

DEGRADATION WILDLIFE POPULATIONS (BUI #3B)



BACKGROUND

Wildlife, specifically species which are part of the aquatic ecosystem, are important ecological indicators commonly used for understanding the overall condition of the waters of the Great Lakes in an Area of Concern (AOC). Aquatic wildlife species used for this indicator are those that spend most (or all) of their lives near water and rely on the Niagara River for breeding and feeding, such as colonial waterbirds, marsh-dependent birds, amphibians and reptiles. The species used to assess this impairment are intended to represent the biological integrity (i.e., the condition of organisms) of the aquatic ecosystem and can also provide information about the water's chemical and physical condition in response to stressors within the AOC such as, legacy pollutants or poor habitat quantity or quality. Other stressors (e.g., climate change, diet, competition, or disease) are not typically considered as causes of impairment within the scope of the Remedial Action Plan (RAP) program. Habitat degradation is addressed through separate criteria although it is still considered as a factor in the context of population impacts.

The 2012 Canada-U.S. Great Lakes Water Quality Agreement (GLWQA) commits both countries to “maintain the chemical, physical, and biological integrity of the Waters of the Great Lakes”, including the connecting channels. Within the scope of the GLWQA's Annex 1 - Areas of Concern, there are fourteen recognized Beneficial Use Impairments (BUI) of these waters which, if impaired locally, would indicate areas where the goals were not being fully met. For a particular AOC, the nature of each identified BUI, whether it relates to an economic, human health, or environmental use, provides information about the water quality, habitat condition/availability, or biological integrity of the aquatic ecosystem. Together, the BUIs are used to indicate the status of an AOC. The *Degradation of Fish and Wildlife Populations* BUI¹ is an environmental indicator intended to understand the condition of and impacts to the Niagara River's wildlife related to historic pollution or habitat conditions due to issues occurring within the geographic scope of the Niagara River AOC.

There are two well-established monitoring programs that have been integral to understanding the impact of pollution on aquatic wildlife in an Area of Concern (AOC). Since the 1970s, Environment and

¹ The Niagara River Remedial Action Plan (RAP) has historically divided this indicator into two separate sub-BUIs focused on either fish or wildlife populations with their own specific delisting criteria. This chapter is for the wildlife portion of the BUI only. The fish component is discussed in a separate chapter.

Climate Change Canada (ECCC) has monitored the spatial and temporal trends of contaminants as well as the number of nests of Great Lakes colonial waterbirds (e.g., herons, gulls, terns). These bird species are important because they are top predators in the food web, they nest in colonies near water, and obtain almost all of their food (fish and aquatic invertebrates) from the water (United States Fish and Wildlife Service 2002). The Great Lakes Marsh Monitoring Program (GLMMP) was established in 1995, as a partnership between Birds Canada, ECCC, and the U.S. Environmental Protection Agency. The program focuses on marshes in the Great Lakes basin with a special emphasis on coastal Great Lakes marshes since many of these locations experienced declines in health due to heavy pollution and development (Birds Canada 2009a).

When the Niagara River was first listed as an AOC, the status of wildlife populations was unknown as there was limited information available (NRRAP 1993a). The RAP Stage 1 Report (1993a) noted that while the Niagara Peninsula has a wide diversity of bird species, a number of wildlife species were endangered or extinct; however, these appeared to be widespread in the developed portion of Ontario, rather than linked to an AOC-specific issue. A follow-up to the RAP Stage 1 Report which added long-term data (1977-1990) missing from the Stage 1 Report illustrated that levels of contaminants had been declining in colonial waterbird eggs and number of nests had increasing since the 1970s (NRRAP 1993b). Since that time, Niagara River corridor has been noted as an important staging and migration area for waterfowl and was designated an Important Bird and Biodiversity Area in 1996 because it supports one of the largest and most diverse concentrations of gulls in the world (Important Bird Areas Canada 2020). The Niagara River corridor also supports several of Canada's species-at-risk, including 44 species (mammals, birds, amphibians, insects, plants, and fungi) listed as Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (A. Bichel, pers. comm. 2020). Furthermore, the Niagara River corridor is home to the only known population of Dusky Salamander in Ontario (NRRAP 1993a, MECP 2020). In 2007, a technical review was conducted to review the impairment status, delisting criteria, and monitoring/assessment needs for all of the remaining impairments at the time (Mackay 2007). The technical review suggested that the wildlife portion of the *Degradation of Fish and Wildlife Populations* BUI status be changed to 'Impaired' mainly because of watershed-wide habitat issues and contaminant issues at Lyons Creek East, which are being addressed through the *Degradation of Benthos* BUI. Consequently, the BUI status was changed from 'Unknown' to 'Impaired' through the completion of the RAP Stage 2 Update Report (NRRAP 2009), despite evidence suggesting improved health of colonial waterbirds nesting within the Niagara River.

Recently, the Niagara River (Ontario) RAP team identified the need for updated monitoring efforts to validate earlier findings of improvements in colonial waterbird populations. As a result, scientists at ECCC conducted a 2-year study examining the spatial and temporal contaminant trends and nest counts in colonial waterbirds. A report on their findings is expected in 2020.

After the release of the Stage 2 RAP Update Report, Birds Canada completed a report summarizing 2 years of water quality, bird, and amphibian monitoring at various locations throughout the watershed, with only one Niagara River site (Archer et al. 2010). The report concluded that, when all marsh bird and amphibian data are considered collectively, the monitored sites were impaired in their overall ability to support these marsh species. However, the authors noted that the ecological condition of individual sites varied. Work is currently underway in partnership with Birds Canada to establish appropriate marsh-monitoring within the geographic scope of the AOC to obtain up-to-date, relevant information about marsh birds and amphibians at locations along the Niagara River, namely the upper portion from Fort Erie to the Horseshoe Falls.

BUI DELISTING CRITERIA REVIEW AND RECOMMENDATIONS

The delisting criteria are locally-developed, AOC-specific goals used to measure progress and assess the condition of each of the BUIs of an AOC. The delisting criteria should be specific, measurable, and feasible. The Niagara River's (Ontario) BUI delisting criteria were last formally reviewed and updated as part of the Niagara River RAP Stage 2 Update (NRRAP 2009). In 2012, the scope of the GLWQA was revised by Canada and the U.S., and specifically states that the BUIs apply to the "Waters of the Great Lakes", including the connecting channels (IJC 2012). This change led to a review of the delisting criteria to ensure they were aligned with the GLWQA's Annex 1 on Areas of Concern, while being realistic, feasible, and scientifically-defensible. A review by staff from Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP) (as part of a Canada-Ontario Agreement Task Team in 2017) indicated that some BUIs may need to be updated and/or revised. As a result of the suggestions, the NRRAP Committees agreed at a November 2018 meeting that the delisting criteria for the remaining five Niagara River BUIs should be reviewed by the Coordinating Committee (or a suitable expert working group) and potential revisions be brought forward to the Implementation and Public Advisory Committees for discussion.

To review and revise the *Degradation of Wildlife Populations* BUI delisting criteria, an expert Technical Work Group was formed consisting of representatives from Birds Canada, ECCC, Métis Nation of Ontario, Niagara Parks Commission, Niagara Peninsula Conservation Authority, and Ontario MECP—led by the RAP Project Manager. At their first meeting, the group reviewed the 2009 BUI Delisting Criteria and agreed that they were still relevant but required some revisions to ensure the criteria were clear, concise, and aligned with geographic scope of the Niagara River AOC (NRRAP April 14, 2020 meeting record). The proposed, revised criteria for removing the *Degradation of Wildlife Populations* BUI are similar to the 2009 version in that they use multiple lines of evidence to determine the condition and status of wildlife in the Niagara River AOC. The first criterion examines the condition of wildlife as it relates to impacts to habitat, while criteria 2 and 3 are related to chemical impacts in the

Niagara River. The main changes are: editing the text to ensure the criteria are clear, concise, and aligned to the geographic scope of the Niagara River AOC, as well as clarifying their intent and application by moving certain details from the criteria into the following section to provide more context, details, and guidance for the future assessment of the BUI. A major difference between the revised Niagara River delisting criteria (2020 version) and the 2009 version is the removal of the criterion that mentioned contaminated sediment sites in the AOC. There are no contaminated sediment sites on the Canadian side of the Niagara River proper (only one site remaining in the watershed—Lyons Creek East). This matter is addressed by a separate BUI (*Degradation of Benthos*) and the Lyons Creek East site will continue to be monitored and assessed through its own delisting criteria, regardless of the status of the *Degradation of Wildlife Populations* BUI.

The *Degradation of Wildlife Populations* BUI will no longer be impaired when...

	Proposed Revised Delisting Criteria (2020)	RAP Stage 2 Update Report (2009)
1	breeding bird and amphibian communities at selected wetland sites along the Niagara River are the same as (or better than) suitable reference site(s);	Maintenance of wetland-dwelling wildlife populations and diversity at or above suitable non-AOC reference sites (as determined by indicators such as Indices of Biotic Integrity and/or community status assessments derived from Bird Studies Canada’s Marsh Monitoring Program).
2	breeding colonial waterbird populations within the Niagara River AOC are the same as (or better than) suitable reference sites;	Maintenance of colonial nesting birds populations on the Canadian side of the Niagara River at or above suitable non-AOC reference sites, examined through the use of sentinel species (i.e., Black-crowned Night- Herons, Herring and/or Ring-billed Gulls).
3a	temporal trends in contaminant concentrations in eggs, tissues, or whole-body burden of sentinel species in the Niagara River AOC are stable or declining;	Temporal trends in contaminant levels (PCBs and dioxin-like PCBs), examined through the use of sentinel species, (i.e., Herring Gull, night-heron, snapping turtle eggs, and/ or livers of mink), are stable or declining. Spatial comparisons show that contaminant concentrations in the eggs of the above species in areas under the influence of the Niagara River (Ontario) AOC are equal to or less than those from sites removed from any influence of the AOC. If the whole body burden concentrations do exceed this level then they must not result in a population level affect to the bird and/or wildlife populations
AND 3b	spatial comparisons show that contaminant concentrations in eggs, tissues, or whole-body burden of sentinel species in the Niagara River AOC are stable or declining relative to other suitable reference sites;	
OR 3c	If the contaminant concentrations in 3a or 3b are not met, then they must not exceed established thresholds associated with potential population-level effects (i.e., reproductive impacts).	

<u>OR</u> 4	To be removed.	if a contaminated site ² (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife consumption, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.
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Description of delisting criteria and application guidance

This section is meant to provide a description of the main components and guidance on application of each criterion including suggestions for sentinel species, reference sites, and assessment metrics.

Criterion 1: Wildlife (bird and amphibian) community

This first criterion is meant to examine the overall community of marsh birds and amphibians breeding within the Niagara River AOC related to habitat-specific stressors.

The assessment of criterion 1 should use community-level metrics (e.g., species richness and total abundance for groups of species), species-level metrics (e.g., abundance for a particular species), and habitat metrics (e.g., emergent vegetation coverage). All metrics will be determined using the well-established Great Lakes Marsh Monitoring Program (GLMMP) protocol (Birds Canada 2009a & 2009b). Ecologically, a community refers to two or more populations of different species that occupy the same environment. Using community-level metrics to assess this criterion shows impacts from aquatic ecosystem stressors (such as habitat loss) broadly and is consistent with an ecosystem approach for evaluating the condition of the Niagara River. Species-level assessments show more specific differences that community-level assessments might not glean, and habitat metrics are used because of influence different habitat traits may have on the presence of birds and amphibians.

For the purpose of this criterion, ‘breeding bird’ specifically means marsh-nesting birds rather than colonial waterbirds (which are mentioned in criterion 2 & 3) or birds belonging to other habitat guilds (e.g., forest or prairie). The marsh-nesting habitat guild is important because it is relevant to AOC-specific issues such as the loss of coastal wetlands in the Upper Niagara River. There are seven marsh-nesting birds noted as focal species in the GLMMP as they rely on marsh habitat for one or more stages of their life cycle and because they are more elusive birds, are used in the broadcast call for the survey. These are, American Bittern, American Coot, Common Moorhen, Least Bittern, Pied-billed Grebe, Sora, and Virginia Rail (Birds Canada 2009a). Non-focal species are also recorded during the survey as

² meaning the 14 original sites identified in Niagara River RAP Stage 1 Update Report (1995) and evaluated as part of the Niagara River RAP Stage 2 Report (1995).

secondary species, aerial foragers, fly-throughs, or outside the station, and will be analyzed in the community-level metrics.

Like the marsh-nesting birds, amphibians (frogs, toads) are used as indicator species as part of the GLMMP because they rely on shallow marsh habitat for their life cycle, are sensitive to contaminants in water, representative of local conditions where they are found, and easily detected. There are thirteen frog and toad species in the Great Lakes basin that are widely distributed and may be present at monitoring locations, nine of which may be expected in the Niagara Region. The GLMMP amphibian surveys are conducted during the spring when male amphibians are calling. Details on how amphibian surveys should be conducted are provided in the *Marsh Monitoring Program Participant's Handbook for Surveying Amphibians* (Birds Canada 2009b).

For this criterion, the Technical Work Group suggests comparing Niagara River (Canadian) locations (Table 1 and Fig.1) to reference sites that have similar habitat features and are representative of local/regional issues. Due to the habitat requirements of the GLMMP, the potential monitoring sites along the Canadian side of the Niagara River will need to be reviewed to determine if they are suitable or not. Potential reference sites outside of the geographic boundary of the Niagara River AOC that may be considered in an assessment of criterion 1 include Twenty Mile Creek mouth near Jordan Harbour (43.158902, -79.374817) and/or Twelve Mile Creek mouth near Erion Avenue (43.176352, -79.268038). Both locations are coastal wetlands outside the Niagara River AOC which are tributaries of Lake Ontario, have urban influences, and have historically been monitored by citizen scientists as part of the Marsh Monitoring Program. There are no known suitable reference sites on the eastern side of Lake Erie (within the Niagara Peninsula watershed). There may also be appropriate coastal wetland sites on the U.S. side of the Niagara River that could serve as within-AOC reference sites as done for the White Lake AOC (Tozer 2017).

Table 1. List of potential *Degradation of Wildlife Populations* BUI (criterion 1) monitoring sites along the Upper Niagara River with details about current monitoring efforts, evidence/expectations of wildlife species relevant to BUI, influences from Niagara River or tributary waters, and recent restoration site.

Site Name	MAP ID	Amphibians	Marsh Birds	Snapping Turtle	Niagara River	Tributary	Restoration site?	Comments
Hook Island	1				•		-	Foot of Dufferin Street in Fort Erie, site is establishing wetland vegetation but high water levels might be impacting suitability.
Frenchman's Creek wetland	2	•	•			•	-	Existing wetland located at the mouth of the tributary near overpass/bridge a few metres before it meets the Niagara River.
Frenchman's Creek restoration site	3				•		NC	Planned restoration site, not completed.
Miller's Creek wetland	4	•	•			•	-	Existing wetland located at the mouth of the tributary near overpass/bridge a few metres before it meets the Niagara River.
Miller's Creek restoration site	5				•		NC	Planned restoration site, not completed.
Gonders Flats	6	•	•				•	Existing established wetland site, improvements to wetland and riparian area completed in 18/19. Located 70 m from historic MMP site called Baker's Creek MMP site (validated coordinates).
Baker's Creek restoration site	7				•		•	Restoration completed in 2018.
Black Creek restoration site	8				•		NC	Planned for completion in 2020.
Boyer's Creek restoration site	9				•		•	Restoration completed in 2018.
Legends Golf Course wetlands	10	•	•	•		•	-	Audubon certified course; reduce use of fertilizer/pesticides and irrigation and improved habitat and water quality. Known snapping turtle breeding location. Three wetlands on site. Large pond likely man-made.
Usshers Creek wetland	11	•	•			•	-	Established wetland located at the mouth of the tributary where it meets the Niagara River.
Usshers Creek restoration site	12				•		•	Restoration completed in 2017.
Dufferin Island	13	•	•	•	•		-	Confirmed snapping turtle breeding location.

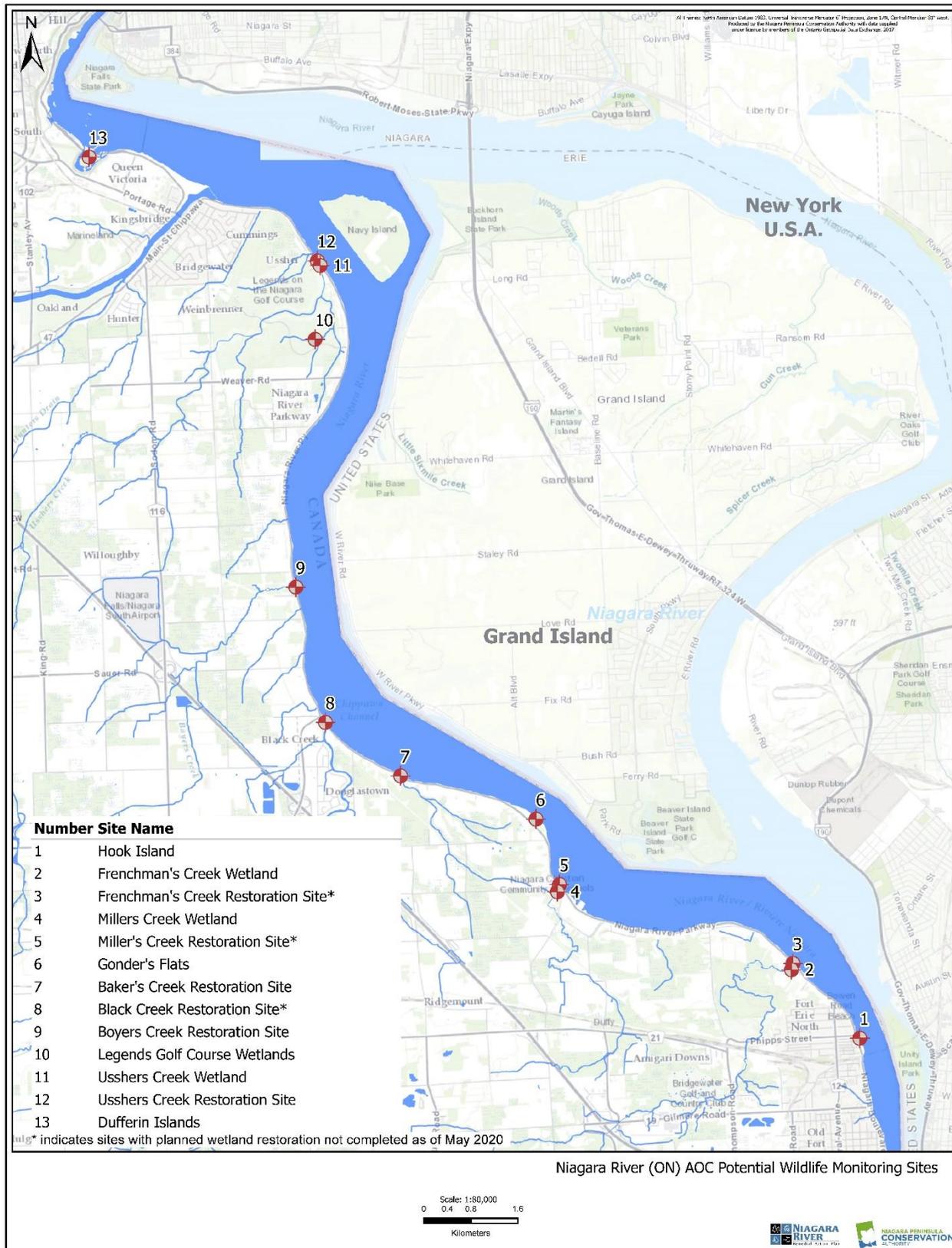


Figure 1. Map of potential Degradation of Wildlife Populations BUI (criterion 1) monitoring sites along the Upper Niagara River corresponding with sites in Table 1 above.

Criterion 2: Breeding colonial waterbird populations

This criterion refers to the population status of colonial waterbirds (e.g., Ringed-bill Gull (*Larus delawarensis*), Herring Gull (*Larus argentatus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Common Tern (*Sterna hirundo*) and Double-crested Cormorant) that breed and forage in the Niagara River AOC rather than species that migrate through the area or use the Niagara River as a stopover in the winter months. Colonial waterbirds have historically been used to estimate population trends in the Great Lakes during four decadal surveys (1977-2007) and annually at Weseloh Rocks from 2010-2017. The assessment of breeding colonial waterbird population trends can be conducted using historical nest count data; however, it should be clear that there is no recent colonial waterbird survey data from Weseloh Rocks due to high water levels since 2017. As such, another approach to consider for assessing this criterion is through artificial incubation of eggs collected from nesting site(s) in the Niagara River AOC. The artificial incubation approach is used to infer the status of waterbird populations through examining embryonic mortality due to contaminants.

Historically, the colony at Weseloh Rocks has been monitored on the Canadian side of the Niagara River AOC; however, since 2017, the site has been impacted by high water levels across the Great Lakes. Another potential site within the Niagara River AOC with a known colonial waterbird colony is located at the North Breakwall on the U.S. side of the Niagara River near the Buffalo Harbour. While this site is on the U.S. side, it is still a relevant location because it is within the geographic boundary of the Niagara River AOC, the waterbirds are expected to consume Niagara River fish, and results should be indicative of local Niagara River conditions.

To meet the criterion, results of breeding waterbird populations from sites in the Niagara River AOC must be compared to an appropriate reference site(s); however, finding a suitable reference location for the Niagara River is challenging because the Great Lakes' connecting channels (i.e., Niagara River, Detroit River, St. Clair River, St. Marys River, St. Lawrence River) are globally unique environments displaying characteristics of both lacustrine (lake) and riverine (river) environments. They contain aquatic habitats similar to other large rivers but have flows and productivity driven by the dynamics in their adjoining Great Lakes. While other connecting channels such as St. Marys River, St. Clair River, Detroit River, and St. Lawrence River may have comparable habitats, they are also AOCs and the comparison would be to another degraded location. Reference locations should be outside of the Niagara River AOC but within the eastern basin of Lake Erie to account for regional impacts. For other Niagara River BUIs such as the *Degradation of Fish Populations (#3A)*, the connecting Great Lakes were recommended as reference sites (i.e., Upper Niagara River compared to eastern basin of Lake Erie and Lower Niagara River with the western basin of Lake Ontario). Similarly, it is suggested that to assess criterion 2 & 3 known colonial waterbird nesting sites located in the eastern basin of Lake Erie should be used to compared to the site in the Upper Niagara River. Reference sites should have known

colonial waterbird colonies to accommodate monitoring. There are two potential reference locations to consider for comparison located in the eastern basin of Lake Erie: Mohawk Island (monitored in 2018) and Port Colborne (monitored annually for contaminants in Herring Gull eggs since 1974). Figure 2 is a map of nearby colonial waterbird monitoring locations.

Criterion 3a: Temporal contaminant concentrations

Criterion 3 has been divided into three parts for clarity. The first two parts (a & b) must both be met while part 3c only applies should part 3a or 3b fail to be met.

Criterion 3a specifically refers to contaminant trends declining (or stable) over time. Contaminants of interest for the assessment of this criterion include (but are not limited to) polychlorinated biphenyls (PCBs), organochlorine compounds, and polybrominated diphenyl ethers (PBDEs) as these have relevance to the historical contaminant issues in the Niagara River. Contaminant concentrations can be measured in the eggs, tissues, or whole-body burden of wildlife species (e.g., Herring Gull, Snapping Turtle, or Double-crested Cormorant) that breed within the Niagara River AOC. Gulls and cormorants have established, known nesting colonies and feed within the Niagara River; therefore, their contaminant concentrations are reflective of Niagara River conditions.

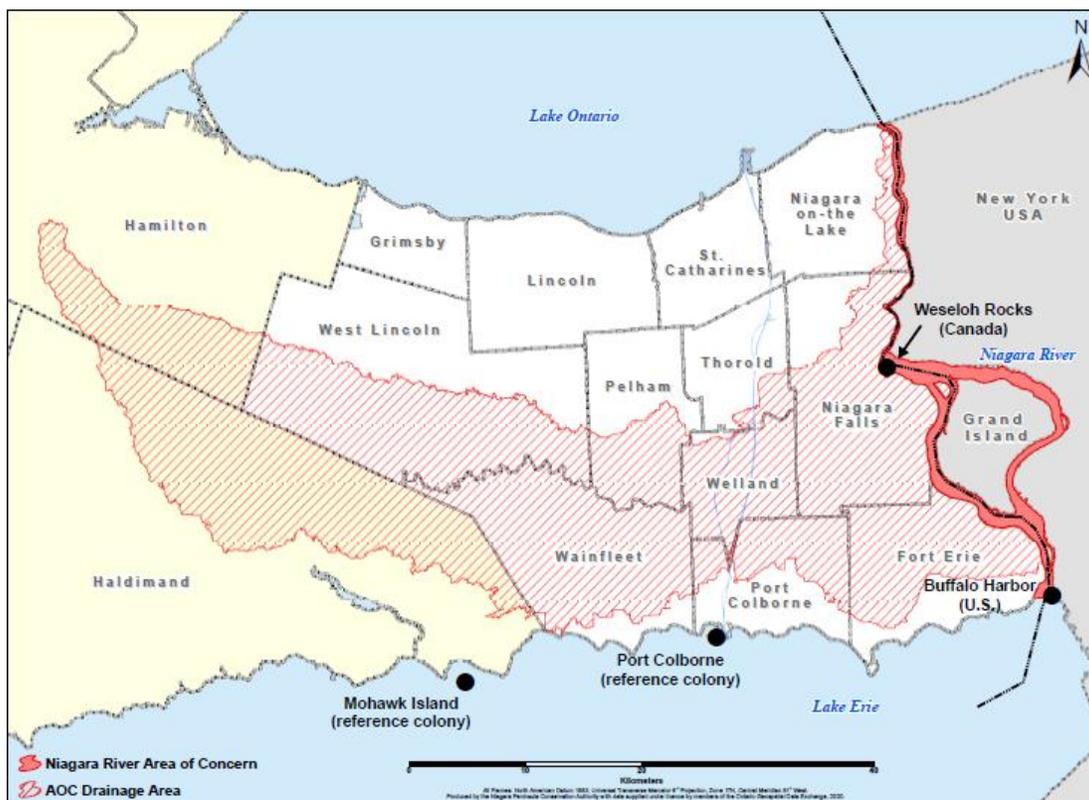


Figure 2. Map of colonial waterbird nesting colonies in the Niagara River Area of Concern and eastern basin of Lake Erie.

Criterion 3b: Spatial contaminant comparisons

Criterion 3b specifically refers to spatial contaminant concentration trends compared to other relevant locations (e.g., nearby reference locations, other Great Lakes AOCs). Contaminants of interest for the assessment of this criterion include (but are not limited to) polychlorinated biphenyls (PCBs), organochlorine compounds, and polybrominated diphenyl ethers (PBDEs) as these have relevance to the historical contaminant issues in the Niagara River. Contaminant concentrations can be measured in the eggs, tissues, or whole-body burden of wildlife species (e.g., Herring Gull, Double-crested Cormorant) that breed within the Niagara River AOC. There is some anecdotal evidence that Snapping Turtles nest and feed near the Upper Niagara River or at the mouths of certain tributaries; therefore, these may be considered as additional information about contaminant concentrations in wildlife to assess this criterion.

As noted in criterion 2, the colonial waterbird colony at Weseloh Rocks was historically monitored on the Canadian side of the Niagara River AOC; however, since 2017, the site has been impacted by high water levels across the Great Lakes. Another potential site within the Niagara River AOC with a known colonial waterbird colony is located at the North Breakwall on the U.S. side of the Niagara River near the Buffalo Harbour. While this site is on the U.S. side, it is still a relevant location because it is within the geographic boundary of the Niagara River AOC, the waterbirds are expected to consume Niagara River fish, and results should be indicative of local Niagara River conditions. Reference locations should be outside of the Niagara River AOC and could include other Great Lakes locations such as two known nearby reference locations in the eastern basin of Lake Erie: Mohawk Island (monitored in 2018) and Port Colborne (monitored annually for contaminants in Herring Gull eggs since 1974). Refer to Figure 1 for a map of nearby colonial waterbird monitoring locations. Furthermore, comparisons could be made to other nearby Great Lakes AOCs (e.g., Detroit River or Hamilton Harbour) for added information/context.

Criterion 3c: Population-level effect

Criterion 3c only applies if criterion 3a and 3b are not met. If parts 3a and 3b are met, then there is no requirement to assess this criterion.

Criterion 3c is meant to examine the concentration of contaminants (e.g., PCBs, organochlorides, PBDEs) in eggs or tissues of Niagara River wildlife (as noted in parts 3a and 3b) compared to established thresholds (from the scientific literature) to infer population-level effects by examining reproductive impacts. For clarity, this criterion does not directly measure population-level effects, rather the assessment of this criterion would use clutch size, fecundity, viability of eggs, and hatchability of eggs to extrapolate potential population-level effects in Niagara River colonial waterbirds.

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