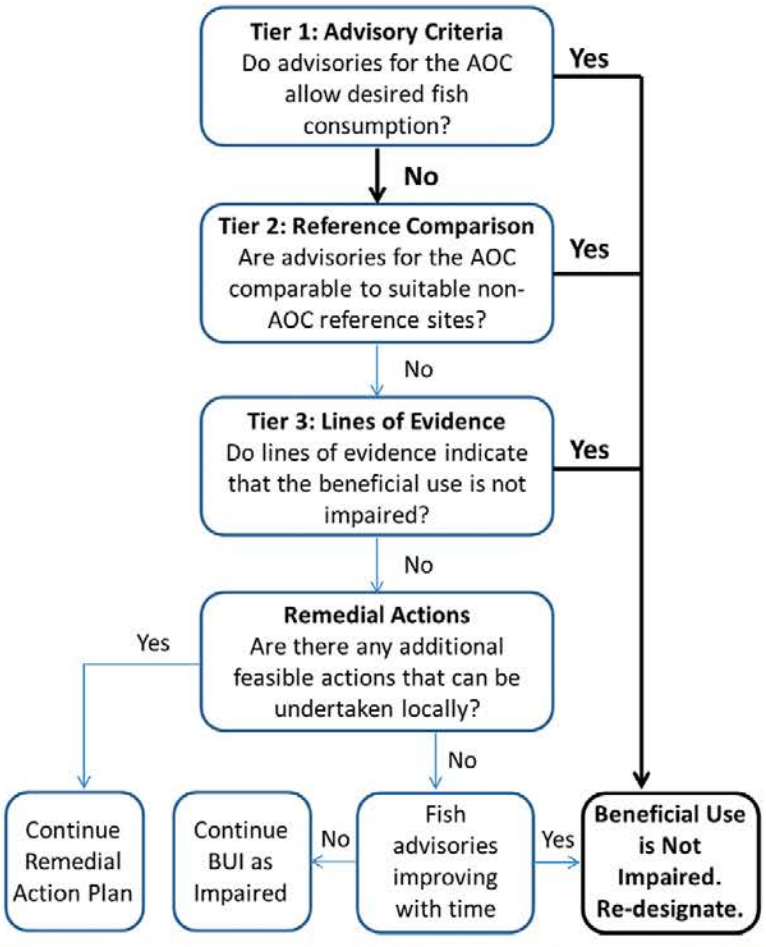


***Figure 3: Tiered assessment framework for the Restrictions on Fish Consumption (Bhavsar et al. 2018).***

### 3.1 Tier 1: Advisory Criteria

Tier 1 assesses whether fish consumption advisories are more or less restrictive than a meal allowance benchmark of 8+ meals per month. This benchmark is based on assessments that were done by MECP which revealed that less than 10% of anglers in Ontario consume wild caught fish more than 8 times per month (Bhavsar *et al*. 2018). A Community Fish Consumption survey for the St. Marys River AOC provides supporting evidence for this benchmark recommendation where less than 3% of survey respondents indicated that they consume more than 8 meals of wild caught fish per month.

The consumption advisories used for analysis in this report are those published in the 2017-2018 and 2023-2024 Guide to Eating Ontario Fish. These advisories can be broadly categorized as restrictive (ie. less than 8 meals/month) and non-restrictive (ie. 8+ meals/month) for the general population.

#### 3.1.1 Consumption Advisories 2017-2018

A total of 146 advisories were published in the 2017-2018 Guide to Eating Ontario Fish for the St. Marys River AOC (Table 3). This includes advisories for the general population (GP) and the sensitive population (SP). Of these published advisories, 46% were considered restrictive and 16% advised 0 meals/month (ie. do not eat).

Gandhi et al. (2020) describe how the published advisories in the 2017-2018 Guide to Eating Ontario Fish could be influenced by historically elevated concentrations of contaminants since certain size classes for some species of fish may not have been captured in recent years. As a result, simulated advisories using only fish caught after 2005 were analyzed in order to avoid the potential for historical influence. Removing the historical influence of potentially elevated contaminant concentrations, the simulated advisories did show an improvement on fish consumption restrictions. The simulated advisories resulted in 32% of advisories being restrictive (ie. 8 meals/month) and only 1% with a complete restriction of 0 meals/month (ie. do not eat).

***Table 4: Fish Consumption advisories (meals/month) for the St. Marys River published in 2017-2018 Guide to Eating Ontario Fish for both the general population (GP) and sensitive population (SP).***

| Fish Species | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| Atlantic Salmon | GP | | | | | | | | 1 | 1 | 1 | 1 | 1 | 0 |
| | SP | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Brown Bullhead | GP | | 32 | 16 | 16 | | | | | | | | | |
| | SP | | 16 | 12 | 8 | | | | | | | | | |
| Chinook Salmon | GP | | | | | | | | | | | 0 | 0 | 0 |
| | SP | | | | | | | | | | | 0 | 0 | 0 |
| Cisco (Lake Herring) | GP | | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| | SP | | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| Longnose Sucker | GP | | | | 2 | 2 | 2 | | | | | | | |
| | SP | | | | 0 | 0 | 0 | | | | | | | |
| Northern Pike | GP | | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 |
| | SP | | 16 | 16 | 16 | 16 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 |
| Pink Salmon | GP | | | | 8 | 8 | 4 | 2 | | | | | | |
| | SP | | | | 8 | 8 | 4 | 2 | | | | | | |
| Rainbow Trout | GP | | 8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | |
| | SP | | 8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | |
| Smallmouth Bass | GP | | | | | 4 | 4 | | | | | | | |
| | SP | | | | | 4 | 4 | | | | | | | |
| Walleye | GP | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 2 | |
| | SP | | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 | |
| White Sucker | GP | | 32 | 32 | 32 | 32 | 16 | 8 | 8 | 8 | | | | |
| | SP | | 32 | 32 | 32 | 32 | 16 | 8 | 8 | 4 | | | | |
| Yellow Perch | GP | 32 | 32 | 16 | 12 | 8 | | | | | | | | |
| | SP | 16 | 12 | 8 | 4 | 0 | | | | | | | | |

### 3.1.2 Consumption Advisories 2023-2024

A total of 170 advisories were published in the 2023-2024 Guide to Eating Ontario Fish for the St. Marys River AOC (Table 4) which includes advisories for the general population (GP) and the sensitive population (SP). Even though there are more advisories reported out on as compared to 2017-18, the advisories for the St. Marys River AOC have become much less restrictive. For example, of these published advisories, 23% were considered restrictive (down from 46%) and 4% advised 0 meals/month (down from 16%).

***Table 5: Fish Consumption advisories (meals/month) for the St. Marys River published in 2023-24 Guide to Eating Ontario Fish for both the general population (GP) and sensitive population (SP).***

| Fish Species | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| Atlantic Salmon | GP | | | | 16 | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 0 |
| | SP | | | | 16 | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 0 |
| Brown Bullhead | GP | | 32 | 16 | 16 | | | | | | | | | |
| | SP | | 16 | 12 | 8 | | | | | | | | | |
| Chinook Salmon | GP | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| | SP | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 0 |
| Cisco (Lake Herring) | GP | 16 | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| | SP | 16 | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| Longnose Sucker | GP | | | | 2 | 2 | 2 | | | | | | | |
| | SP | | | | 0 | 0 | 0 | | | | | | | |
| Northern Pike | GP | | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 |
| | SP | | 16 | 16 | 16 | 16 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 |
| Pink Salmon | GP | | | | | 16 | 16 | | | | | | | |
| | SP | | | | | 16 | 16 | | | | | | | |
| Rainbow Smelt | GP | 8 | | | | | | | | | | | | |
| | SP | 8 | | | | | | | | | | | | |
| Rainbow Trout | GP | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | |
| | SP | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | |
| Round Whitefish | GP | | | | | | | 32 | | | | | | |
| | SP | | | | | | | 16 | | | | | | |
| Smallmouth Bass | GP | | 32 | 16 | 8 | 4 | 4 | | | | | | | |
| | SP | | 12 | 8 | 8 | 4 | 4 | | | | | | | |
| Walleye | GP | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 12 | 12 | 8 | 2 | |
| | SP | | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | |
| White Sucker | GP | | 32 | 32 | 32 | 32 | 12 | 12 | 8 | 8 | | | | |
| | SP | | 32 | 32 | 32 | 32 | 12 | 8 | 4 | 4 | | | | |
| Yellow Perch | GP | 32 | 16 | 16 | 16 | 8 | | | | | | | | |
| | SP | 16 | 8 | 4 | 4 | 4 | | | | | | | | |

### 3.1.3 Tier 1 Results

Table 5 shows the maximum meals per month based on Ontario's published fish consumption advisories in 2017-18 and 2023-24. The 2017-2018 advisories show that Atlantic Salmon, Chinook Salmon, Longnose Sucker, and Smallmouth Bass are species with consumption advisories that were more restrictive than a meal allowance benchmark of 8+ meals per month, thereby failing the Tier 1 assessment. In 2023-24, improvements have been seen regarding Atlantic Salmon and Smallmouth Bass with options available for select sizes of fish from the AOC that can be safely consumed at a frequency of 8 or more meals per month. However, Chinook

Salmon and Longnose Sucker still have consumption advisories that were more restrictive than a meal allowance benchmark of 8+ meals per month. Based on the tiered assessment framework, a Tier 2 analysis is required.

***Table 6: Summary of Tier 1 Assessment for the St. Marys River AOC.***

| Species | Population | 2017-2018 | | 2023-2024 | |
|---|---|---|---|---|---|
| | | Max Consumption (meals/month) | Tier 1 Pass/Fail | Max Consumption (meals/month) | Tier 1 Pass/Fail |
| Atlantic Salmon | GP | 1 | ☒ | 16 | ☑ |
| | SP | 0 | ☒ | 16 | ☑ |
| Brown Bullhead | GP | 32 | ☑ | 32 | ☑ |
| | SP | 16 | ☑ | 16 | ☑ |
| Chinook Salmon | GP | 0 | ☒ | 4 | ☒ |
| | SP | 0 | ☒ | 4 | ☒ |
| Cisco | GP | 16 | ☑ | 16 | ☑ |
| | SP | 16 | ☑ | 16 | ☑ |
| Longnose Sucker | GP | 2 | ☒ | 2 | ☒ |
| | SP | 0 | ☒ | 0 | ☒ |
| Northern Pike | GP | 32 | ☑ | 32 | ☑ |
| | SP | 16 | ☑ | 16 | ☑ |
| Pink Salmon | GP | 8 | ☑ | 16 | ☑ |
| | SP | 8 | ☑ | 16 | ☑ |
| Rainbow Smelt | GP | | | 8 | ☑ |
| | SP | | | 8 | ☑ |
| Rainbow Trout | GP | 8 | ☑ | 16 | ☑ |
| | SP | 8 | ☑ | 16 | ☑ |
| Round Whitefish | GP | | | 32 | ☑ |
| | SP | | | 16 | ☑ |
| Smallmouth Bass | GP | 4 | ☒ | 32 | ☑ |
| | SP | 4 | ☒ | 12 | ☑ |
| Walleye | GP | 16 | ☑ | 32 | ☑ |
| | SP | 12 | ☑ | 12 | ☑ |
| White Sucker | GP | 32 | ☑ | 32 | ☑ |
| | SP | 32 | ☑ | 32 | ☑ |
| Yellow Perch | GP | 32 | ☑ | 32 | ☑ |
| | SP | 16 | ☑ | 16 | ☑ |

It should be noted that Atlantic Salmon and Chinook Salmon were most recently monitored in 2016. This was the first time since 2000. The new data were available in later part of 2017, and as such were incorporated in the next update to the Guide to Eating Ontario Fish in 2020. The

new data resulted in noticeable improvements in their advisories as shown in Table 6. Longnose Sucker has not been monitored since 1985; as such, their advisories are based on the levels found 40 years ago. Considering substantial declines in fish contaminant levels for the river during the last four decades, we can expect that the current contaminant levels in Longnose Sucker would be dramatically lower and would result in much less restrictive advisories.

### 3.2 Tier 2: Reference Comparison

Tier 2 of the assessment framework calls for a reference comparison, which is in line with the delisting criteria for the BUI. That is, "*This BUI will no longer be impaired when the fish consumption advisories in the AOC are no more restrictive than the advisories in suitable reference sites. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events".* To account for the requirement of having two sampling events, reference comparisons were completed using data published in the Guide to Eating Ontario Fish from 2017-2018 and 2023-2024. Non-AOC regions in Lake Superior and Lake Huron were considered reference locations (see Appendix A for a list of reference locations). Advisories were classified into better, similar, or worse than the reference areas. A summary comparison between the St. Marys River AOC and other non-AOC locations in the Canadian waters of Lake Superior and Lake Huron can be seen in Table 7. A detailed comparison can be found in Appendix A.

#### 3.2.1 Reference Comparison 2017-2018

For the general population, the advisories for 6 out of 11 species (55%) caught from the AOC are considered similar to or better than reference regions. That leaves five species having greater than 50% of the advisories considered worse than the reference regions, and include: Chinook Salmon, Longnose Sucker, Pink Salmon, Rainbow Trout, and Smallmouth Bass (Table 7a).

For the sensitive population, the advisories for 8 out of 11 species (73%) are considered similar to or better than reference regions. That leaves three species having greater than 50% of the advisories considered worse than the reference regions, and include: Longnose Sucker, Pink Salmon, and Rainbow Trout (Table 7b).

***Table 7: A summary comparison between the St. Marys River AOC and other non-AOC locations in the Canadian waters of Lake Superior and Lake Huron. Worse/similar/better are counts of advisories compared to the reference locations. %Worse shows the percentage of the AOC advisories that are worse compared to the reference locations. Percent values >50% are highlighted in red.***

**a) General Population**

| 2017-2018 | | | | Fish Species | 2023-2024 | | | |
|---|---|---|---|---|---|---|---|---|
| % Worse | Worse | Similar | Better | | Better | Similar | Worse | % Worse |
| 21% | 4 | 7 | 3 | Brown Bullhead | 0 | 6 | 3 | 33% |
| 88% | 0 | 6 | 44 | Chinook Salmon | 15 | 24 | 26 | 40% |
| 17% | 16 | 4 | 4 | Cisco | 11 | 9 | 10 | 33% |
| 90% | 1 | 2 | 28 | Longnose Sucker | 0 | 0 | 21 | 100% |
| 25% | 39 | 38 | 26 | Northern Pike | 28 | 36 | 14 | 18% |
| 67% | 6 | 4 | 20 | Pink Salmon | 8 | 2 | 0 | 0% |
| | | | | Rainbow Smelt | 1 | 2 | 4 | 57% |
| 86% | 0 | 27 | 161 | Rainbow Trout | 47 | 50 | 33 | 25% |
| | | | | Round Whitefish | 3 | 2 | 0 | 0% |
| 78% | 0 | 4 | 14 | Smallmouth Bass | 4 | 12 | 19 | 54% |
| 40% | 20 | 48 | 45 | Walleye | 64 | 22 | 4 | 4% |
| 37% | 11 | 38 | 29 | White Sucker | 20 | 22 | 13 | 24% |
| 6% | 15 | 32 | 3 | Yellow Perch | 12 | 14 | 2 | 7% |

**b) Sensitive Population**

| 2017-2018 | | | | Fish Species | 2023-2024 | | | |
|---|---|---|---|---|---|---|---|---|
| % Worse | Worse | Similar | Better | | Better | Similar | Worse | % Worse |
| 21% | 3 | 8 | 3 | Brown Bullhead | 0 | 8 | 1 | 11% |
| 22% | 0 | 39 | 11 | Chinook Salmon | 11 | 29 | 25 | 38% |
| 17% | 16 | 4 | 4 | Cisco | 11 | 12 | 7 | 23% |
| 90% | 0 | 3 | 28 | Longnose Sucker | 0 | 0 | 21 | 100% |
| 23% | 28 | 51 | 24 | Northern Pike | 32 | 33 | 13 | 17% |
| 67% | 5 | 5 | 20 | Pink Salmon | 8 | 2 | 0 | 0% |
| | | | | Rainbow Smelt | 1 | 2 | 4 | 57% |
| 86% | 0 | 27 | 161 | Rainbow Trout | 55 | 54 | 21 | 16% |
| | | | | Round Whitefish | 1 | 2 | 2 | 40% |
| 11% | 5 | 11 | 2 | Smallmouth Bass | 13 | 21 | 1 | 3% |
| 27% | 26 | 57 | 30 | Walleye | 41 | 37 | 12 | 13% |
| 13% | 28 | 40 | 10 | White Sucker | 23 | 22 | 10 | 18% |
| 18% | 17 | 24 | 9 | Yellow Perch | 7 | 15 | 6 | 21% |

### 3.2.2 Reference Comparison 2023-24

For the majority of species, the consumption advisories for the St. Marys River AOC are similar or better for the same size and species of fish as compared to the reference regions in non-AOC regions of Lake Superior and Lake Huron (Table 6). Three species (out of 13 examined) had greater than 50% of the advisories considered worse than the reference regions: Rainbow Smelt, Smallmouth Bass, and Longnose Sucker.

Even though the advisories for Rainbow Smelt are considered worse than reference regions, they are still considered non-restrictive in that they still allow for 8+ meals/month. Smallmouth Bass has some advisories that are considered restrictive but there are also some size categories that are non-restrictive. Thus, there are options to select size of smallmouth bass that would allow for safe consumption at a frequency of 8+ meals/month. For the Longnose Sucker, all of the advisories (100%) are considered worse than reference regions. The Guide to Eating Ontario Fish advises that people from the general population can still eat 1-2 meals per month of this fish species. Results of the community fish consumption survey shows that less than 1% (N=2) of survey participants consume Longnose Sucker more frequently than the amount advised.

### 3.2.3 Virtual Advice

Gandhi et al. (2020) describe how the published advisories in the 2017-2018 Guide to Eating Ontario Fish could be influenced by historically elevated concentrations of contaminants since certain size classes for some species of fish may not have been captured in recent years. As a result, Gandhi et al. (2020) conducted a reference comparison using data collected post-2005, in order to avoid the potential for historical influence.

Removing the historical influence of potentially elevated contaminant concentrations, most of the advisories for the St. Marys River AOC were similar or better for the same size and species of fish as compared to the reference regions. For the general population, the advisories for the majority of species (88%) are considered similar to or better than reference regions with only one species (Cisco) having greater than 50% of the total advisories considered worse than the reference regions. Only 41% of the advisories for Cisco are similar to or better than reference regions, however, none of these advisories are considered restrictive (Table 7). This means that even though fish consumption advisories for Cisco are worse than in non-AOC areas of Lakes Superior and Huron, the advisories themselves are still considered non-restrictive in that they allow for 8+ meals/month. For the sensitive population, the advisories for all of the species (100%) are considered similar to or better than reference regions.

***Table 8: A summary of simulated advisory comparisons between the St. Marys River AOC and non-AOC regions in Lakes Superior and Huron (Gandhi et al. 2020).***

| Species | | % Excellence | Better | Similar | Worse | % Worse |
|---|---|---|---|---|---|---|
| Chinook Salmon | GP | 0% | 20 | 37 | 22 | 28% |
| | SP | 0% | 15 | 43 | 21 | 27% |
| Cisco | GP | 100% | 4 | 3 | 10 | 59% |
| | SP | 100% | 4 | 5 | 8 | 47% |
| Northern Pike | GP | 100% | 8 | 31 | 6 | 13% |
| | SP | 60% | 10 | 25 | 10 | 22% |
| Pink Salmon | GP | 100% | 12 | 0 | 0 | 0% |
| | SP | 100% | 12 | 0 | 0 | 0% |
| Rainbow Trout | GP | 63% | 34 | 42 | 44 | 37% |
| | SP | 63% | 38 | 44 | 38 | 32% |
| Walleye | GP | 100% | 26 | 43 | 5 | 7% |
| | SP | 43% | 20 | 47 | 7 | 9% |
| White Sucker | GP | 100% | 5 | 21 | 9 | 26% |
| | SP | 80% | 11 | 15 | 9 | 26% |
| Yellow Perch | GP | 100% | 9 | 15 | 0 | 0% |
| | SP | 100% | 13 | 10 | 1 | 4% |

### 3.2.4 Tier 2 Results

The Tier 2 analysis supports the rationale for redesignating the BUI to “not impaired” status for the St. Marys River AOC. The results of the Tier 2 analysis meet the delisting criteria for the BUI as the majority of advisories are similar to or better than those for non-AOC regions of Lake Superior and Lake Huron. In 2023-24, for two species where advisories within the AOC are considered more restrictive than the reference sites, the advisories still constitute a non-restrictive diet of fish (8+ meals per month) from the AOC. That is, a few fish species had higher restrictions for consumption when caught from the AOC compared to those caught from Lake Superior and Lake Huron, but the MECP’s Guide to Eating Ontario Fish advises people can still eat 1-8 meals per month of these fish species and results of the community fish consumption survey shows that less than 1% of survey participants consume these species more frequently than that. Therefore, this does not amount to cause of impairment.

For the Longnose Sucker, all of the advisories (100%) are considered worse than reference regions, however, the results of the community fish consumption survey shows that only 0.2% (N=1) of survey participants consume Longnose Sucker more frequently than the current advisories even though they are considered restrictive.

### 3.3 Tier 3: Lines of evidence/contaminant trends

Based on the outcome of Tier 2, there is no requirement for a Tier 3 analysis. However, Gandhi et al. (2020) did conduct a temporal trend analysis of PCBs, mercury and dioxins/furans for select size classes and species of fish (Figure 3). In general, the analysis showed declining trends in contaminants over the last 30-40 years. For more information, refer to the Gandhi et al. (2020) study in Appendix B.

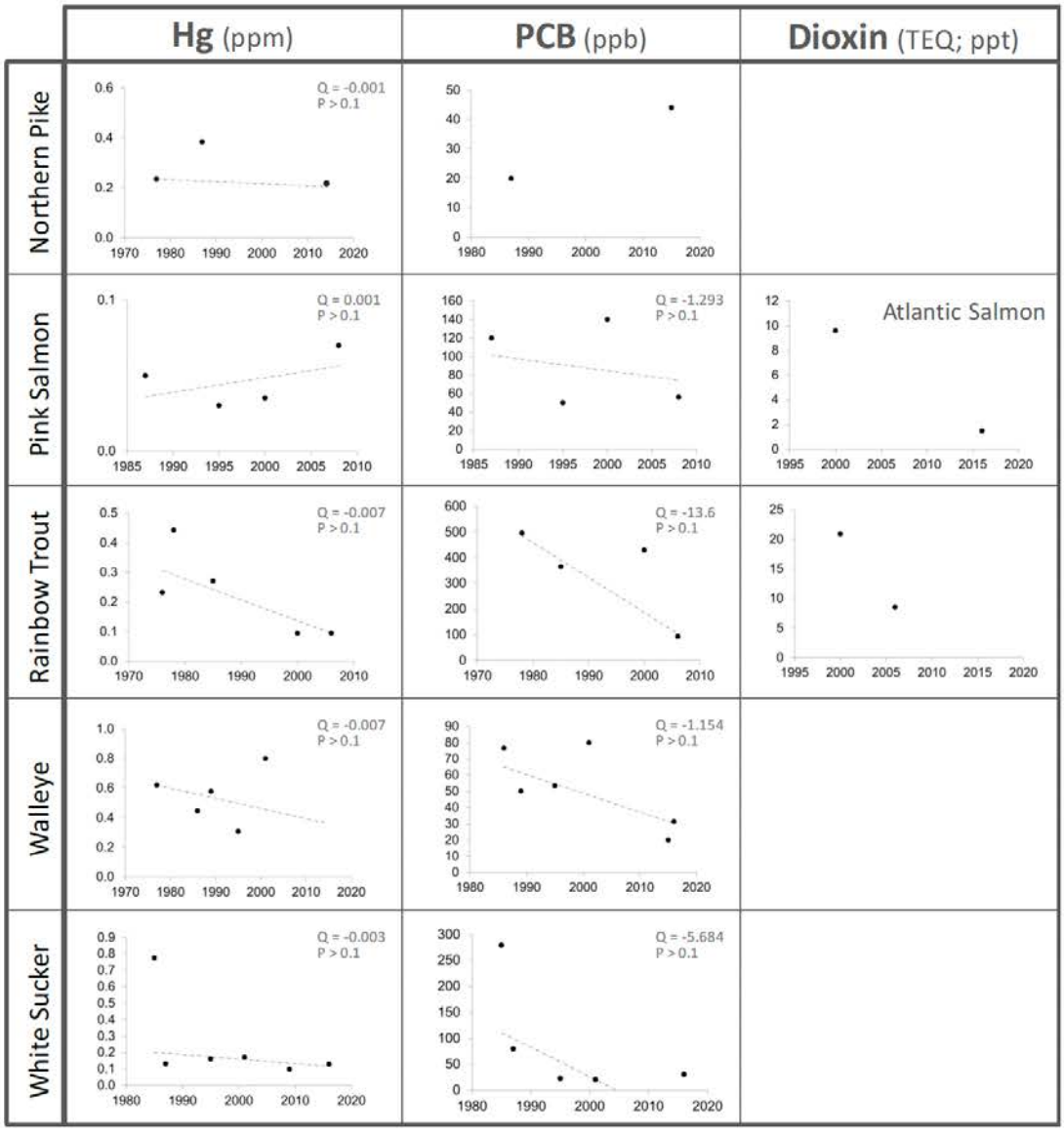


***Figure 4: Temporal trend analyses of Hg, PCB and dioxins/furans/dioxin-like PCBs toxic equivalent (TEQ) concentrations for limited size classes of species from the St. Marys River. Q denotes Sen's Slope. P value is statistical significance (Gandhi et al. 2020)***

PCBs tend to accumulate in fatty fish. Rainbow Trout has shown declining trends over the last 4 decades with an 81% reduction. Pink Salmon, Walleye and White Sucker have also shown declining trends. Although Northern Pike did not display a declining trend, the PCB levels were low over the time period. No species monitored displayed a statistically significant increasing PCB trend. The analysis provides a good indication of PCB level declines especially for a species that displayed relatively higher PCB levels in the past such as Rainbow Trout.

Mercury has also shown a declining trend in most species including Northern Pike, Rainbow Trout, Walleye, and White Sucker. Walleye can be a good indicator fish for mercury contamination. The mercury levels in 40-50cm Walleye have declined by 58% in the last 4 decades. Pink Salmon showed a slight increase in mercury levels however the trends were statistically non-significant and the concentrations relatively low. Dioxins and furans are assessed in terms of toxic equivalent (TEQ). Values from limited measurements of Atlantic Salmon and Rainbow Trout indicate decreases in levels.

### 3.4 Tier 4 Completion of Remedial Actions

Tier 4 of the assessment framework looks at whether all local remedial actions are complete. The Stage 2 RAP report (released in 2002) outlines a strategy to remediate all impaired BUIs in the St. Marys River AOC. It describes approximately sixty recommended actions and monitoring initiatives to undertake toward restoring the beneficial uses. The Stage 2 RAP report recommends one remedial action and two monitoring actions directly related to the *Restrictions on Fish and Wildlife Consumption* BUI. These are:

i. Action PS-1: Virtual elimination of all persistent and bioaccumulative contaminants from industrial and municipal discharge;
ii. Monitoring Action FFM-3: The fish harvest survey; and
iii. Monitoring Action FFM-4: The fish contaminant monitoring programs.

#### 3.4.1 Virtual elimination of all persistent and bioaccumulative contaminants from industrial and municipal discharge (Action PS-1)

The status of this action is ongoing. Currently, the St. Marys River AOC has one active industry along the Canadian side of the river, Algoma Steel. The facility has undergone many upgrades since the early 1990s, including the commissioning of a main filtration plant for wastewater (1991) and incorporation of technology to reduce phenol concentrations in wastewater (1997-1999). In 2001, Algoma Steel signed an Environmental Management Agreement (EMA) with the federal and provincial governments to undertake a number of initiatives including recycling all

in-storage mercury by December 31, 2001, and destroying all in-storage PCBs by December 31, 2005.

In 2019, Algoma Steel entered into the Legacy Environmental Action Plan (LEAP) agreement with the Province of Ontario, which is a risk-based environmental management agreement that requires source track-down investigations. Objectives of the LEAP include: identifying, assessing, managing, and mitigating off-site adverse environmental effects caused by legacy environmental contamination. The targeted investment of this agreement is $79.8 million over 21 years. In addition, the company is currently constructing two electric-arc-furnaces (EAF) to replace its existing blast furnace and basic oxygen steelmaking operations. This change is expected to reduce Algoma Steel's carbon emissions by approximately 70%.

There were actions to address persistent and bioaccumulative contaminants from industrial discharge on the U.S. side of the AOC as well. Tannery Bay located on the Michigan side of the St. Marys River operated as a sawmill and tannery until its closure in 1958. Environmental investigations in 1978-1995 showed that sediments in the area were contaminated with mercury, chromium, lead, cadmium, and arsenic. In 2006-07, Tannery Bay underwent a sediment cleanup through a partnership with the federal Environmental Protection Agency, Michigan's Clean Initiative, and the property owner. A total of 44,000 cubic yards of sediment were excavated from Tannery Bay, effectively removing 70 lbs of mercury from the environment.

Other actions to note that helped to improve overall water quality in the St. Marys River AOC include:

- In 2012, the St. Marys Paper plant was decommissioned and the site dismantled. Before closure, contaminants in the mill's wastewater were reduced significantly between 1995 and 2006 due to the installation of an activated sludge secondary treatment facility. Since its closure, the mill is no longer a source of wastewater discharge to the river.
- The City of Sault Ste. Marie's East End Wastewater Treatment Plant underwent upgrades in 2006 to include secondary treatment using the first biological nutrient removal system in Ontario. This included UV light for disinfection resulting in no chlorine discharge to the river. The city also has a Stormwater Management Plan that identifies ways to improve the management of stormwater runoff and reduce inputs of contaminants to the river such as oil, grease, nutrients and bacteria.
- A Sediment Management Strategy was developed in 2021 that provides a summary of the history, current status, and actions required as related to the management of contaminated sediment in the AOC. Five depositional areas with contaminated sediment were identified including the Algoma Boat Slip, Federal Water Lot (Transport Canada), Bellevue Marine Park, East of Bellevue Marine Park, and Lake George Channel/Little Lake

Geroge/Lake George. The Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment was used to determine the most suitable management approach for each depositional area, with the Algoma Steel Boat Slip being the only area requiring active management.

### 3.4.2 The fish harvest survey (Monitoring Action FFM-3)

The status of this action is complete. The Ontario Ministry of Natural Resources (MNR) and the Michigan Department of Natural Resources (MDNR) conducted joint creel surveys examining the fish harvest in the river (Godby et al 2019). This was accompanied by a fish community gillnet survey of the river by the St. Marys River Fisheries Task Group and its member agencies. The general conclusion is that managed fish populations are stable or increasing.

Furthermore, Fisheries and Oceans Canada completed an assessment of the AOC fish community using an index of biotic integrity (IBI) approach in two separate studies. The IBI approach assesses multiple indicators of ecological conditions relative to an un-impacted condition. Both studies conclude the St. Marys River is home to a healthy fish community that is complex, diverse, and dominated by native species (Pratt & O'Connor, 2011 and 2017).

Together, these studies identify the St. Marys River as having a healthy and diverse fish community and supported the successful redesignation of the *Degradation of Fish and Wildlife Populations* BUI to "not impaired" in January 2024.

### 3.4.3 The fish contaminant monitoring programs (Monitoring Action FFM-4)

This action refers to monitoring programs, being implemented in Ontario and in Michigan. Regarding the Ontario side, the status of this action is ongoing. The MECP in conjunction with MNR collects fish for contaminant analysis through the Fish Contaminant Monitoring Program. This program is used to assess measured contaminant levels to determine how many fish meals a person can safely eat per month for the type, size and location where the fish was caught. The consumption advisories generated are typically based on health protection guidelines provided by Health Canada and can be found in the Guide to Eating Ontario Fish.

In 2013, the MECP reviewed the availability of fish contaminant data for the St. Marys River AOC and identified priorities for monitoring. Fish collections were completed in 2014, 2015 and 2016 in order to provide an update on contaminant levels in comparison to reference sites. The resulting data was used in the 2020 assessment published by the MECP and University of Toronto – Appendix B.

## 4.0 Community Fish Consumption Survey

Gandhi et al. (2020) conducted an assessment of the *Restrictions on Fish Consumption* BUI with results suggesting levels of contaminants in fish from the St. Marys River have declined to an extent that the BUI can be considered "not impaired". The assessment made the assumption that 8+ meals per month can be considered as a "non-restrictive" diet of fish. As a result, the authors recommended that a community fish consumption survey be conducted to test this critical assumption/assertion.

The St. Marys River AOC Community Fish Consumption Survey ran from May 2021 – November 2023. A total of 673 surveys were collected during the survey period. Key findings from the Community Fish Consumption Survey Report for the St. Marys River (Appendix C) include:

- Among the survey participants, 479 (71%) indicated that they eat fish caught from the St. Marys River AOC, but less than 3% were categorized as very frequent consumers of 8 or more meals per month. **Based on these results, fish consumption restrictions equal to or greater than 8 meals per month can be considered a non-restrictive diet of fish.**

- Using simulated advisories, Gandhi et al. (2020) reported that within the St. Marys River AOC, Chinook Salmon had restrictive advisories (ie. <8 meals/month). The results of the community fish consumption survey shows that less than 1% (N=3) of survey participants consume Chinook Salmon more frequently. They also reported that advisories on fish consumption for AOC fish are similar to reference locations in Lakes Huron and Superior, with the exception of Cisco. However, people can still eat 8+ meals/ month of this fish species. **Therefore, even though advisories were considered restrictive for Chinook Salmon within the St. Marys River AOC and Cisco had higher advisories as compared to reference sites, the survey results show that these restrictions still allow for a "non-restrictive" diet of fish from the AOC.**

- A tiered assessment was conducted using published advisories in the Guide to Eating Ontario Fish in 2017-2018 and 2023-2024. Although improvements were seen when comparing fish consumption advice from 2017-18 to 2023-24, Tier 1 of the assessment failed because Chinook Salmon and Longnose Sucker have consumption advisories that are more restrictive than a meal allowance benchmark of 8+ meals/month. The 2023-24 results of the Tier 2 assessment showed that 3 species have advisories within the AOC and are considered more restrictive than the reference sites. For Smallmouth Bass and Rainbow Smelt the advisories still constitute a non-restrictive diet of fish from the AOC.

For the Longnose Sucker, all of the advisories (100%) are considered worse than reference regions, however, the results of the community fish consumption survey shows that only 0.2% (N=1) of survey participants consume Longnose Sucker more frequently than the current advisories even though they are considered restrictive. Therefore, this does not amount to cause of impairment.

- Longnose Sucker has not been monitored since 1985; therefore, current advisories are based on contaminant levels measured nearly 40 years ago. The appearance of worsened advisories for Longnose Sucker in the SMR AOC during both the 2017/18 and 2023/24 periods is a reflection of reliance on outdated 1985 data. In contrast, advisories for some reference locations have been updated using more recent monitoring data, resulting in improved consumption guidance likely due to declining contaminant levels.

- Rainbow Smelt had not been previously monitored. The newly issued advisories are based on elevated PFAS levels, which may fall outside the scope of the Area of Concern (AOC) assessment. Nonetheless, as correctly highlighted in the report, the current consumption advisory of 8 meals per month for Rainbow Smelt meets the criteria for BUI redesignation.

- Based on the above, **the Tier 2 analysis supports the rationale for redesignating the BUI to a "not impaired" status for the AOC.**

## 5.0 Conclusions and Recommendations Regarding Redesignation

Based on the information presented in this report, it is recommended that the *Restrictions on Fish and Wildlife Consumption* BUI be redesignated to "Not Impaired" for the Canadian side of the St. Marys River AOC.

This recommendation is due to the fact that the established BUI delisting criteria: ***"This BUI will no longer be impaired when the fish consumption advisories in the AOC are no more restrictive than the advisories in suitable reference sites. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events,"*** as endorsed by BPAC, have been fulfilled and is based on the following:

- The outcome of the multi-tiered analysis framework supports the redesignation to "not impaired" status. Based on examination of fish consumption advisories, analysis of Tier 1 indicates that restrictions within the AOC are generally non-restrictive. Results from the

Tier 2 analysis highlight that the advisories within the AOC are similar to or better than regional advisories in Lake Superior and Lake Huron.

- A community fish consumption survey was completed and the results confirm the critical assumption of 8+ meals/month as a “non-restrictive” diet of fish used in the tiered assessment analysis.
- The one remedial action (PS-1) and the two monitoring actions (FFM-3 and FFM-4) recommended in the Stage 2 RAP report (2002) are either ongoing or complete.

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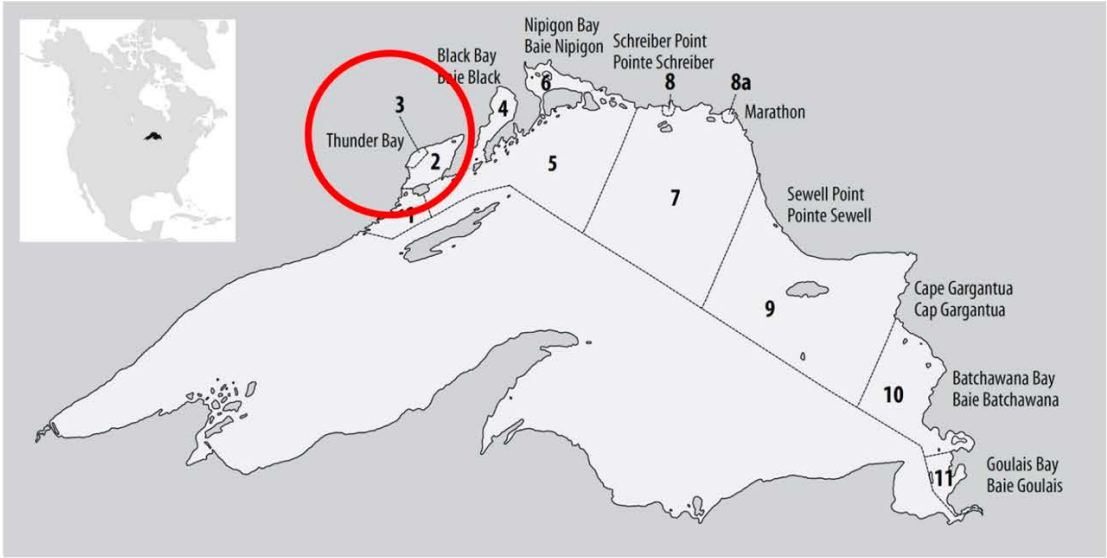
# Appendix A: Supporting information for Tier 2 assessment (ie. reference comparison analysis)

**Lake Superior regions for fish consumption advisories**

Taken from the 2017-18 Guide to Eating Ontario Fish (OMOECC, 2017)




1. Border/Pie Island area – from U.S. border to west of Pie Island
2. Thunder Bay Outer Harbour area – open waters of Thunder Bay, North of Pie Island to Thunder Cape
3. Thunder Bay Inner Harbour – inner Harbour within the breakwall and in the vicinity of the Kaministiquia River Delta
4. Black Bay area – Black Bay from north of Edward Island
5. Pie Island/Schreiber Point area – open water from Pie Island to Schreiber Point
6. Nipigon Bay – bay area from north of Simpson Island to Nipigon River mouth
7. Schreiber Point/Sewell Point area – open water from Schreiber Point to Sewell Point
8. Jackfish Bay – including Moberly and Tunnel bays

8a. Peninsula Harbour – Harbour and immediate vicinity

9. Michipicoten Island area – open water from Sewell Point to Cape Gargantua
10. Agawa Bay/Batchawana Bay area – open water from south of Cape Gargantua to Batchawana Bay
11. Goulais Bay area – from south of Batchawana Bay to St. Marys River

**Lake Huron regions for fish consumption advisories**

Taken from the 2017-18 Guide to Eating Ontario Fish (OMOECC, 2017)


St. Marys River - St. Marys River from Lake Superior to St. Joseph Channel
NC1 - north side of Manitoulin Island from St. Joseph Island to Serpent Harbour
NC2 - north side of Manitoulin Island from east of Serpent Harbour to Killarney Bay
NC2a - Whalesback Channel – Spanish River Mouth to Wicksteed Point
GB1 - Bold Point to south of Killarney Bay / the French River mouth
GB2 - south of Fitzwilliam Island to the middle of the Bay
GB3 - middle of the Bay to south of the French River mouth / the Moon River mouth
GB4 - southern Georgian Bay from south of Lion's Head to south of the Moon River mouth
GB4a - Collingwood Harbour – harbour area
H1 - open water south of Manitoulin
H2 - from Fitzwilliam Island to Stokes Bay
H3 - from south of Stokes Bay to Point Clark
H4 - from south of Point Clark to north of Grand Bend
H5 - from Grand Bend to Point Edward

*Table 1a-k: Comparison of St. Marys River AOC advisories with other non-AOC Lake Superior and Lake Huron Areas using published advisories in the Guide to Eating Ontario Fish 2017-2018. St. Marys River AOC advisories in grey; blue, similar to the AOC; red, more stringent than AOC; green, better than AOC.*

a) Brown Bullhead

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 16 | 16 | | | | | | | | | |
| | SP | | 16 | 12 | 8 | | | | | | | | | |
| North Channel NC1 | **GP** | | 32 | 32 | | | | | | | | | | |
| | **SP** | | 12 | 12 | | | | | | | | | | |
| Georgian Bay GB4 | **GP** | | 32 | 32 | 16 | 16 | | | | | | | | |
| | **SP** | | 32 | 12 | 8 | 8 | | | | | | | | |
| Saugeen River | **GP** | | 32 | 32 | 16 | | | | | | | | | |
| | **SP** | | 16 | 12 | 8 | | | | | | | | | |
| Georgian Bay GB3 | **GP** | | 16 | 16 | 16 | 16 | | | | | | | | |
| | **SP** | | 16 | 16 | 16 | 16 | | | | | | | | |
| Lake Huron H3 | **GP** | | 8 | 8 | 8 | | | | | | | | | |
| | **SP** | | 8 | 8 | 8 | | | | | | | | | |

b) Chinook Salmon

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | | | | | | | | 0 | 0 | 0 |
| | SP | | | | | | | | | | | 0 | 0 | 0 |
| Lake Superior 4 – Black Bay Area | **GP** | | | 32 | 32 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | 32 | 16 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior 6 – Nipigon Bay | **GP** | | | | | | | | | | 4 | 2 | 2 | 2 |
| | **SP** | | | | | | | | | | 4 | 0 | 0 | 0 |
| | **GP** | | | | 12 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake Superior 9 – Michipicoten Island Area | **SP** | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 2 | 2 |
| | **SP** | | | | | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 |
| Michipicoten River | **GP** | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Goulais River | **GP** | | | | | | | 8 | 8 | 4 | 2 | 2 | 2 | 1 |
| | **SP** | | | | | | | 8 | 8 | 4 | 0 | 0 | 0 | 0 |
| North Channel NC1 | **GP** | | | | | | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 |
| | **SP** | | | | | | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 |
| Georgian Bay GB4 | **GP** | | | | 8 | 8 | 8 | 8 | 2 | 2 | 2 | 2 | 2 | 2 |
| | **SP** | | | | 8 | 8 | 8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lake Huron H1 | **GP** | | | | | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 |
| | **SP** | | | | | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Saugeen River | **GP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 1 |
| | **SP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Lake Huron H4 | **GP** | | | 32 | 16 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | **SP** | | | 32 | 16 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Ausable River | **GP** | | | | | | | | | | | 2 | 2 | 1 |
| | **SP** | | | | | | | | | | | 0 | 0 | 0 |
| Lake Huron H5 | **GP** | | | 16 | 16 | 16 | 16 | 12 | 8 | 4 | 4 | 4 | 2 | 1 |
| | **SP** | | | 16 | 16 | 16 | 16 | 12 | 8 | 4 | 4 | 4 | 0 | 0 |
| Lake Superior 5 – Pie Island | **GP** | | | | | 32 | 32 | 16 | 8 | 8 | | | | |
| | **SP** | | | | | 32 | 16 | 16 | 8 | 8 | | | | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | | | | | | | | | | 0 |
| | **SP** | | | | | | | | | | | | | 0 |
| Georgian Bay GB1 | **GP** | | | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| | **SP** | | | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lake Huron H3 | **GP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 0 |
| | **SP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Lake Superior 11 – Goulais Bay Area | **GP** | | | | | | | 8 | 8 | 4 | 2 | 2 | 2 | 1 |
| | **SP** | | | | | | | 8 | 8 | 4 | 0 | 0 | 0 | 0 |
| Steel River | **GP** | | | | | | | | | | | | | 0 |
| | **SP** | | | | | | | | | | | | | 0 |

c) Cisco

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| | SP | | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| Lake Superior 4 – Black Bay Area | **GP** | | | | 4 | 4 | 4 | | | | | | | |
| | **SP** | | | | 4 | 4 | 4 | | | | | | | |
| Lake Superior 9 – Michipicoten Island Area | **GP** | | | | | | 4 | 4 | 4 | | | | | |
| | **SP** | | | | | | 4 | 4 | 4 | | | | | |
| North Channel NC1 | **GP** | | 16 | 16 | 16 | 8 | 8 | 8 | | | | | | |
| | **SP** | | 16 | 16 | 16 | 8 | 8 | 8 | | | | | | |
| Lake Huron H1 | **GP** | | | | | 8 | 8 | 8 | | | | | | |
| | **SP** | | | | | 8 | 8 | 8 | | | | | | |
| Lake Superior 5 – Pie Island | **GP** | | | 32 | 32 | 32 | 16 | 16 | | | | | | |
| | **SP** | | | 32 | 32 | 32 | 16 | 12 | | | | | | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | | | 12 | | | | | | | |
| | **SP** | | | | | | 12 | | | | | | | |
| Georgian Bay GB1 | **GP** | | | | | | 8 | 2 | 1 | | | | | |
| | **SP** | | | | | | 8 | 0 | 0 | | | | | |
| Lake Huron H3 | **GP** | 4 | 4 | 4 | 4 | 0 | 0 | 0 | | | | | | |
| | **SP** | 4 | 4 | 4 | 4 | 0 | 0 | 0 | | | | | | |
| Lake Superior 11 – Goulais Bay Area | **GP** | | | 2 | 2 | | | | | | | | | |
| | **SP** | | | 0 | 0 | | | | | | | | | |

d) Longnose Sucker

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | 2 | 2 | 2 | | | | | | | |
| | SP | | | | 0 | 0 | 0 | | | | | | | |
| Lake Superior 4 – Black Bay Area | **GP** | | 32 | 32 | 12 | 12 | 12 | 12 | | | | | | |
| | **SP** | | 32 | 32 | 12 | 12 | 12 | 12 | | | | | | |
| Lake Superior 6 – Nipigon Bay | **GP** | | | | | 8 | 8 | 8 | 4 | | | | | |
| | **SP** | | | | | 8 | 8 | 4 | 4 | | | | | |
| Lake Superior 9 – Michipicoten Island Area | **GP** | | | 8 | 8 | 8 | 4 | 4 | | | | | | |
| | **SP** | | | 8 | 8 | 8 | 4 | 4 | | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | | 4 | | | | | | | | |
| | **SP** | | | | | 4 | | | | | | | | |
| Georgian Bay GB4 | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 16 | | | | | | |
| Lake Huron H4 | **GP** | | 32 | 32 | 32 | 32 | 16 | 16 | | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 16 | | | | | | |
| Lake Huron H5 | **GP** | | | | | 2 | 1 | 1 | | | | | | |
| | **SP** | | | | | 0 | 0 | 0 | | | | | | |
| Lake Superior 5 – Pie Island | **GP** | | | | 32 | 32 | 16 | 8 | 4 | | | | | |
| | **SP** | | | | 32 | 32 | 8 | 8 | 4 | | | | | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | | 16 | 12 | 2 | 2 | | | | | |
| | **SP** | | | | | 8 | 8 | 0 | 0 | | | | | |
| Lake Superior 1 – Border/Pie Island Area | **GP** | | | | | 32 | 12 | 8 | 4 | | | | | |
| | **SP** | | | | | 16 | 8 | 8 | 4 | | | | | |
| Georgian Bay GB1 | **GP** | | | | | | 2 | 2 | | | | | | |
| | **SP** | | | | | | 0 | 0 | | | | | | |
| Lake Huron H3 | **GP** | | 16 | 16 | 12 | 8 | 4 | | | | | | | |
| | **SP** | | 16 | 16 | 12 | 8 | 4 | | | | | | | |
| Lake Superior 11 – Goulais Bay Area | **GP** | | | | 12 | 8 | 4 | | | | | | | |
| | **SP** | | | | 12 | 8 | 4 | | | | | | | |

e) Northern Pike

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 |
| | SP | | 16 | 16 | 16 | 16 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 |
| Lake Superior 4 – Black Bay Area | **GP** | | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | | | | | | | | 12 | 8 | 4 |
| | **SP** | | | | | | | | | | | 4 | 4 | 0 |
| North Channel NC1 | **GP** | | | | | | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 8 |
| | **SP** | | | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 0 |
| Georgian Bay GB4 | **GP** | | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 8 | 4 |
| | **SP** | | | 16 | 16 | 16 | 16 | 8 | 8 | 8 | 4 | 4 | 4 | 0 |
| Ausable River | **GP** | | | | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | | | | 16 | 16 | 16 | 16 | 12 | | |
| | **SP** | | | | | | | 8 | 8 | 4 | 4 | 4 | | |
| Lake Superior 1 – Border/Pie Island Area | **GP** | | | | | | | | | 16 | 12 | 12 | 8 | 4 |
| | **SP** | | | | | | | | | 4 | 4 | 4 | 4 | 0 |
| Georgian Bay GB3 | **GP** | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 4 |
| | **SP** | | | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 |
| Georgian Bay GB1 | **GP** | | | | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 |
| | **SP** | | | | 16 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 |
| Lake Huron H3 | **GP** | | | | | 32 | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 12 |
| | **SP** | | | | | 16 | 16 | 16 | 12 | 12 | 8 | 8 | 8 | 4 |
| Lake Superior 11 – Goulais Bay Area | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 |
| | **SP** | | | | 8 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 |
| Tadenac Bay (Georgian Bay) | **GP** | | | | 32 | 32 | 32 | 16 | 16 | 12 | 8 | 8 | 4 | 2 |
| | **SP** | | | | 16 | 16 | 12 | 8 | 8 | 4 | 4 | 4 | 0 | 0 |

f) Pink Salmon

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | 8 | 8 | 4 | 2 | | | | | | |
| | SP | | | | 8 | 8 | 4 | 0 | | | | | | |
| Lake Superior 9 – Michipicoten Island Area | **GP** | | | | 12 | 12 | 12 | 8 | 2 | | | | | |
| | **SP** | | | | 12 | 12 | 12 | 8 | 0 | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | | 12 | 12 | 12 | 12 | | | | | |
| | **SP** | | | | | 12 | 12 | 12 | 12 | | | | | |
| Michipicoten River | **GP** | | | | 12 | 12 | 12 | | | | | | | |
| | **SP** | | | | 12 | 12 | 12 | | | | | | | |
| North Channel NC1 | **GP** | | | | | 16 | 12 | 8 | 4 | 2 | | | | |
| | **SP** | | | | | 16 | 12 | 8 | 4 | 0 | | | | |
| Georgian Bay GB4 | **GP** | | | | | | 4 | 4 | 4 | | | | | |
| | **SP** | | | | | | 4 | 4 | 4 | | | | | |
| Lake Huron H5 | **GP** | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | **SP** | | | | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| Lake Superior 5 – Pie Island | **GP** | | | | | 8 | | | | | | | | |
| | **SP** | | | | | 8 | | | | | | | | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | 12 | 12 | 12 | | | | | | | |
| | **SP** | | | | 12 | 12 | 12 | | | | | | | |
| Lake Huron H3 | **GP** | | | | 4 | 4 | 4 | 2 | | | | | | |
| | **SP** | | | | 4 | 4 | 4 | 0 | | | | | | |
| Steel River | **GP** | | | | 12 | 12 | 12 | | | | | | | |
| | **SP** | | | | 12 | 12 | 12 | | | | | | | |

g) Rainbow Trout

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | |
| | SP | | 8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | |
| Lake Superior 4 – Black Bay Area | **GP** | | | | | | 16 | 16 | 16 | 16 | 12 | 4 | 4 | |
| | **SP** | | | | | | 16 | 16 | 16 | 12 | 12 | 4 | 4 | |
| Lake Superior 6 – Nipigon Bay | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | | | |
| | **SP** | | | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | | | |
| Lake Superior 9 – Michipicoten Island Area | **GP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 8 | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | 8 | |
| | **SP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | 8 | |
| Michipicoten River | **GP** | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| | **SP** | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| Goulais River | **GP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| | **SP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| North Channel NC1 | **GP** | | | | | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 2 | |
| | **SP** | | | | | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | |
| Georgian Bay GB4 | **GP** | | 8 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | |
| | **SP** | | 8 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | |
| Lake Huron H1 | **GP** | | | | | | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 8 |
| | **SP** | | | | | | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 8 |
| Saugeen River | **GP** | | | | | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 4 |
| | **SP** | | | | | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 4 |
| Lake Huron H4 | **GP** | | | | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 8 | 4 |
| | **SP** | | | | 32 | 16 | 16 | 16 | 12 | 12 | 12 | 12 | 8 | 4 |
| Ausable River | **GP** | | | | | | | 8 | 8 | 4 | 4 | 4 | 4 | |
| | **SP** | | | | | | | 8 | 8 | 4 | 4 | 4 | 4 | |
| Lake Huron H5 | **GP** | | | | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior 5 – Pie Island | **GP** | | | | | | | | | 8 | 4 | 4 | | |
| | **SP** | | | | | | | | | 8 | 4 | 4 | | |
| | **GP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **SP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |
| Lake Superior 1 – Border/Pie Island Area | **GP** | | | | 16 | 16 | 16 | 12 | 12 | | | | | |
| | **SP** | | | | 16 | 12 | 12 | 8 | 8 | | | | | |
| Lake Huron H3 | **GP** | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | **SP** | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Lake Superior 11 – Goulais Bay Area | **GP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| | **SP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| Manitou River | **GP** | | | | | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 |
| | **SP** | | | | | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 |
| Steel River | **GP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |
| | **SP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |
| Speckled Trout Creek | **GP** | | | | | | | 32 | 32 | 32 | 32 | 12 | 8 | |
| | **SP** | | | | | | | 16 | 16 | 16 | 16 | 12 | 8 | |
| Pancake River | **GP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | | |
| | **SP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | | |
| Old Woman River | **GP** | | | | | | | | | 8 | 8 | 8 | | |
| | **SP** | | | | | | | | | 8 | 8 | 4 | | |
| Big Carp River | **GP** | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| | **SP** | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| Chippewa River | **GP** | | | | | | | 16 | 16 | 16 | 16 | | | |
| | **SP** | | | | | | | 8 | 8 | 8 | 8 | | | |

h) Smallmouth Bass

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | | 4 | 4 | | | | | | | |
| | SP | | | | | 4 | 4 | | | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | 32 | 32 | 32 | | | | | | | | | | |
| | **SP** | 16 | 12 | 12 | | | | | | | | | | |
| North Channel NC1 | **GP** | | | 16 | 16 | 4 | 4 | | | | | | | |
| | **SP** | | | 8 | 8 | 4 | 4 | | | | | | | |
| Georgian Bay GB4 | **GP** | | 32 | 32 | 16 | 16 | 12 | 8 | 4 | | | | | |
| | **SP** | | 12 | 12 | 8 | 8 | 4 | 4 | 0 | | | | | |
| Saugeen River | **GP** | | | 16 | 12 | 8 | 4 | 4 | | | | | | |
| | **SP** | | | 8 | 4 | 0 | 0 | 0 | | | | | | |
| Ausable River | **GP** | 12 | 12 | 12 | 8 | 8 | 8 | 4 | | | | | | |
| | **SP** | 8 | 4 | 4 | 4 | 4 | 0 | 0 | | | | | | |
| Lake Huron H5 | **GP** | | 16 | 16 | 16 | 12 | 8 | 8 | | | | | | |
| | **SP** | | 8 | 8 | 4 | 4 | 4 | 0 | | | | | | |
| Georgian Bay GB3 | **GP** | 32 | 16 | 12 | 12 | 12 | 12 | 12 | | | | | | |
| | **SP** | 12 | 8 | 8 | 8 | 8 | 4 | 4 | | | | | | |
| Georgian Bay GB1 | **GP** | | | 16 | 16 | 12 | 8 | 8 | | | | | | |
| | **SP** | | | 8 | 8 | 4 | 4 | 0 | | | | | | |
| Lake Huron H3 | **GP** | 16 | 16 | 8 | 8 | 8 | 4 | 4 | | | | | | |
| | **SP** | 8 | 8 | 8 | 4 | 0 | 0 | 0 | | | | | | |
| Tadenac Bay (Georgian Bay) | **GP** | | | | 12 | 12 | 8 | 8 | | | | | | |
| | **SP** | | | | 8 | 4 | 4 | 0 | | | | | | |

i) Walleye

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 2 | |
| | SP | | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 | |
| Lake Superior 4 – Black Bay Area | **GP** | 32 | 32 | 32 | 12 | 12 | 12 | 12 | 12 | | | | | |
| | **SP** | 32 | 32 | 16 | 12 | 12 | 12 | 12 | 4 | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| | **SP** | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North Channel NC1 | **GP** | | | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 8 | 4 |
| | **SP** | | | 16 | 16 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 |
| Georgian Bay GB4 | **GP** | | | | 32 | 16 | 16 | 16 | 16 | 12 | 8 | 4 | 4 | 2 |
| | **SP** | | | | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 | 0 |
| Lake Huron H4 | **GP** | | | | 32 | 16 | 16 | 8 | 4 | 2 | | | | |
| | **SP** | | | | 32 | 16 | 8 | 4 | 4 | 0 | | | | |
| Ausable River | **GP** | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | | | |
| | **SP** | | | | 4 | 4 | 0 | 0 | 0 | 0 | 0 | | | |
| Lake Huron H5 | **GP** | | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | |
| | **SP** | | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | | | | |
| | **SP** | | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 0 | | | | |
| Lake Superior 1 – Border/Pie Island Area | **GP** | 32 | 32 | 32 | 16 | 16 | 16 | 12 | 12 | 8 | | | | |
| | **SP** | 12 | 12 | 12 | 12 | 8 | 4 | 4 | 4 | 0 | | | | |
| Georgian Bay GB3 | **GP** | | 32 | 16 | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 2 |
| | **SP** | | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | 0 |
| Georgian Bay GB1 | **GP** | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | |
| | **SP** | | 16 | 16 | 16 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | |
| Lake Huron H3 | **GP** | | | | 32 | 16 | 16 | 16 | 12 | 8 | 4 | | | |
| | **SP** | | | | 16 | 16 | 12 | 8 | 4 | 4 | 0 | | | |
| Lake Superior 11 – Goulais Bay Area | **GP** | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 8 | | |
| | **SP** | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| Mississagi River | **GP** | | | | | 12 | 4 | 4 | | | | | | |
| | **SP** | | | | | 12 | 4 | 4 | | | | | | |

j) White Sucker

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 32 | 32 | 32 | 16 | 8 | 8 | 8 | | | | |
| | SP | | 32 | 32 | 32 | 32 | 16 | 8 | 8 | 4 | | | | |
| Lake Superior 4 – Black Bay Area | **GP** | 32 | 32 | 32 | 32 | 12 | 12 | 12 | | | | | | |
| | **SP** | 32 | 32 | 32 | 32 | 12 | 12 | 8 | | | | | | |
| Lake Superior 6 – Nipigon Bay | **GP** | | 32 | 32 | 16 | 16 | 16 | 16 | 4 | | | | | |
| | **SP** | | 32 | 32 | 16 | 16 | 16 | 4 | 4 | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | | 32 | 32 | 32 | 32 | 32 | 16 | 16 | | | | | |
| | **SP** | | 32 | 32 | 32 | 32 | 16 | 12 | 8 | | | | | |
| North Channel NC1 | **GP** | | | 32 | 32 | 32 | 32 | 32 | 32 | | | | | |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 12 | | | | | |
| Georgian Bay GB4 | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | 32 | | | | | |
| | **SP** | | 32 | 32 | 32 | 32 | 16 | 16 | 12 | | | | | |
| Lake Huron H1 | **GP** | | | | 32 | 32 | 32 | 32 | | | | | | |
| | **SP** | | | | 32 | 32 | 16 | 16 | | | | | | |
| Lake Huron H4 | **GP** | | 32 | 32 | 32 | 32 | 32 | 16 | 12 | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 12 | 8 | 4 | | | | | |
| Lake Huron H5 | **GP** | | | 32 | 16 | 16 | 12 | 8 | | | | | | |
| | **SP** | | | 32 | 16 | 16 | 8 | 4 | | | | | | |
| Lake Superior 5 – Pie Island | **GP** | | | | | | 32 | 16 | | | | | | |
| | **SP** | | | | | | 16 | 12 | | | | | | |
| Lake Superior 7 – Schreiber Point/Sewell Point Area | **GP** | | | | | | 16 | 12 | 12 | | | | | |
| | **SP** | | | | | | 4 | 4 | 4 | | | | | |
| Lake Superior 1 – Border/Pie Island Area | **GP** | | | 16 | 16 | 16 | 16 | 12 | 12 | | | | | |
| | **SP** | | | 8 | 8 | 8 | 8 | 4 | 4 | | | | | |
| Georgian Bay GB1 | **GP** | | | | 32 | 32 | 32 | 32 | 32 | | | | | |
| | **SP** | | | | 32 | 32 | 16 | 16 | 16 | | | | | |
| Lake Huron H3 | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | 12 | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 12 | 4 | | | | | |
| Lake Superior 11 – Goulais Bay Area | **GP** | | 32 | 32 | 32 | 32 | 16 | 16 | | | | | | |
| | **SP** | | 32 | 32 | 32 | 32 | 8 | 8 | | | | | | |

k) Yellow Perch

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | 32 | 32 | 16 | 12 | 8 | | | | | | | | |
| | SP | 16 | 12 | 8 | 4 | 0 | | | | | | | | |
| Lake Superior 4 – Black Bay Area | **GP** | 32 | 32 | 16 | 16 | | | | | | | | | |
| | **SP** | 32 | 16 | 8 | 8 | | | | | | | | | |
| Lake Superior 6 – Nipigon Bay | **GP** | 32 | 32 | 16 | 16 | 4 | | | | | | | | |
| | **SP** | 16 | 12 | 4 | 4 | 0 | | | | | | | | |
| Lake Superior 10 – Agawa & Batchewana Bays | **GP** | 32 | 16 | 12 | 4 | | | | | | | | | |
| | **SP** | 12 | 4 | 4 | 0 | | | | | | | | | |
| North Channel NC1 | **GP** | 32 | 16 | 16 | 16 | | | | | | | | | |
| | **SP** | 12 | 12 | 8 | 8 | | | | | | | | | |
| Georgian Bay GB4 | **GP** | 32 | 16 | 16 | 12 | 4 | | | | | | | | |
| | **SP** | 16 | 8 | 8 | 4 | 0 | | | | | | | | |
| Lake Huron H1 | **GP** | | 32 | 16 | 12 | 8 | | | | | | | | |
| | **SP** | | 16 | 8 | 4 | 0 | | | | | | | | |
| Lake Huron H4 | **GP** | 32 | 16 | 16 | 12 | 8 | | | | | | | | |
| | **SP** | 12 | 8 | 4 | 4 | 4 | | | | | | | | |
| Lake Huron H5 | **GP** | 32 | 16 | 16 | 12 | 8 | | | | | | | | |
| | **SP** | 32 | 8 | 4 | 4 | 4 | | | | | | | | |
| Georgian Bay GB3 | **GP** | 12 | 12 | 12 | | | | | | | | | | |
| | **SP** | 12 | 8 | 8 | | | | | | | | | | |
| Georgian Bay GB1 | **GP** | 32 | 32 | 12 | | | | | | | | | | |
| | **SP** | 16 | 12 | 4 | | | | | | | | | | |
| Lake Huron H3 | **GP** | 32 | 16 | 16 | 12 | | | | | | | | | |
| | **SP** | 16 | 8 | 4 | 4 | | | | | | | | | |
| Lake Superior 11 – Goulais Bay Area | **GP** | 32 | 32 | 16 | 8 | | | | | | | | | |
| | **SP** | 16 | 16 | 8 | 4 | | | | | | | | | |

*Table 2a-m: Comparison of St. Marys River AOC advisories with other non-AOC Lake Superior and Lake Huron Areas using published advisories in the Guide to Eating Ontario Fish 2023-2024. St. Marys River AOC advisories in grey; blue, similar to the AOC; red, more stringent than AOC; green, better than AOC.*

a) Brown Bullhead

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 16 | 16 | | | | | | | | | |
| | SP | | 16 | 12 | 8 | | | | | | | | | |
| Georgian Bay (Lake Huron) | **GP** | | 32 | 32 | 16 | 16 | | | | | | | | |
| | **SP** | | 32 | 12 | 8 | 8 | | | | | | | | |
| Lake Huron (Main Basin) | **GP** | | 32 | 32 | 16 | | | | | | | | | |
| | **SP** | | 16 | 12 | 8 | | | | | | | | | |
| Saugeen River | **GP** | | 32 | 32 | 16 | | | | | | | | | |
| | **SP** | | 16 | 12 | 8 | | | | | | | | | |

b) Chinook Salmon

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| | SP | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior (Eastern Basin) | **GP** | | | | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | | 12 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Lake Superior (Western Basin) | **GP** | | | | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 12 |
| | **SP** | | | | | 32 | 16 | 16 | 12 | 8 | 8 | 8 | 8 | 4 |
| Black Bay (Lake Superior) | **GP** | | | 32 | 32 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | 4 | 2 |
| | **SP** | | | 32 | 16 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Nipigon Bay (Lake Superior) | **GP** | | | | | | | | 32 | 12 | 4 | 2 | 2 | 2 |
| | **SP** | | | | | | | | 12 | 8 | 4 | 0 | 0 | 0 |
| Steel River (Lake Superior) | **GP** | | | | | | | | | | | | | 0 |
| | **SP** | | | | | | | | | | | | | 0 |
| Goulais River (Lake Superior) | **GP** | | | | | | | 8 | 8 | 4 | 2 | 2 | 2 | 1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SP** | | | | | | | 8 | 8 | 4 | 0 | 0 | 0 | 0 |
| North Channel NCI | **GP** | | | | | 8 | 8 | 4 | 4 | 4 | 4 | 2 | 2 | 1 |
| | **SP** | | | | | 8 | 8 | 4 | 4 | 4 | 4 | 0 | 0 | 0 |
| Lake Huron (Main Basin) | **GP** | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 4 | 2 |
| | **SP** | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 0 |
| Georgian Bay (Lake Huron) | **GP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | 4 |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 8 | 8 | 4 |
| Saugeen River (Lake Huron) | **GP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 1 |
| | **SP** | | | 16 | 8 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Ausable River (Lake Huron) | **GP** | | | | | | | | | | | | 4 | 2 |
| | **SP** | | | | | | | | | | | | 4 | 0 |

c) Cisco

| **Location** | **Population** | **Size classes (cm)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **15-20** | **20-25** | **25-30** | **30-35** | **35-40** | **40-45** | **45-50** | **50-55** | **55-60** | **60-65** | **65-70** | **70-75** | **75+** |
| St. Marys River AOC | GP | 16 | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| | SP | 16 | 16 | 16 | 16 | 16 | 12 | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | | | 8 | 8 | 4 | 4 | 4 | 4 | | | | | |
| | **SP** | | | 8 | 8 | 4 | 4 | 4 | 4 | | | | | |
| Lake Superior (Western Basin) | **GP** | | | 32 | 32 | 32 | 16 | 16 | | | | | | |
| | **SP** | | | 32 | 32 | 16 | 16 | 12 | | | | | | |
| Black Bay (Lake Superior) | **GP** | | 4 | 4 | 4 | 4 | 4 | | | | | | | |
| | **SP** | | 4 | 4 | 4 | 4 | 4 | | | | | | | |
| Nipigon Bay (Lake Superior) | **GP** | | | | | 32 | | | | | | | | |
| | **SP** | | | | | 16 | | | | | | | | |
| North Channel NCI | **GP** | | | 16 | 16 | 16 | 16 | 16 | 8 | | | | | |
| | **SP** | | | 16 | 16 | 16 | 12 | 12 | 8 | | | | | |
| Lake Huron (Main Basin) | **GP** | 16 | 16 | 16 | 16 | 16 | 16 | 16 | | | | | | |
| | **SP** | 16 | 16 | 16 | 16 | 16 | 16 | 16 | | | | | | |
| Georgian Bay (Lake Huron) | **GP** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | | |
| | **SP** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | | |

d) Longnose Sucker

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | 2 | 2 | 2 | | | | | | | |
| | SP | | | | 0 | 0 | 0 | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | | | 12 | 8 | 4 | 4 | 4 | | | | | | |
| | **SP** | | | 12 | 8 | 4 | 4 | 4 | | | | | | |
| Lake Superior (Western Basin) | **GP** | | | | 32 | 32 | 16 | 8 | 4 | | | | | |
| | **SP** | | | | 32 | 12 | 8 | 8 | 4 | | | | | |
| Black Bay (Lake Superior) | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 12 | | | | | | |
| Nipigon Bay (Lake Superior) | **GP** | | | | | 12 | 4 | 4 | 2 | | | | | |
| | **SP** | | | | | 12 | 4 | 4 | 0 | | | | | |
| Michipicoten River (Lake Superior) | **GP** | | | | | 32 | 16 | 12 | | | | | | |
| | **SP** | | | | | 16 | 4 | 4 | | | | | | |
| North Channel NCI | **GP** | | | | | 4 | 4 | 4 | | | | | | |
| | **SP** | | | | | 4 | 4 | 4 | | | | | | |
| Lake Huron (Main Basin) | **GP** | | 32 | 32 | 32 | 32 | 16 | 16 | | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 16 | | | | | | |
| Georgian Bay (Lake Huron) | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | 32 | | | | | |
| | **SP** | | 32 | 32 | 32 | 32 | 16 | 12 | 12 | | | | | |

e) Northern Pike

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 |
| | SP | | 16 | 16 | 16 | 16 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 |
| Lake Superior (Eastern Basin) | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 4 |
| | **SP** | | | | 8 | 8 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 0 |
| Lake Superior (Western Basin) | **GP** | | | | | | | | | 16 | 12 | 12 | 8 | 4 |
| | **SP** | | | | | | | | | 4 | 4 | 4 | 4 | 0 |
| Black Bay (Lake Superior) | **GP** | | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 12 | 4 |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 4 | 4 | 0 |
| Nipigon Bay (Lake Superior) | **GP** | | | | | | | | | 32 | 32 | 16 | 12 | 2 |
| | **SP** | | | | | | | | | 16 | 12 | 8 | 4 | 0 |
| Michipicoten River (Lake Superior) | **GP** | | | | | | | | | 16 | 16 | | | |
| | **SP** | | | | | | | | | 4 | 4 | | | |
| North Channel NCI | **GP** | | | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 8 |
| | **SP** | | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | 4 | 0 |
| Lake Huron (Main Basin) | **GP** | | | | | 32 | 32 | 32 | 32 | 32 | 16 | 16 | 12 | 12 |
| | **SP** | | | | | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 4 |
| Georgian Bay (Lake Huron) | **GP** | | | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | **SP** | | | 16 | 12 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Mississagi River (Lake Huron) | **GP** | | | | | | | 8 | 8 | 8 | 4 | 4 | 2 | 0 |
| | **SP** | | | | | | | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Ausable River (Lake Huron) | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 8 | 4 | 4 | 4 | |
| | **SP** | | | | 12 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 0 | |

f) Pink Salmon

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | | | | 16 | 16 | | | | | | | |
| | SP | | | | | 16 | 16 | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | | | | 12 | 12 | 12 | 12 | 8 | 2 | | | | |
| | **SP** | | | | 12 | 12 | 12 | 12 | 8 | 0 | | | | |
| Lake Superior (Western Basin) | **GP** | | | | 16 | 8 | 8 | | | | | | | |
| | **SP** | | | | 16 | 8 | 8 | | | | | | | |
| Steel River (Lake Superior) | **GP** | | | | 12 | 12 | 12 | | | | | | | |
| | **SP** | | | | 12 | 12 | 12 | | | | | | | |
| North Channel NCI | **GP** | | | | | 16 | 16 | 16 | 16 | | | | | |
| | **SP** | | | | | 16 | 16 | 16 | 16 | | | | | |
| Georgian Bay (Lake Huron) | **GP** | | | | | 4 | 4 | 4 | 4 | 4 | | | | |
| | **SP** | | | | | 4 | 4 | 4 | 4 | 4 | | | | |

g) Rainbow Smelt

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | 8 | | | | | | | | | | | | |
| | SP | 8 | | | | | | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | 8 | | | | | | | | | | | | |
| | **SP** | 8 | | | | | | | | | | | | |
| Lake Superior (Western Basin) | **GP** | 16 | | | | | | | | | | | | |
| | **SP** | 16 | | | | | | | | | | | | |
| Black Bay (Lake Superior) | **GP** | 16 | | | | | | | | | | | | |
| | **SP** | 16 | | | | | | | | | | | | |
| Nipigon Bay (Lake Superior) | **GP** | 16 | | | | | | | | | | | | |
| | **SP** | 16 | | | | | | | | | | | | |
| North Channel NCI | **GP** | 4 | 4 | | | | | | | | | | | |
| | **SP** | 4 | 4 | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake Huron (Main Basin) | **GP** | 12 | 12 | | | | | | | | | | | |
| | **SP** | 12 | 12 | | | | | | | | | | | |
| Georgian Bay (Lake Huron) | **GP** | 8 | 8 | | | | | | | | | | | |
| | **SP** | 8 | 8 | | | | | | | | | | | |

h) Rainbow Trout

| **Location** | **Population** | **Size classes (cm)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **15-20** | **20-25** | **25-30** | **30-35** | **35-40** | **40-45** | **45-50** | **50-55** | **55-60** | **60-65** | **65-70** | **70-75** | **75+** |
| St. Marys River AOC | GP | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | |
| | SP | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | |
| Lake Superior (Eastern Basin) | **GP** | | | 32 | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 16 |
| | **SP** | | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 12 | 8 |
| Lake Superior (Western Basin) | **GP** | | | | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 4 | |
| | **SP** | | | | 16 | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 4 | |
| Black Bay (Lake Superior) | **GP** | | | | | | 16 | 16 | 16 | 16 | 12 | 4 | 2 | |
| | **SP** | | | | | | 16 | 16 | 16 | 12 | 12 | 4 | 0 | |
| Nipigon Bay (Lake Superior) | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | | | |
| | **SP** | | | | 16 | 16 | 16 | 16 | 16 | 12 | 12 | | | |
| Chippewa River (Lake Superior) | **GP** | | | | | | | 16 | 16 | 16 | 16 | | | |
| | **SP** | | | | | | | 8 | 8 | 8 | 8 | | | |
| Old Woman River (Lake Superior) | **GP** | | | | | | | | | 8 | 8 | 8 | | |
| | **SP** | | | | | | | | | 8 | 8 | 4 | | |
| Pancake River (Lake Superior) | **GP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | | |
| | **SP** | | | | 12 | 12 | 12 | 8 | 8 | 8 | 8 | 8 | | |
| Speckled Trout Creek (Lake Superior) | **GP** | | | | | | | 32 | 32 | 32 | 32 | 12 | 8 | |
| | **SP** | | | | | | | 16 | 16 | 16 | 16 | 12 | 8 | |
| Steel River (Lake Superior) | **GP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |
| | **SP** | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 4 | |
| Goulais River (Lake Superior) | **GP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| | **SP** | | | | 16 | 16 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | |
| Big Carp River (Sault Ste Marie) | **GP** | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| | **SP** | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| North Channel NCI | **GP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | |
| | **SP** | | | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 8 | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake Huron (Main Basin) | **GP** | | | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 4 |
| | **SP** | | | 32 | 32 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 4 |
| Georgian Bay (Lake Huron) | **GP** | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 |
| | **SP** | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 8 |
| Saugeen River (Lake Huron) | **GP** | | | | | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 4 |
| | **SP** | | | | | 16 | 16 | 16 | 16 | 12 | 12 | 12 | 8 | 4 |
| Ausable River (Lake Huron) | **GP** | | | | | | | 16 | 16 | 12 | 8 | 8 | 4 | |
| | **SP** | | | | | | | 16 | 16 | 12 | 8 | 8 | 4 | |
| Manitou River (Lake Huron) | **GP** | | | | | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 |
| | **SP** | | | | | | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 4 |

i) Round Whitefish

| **Location** | **Population** | **Size classes (cm)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **15-20** | **20-25** | **25-30** | **30-35** | **35-40** | **40-45** | **45-50** | **50-55** | **55-60** | **60-65** | **65-70** | **70-75** | **75+** |
| St. Marys River AOC | GP | | | | | | | 32 | | | | | | |
| | SP | | | | | | | 16 | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | | 16 | 16 | 16 | 16 | 16 | | | | | | | |
| | **SP** | | 16 | 16 | 16 | 16 | 16 | | | | | | | |
| Lake Superior (Western Basin) | **GP** | | | | 32 | 32 | 32 | 16 | | | | | | |
| | **SP** | | | | 32 | 16 | 16 | 16 | | | | | | |
| Black Bay (Lake Superior) | **GP** | | | 32 | 32 | 32 | 32 | 32 | | | | | | |
| | **SP** | | | 32 | 32 | 32 | 32 | 32 | | | | | | |
| North Channel NCI | **GP** | | | | 12 | 12 | 12 | 12 | 12 | | | | | |
| | **SP** | | | | 12 | 12 | 12 | 12 | 12 | | | | | |
| Lake Huron (Main Basin) | **GP** | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | | | | | |
| | **SP** | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | | | | | |
| Georgian Bay (Lake Huron) | **GP** | | | 32 | 32 | 32 | 32 | 32 | 32 | 32 | | | | |
| | **SP** | | | 32 | 32 | 32 | 32 | 32 | 32 | 32 | | | | |

j) Smallmouth Bass

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 16 | 8 | 4 | 4 | | | | | | | |
| | SP | | 12 | 8 | 8 | 4 | 4 | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | 32 | 32 | 16 | 16 | 12 | 8 | 4 | | | | | | |
| | **SP** | 16 | 12 | 8 | 4 | 4 | 0 | 0 | | | | | | |
| Black Bay (Lake Superior) | **GP** | | | | | 12 | 8 | 8 | | | | | | |
| | **SP** | | | | | 4 | 4 | 0 | | | | | | |
| North Channel NCI | **GP** | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | |
| | **SP** | | 8 | 8 | 8 | 4 | 4 | 4 | 0 | | | | | |
| Lake Huron (Main Basin) | **GP** | 32 | 32 | 16 | 16 | 12 | 8 | 8 | 4 | 4 | | | | |
| | **SP** | 16 | 12 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | | | | |
| Georgian Bay (Lake Huron) | **GP** | 32 | 32 | 16 | 16 | 16 | 16 | 8 | 8 | | | | | |
| | **SP** | 16 | 16 | 8 | 8 | 4 | 4 | 4 | 4 | | | | | |
| Saugeen River (Lake Huron) | **GP** | | | 16 | 12 | 8 | 4 | 4 | | | | | | |
| | **SP** | | | 8 | 4 | 0 | 0 | 0 | | | | | | |
| Ausable River (Lake Huron) | **GP** | 16 | 16 | 12 | 8 | 8 | 8 | 4 | | | | | | |
| | **SP** | 8 | 4 | 4 | 4 | 4 | 0 | 0 | | | | | | |
| Mississagi River (Lake Huron) | **GP** | | | 16 | 16 | 8 | 4 | 4 | | | | | | |
| | **SP** | | | 8 | 4 | 4 | 0 | 0 | | | | | | |

k) Walleye

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 32 | 32 | 32 | 16 | 16 | 16 | 12 | 12 | 8 | 2 | |
| | SP | | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 0 | |
| Lake Superior (Eastern Basin) | **GP** | | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 4 | 4 | 4 | 0 | |
| | **SP** | | 12 | 12 | 12 | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | |
| Lake Superior (Western Basin) | **GP** | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 4 | 2 | | |
| | **SP** | 16 | 16 | 16 | 12 | 12 | 8 | 4 | 4 | 0 | 0 | 0 | | |
| Black Bay (Lake Superior) | **GP** | 32 | 32 | 32 | 32 | 16 | 16 | 12 | 8 | 4 | 4 | 4 | | |
| | **SP** | 32 | 32 | 16 | 16 | 8 | 4 | 4 | 4 | 0 | 0 | 0 | | |
| Nipigon Bay (Lake Superior) | **GP** | | | | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 4 | 2 |
| | **SP** | | | | 16 | 12 | 8 | 8 | 4 | 4 | 4 | 0 | 0 | 0 |
| North Channel NCI | **GP** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 4 |
| | **SP** | 12 | 12 | 12 | 12 | 12 | 12 | 8 | 4 | 4 | 4 | 4 | 4 | 0 |
| Lake Huron (Main Basin) | **GP** | | | 16 | 16 | 16 | 16 | 16 | 12 | 8 | 8 | 4 | 4 | |
| | **SP** | | | 16 | 16 | 16 | 8 | 8 | 4 | 4 | 0 | 0 | 0 | |
| Georgian Bay (Lake Huron) | **GP** | | 32 | 32 | 16 | 16 | 16 | 16 | 12 | 12 | 8 | 8 | 8 | 4 |
| | **SP** | | 16 | 12 | 8 | 8 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 0 |
| Ausable River (Lake Huron) | **GP** | | | | 12 | 8 | 8 | 8 | 4 | 4 | 4 | | | |
| | **SP** | | | | 4 | 4 | 0 | 0 | 0 | 0 | 0 | | | |
| Mississagi River (Lake Huron) | **GP** | 12 | 8 | 8 | 8 | 8 | 4 | 4 | 4 | 2 | 0 | 0 | 0 | |
| | **SP** | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

l) White Sucker

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | | 32 | 32 | 32 | 32 | 12 | 12 | 8 | 8 | | | | |
| | SP | | 32 | 32 | 32 | 32 | 12 | 8 | 4 | 4 | | | | |
| Lake Superior (Eastern Basin) | **GP** | | 32 | 32 | 32 | 16 | 16 | 12 | 8 | | | | | |
| | **SP** | | 32 | 32 | 32 | 16 | 16 | 12 | 8 | | | | | |
| Lake Superior (Western Basin) | **GP** | | | 16 | 16 | 16 | 16 | 12 | 8 | | | | | |
| | **SP** | | | 8 | 8 | 8 | 8 | 4 | 4 | | | | | |
| Black Bay (Lake Superior) | **GP** | 32 | 32 | 32 | 32 | 32 | 32 | 16 | 4 | | | | | |
| | **SP** | 32 | 32 | 32 | 32 | 32 | 16 | 8 | 4 | | | | | |
| Nipigon Bay (Lake Superior) | **GP** | 32 | 32 | 32 | 16 | 16 | 16 | 16 | 16 | | | | | |
| | **SP** | 32 | 32 | 32 | 16 | 16 | 16 | 4 | 4 | | | | | |
| North Channel NCI | **GP** | 32 | 16 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | | | | |
| | **SP** | 32 | 16 | 16 | 16 | 8 | 4 | 4 | 4 | 4 | | | | |
| Lake Huron (Main Basin) | **GP** | | 16 | 16 | 16 | 16 | 16 | 8 | 8 | | | | | |
| | **SP** | | 16 | 16 | 16 | 16 | 16 | 8 | 4 | | | | | |
| Georgian Bay (Lake Huron) | **GP** | | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 16 | | | | |
| | **SP** | | 32 | 32 | 32 | 32 | 32 | 16 | 16 | 12 | | | | |
| Mississagi River (Lake Huron) | **GP** | | | | 32 | 32 | 16 | 12 | 8 | | | | | |
| | **SP** | | | | 16 | 16 | 8 | 4 | 4 | | | | | |

m) Yellow Perch

| Location | Population | Size classes (cm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 | 75+ |
| St. Marys River AOC | GP | 32 | 16 | 16 | 16 | 8 | | | | | | | | |
| | SP | 16 | 8 | 4 | 4 | 4 | | | | | | | | |
| Lake Superior (Eastern Basin) | **GP** | 32 | 16 | 8 | 4 | | | | | | | | | |
| | **SP** | 16 | 8 | 0 | 0 | | | | | | | | | |
| Black Bay (Lake Superior) | **GP** | 32 | 16 | 8 | 4 | | | | | | | | | |
| | **SP** | 16 | 8 | 4 | 0 | | | | | | | | | |
| Nipigon Bay (Lake Superior) | **GP** | 32 | 32 | 16 | 16 | 8 | | | | | | | | |
| | **SP** | 16 | 12 | 4 | 4 | 4 | | | | | | | | |
| North Channel NCI | **GP** | 32 | 16 | 12 | 8 | 8 | | | | | | | | |
| | **SP** | 12 | 12 | 4 | 4 | 4 | | | | | | | | |
| Lake Huron (Main Basin) | **GP** | 16 | 16 | 16 | 16 | 16 | | | | | | | | |
| | **SP** | 16 | 16 | 12 | 8 | 8 | | | | | | | | |
| Georgian Bay (Lake Huron) | **GP** | 8 | 4 | 4 | 4 | 4 | | | | | | | | |
| | **SP** | 8 | 4 | 4 | 4 | 0 | | | | | | | | |

**Appendix B: Assessment of fish consumption beneficial use impairment at the Great Lakes Thunder Bay and St. Marys River Areas of Concern, Canada (Gandhi et al. 2020).**

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# Assessment of fish consumption beneficial use impairment at the Great Lakes Thunder Bay and St. Marys River Areas of Concern, Canada

Nilima Gandhi [a,*], Donald A. Jackson [a], Satyendra P. Bhavsar [b]

[a] Department of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks Street, Toronto, Ontario M5S 3B2, Canada
[b] Ontario Ministry of the Environment, Conservation and Parks, Toronto, Ontario M9P 3V6, Canada

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ABSTRACT

The North American Great Lakes were designated with 43 locally degraded Areas of Concern (AOCs) in the 1980s. Remediation activities geared towards restoring beneficial use impairments (BUIs) at the AOCs have been conducted by both the American and Canadian governments. Here we examine if the fish consumption BUI has been restored at the Thunder Bay Harbour and St. Marys River AOCs within the Canadian waters by applying a three-tier assessment framework using the fish contaminant data collected by the Government of Ontario, Canada. Fish consumption advisories published by the government as well as simulated advisories based on the post-2005 data were examined in Tiers 1 and 2. The results highlighted that the restrictions advised on eating fish from the AOCs are mild and are typically similar to other non-AOC areas of lakes Superior and Huron. Temporal trend analyses of three contaminants of concern, mercury, PCB and dioxins/furans, generally showed substantial improvements over the last 30+ years and mostly continued declining trends in the recent years. These findings support a re-designation of the fish consumption BUI to "not impaired" at the two AOCs. As a follow up, it is recommended to confirm improvements in the dioxin/furan/dioxin-like PCB levels in fish at the Thunder Bay AOC. It is also advisable to conduct a survey to properly define "beneficial use" of fish consumption for the AOCs (i.e., which fish and in what quantity do people eat), and thereby validate the critical assumption of 8+ meals/month as a non-restrictive advice used in this assessment.


## Introduction

Canada and the United States share the North American Great Lakes, arguably the most important freshwater resource in the world. The lakes contain about one fifth of the world's surface freshwater, and substantially contribute to the region's economic, social and cultural well-being. In 1972, the two countries committed to restore and protect the waters of the Great Lakes through the Great Lakes Water Quality Agreement, which helps the parties to identify and implement binational priorities and actions. The agreement was revised in 1978 and 2012, and amended in 1983 and 1987.

The amendment of 1987 identified Areas of Concern (AOCs) where various beneficial uses of the waters were impaired due to degradation of water quality as a result of local human activities. Restrictions advised on eating fish from the AOC due to elevated contaminants is one of the 14 beneficial use impairments (BUIs) considered by the International Joint Commission (IJC) of Canada and the U.S. while identifying the AOCs. Not all the 14 beneficial uses were impaired at all the 43 AOCs (12 within the Canadian waters, 26 within the US waters and 5 shared binationally); however, the fish consumption BUI was and has been widely prevalent.

The fish consumption beneficial use has been identified previously as impaired at Thunder Bay Harbour (TBH), a Canadian AOC on the north shore of Lake Superior. The water quality at TBH, one of Canada's largest inland shipping ports, was affected by prolonged discharges primarily from the forest-product industry such as pulp and paper mills. Substantial improvements in the water quality of TBH have been achieved through collaborative efforts of federal and provincial government agencies, local industry, and other stakeholders (Government of Canada, 2016). For example, the federal pulp and paper effluent regulations implemented in 1992 and the provincial Effluent Monitoring and Effluent Limit (EMEL) regulations introduced in the mid-1990s resulted in improvements in the mill processes and upgrades to wastewater treatment facilities (Government of Canada, 2016). In addition, a significant amount of contaminated sediment was

* Corresponding author.
*E-mail address:* nilima.gandhi@utoronto.ca (N. Gandhi).

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removed (11000 $m^3$) or contained (21000 $m^3$), an 850 m long rock barrier was constructed to isolate the contaminated area, and 5 ha of fish habitat were created. These efforts have led to re-designation of two BUIs to "not impaired" (i.e., BUI Degradation of Aesthetics and Restrictions on Dredging Activities), and many other BUIs may soon be re-designated (i.e., fish tumours and other deformities, degradation of fish and wildlife populations, and bird or animal deformities or other reproductive problems). The beneficial use of fish consumption still remains impaired due to historical releases of mercury, polychlorinated biphenyls (PCBs), and dioxins/furans contributing to the elevated levels in fish at the AOC (Government of Canada, 2016).

Similar to TBH, the fish consumption beneficial use has been considered impaired at the St. Marys River (SMR), a connecting channel between lakes Superior and Huron and a binational AOC. It was designated an AOC due to degraded water quality mainly under the influence of pollution from local industries and municipal wastewater, as well as creation of navigation routes and hydropower generation facility (Government of Canada, 2017). Regulatory and other actions, notably implementation of federal pulp and paper regulations, the Fisheries Act, and EMEL regulations in the mid-1990s, improved municipal and industrial wastewater inputs to the river (Government of Canada, 2017). Recently (in 2015), the City of Sault Ste. Marie implemented a plan to better manage urban runoff and thereby further reducing pollutants entering the river (Government of Canada, 2017). The actions have resulted in improved river conditions leading to recovery of populations of colonial waterbirds with no physical deformities, low contaminant levels in bird eggs, and the reproductive success for colonial waterbirds within the AOC (Government of Canada, 2017). In 2016, the bird and animal deformities and reproductive problems beneficial use impairment was re-designated to "not impaired" (Government of Canada, 2017). Similarly, the beneficial uses of aesthetics, eutrophication and undesirable algae, and beach closings in the river are no longer impaired.

Because the actions taken to date could have reduced fish contaminant levels at the two AOCs, it is necessary to assess if the beneficial use of fish consumption has been restored to the extent that it can be deemed "not impaired". In this study, we utilize the current re-designation criteria for the Fish Consumption BUI at the AOCs along with a generic re-designation criterion and BUI assessment framework proposed by Bhavsar et al. (2018) to examine the status of the BUI at the TBH and SMR AOCs. Data and information collected by Ontario Ministry of the Environment, Conservation and Parks (OMECP) were utilized. The three-tier assessment framework allowed for a logical evaluation of the fish contaminant levels and consumption advisories considering a variety of other factors and conditions. The findings of the study are expected to aid in the decision-making process of the BUI re-designation to "not impaired".

## Methods

### *Study area*

The TBH AOC located on the north shore of Lake Superior spans about 28 km along the shoreline of TBH from Green Bay in the north to Flatland Island in the south, as well as about 9 km offshore including the Welcome Islands (Fig. 1). The harbour and AOC are adjacent to the City of Thunder Bay, which is one of Canada's largest inland shipping ports. The marsh area of the harbour provides habitat for a variety of fish and supports both a commercial and sport fishery.

The St. Marys River is a connecting channel between lakes Superior and Huron and is shared by the Canadian Province of Ontario and the State of Michigan, U.S. The region's economy has strong ties with tourism centered on recreational activities including sport fishing. The AOC spans from the head of the river at Whitefish Bay, downstream through the St. Joseph Channel to Humburg Point on the Ontario side, and to the straits of Detour on the Michigan side (Fig. 1).

### *Re-designation criteria*

The guidance provided by the IJC in 1991 to re-designate the fish consumption BUI recommended *contaminant levels in fish not to exceed current guidelines, and no public health advisories in effect for human consumption of fish due to contaminant input from the watershed* (IJC, 1991). Many AOCs have revised or are considering revisions to this re-designation criteria to address continued restrictions on eating fish not only at the AOCs but also on a larger lake-wide scale despite substantial improvements in the fish contaminant levels over the last few decades (Bhavsar et al., 2007; Bhavsar et al., 2008; Bhavsar et al., 2010; Carlson et al., 2010; Gewurtz et al., 2010; Neff et al., 2013; Robinson et al., 2015; Neff et al., 2016). The government agencies and scientific community have realised that PCBs, the major contaminant of concern for the Great Lakes, are more persistent and toxic than previously thought. This updated knowledge has resulted in downward revisions to many fish advisory benchmarks. For example, the PCB benchmark for an 8 meals/month advisory in Ontario has decreased by almost 20-fold from up to 2000 ppb during the 1980s to 105 ppb at present. As such, "no restriction on eating fish" appears to be a non-achievable goal in foreseeable future for the Great Lakes (USEPA, 2006).

To accommodate the revised understanding, the re-designation criteria for the fish consumption BUI at the TBH AOC was modified as the following: this beneficial use will no longer be impaired when the fish consumption advisories in the AOC (inner and outer Harbour; Lake Superior advisory regions 2 and 3; Fig. 1c) are no more restrictive than the advisories for the same contaminants in an open-water reference site (Schreiber Point to Sewell Point – Lake Superior advisory region 7; Fig. 1c), based on samples collected in the same time frame (<5 years) for a minimum of two consecutive studies. The revised re-designation criteria for the SMR AOC are: "This beneficial use will no longer be impaired when the fish consumption advisories in the AOC are no more restrictive than the advisories for the same contaminants in a suitable reference site. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events."

To avoid inconsistencies among AOCs, a generic re-designation criterion has been recently proposed as: "Consumption advisories for fish of interest in the AOC are non-restrictive or no more restrictive than the advisories for suitable reference site(s) due to contaminants from locally-controllable sources" (Bhavsar et al., 2018). As is evident, currently adopted re-designation criteria for the TBH and SMR AOCs are in a good agreement with the newly proposed generic re-designation criterion such that they all strongly rely on how the advisories for the AOCs compare with suitable reference areas.

### *Assessment framework*

An assessment of the fish consumption BUI depends on the fish advisories issued by the authorised agencies. However, the advisories are impacted by changes in both local fish contaminant levels and advisory benchmarks. Another important aspect of the assessment is characterising the "beneficial use" in terms of maximum meals of fish from the AOC that most people would typically consume. In addition, various other ecological factors (e.g., invasive species, redox conditions) and the biological attributes of the fish

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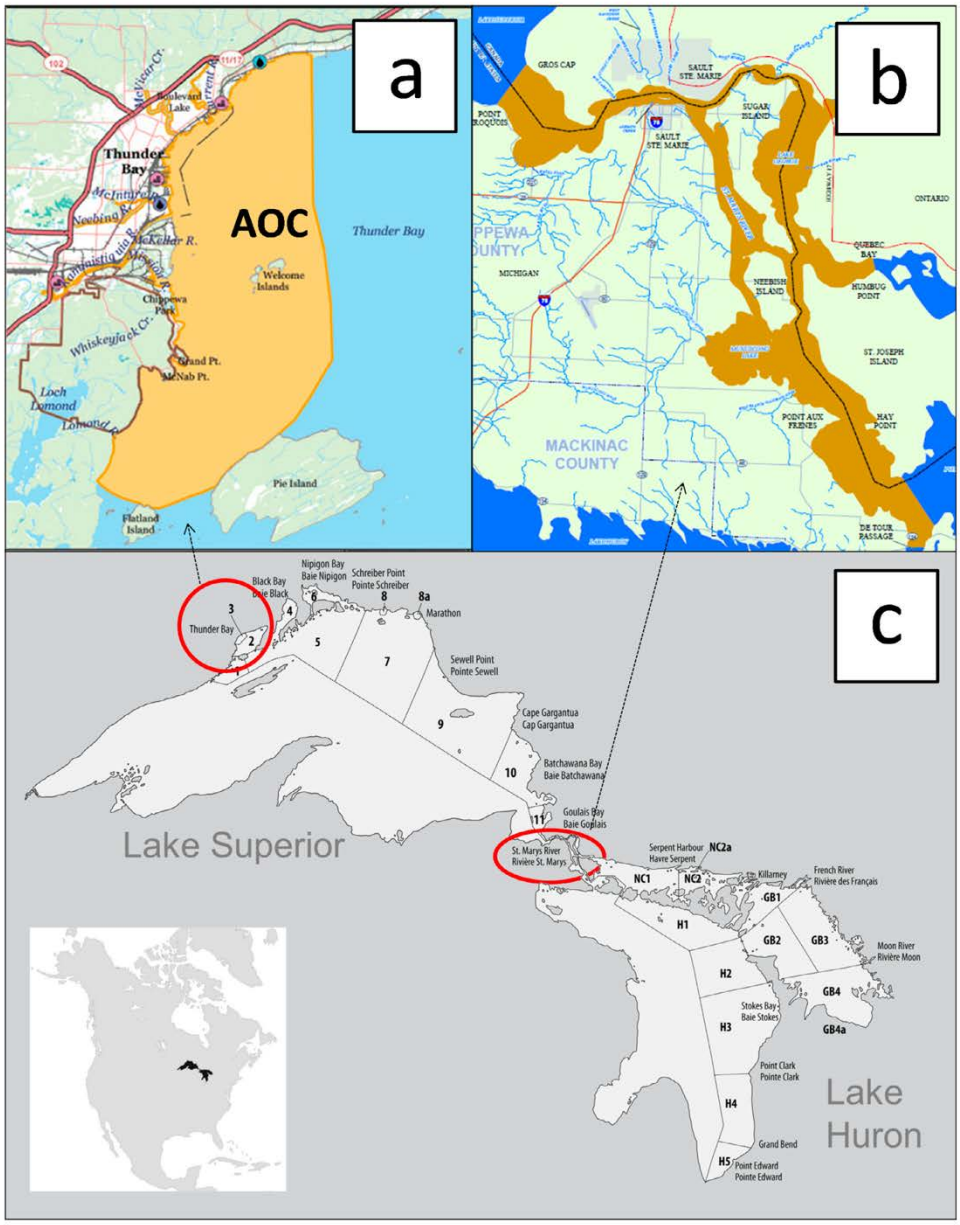


**Fig. 1.** Map of (a) Thunder Bay AOC, (b) St. Marys River AOC, and (C) Lake Superior regions used for fish consumption advisories issued by OMECP. The AOC maps were taken from Environment Canada and Climate Change (ECCC). The descriptions of the advisory regions are included in ESM Figs. S1 and S2.

species being monitored (e.g., movement, growth, condition) can influence accumulation of contaminants in fish, complicating connections between restoration activities to improvements in safety of eating fish from the AOC.

To ensure that the fish consumption BUI assessment is scientifically sound, comprehensive, transparent and consistent, the assessment framework (Fig. 2) and application guidance recently proposed by Bhavsar et al. (2018) were used in this study. The three-tier framework first examines the fish advisories for the AOC in Tier 1. Because advising fewer meals than the preference of local stakeholders would require a compromise, the assessment advances to Tier 2 instead of an outcome of "not impaired". In Tier 2, fish advisories for the AOC are compared to other suitable reference locations to gain a regional perspective on fish contaminant

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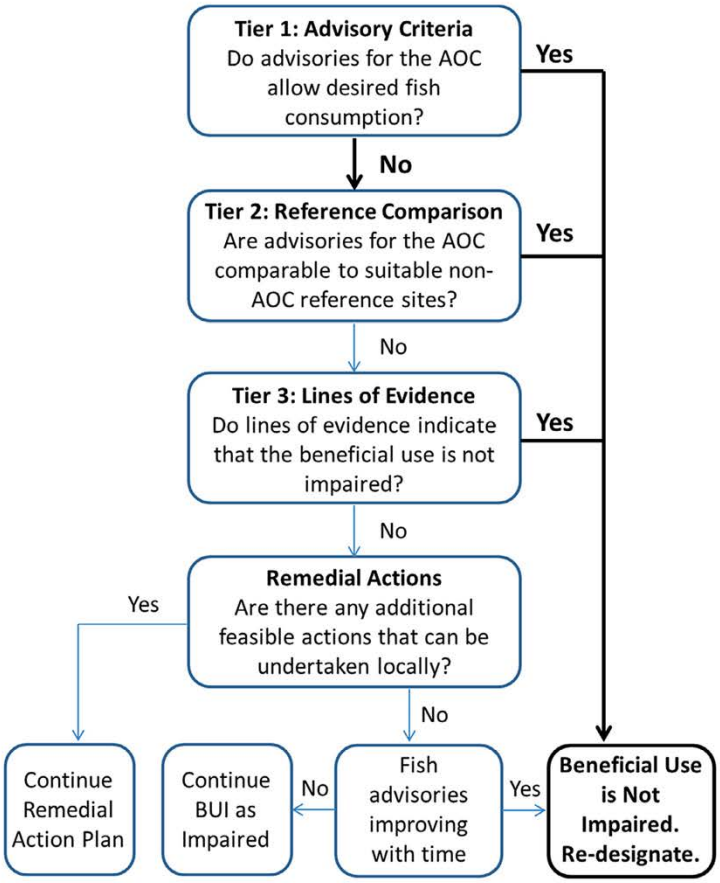


**Fig. 2.** Application of the fish consumption BUI assessment framework to the Thunder Bay and St. Marys River AOCs. The framework was adopted from Bhavsar et al. (2018).

levels and related restrictions on eating fish (Fig. 1, Electronic Supplementary Material (ESM) Figs. S1 and S2). If the AOC advisories are more restrictive than the reference locations for the same contaminants, the assessment moves to Tier 3 for a more in-depth lines-of-evidence analysis; otherwise an outcome of "not impaired" is reached. In Tier 3, contaminant trends along with a variety of ecological factors and processes (if required) are evaluated to understand contaminant dynamics and accumulation in food-web/fish at the AOC. This evaluation aids in understanding if local sources contributing to the impairment have been controlled, AOC conditions are improving, and/or external or non-controllable factors are driving the AOC fish advisories. The findings of the Tier 3 application are evaluated using the best professional judgement of the experts working on the topic to understand if the beneficial use can be considered "not impaired". Otherwise, additional feasible local remediation actions are explored. In the absence of any additional action, the BUI can be considered "not impaired" if the same/less restrictive advisories at the AOC compared to the reference locations can be expected within a reasonable time period (e.g., a decade) as a result of continued improvements in fish contaminant levels due to remediation actions already completed.

*Data source*

A fish consumption BUI assessment hinges on fish contaminant measurements that are in turn used to advise on the safe consumption of fish. The Province of Ontario operates a very comprehensive fish contaminant monitoring program and issues advice through the Guide to Eating Ontario Fish (Ontario.ca/Fishguide). Data collected by the program for lakes Superior and Huron, including the two AOCs over the last 40+ years, were considered in the assessment. Based on history of the contaminations and contaminants responsible for restrictions on eating fish from the AOCs and lakes Superior and Huron, PCB, mercury (Hg) and dioxins/furans/dioxin-like PCB were selected as contaminants of concern/interest. For the TBH AOC, both inner and outer harbour areas were included in consideration of the AOC boundary and potential fish movements between the two areas.

*Beneficial use*

In the absence of a consumer survey of fish consumption from the two AOCs, an 8+ meals/month advisory was considered "non-restrictive" for the purpose of this BUI assessment based on the

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generic fish consumption surveys conducted by the Government of Ontario indicating that most (90%) of the anglers do not eat wild caught fish more frequently (Awad, 2006). This is evident from the advisories issued through the Guide to Eating Ontario Fish in which a maximum of 8 meals/month was advised until 2015 when the advisories were extended to 32 meals/month to address the needs of subsistence fishers (OMOE, 2013; OMOECC, 2015). Advisories issued by all American states adjacent to the Great Lakes start at 4 meals/month for PCB (except MI starts at 16) and Hg (except OH starts at 8, MI starts at 16) (Consortium, 2020). As such, the 8+ meals/month advisories were classified as "non-restrictive", 4, 2 and 1 meals/month were considered "partial restriction", and 0 meal/month or "do not eat" as "complete restriction".

*Tier 3 trend analysis*

Mann-Kendall (MK) tests (Gilbert, 1987) were conducted on annual average concentrations for a variety of fish at both AOCs monitored at a reasonable frequency. Potential influence of varying sizes of fish collected over the years was accounted for by using narrow size ranges only (40–50 cm for Longnose Suckers and White Suckers; 50–60 cm for all other species) based on availability of data and previous studies (Bhavsar et al., 2007; Bhavsar et al., 2008; Bhavsar et al., 2010). The MK tests were conducted using a MAKESENSE 1.0 template (Salmi et al., 2002). Trends were considered significant at $P < 0.1$.

## Results and discussion

*Tier 1: Advisory criteria*

*Published advisories*

Fish consumption advisories for the two AOCs published by the Government of Ontario in the 2017–2018 edition of the Guide to Eating Ontario Fish are shown in ESM Table S1 (OMOECC, 2017). In total, there are 302 and 146 combinations of species and 5 cm size-specific advisories for the TBH and SMR AOCs, respectively (both general population (GP) and sensitive population (SP) considered). The advisories ranged from 0 (do not eat) to 32 (non-restrictive) meals/month with 50% and 46% of the advisories being <8 meals/month and 17% and 16% of the advisories being "do not eat" for the TBH and SMR AOCs, respectively. These restrictions are similar to those for all the non-AOC areas combined within each of lakes Superior and Huron (44–46% <8 meals/months; 15–17% "do not eat"), and better than those for all the non-AOC areas combined within each of the lower Great Lakes, i.e., lakes Erie and Ontario (59–62% <8 meals/months; 22–29% "do not eat") (OMOECC, 2017).

For the published GP advisories in the 2017–2018 Guide to Eating Ontario Fish, 36% and 40% are at <8 meals/month and 4% and 5% are at "do not eat" for the TBH and SMR AOCs, respectively (ESM Table S1). These restrictions are similar to those for all the areas combined within each of lakes Superior and Huron (37–39% <8 meals/months; 5%-6% "do not eat"), as well as less stringent than all the areas combined within lakes Erie and Ontario (52–57% <8 meals/months; 3–13% "do not eat") (OMOECC, 2017). These observations are based on the officially published advisories, and highlight that the safety of eating fish from the two AOCs is similar or better than the other regions of the same lakes, as well as throughout the Canadian waters of the Great Lakes in general.

The restrictions on eating fish from the AOCs are advised primarily due to elevated levels of mercury and PCB and secondarily to dioxin-like PCBs and Toxaphene (for TBH only) (OMOECC, 2017). These contaminants are also responsible for restrictions on eating fish from other parts of lakes Superior and Huron (OMOECC, 2017). Long-range transport and atmospheric deposition has been identified as an external source of Toxaphene, and there is no known point source within the AOCs or on the Canadian side of Lake Superior (Murphy et al., 2012). As such, the Toxaphene issue cannot be addressed through the AOC program. It should be noted that Toxaphene has been banned in the U.S. since 1990 and globally (through the Stockholm Convention on Persistent Organic Pollutants) since 2001. As such, declines in the levels of Toxaphene in Lake Superior fish can be expected to continue.

*Simulated advisories*

A closer look at the published advisories confirmed that certain size classes of some fish may not have been captured in recent years and the advisories have been issued using older data to protect the health of people eating these fish (OMECP unpublished information). To avoid the potential influence of historically elevated concentrations, the Tier 1 analysis of whether advisories for the AOCs allow desired fish consumption was also conducted using only recent (post-2005) data. The time period for this analysis was selected such that it maximizes coverage of fish types/sizes while avoiding historical influence.

These simulated advisories support the above described observations from the published advisories. A breakdown of the combined GP and SP advisories for the TBH AOC would be 48% at <8 meals/month (i.e., partial or complete restriction) and 13% "do not eat" (i.e., complete restriction) (ESM Table S2a). For the SMR AOC, the combined GP and SP advisories would be even better (32% at <8 meals/month, only 1% "do not eat"; ESM Table S2b). For the GP, none of the advisories for the two AOCs would be "do not eat" or complete restriction (Fig. 3). Most of the GP advisories would be non-restrictive (69% of TBH and 75% of SMR advisories at 8+ meals/month), while the remaining advisories would be partial restrictions (1–4 meals/month) (Fig. 3).

Although all advisories for Lake Trout and Yellow Perch at TBH and Chinook Salmon at SMR are <8 meals/month, some or all advisories for all other species are 8+ meals/month (Fig. 3). These results suggest that there are options available to select type and size of fish from the AOC that can be safely consumed at a frequency of 8 or more meals/month. Walleye is typically the most popular fish angled for eating in Province of Ontario (Awad, 2006). Walleye found at both the AOCs can be consumed by GP without any practical restrictions (i.e., 8+ meals/month) (Fig. 3). However, restrictions are advised for the SP on eating Walleye and other fish at both the AOCs (ESM Tables S1 and S2).

Overall, the Tier 1 analysis, based on examination of both published and simulated advisories using the recent data, indicates that restrictions on eating fish from the AOCs are similar to the lake-wide conditions. However, it does not, by itself, support a re-designation of the BUI to "not impaired".

*Tier 2: Reference comparison*

A Tier 2 analysis was conducted using the post-2005 data. All the non-AOC regions of the Canadian waters of Lake Superior were considered as reference locations for the TBH AOC, while both Lake Superior (upstream) and Lake Huron (downstream) regions were considered as reference locations for the SMR AOC (Fig. 1). Such a regional comparison, as opposed to one or two reference locations, should provide a more robust perspective on the BUI status for the AOCs. For example, a comparison of TBH advisories with an open-water reference site (Schreiber Point to Sewell Point – Lake Superior advisory region 7) would have to be based on only 14 advisories instead of 246 advisories when all the non-AOC regions of the Canadian waters of Lake Superior is considered (ESM Table S3). The AOC advisories were assessed as a percentage of being "excellent" (8+ meals/month), as well as classified into better, similar, or worse than the reference areas.

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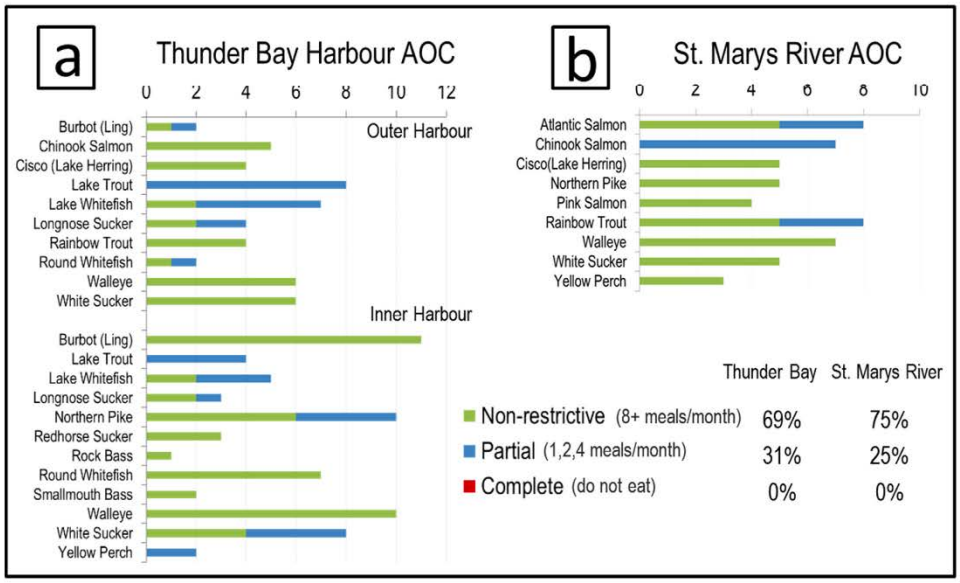


**Fig. 3.** Breakdown of number of (simulated) fish consumption advisories for the general population using the post-2005 contaminant monitoring data collected for the two AOCs. Please refer to the method section for the classification of the advisories into the three categories. The 8+ meals/month advisories were classified as "non-restrictive", 4, 2 and 1 meals/month were considered "partial restriction", and 0 meal/month or "do not eat" as "complete restriction".

For the GP, most of the advisories for both the AOCs are either similar to or better than the corresponding advisories for the same type and size of fish monitored at the reference locations (ESM Tables S3 and S4). A summary of the analysis shows that the majority of fish types (9 of 15 or 60% at TBH, 6 of 8 or 75% at SMR) have >89% of the advisories as non-restrictive (Table 1a). Only 3 of 15 (20%) types of fish at TBH and 1 of 8 (13%) at SMR have <50% of the advisories as non-restrictive (Table 1a). The GP advisories for majority of the species at the two AOCs (8 of 15 or 53% at TBH, 7 of 8 or 88% at SMR) are better or similar compared to the reference locations (Table 1a). Only one of 15 (7%) types of fish at TBH, and none (0%) at SMR, have >50% of the GP advisories that are worse compared to the reference locations and <50% of the advisories as non-restrictive (Table 1a).

Similar to the GP, most of the SP advisories for both the AOCs, especially SMR, are either similar to or better than the corresponding advisories for the same type and size of fish monitored at the reference locations (ESM Tables S5 and S6). Half of the species at TBH and all of the species at SMR have similar or better SP advisories compared to the reference locations (Table 1b). Further, only 4 of 7 (43%) types of TBH fish that have >50% of the SP advisories worse compared to the reference locations also have <50% of the advisories as non-restrictive, implying that the advisories potentially may not be impairing the consumption use benefit (Table 1b).

Overall, the Tier 2 results highlight that the advisories for the AOCs based on the post-2005 data are generally non-restrictive, and similar/better than the other regional advisories for the Great Lakes. Considering the newly proposed generic re-designation criterion, as well as currently adopted re-designation criteria for both the AOCs, strongly rely on how the advisories for the AOCs compare to suitable reference areas, the outcome of the Tier 2 analysis supports the re-designation of the BUI as "not impaired".

*Tier 3: Lines of evidence (contaminant trends)*

A Tier 3 analysis was not necessary based on the outcomes of Tier 2; however, a temporal trend analysis was conducted for the three classes of contaminants of concern/interest as an additional line of evidence.

PCBs, a group of lipophilic chemicals, tends to accumulate at elevated levels in fatty fish. Both Lake Trout at TBH and Rainbow Trout at SMR displayed strong declining trends over the last 35–40 years with the decreases of about 56% and 81%, respectively (Fig. 4). Other fish such as Chinook Salmon, Longnose Sucker, and Walleye at the TBH AOC, and Pink Salmon, Walleye, and White Sucker at the SMR AOC also showed declining PCB trends (ESM Figs. S3, S4). Northern Pike at both AOCs did not display a declining PCB trend; however, the PCB levels were low and/or variable over the time period (ESM Figs. S3, S4). The lack of decrease in PCB over time in Lake Whitefish at TBH can be concerning; this trend should be re-examined using new data. No species monitored at both the AOCs displayed a statistically significant increasing PCB trend. Almost all the PCB trends were, however, statistically non-significant largely due to the low number of monitoring points over the three decades. Nevertheless, the data provide a good indication of substantial declines in the PCB levels for most monitored species at both the AOCs, especially for the species that displayed relatively higher PCB levels in the past (e.g., Lake Trout and Longnose Sucker at TBH, Rainbow Trout at SMR).

Similar to PCB, Hg also showed a declining trend in most species at both the AOCs (6 of 7 or 86% at TBH, 4 of 5 or 80% at SMR), albeit many trends were of marginal statistical significance (Fig. 4, ESM Figs. S3, S4). Chinook Salmon at TBH and Pink Salmon at SMR were the only species that showed increased Hg over the years, albeit the trends were statistically non-significant, and the concentrations were relatively low. Some increases in overall mercury levels

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**Table 1**
A summary of advisory comparison between the two AOCs and other non-AOC locations in the Canadian waters of lakes Superior and Huron. A detailed comparison has been presented in ESM Tables S3 and S4. The "% Excellent" category shows percentage of the AOC advisories that are 8+ meals/month, worse/similar/better are counts of advisories compared to the reference locations, and "% Worse" category shows percentage of the AOC advisories that are worse compared to the reference locations. Percent values >80% are highlighted in black, and 50–80% in grey.

**a) General Population**

| Thunder Bay AOC | | | | | SPECIES | St. Marys River AOC | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| % Worse | Worse | Similar | Better | % Excellent | | % Excellent | Better | Similar | Worse | % Worse |
| 0% | | 1 | 17 | 100% | Chinook Salmon | 0% | 20 | 37 | 22 | 28% |
| 100% | 5 | | | 100% | Cisco | 100% | 4 | 3 | 10 | 59% |
| 25% | 12 | 23 | 13 | 0% | Lake Trout | | | | | |
| 45% | 17 | 17 | 4 | 33% | Lake Whitefish | | | | | |
| 58% | 7 | 5 | | 92% | Burbot (Ling) | | | | | |
| 25% | 5 | 13 | 2 | 57% | Longnose Sucker | | | | | |
| 100% | 11 | | | 60% | Northern Pike | 100% | 8 | 31 | 6 | 13% |
| | | | | | Pink Salmon | 100% | 12 | | | 0% |
| 28% | 13 | 15 | 19 | 100% | Rainbow Trout | 63% | 34 | 42 | 44 | 37% |
| | | | | 100% | Redhorse Sucker | | | | | |
| 0% | | 1 | | 100% | Rock Bass | | | | | |
| 100% | 4 | | | 89% | Round Whitefish | | | | | |
| 100% | 1 | | | 100% | Smallmouth Bass | | | | | |
| 39% | 7 | 11 | | 100% | Walleye | 100% | 26 | 43 | 5 | 7% |
| 23% | 3 | 10 | | 71% | White Sucker | 100% | 5 | 21 | 9 | 26% |
| 100% | 10 | | | 0% | Yellow Perch | 100% | 9 | 15 | | 0% |

**b) Sensitive Population**

| Thunder Bay AOC | | | | | SPECIES | St. Marys River AOC | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| % Worse | Worse | Similar | Better | % Excellent | | % Excellent | Better | Similar | Worse | % Worse |
| 0% | | 3 | 15 | 100% | Chinook Salmon | 0% | 15 | 43 | 21 | 27% |
| 100% | 5 | | | 100% | Cisco | 100% | 4 | 5 | 8 | 47% |
| 25% | 12 | 28 | 8 | 0% | Lake Trout | | | | | |
| 45% | 17 | 17 | 4 | 33% | Lake Whitefish | | | | | |
| 42% | 5 | 7 | | 0% | Burbot (Ling) | | | | | |
| 40% | 8 | 9 | 3 | 43% | Longnose Sucker | | | | | |
| 100% | 11 | | | 0% | Northern Pike | 60% | 10 | 25 | 10 | 22% |
| | | | | | Pink Salmon | 100% | 12 | | | 0% |
| 21% | 10 | 17 | 20 | 100% | Rainbow Trout | 63% | 38 | 44 | 38 | 32% |
| | | | | 33% | Redhorse Sucker | | | | | |
| 100% | 1 | | | 0% | Rock Bass | | | | | |
| 75% | 3 | 1 | | 67% | Round Whitefish | | | | | |
| 100% | 1 | | | 100% | Smallmouth Bass | | | | | |
| 39% | 7 | 11 | | 38% | Walleye | 43% | 20 | 47 | 7 | 9% |
| 77% | 10 | 3 | | | White Sucker | 80% | 11 | 15 | 9 | 26% |
| 100% | 10 | | | 0% | Yellow Perch | 100% | 13 | 10 | 1 | 4% |

in Lake Superior salmon have been reported for the 2000s (Visha et al., 2018). Walleye, a predatory lean fish, can be considered the best available indicator species for Hg contamination due to elevated levels typically observed in them (Bhavsar et al., 2011). The Hg levels in 40–50 cm Walleye have declined since the mid-1970s by about 60% and 58% at the TBH and SMR AOCs, respectively (Fig. 4).

Dioxins, furans and dioxin-like PCBs are assessed in terms of toxic equivalent (TEQ) concentrations in relation to the most toxic chemical of the group (2,3,7,8-tetrachlorodibenzo-p-dioxin). Of the two fish monitored for dioxins/furans/dioxin-like PCBs at TBH, Lake Whitefish showed 43% decrease in the TEQ concentrations, but lake trout TEQ increased by 158% between the late 1990s and 2012 (Fig. 4, ESM Fig. S3). For SMR, annual average values from the limited measurements for narrow-sized Atlantic Salmon and Rainbow Trout indicate decreases in the dioxin levels during the 2000s (Fig. 4 and ESM S4). When all the dioxin TEQ data available for Atlantic Salmon and Rainbow Trout at SMR regardless of their lengths were considered, statistically significant decreases of, on average, 88% and 94%, respectively, were observed between 2000 and 2016 (ESM Fig. S5). However, such an expanded data analysis for the dioxin TEQ levels in fish at TBH did not find statistically significant declines in the concentrations (Fig, S6). The dioxin levels in fish from the Great Lakes are generally declining (Bhavsar et al., 2008; Gandhi et al., 2019). As such, it is recommended to re-examine dioxin TEQ trends for TBH using more recent data. This is important considering that pulp and paper mills, which could be a source of dioxins/furans, impacted water quality at TBH; and the federal pulp and paper effluent regulations implemented in 1992 and the provincial EMEL regulations introduced in the mid-1990s resulted in improvements in the mill processes.

It has been widely recognized that eating fish provides a variety of health benefits including cognitive development and cardiovascular fitness due to high-quality protein, omega-3 fatty acids, minerals and vitamins in fish; however, contaminants, mainly mercury, in fish remains a health concern (Mozaffarian and Rimm, 2006). Although relatively limited information is available

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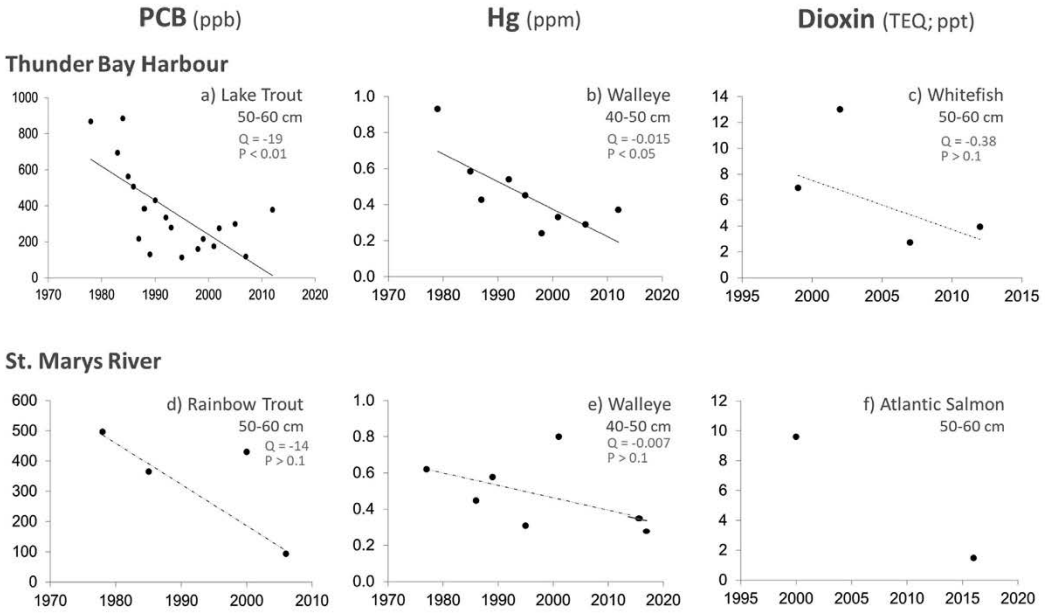


**Fig. 4.** Temporal trend analyses of PCB, Hg and dioxins/furans/dioxin-like PCBs toxic equivalent (TEQ) concentrations on limited size classes of select species. Q denotes Sen's Slope. P value is statistical significance. Black line shows MK linear trend. The detailed analysis has been presented in ESM Figs. S3 and S4.

to conduct a detailed risk-benefit analysis of eating Great Lakes fish, recent studies have helped in addressing the data and knowledge gap (Turyk et al., 2012; Neff et al., 2014; Williams et al., 2014; Strandberg et al., 2017; Strandberg et al., 2018). The BUI Fish Consumption assessment conducted in this study did not consider the beneficial aspect of eating fish due to current limitation of the science on performing a quantitative analysis on this topic (Williams et al., 2014). But these recent studies have shown that some Great Lakes fish can be a good source of beneficial omega-3 fatty acids even if they are consumed as per the restrictions advised due to the presence of contaminants. Further reductions in contaminant burdens of many Great Lakes fish, especially PCBs in fatty fish, would be necessary throughout the basin (not just the AOCs) to fully utilize beneficial aspects of eating these fish. Because PCBs were banned more than 40 years ago, their levels have dramatically declined and continue to decline in Great Lakes fish (Bhavsar et al., 2007; Hites and Holsen, 2019). As such, we can expect overall improvements in fish consumption beneficial use of eating Great Lakes fish in the coming decades.

## Conclusions

Beneficial use of fish consumption has been considered impaired at the TBH and SMR AOCs. A 3-tier assessment framework applied using the AOC specific re-designation criteria, as well as recently proposed generic re-designation criteria supports changing the status of the BUI to "not impaired". However, it is recommended that fish-eating pattern surveys are conducted at the AOCs to better define the beneficial use and confirm the critical assumption of 8+ meals/month as "non-restrictive" adopted in this assessment. As per the 2016 Canadian Census, 13–15% of the Thunder Bay and Sault Ste. Marie population self identified as belonging to an indigenous group; however, the extent of sustenance fishery at the two AOCs is not presently clear. Continued monitoring of contaminants of concern, especially dioxins/furans in Lake Trout at TBH, is suggested to document further recovery of the AOCs.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jglr.2020.03.009.

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## Appendix C: Community Fish Consumption Survey

St. Marys River Area of Concern
Ontario, Canada

# Community Fish Consumption Survey Report

Lisa Derickx
Remedial Action Plan Coordinator,
Algoma University

August 2024

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## Introduction

The St. Marys River is a connecting channel that flows between Lake Superior and Lake Huron, with the largest settlement being Sault Ste. Marie, Ontario. The St. Marys River has been recognized as one of 43 Areas of Concern (AOC) within the Great Lakes Basin under the *Canada-U.S. Great Lakes Water Quality Agreement*. Of the 14 possible Beneficial Use Impairments (BUIs) identified for AOCs, nine were originally deemed impaired for the St. Marys River AOC, and one required further assessment (under the Stage 1 Remedial Action Plan report, released in 1992). Since then, five BUIs were redesignated to "not-impaired".

One of the remaining impairments in the St. Marys River AOC is *Restrictions on Fish and Wildlife Consumption*, which was identified as impaired for fish consumption. Historical reasons for impairment include three major contaminants of concern affecting consumption advisories: Mercury, Polychlorinated Biphenyls (PCBs), and dioxins and furans.

The BUI delisting criteria established under the Remedial Action Plan process states that this beneficial use will no longer be impaired when, "*the fish consumption advisories in the Area of Concern are no more restrictive than the advisories for the same contaminants in suitable reference sites. Comparisons shall be based on samples collected in the same timeframe for a minimum of two consecutive sampling events".*

Initial results of an assessment of this BUI was published in March 2020 by experts at the Ontario Ministry of the Environment, Conservation and Parks (MECP) and the University of Toronto (Gandhi et al. 2020). The results suggest that levels of contaminants in fish – in particular the three noted above – from the St. Marys River have declined to an extent that the BUI can be considered "not impaired". However, the initial assessment and associated journal article makes the assumption that 8+ meals per month can be considered as a "non-restrictive" diet of fish. As a result, it was recommended that a community fish consumption survey be conducted to test this critical assumption/assertion in order to help complete a future BUI status assessment.

Results from the 2020 assessment also show that fish consumption advisories are similar when comparing the St. Marys River AOC to areas in Lake Superior and Lake Huron, with one exception - Chinook Salmon. That fish has what is considered a partial restriction with an advisory of 1-4 meals per month depending on the size of the Chinook Salmon. The community fish consumption survey can therefore also help determine whether this would constitute a "non- restrictive" diet of fish from the St. Marys River based on community fish consumption pattern, and in doing so, help complete a future BUI status assessment.

Subsequently, a St. Marys River AOC Community Fish Consumption Survey was undertaken between May 2021 and November 2023. The survey was designed to help assess the *Restrictions on Fish Consumption* BUI by identifying the consumption habits of people who catch and eat various fish species from the St. Marys River AOC, and to gain added insight on consumption of Chinook Salmon.

A total of 673 individual responses were collected during the survey period, and this report is a summary on the methods taken and a synthesis of the findings.

## Methods

The survey asked participants a total of 21 questions falling under 5 different categories (Appendix 1). The categories are fishing practices, fish consumption habits, fish consumption advisories, participant information, and contact details. The questions touched upon topics related to the types and frequency of fish caught and eaten, preferred areas for fishing, fish preparation and cooking methods, knowledge and use of the MECP's *Guide to Eating Ontario Fish*[2], personal information related to age and weight, and whether the person completing the survey belonged to the sensitive population (i.e., children under 15 years old and anyone who is pregnant or may become pregnant).

Both in-person and online surveys were collected between May 1, 2021 and November 15, 2023. In-person surveys were conducted at various locations along the river between the city of Sault Ste. Marie and St. Joseph Island. These locations included marinas and popular onshore fishing locations. The survey was promoted at events, such as:

- Sustain Algoma Expo on July 16, 2022, and June 17, 2023
- Regional Freshwater Conference held virtually on February 16, 2022
- By the Rapids Event on August 24, 2022
- Great Lakes Outdoor Show on April 1, 2023
- Laird Fair on August 20, 2023

On October 7, 2022, the Survey Coordinator delivered an in-person presentation to members of the St. Joseph Island Hunters and Anglers Association. The presentation provided an overview on the St. Marys River AOC and Remedial Action Plan, the *Restrictions on Fish Consumption* BUI,

[2] Available online: www.ontario.ca/page/guide-eating-ontario-fish

the Community Fish Consumption Survey, and the MECP's *Guide to Eating Ontario Fish*. After the presentation members were given the opportunity to fill out the survey.

Local Indigenous communities were invited to participate in the survey. In-person surveys were collected at a Garden River First Nation community event on February 15, 2023, and promoted by staff at their Lands and Resources Department. Survey responses collected were amalgamated into the total survey responses in this report, as Garden River's request. Discussions took place with staff at the Batchewana First Nation, but its leadership decided not to participate in the survey exercise.

The Métis Nation of Ontario voiced their preference to conduct its own community fish consumption survey. This was completed with financial support from the MECP. The data from the Métis Nation of Ontario's survey is not included in this report (at their request), but the results summarized in the Métis Nation of Ontario's findings report does not contradict the consolidated findings based on the 673 surveys completed.

To reach the broader community, the survey was also posted online by Algoma University and promoted via social media and wallet sized printouts that were handed out at events. Several gift card giveaways were used to promote survey participation, including a partnership promotion with the Sault Ste. Marie Trading Post. All of these efforts resulted in a total of 673 survey responses.

## Results and Discussion

### i) Fishing the St. Marys River AOC

Out of the 673 survey participants, 83% (N=556) go fishing on the Canadian side of the St. Marys River AOC (Figure 1). The majority of these survey participants have been fishing the river for over 5 years (Figure 2).

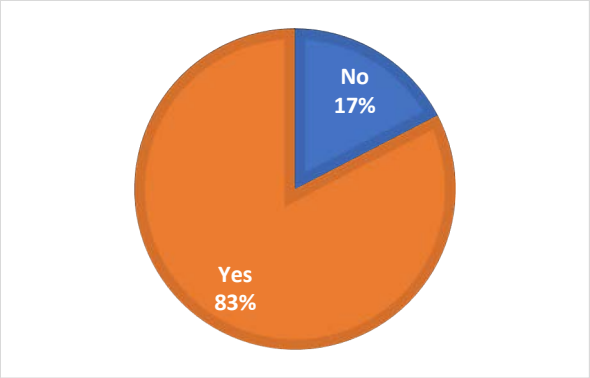



*Figure 5: Percentage of survey participants who fish the Canadian side of the St. Marys River AOC.*

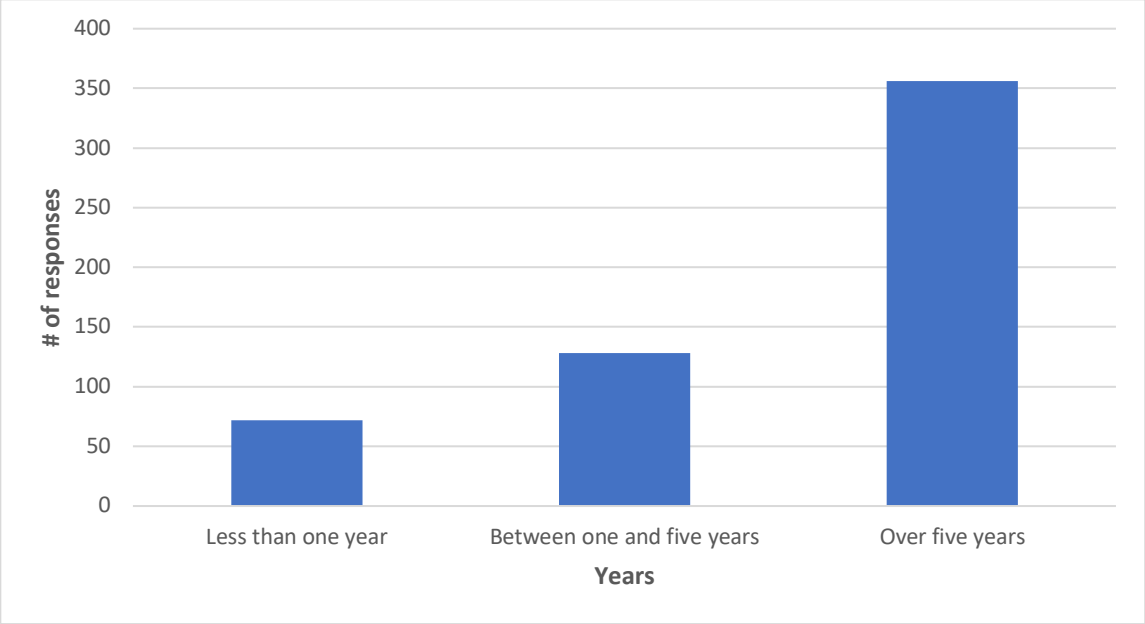



*Figure 6: Number of years survey participants have fished the St. Marys River.*

### ii) Preferred fishing locations

Based on the survey responses, all areas of the St. Marys River AOC are desirable locations for fishing (Figure 3). Many areas of the river have convenient access and scenic surroundings which makes these locations attractive to fishing enthusiasts. Outside of the AOC, many survey participants enjoy fishing inland lakes within the Algoma region as well as other areas in Lakes Huron and Superior (Figure 4).

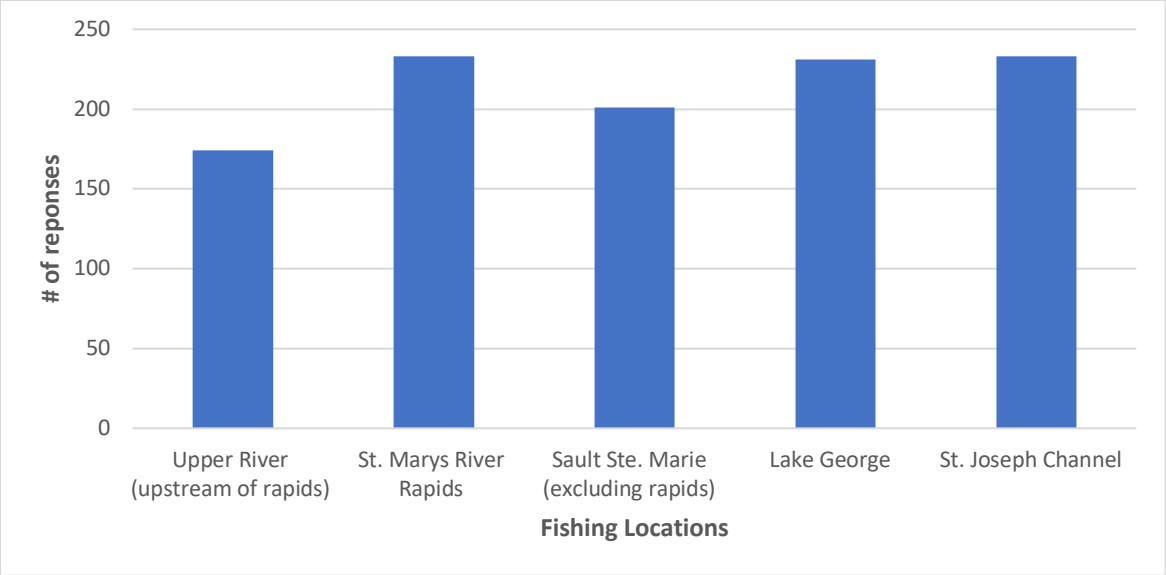



*Figure 7: Fishing location preference within the St. Marys River AOC.*

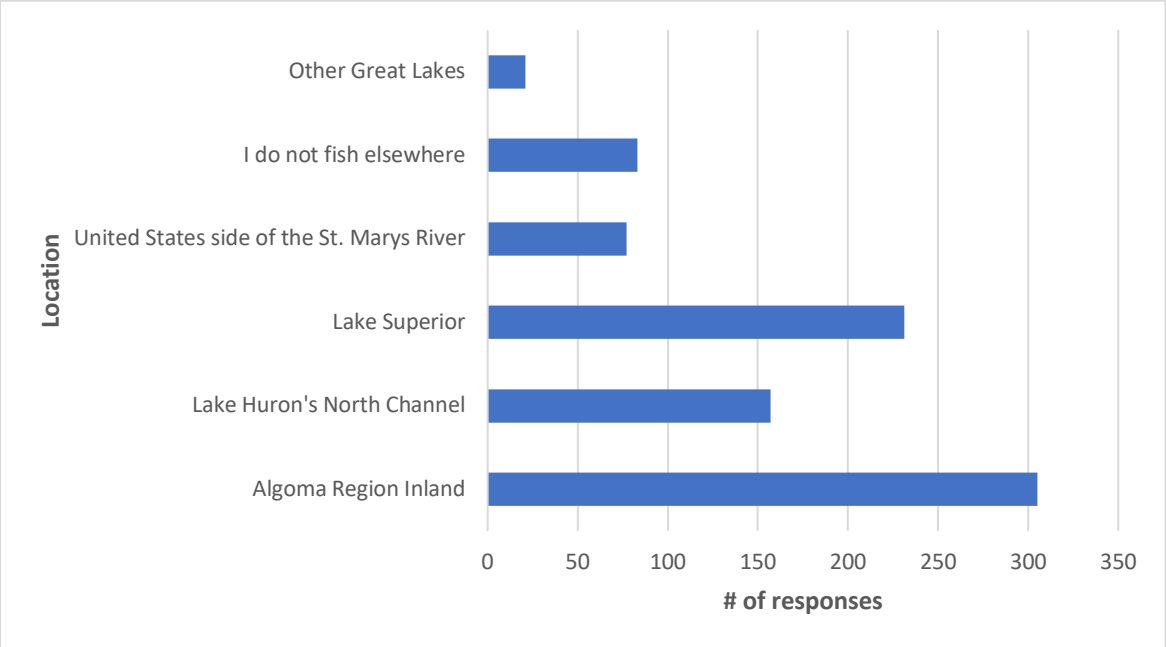



*Figure 8: Locations outside of the AOC where survey participants like to fish.*

### iii) Preference for eating fish caught in the St. Marys River AOC

Survey participants were asked whether they eat fish caught from the St. Marys River AOC. Out of the total survey respondents, 71% (N=479) do in fact eat fish caught within the river (Figure 5).

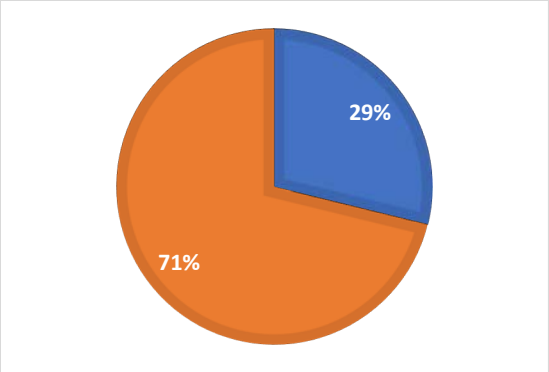



*Figure 9: Percentage of survey participants who eat the fish that they catch from the St. Marys River AOC.*

Of those survey participants (29%, N=194) who indicated they do not eat fish caught from the St. Marys River AOC, the most common reason for not wanting to is the belief that the water is polluted (N=97). In having an Area of Concern designation, one can assume some people may still think that the water is polluted. However, studies have shown that water quality in the St. Marys River AOC has greatly improved. In fact, the original three BUIs related to impaired water quality were officially redesignated to not impaired status in 2018. These are: *Eutrophication and Undesirable Algae*, *Degradation of Aesthetics* (Ginou, 2016), and *Beach Closings* (Derickx, 2017).

The second most common reason stated for not wanting to eat fish caught from the St. Marys River AOC is the preferred practice of catch and release, and the desire to protect fish populations (N=82). For the St. Marys River AOC, the *Degradation of Fish and Wildlife Populations* BUI was based on fish population dynamics and assessed whether local environmental conditions support a healthy fish population. The Department of Fisheries and Oceans Canada (DFO) conducted surveys in 2009 and 2014 to assess the St. Marys River fish community, and concluded the St. Marys River maintains a native fish community that is complex, diverse, and healthy (O'Connor & Pratt, 2017).

The belief that the fish are diseased and/or unhealthy is the third most common reason (N=69) for not wanting to eat fish caught from the AOC. Consumption advisories for eating fish from the St. Marys River AOC is assessed through the MECP's Fish Contaminant Monitoring Program. Recent advisory comparisons show that "the safety of eating fish from the AOC is similar or better than other regions of the same lake as well as throughout the Canadian waters of the Great Lakes in general" (Gandhi et al. 2020).

Finally, some survey participants indicated that they prefer to purchase fish from a store or market (N=22), and some either don't like the taste of fish (N=14) or just don't like to eat fish

(N=8). Survey participants were given the option to include other reasons for not wanting to eat the fish from the river. Reasons given for this other category include: (i) not being able to catch any fish, (ii) allergies to fish, (iii) preference for fish from smaller inland lakes, and (iv) not wanting to consume toxins/heavy metals (Figure 6).

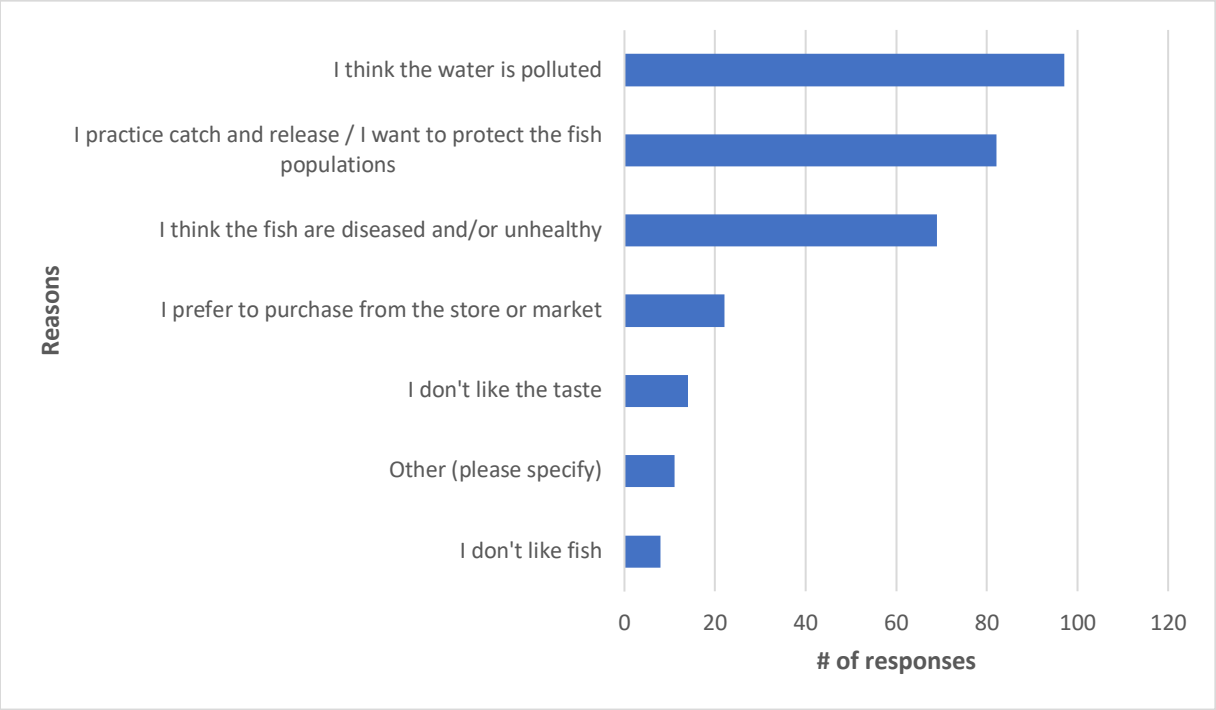
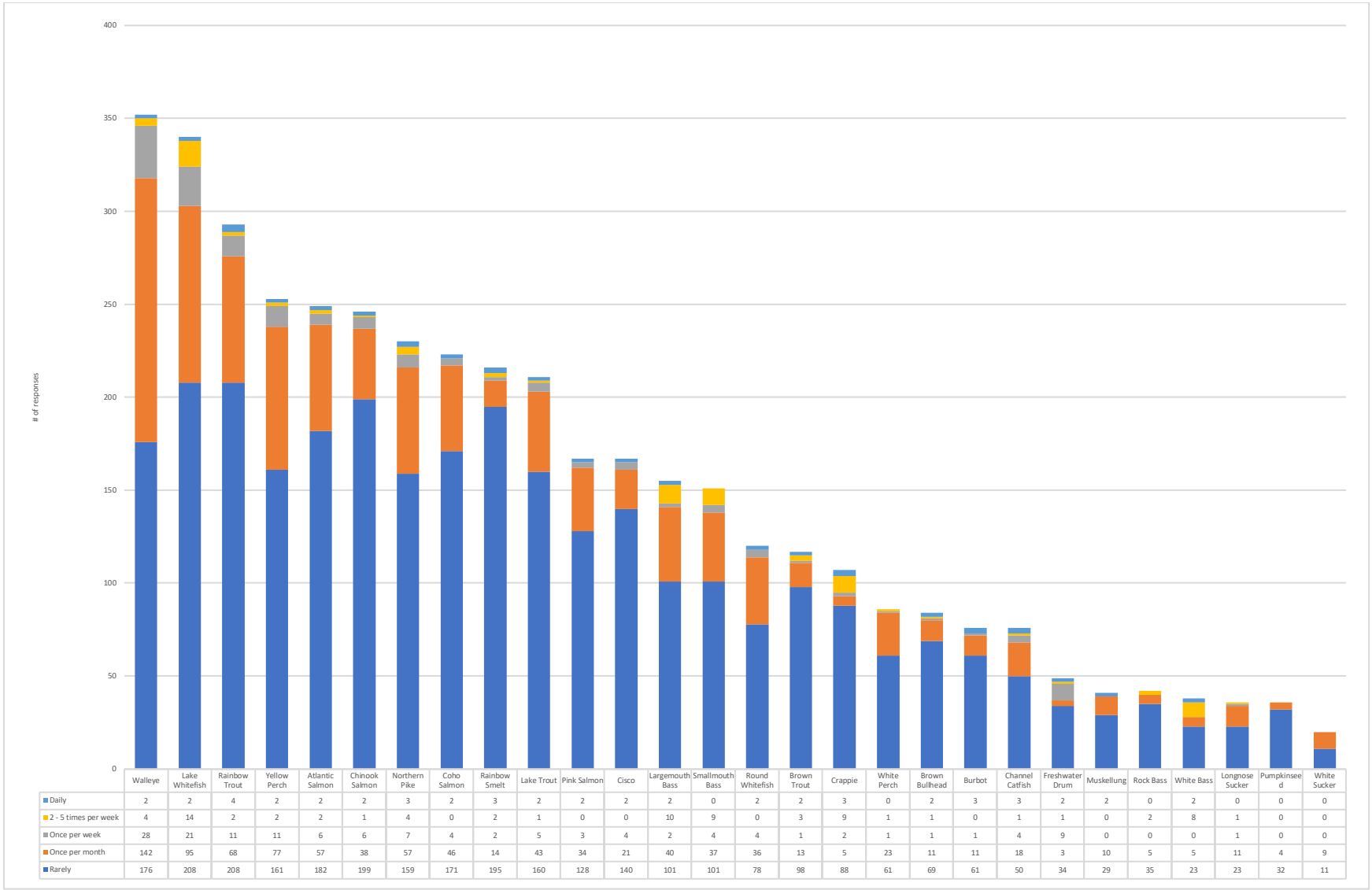



*Figure 10: Reasons for why survey participants don't eat fish caught from the St. Marys River AOC.*

### iv) Species consumed from the St. Marys River AOC

Based on the survey results, the three most sought after species of fish are: Walleye, Lake Whitefish, and Rainbow Trout (Figure 7). Although these species are the most consumed species, 99% of survey participants indicated that they consume 4 meals/month or less of Walley and Rainbow Trout, and 97% of participants indicated that they consume 4 meals/month or less of Lake Whitefish.




| | Walleye | Lake Whitefish | Rainbow Trout | Yellow Perch | Atlantic Salmon | Chinook Salmon | Northern Pike | Coho Salmon | Rainbow Smelt | Lake Trout | Pink Salmon | Cisco | Largemouth Bass | Smallmouth Bass | Round Whitefish | Brown Trout | Crappie | White Perch | Brown Bullhead | Burbot | Channel Catfish | Freshwater Drum | Muskellung | Rock Bass | White Bass | Longnose Sucker | Pumpkinseed | White Sucker |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily | 2 | 2 | 4 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 0 | 2 | 2 | 3 | 0 | 2 | 3 | 3 | 2 | 2 | 0 | 2 | 0 | 0 | 0 |
| 2 - 5 times per week | 4 | 14 | 2 | 2 | 2 | 1 | 4 | 0 | 2 | 1 | 0 | 0 | 10 | 9 | 0 | 3 | 9 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 8 | 1 | 0 | 0 |
| Once per week | 28 | 21 | 11 | 11 | 6 | 6 | 7 | 4 | 2 | 5 | 3 | 4 | 2 | 4 | 4 | 1 | 2 | 1 | 1 | 1 | 4 | 9 | 0 | 0 | 0 | 1 | 0 | 0 |
| Once per month | 142 | 95 | 68 | 77 | 57 | 38 | 57 | 46 | 14 | 43 | 34 | 21 | 40 | 37 | 36 | 13 | 5 | 23 | 11 | 11 | 18 | 3 | 10 | 5 | 5 | 11 | 4 | 9 |
| Rarely | 176 | 208 | 208 | 161 | 182 | 199 | 159 | 171 | 195 | 160 | 128 | 140 | 101 | 101 | 78 | 98 | 88 | 61 | 69 | 61 | 50 | 34 | 29 | 35 | 23 | 23 | 32 | 11 |

*Figure 11: How often do survey participants eat fish caught from the St. Marys River over the course of a year*

Among the survey participants, 479 (71%) indicated that they eat fish caught from the St. Marys River AOC, but only between 0-3% were categorized as very frequent consumers of 8 or more meals per month (Table 1). Based on these results, fish consumption restrictions equal to or greater than 8 meals per month can in fact be considered non-restrictive diet of fish. This supports the initial assessment published in March 2020 by experts at the MECP and the University of Toronto (Gandhi et al. 2020). The results of the community fish consumption upholds their assertion that 8+ meals per month can be considered a "non-restrictive" diet of fish in the context of the St. Marys River AOC and Remedial Action Plan. Thus, the first goal of the community survey is complete in order to help deliver a fulsome BUI status assessment.

*Table 9: Frequency of consumption for fish caught from the St. Marys River AOC.*

| **Fish Species** | **8+ meals/month** | | **4 meals/month** | | **1 meal/month** | | **<1 meal/month** | | **0 meals/month** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| Walleye | 6 | 1 | 28 | 6 | 142 | 30 | 176 | 37 | 127 | 27 |
| Lake Whitefish | 16 | 3 | 21 | 4 | 95 | 20 | 208 | 43 | 139 | 29 |
| Rainbow Trout | 6 | 1 | 11 | 2 | 68 | 14 | 208 | 43 | 186 | 39 |
| Yellow Perch | 4 | 1 | 11 | 2 | 77 | 16 | 161 | 34 | 226 | 47 |
| Atlantic Salmon | 4 | 1 | 6 | 1 | 57 | 12 | 182 | 38 | 230 | 48 |
| Chinook Salmon | 3 | 1 | 6 | 1 | 38 | 8 | 199 | 42 | 233 | 49 |
| Northern Pike | 7 | 1 | 7 | 1 | 57 | 12 | 159 | 33 | 249 | 52 |
| Coho Salmon | 2 | 0 | 4 | 1 | 46 | 10 | 171 | 36 | 256 | 53 |
| Rainbow Smelt | 5 | 1 | 2 | 0 | 14 | 3 | 195 | 41 | 263 | 55 |
| Lake Trout | 3 | 1 | 5 | 1 | 43 | 9 | 160 | 33 | 268 | 56 |
| Pink Salmon | 2 | 0 | 3 | 1 | 34 | 7 | 128 | 27 | 312 | 65 |
| Cisco | 2 | 0 | 4 | 1 | 21 | 4 | 140 | 29 | 312 | 65 |
| Largemouth Bass | 12 | 3 | 2 | 0 | 40 | 8 | 101 | 21 | 324 | 68 |
| Smallmouth Bass | 9 | 2 | 4 | 1 | 37 | 8 | 101 | 21 | 328 | 68 |
| Round Whitefish | 2 | 0 | 4 | 1 | 36 | 8 | 78 | 16 | 359 | 75 |
| Brown Trout | 5 | 1 | 1 | 0 | 13 | 3 | 98 | 20 | 362 | 76 |
| Crappie | 12 | 3 | 2 | 0 | 5 | 1 | 88 | 18 | 372 | 78 |
| White Perch | 1 | 0 | 1 | 0 | 23 | 5 | 61 | 13 | 393 | 82 |
| Brown Bullhead | 3 | 1 | 1 | 0 | 11 | 2 | 69 | 14 | 395 | 82 |
| Burbot | 3 | 1 | 1 | 0 | 11 | 2 | 61 | 13 | 403 | 84 |
| Channel Catfish | 4 | 1 | 4 | 1 | 18 | 4 | 50 | 10 | 403 | 84 |
| Freshwater Drum | 3 | 1 | 9 | 2 | 3 | 1 | 34 | 7 | 430 | 90 |
| Muskellung | 2 | 0 | 0 | 0 | 10 | 2 | 29 | 6 | 438 | 91 |
| Rock Bass | 2 | 0 | 0 | 0 | 5 | 1 | 35 | 7 | 437 | 91 |
| White Bass | 10 | 2 | 0 | 0 | 5 | 1 | 23 | 5 | 441 | 92 |
| Longnose Sucker | 1 | 0 | 1 | 0 | 11 | 2 | 23 | 5 | 443 | 92 |
| Pumpkinseed | 0 | 0 | 0 | 0 | 4 | 1 | 32 | 7 | 443 | 92 |
| White Sucker | 0 | 0 | 0 | 0 | 9 | 2 | 11 | 2 | 459 | 96 |

Recall the second goal of the community survey was to gain insight into the consumption of Chinook Salmon, because it was the one fish species that had higher restrictions for consumption when caught from the St. Marys River AOC compared to those caught from Lake Superior and Lake Huron. Gandhi et al. (2020) reported that advisories on fish consumption for AOC fish are similar to reference locations in Lakes Huron and Superior, with the exception of Chinook Salmon. However, the MECP's *Guide to Eating Ontario Fish* advises people can still eat 1-4 meals per month of this fish species. The results of the community survey shows that less than 1% (N=3) of survey participants consume Chinook Salmon more frequently than that. Therefore, the fact that Chinook Salmon caught from within the AOC have relatively higher consumption restrictions compared to those from the connecting lakes is not a cause of impairment to the BUI, because only 3 people out of 673 (0.45%) surveyed prefer to consume more than what the MECP's *Guide to Eating Ontario Fish* advises. Thus, the second goal of the community survey is complete in order to help support a fulsome BUI status assessment.

There are options available to select type, fish size and meal portion of fish from the AOC that can be safely consumed at a frequency of 8+ meals/month. Therefore, even though advisories are a little more restrictive for Chinook Salmon within the St. Marys River AOC as compared to reference sites, the results of this survey show that these restrictions still allow for a "non-restrictive" diet of fish from the St. Marys River AOC.

### v) Preferred preparation and cooking methods

The majority of survey respondents (N=399, 59%) prefer to fry their fish (Figure 8). Certain toxins – including PCBs and dioxins and furans that drive advisories for the St. Marys River – accumulate in the fat of fish. Cooking methods that allow for the fat to drip away from the fish can help to reduce these toxins being consumed. In addition to cooking methods, the way a fish is prepared for consumption can also help to reduce toxins. Trimming off the fat and removing the skin before cooking reduces the amount of contaminants, as well as removing fish organs and eggs. Fifty-six percent of survey respondents prefer to eat fish as fillets with the skin removed (Figure 9).

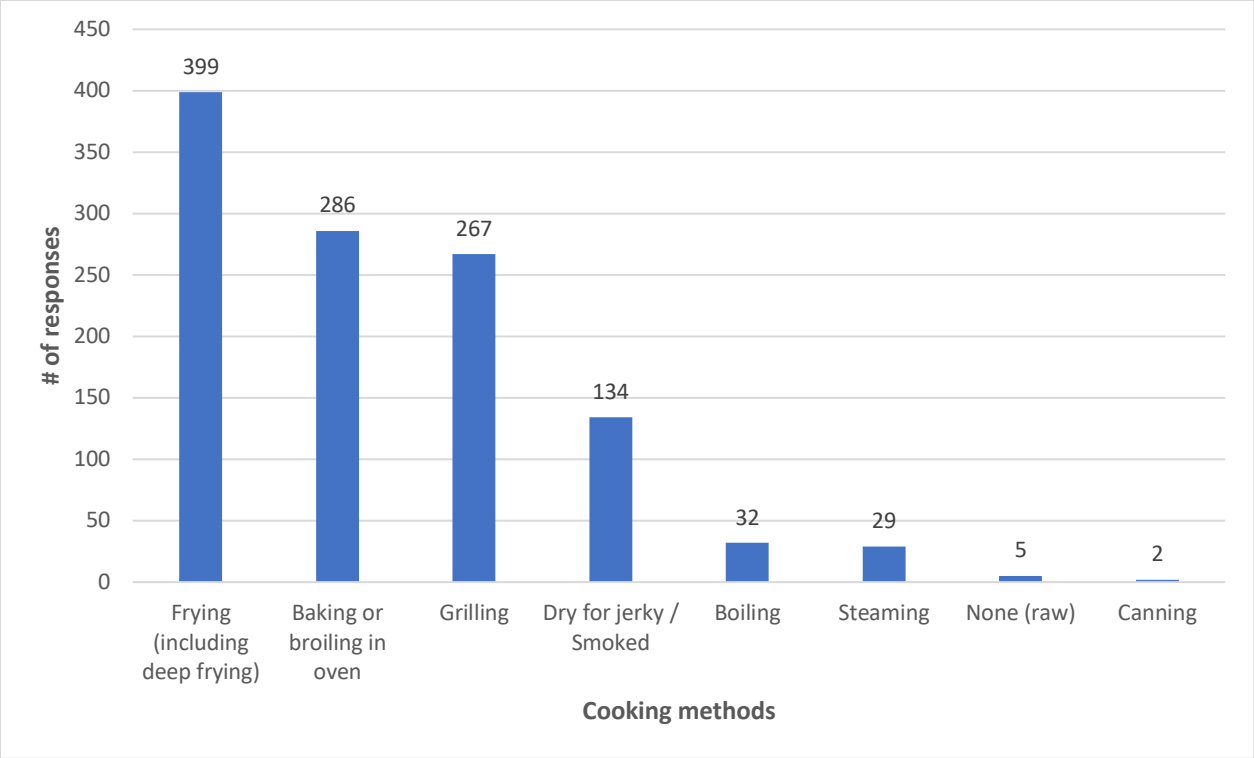



*Figure 12: Preferred methods used to cook fish ranked from greatest to least.*

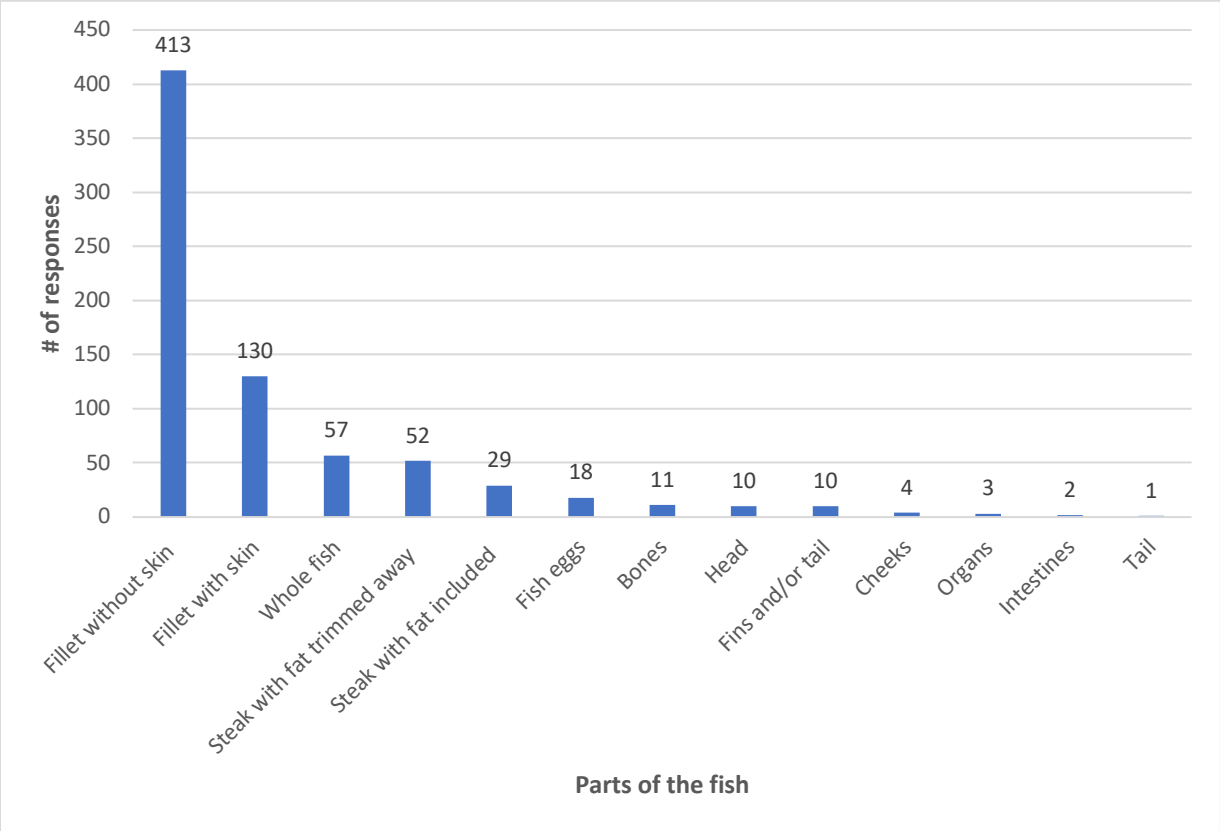



*Figure 13: Parts of the fish consumed ranked from greatest to least.*

### vi) Guide to Eating Ontario Fish

Fish can be part of a healthy diet, but they can sometimes contain contaminants. In order to minimize exposure to harmful toxins it is important to make informed decisions by following consumption advice provided in the MECP's *Guide to Eating Ontario Fish*[3]. The guide provides information on the type and amount of fish that are safe to eat.

Advisories in the *Guide to Eating Ontario Fish* are based on two separate benchmarks: general population and sensitive population. The sensitive population includes children under the age of 15 and women of child-bearing age. Fish consumption advice is more conservative for the sensitive population. Many survey respondents indicate that they share fish with other family members and friends (Table 2). It is important to understand the difference in consumption advice when preparing, cooking, and sharing fish meals with others belonging to the sensitive population.

*Table 10: Responses to "who else eats the fish you catch?"*

| Who else eats the fish you catch? | # of Responses |
|---|---|
| Spouse/Partner | 329 |
| Children under age of 15 | 143 |
| Children 15 and older | 110 |
| Pregnant family members | 13 |
| Other family members | 228 |
| Neighbours or friends | 158 |
| Only me | 42 |

Only 59% of the survey participants have heard about the *Guide to Eating Ontario Fish* (Figure 10) and only 44% of these participants check the Guide prior to eating fish caught from the St. Marys River AOC.

[3] www.ontario.ca/page/guide-eating-ontario-fish

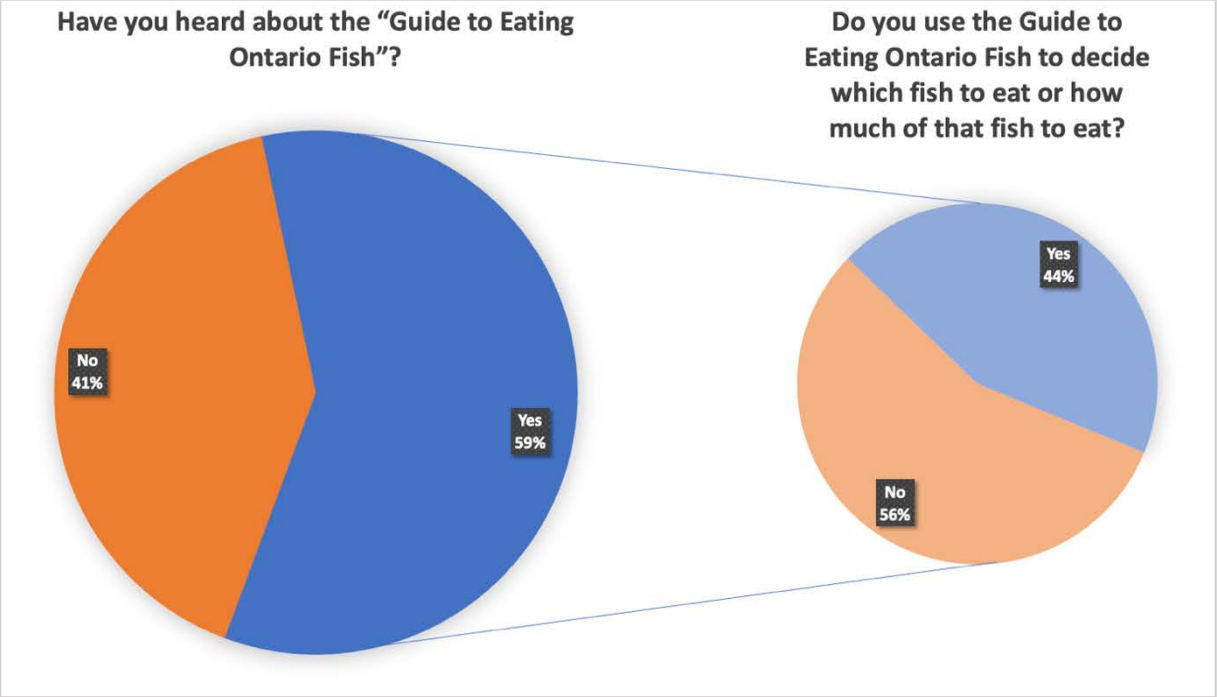



*Figure 14: Survey participant knowledge and usage of the "Guide to Eating Ontario Fish".*

Of the 56% of survey participants who choose not to use the Guide, the majority state that they prefer to use their own best judgement (N=113). Other responses include already knowing the information (N=38), finding the guide too complicated (N=32), and getting information elsewhere (N= 9). When giving the chance to provide other reasoning, many survey participants expressed that they do not eat enough fish to feel the need to consult consumption advice (Table 3).

*Table 11: Responses to why survey participants don't use the Guide to Eating Ontario Fish.*

| Reasons | # of Responses |
|---|---|
| The Guide is too complicated | 32 |
| I already know the information | 38 |
| I use my best judgement | 113 |
| I get information elsewhere | 9 |
| I don't eat fish | 18 |
| Other | 24 |

## Conclusion

This report summarizes the results of the St. Marys River AOC Community Fish Consumption Survey. The survey was an action recommended by experts at the MECP and the University of Toronto when publishing their initial assessment in March 2020 (Gandhi et al. 2020). The purpose of the survey is to help support a fulsome assessment of the status of the *Restriction on Fish Consumption* Beneficial Use Impairment, in particular to: 1) confirm or reject the authors' assertion that 8+ meals per month can be considered a "non-restrictive" diet of fish for the Remedial Action Plan of the St. Marys River AOC; and 2) gain additional insight on community consumption preferences for Chinook Salmon, the only fish species that had consumption advisories that were relatively higher when caught within the AOC compared to Lake Superior and Lake Huron.

As outlined in the Stage 1 and Stage 2 Remedial Action Plan reports (released in 1992 and 2002, respectively), historical reasons for BUI impairment included elevated levels of Mercury, PCBs and dioxins/furans in a variety of fish species, and the subsequent fish consumption advisories that were more restrictive for fish caught from the St. Marys River compared to Lake Superior and Lake Huron. For the beneficial use impairment to be considered no longer impaired, the established BUI delisting criteria states:

> ***The fish consumption advisories in the Area of Concern should be no more restrictive than the advisories for the same contaminants in suitable reference sites*.**

In 2020, an updated comparison between AOC fish and fish from upstream regions in Lake Superior and downstream regions in Lake Huron show that most advisories on fish consumption for AOC-caught fish are similar to or better than advisories in the reference locations (Gandhi et al. 2020). There is one exception, with Chinook Salmon having slightly more restrictive advisories. However, these advisories still allow for 1-4 meals per month and the results of the Community Fish Consumption Survey show only 0.45% of survey participants prefer to consume more than this amount. Therefore, for the purposes of the Remedial Action Plan, current advisories for consuming Chinook Salmon from the St. Marys River AOC does not create an impairment for the BUI.

Another important aspect of the Community Fish Consumption Survey was to determine the maximum number of meals of fish from the AOC that most people would typically consume. Assumptions/assertions have been made in prior assessments (Gandhi et al. 2020) using a benchmark of 8 meals/month or higher to define a non-restrictive diet of fish. Based on the results of the Community Fish Consumption Survey, 97% of survey participants do not consume

AOC-caught fish at a frequency of 8 or more meals per month. Therefore, for the purposes of the Remedial Action Plan, fish consumption restrictions of 8+ meals/month can be considered a non-restrictive diet of fish for the St. Marys River AOC.

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