

# Recovery Strategy for the Riverine Clubtail (*Stylurus amnicola*), Great Lakes Plains population, in Canada

## Riverine Clubtail



2021



Government  
of Canada

Gouvernement  
du Canada

Canada

**Recommended citation:**

Environment and Climate Change Canada. 2021. Recovery Strategy for the Riverine Clubtail (*Stylurus amnicola*), Great Lakes Plains population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 3 parts, 37 pp. + v + 22 pp. + 5 pp.

**Official version**

The official version of the recovery documents is the one published in PDF. All hyperlinks were valid as of date of publication.

**Non-official version**

The non-official version of the recovery documents is published in HTML format and all hyperlinks were valid as of date of publication.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)<sup>1</sup>.

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Également disponible en français sous le titre  
« Programme de rétablissement du gomphe riverain (*Stylurus amnicola*), population des plaines des Grands Lacs, au Canada »

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ISBN 978-0-660-40408-0

Catalogue no. En3-4/345-2021E-PDF

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<sup>1</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html](http://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html)

# RECOVERY STRATEGY FOR THE RIVERINE CLUBTAIL (*Stylurus amnicola*), GREAT LAKES PLAINS POPULATION, IN CANADA

2021

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario* (Part 2) and the *Riverine Clubtail – Ontario Government Response Statement* (Part 3) under Section 44 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Riverine Clubtail, Great Lakes Plains population, in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario*, prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario*, prepared by Mlynarek (2015) for the Ontario Ministry of Natural Resources and Forestry.

Part 3 – *Riverine Clubtail – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources and Forestry.

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Part 2 – *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario*, prepared by Mlynarek (2015) for the Ontario Ministry of Natural Resources and Forestry

Part 3 – *Riverine Clubtail: Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources and Forestry

**Part 1 – Federal Addition to the *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario*, prepared by Environment and Climate Change Canada**

## Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)<sup>2</sup> agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Riverine Clubtail, Great Lakes Plains population, and has prepared the federal component of this recovery strategy (Part 1), as per Section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Ontario Ministry of Natural Resources and Forestry as per section 39(1) of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Ontario Ministry of Natural Resources and Forestry led the development of the attached recovery strategy for the Riverine Clubtail (Part 2) in cooperation with Environment and Climate Change Canada. The Province of Ontario also led the development of the attached Government Response Statement (Part 3), which is the Ontario Government's policy response to its provincial recovery strategy and summarizes the prioritized actions that the Ontario government intends to take and support.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Riverine Clubtail, Great Lakes Plains population, and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

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<sup>2</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2](http://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2)

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area<sup>3</sup> be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

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<sup>3</sup> These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the Oceans Act, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

## **Acknowledgements**

This document was developed by Ken Tuininga, Lee Voisin and Elisabeth Shapiro (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario (ECCC, CWS - ON)) as well as Kristina Fitzgerald and Marie-Claude Archambault (formerly ECCC, CWS-ON). Angela Darwin, Judith Girard, Krista Holmes, John Brett, Juliana Galvis-Amaya and Andrea Kettle (ECCC, CWS-ON), Matthew Huntley (ECCC, CWS-NCR), Colin Jones (Natural Heritage Information Centre, Ontario Ministry of Natural Resources and Forestry), Sarah Parna, Leanne Jennings, Ayesha Prasad, Lauren Sharkey (Ontario Ministry of Environment Conservation and Parks) reviewed and provided comments and advice during the development of this document.

Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Indigenous organizations, landowners, citizens, and stakeholders who provided input and/or participated in consultation meetings.



## Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the Government of Ontario's *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario* (Part 2 of this document, referred to henceforth as “the provincial recovery strategy”) and/or to provide updated or additional information. It should be noted that while the provincial recovery strategy and government response statement pertain to the Riverine Clubtail species as a whole, this federal addition is specific to the Great Lakes Plains population only.

Environment and Climate Change Canada (ECCC) is adopting the Ontario recovery strategy (Part 2) with the exception of section 2.0, Recovery. In place of section 2.0, ECCC has established a population and distribution objective and performance indicators, and is adopting the government of Ontario's government-led and government-supported actions of the *Riverine Clubtail – Ontario Government Response Statement* (Part 3) as the broad strategies and general approaches to meet the population and distribution objectives.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the provincial recovery strategy referring to protection of the species' habitat may not directly correspond to federal requirements with respect to critical habitat. Recovery measures dealing with the protection of habitat are adopted; however, whether these measures will result in protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

## Recovery Feasibility Summary

Recently, the Government of Canada published the [proposed] “Species at Risk Policies- Policy on Survival and Recovery” (2016)<sup>4</sup> to guide consistent interpretation of major concepts applicable under the federal *Species at Risk Act* (SARA). Recovery feasibility for the Riverine Clubtail, Great Lakes Plains population, was assessed following this new guidance. If new information becomes available or if required due to amendments to the Policy on Survival and Recovery, feasibility may be re-assessed in an amendment to this recovery strategy.

Based on the best available information, the Riverine Clubtail, Great Lakes Plains population, was probably never particularly widespread or abundant in southern Ontario and is considered to be historically precarious (see Appendix A). It was discovered in Ontario in 1999 and despite a significant amount of surveying in southern Ontario is

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<sup>4</sup> [https://wildlife-species.canada.ca/species-risk-registry/document/default\\_e.cfm?documentID=2985](https://wildlife-species.canada.ca/species-risk-registry/document/default_e.cfm?documentID=2985)

only known from two locations<sup>5</sup> in southwestern Ontario. It is worth noting that in 2014 and 2015 two new locations for Riverine Clubtail were discovered in northern Ontario (NHIC 2016). Due to the geographic location of these new locations, it is unclear which population these locations belong to, though they are not expected to be included in the Great Lakes Plains population. As a result, these locations are not included in this federal addition.

For a species that is determined to be historically precarious, recovery will be considered feasible if the extent of irreversible change<sup>6</sup> is such that under the best achievable scenario<sup>7</sup> the condition of the species can be improved to a point that it is approaching the historical condition<sup>8</sup>. The main instance of irreversible change that must be considered for the Riverine Clubtail, Great Lakes Plains population, is the permanent loss, degradation, and fragmentation of significant suitable habitat.

There are unknowns regarding the feasibility of recovery for Riverine Clubtail, Great Lakes Plains population. In keeping with the precautionary principle, a recovery strategy has been prepared as per Section 41(1) of SARA, as would be done when recovery is determined to be feasible. This recovery strategy attempts to address the unknowns surrounding the feasibility of recovery. A more thorough discussion of the recovery feasibility assessment for Riverine Clubtail, Great Lakes Plains population, can be found in Appendix A.

To determine whether recovery is technically and biologically feasible in Canada for a historically precarious species, such as the Riverine Clubtail, Great Lakes Plains population, any information that is known or estimated about the historical condition of the species should be used to understand the appropriate context of each fundamental characteristic of the species (Table 1) (GOC 2016; Appendix A).

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<sup>5</sup> A location is a geographically distinct area in which a single threatening event can rapidly affect all individuals of the wildlife species present.

<sup>6</sup> A change that results in the establishment of a new set of ecological or biological conditions that constrain the ability of the species to return to its historic condition and which cannot reasonably be changed in a way that improves those conditions for the species within a biologically relevant time frame (e.g., loss of genetic diversity, loss of food/host species, effects of permanent infrastructure) (GOC 2016).

<sup>7</sup> The biologically and technically achievable scenario with the lowest possible risk of extinction to the species that can be achieved, taking into account irreversible change (GOC 2016).

<sup>8</sup> An estimate of the historic level of redundancy, resilience, representation, population and distribution, trend, threats, ecological role and any other factors that together determine the risk of extinction or extirpation of the species in Canada prior to significant effects of human activity, based on best available information (GOC 2016).

**Table 1. Determination of Recovery Feasibility for Historically Precarious Species**

<b>Fundamental Species Characteristic</b>	<b>Recovery Threshold</b>	<b>Technically and Biologically Feasible to Achieve Recovery Threshold Before Opportunity Lost? (Y/N/Unknown)</b>
<b>Population Trend</b>	Stable or increasing over 10 years or 3 generations whichever is longer (up to 100 years).	Unknown
<b>Resilience (Population size)</b>	Approximating historical condition	Unknown
<b>Redundancy (Population # / Distribution)</b>	Approximating historical condition	Unknown
<b>Population Connectivity</b>	Approximating historical condition	Unknown
<b>Mitigation of Human-caused Threats</b>	Significant threats avoided or mitigated to the extent that they no longer threaten the species	Unknown
<b>Species Condition<sup>9</sup></b>	Improved over when first assessed as at risk	Unknown
<b>Representation (Species presence in appropriate ecological communities)</b>	Approximating historical condition at a coarse scale	Unknown
<b>Independent of connectivity with populations outside of Canada</b>	Connectivity okay if necessary	Yes
<b>Independent of Species Interventions</b>	Yes	Yes

## Narrative to Support Recovery Feasibility

The distribution of Riverine Clubtail is highly localized and limited to rivers and riparian zones. However, it is able to inhabit a wide variety of riverine habitats across its Canadian range including small to large rivers with nearby well vegetated riparian forest. The species is reliant upon continuous suitable habitat for dispersal, which makes it sensitive to habitat fragmentation. The Great Lakes Plains population is found in two isolated locations in southern Ontario and is not considered to be connected to any other populations in Canada or the United States. It is found along two tributaries (Big Creek and Big Otter Creek) of Lake Erie in Norfolk and Elgin counties (COSEWIC 2012). The Great Lakes Plains population is surrounded by agricultural land, and the pressures associated with this land use, as well as other types of development, serve to

<sup>9</sup> The condition of the species refers to the combination of the level of redundancy, resilience, representation, population and distribution, trend, threats, ecological role and any other factors that together determine the risk of extinction or extirpation of the species in Canada (GOC 2016).

isolate the population. This makes the currently existing suitable habitat essential to the species.

The Great Lakes Plains population's historical condition in Canada is not well documented, as the population was first observed in 1999 (Catling et al. 1999). Data collected over the last 20 years suggest that the species has always been reported to occur in small colonies and is not considered abundant; most survey records report six or fewer adults and/or emerging larvae (COSEWIC 2012).

Given the extent of irreversible change the species has experienced, the unknowns concerning the historical condition of the Riverine Clubtail as well as the lack of abundance measures, it has been determined that the feasibility of recovery for the Riverine Clubtail, Great Lakes Plains population, in Canada is unknown. It is likely that the species was never widespread globally or in Canada, and will likely continue to be considered rare in Canada despite recovery actions to mitigate threats and fill knowledge gaps.

## 1. COSEWIC\* Species Assessment Information

**Date of Assessment:** November 2012

**Common Name (population):** Riverine Clubtail, Great Lakes Plains population

**Scientific Name:** *Stylurus amnicola*

**COSEWIC Status:** Endangered

**Reason for Designation:** This dragonfly population is restricted to two small creeks that flow into Lake Erie. The impact of a variety of threats was determined to be very high, suggesting that there may be a substantial decline over the next decade. The threats include water withdrawal from the streams, pollution, and invasive alien species of fish that would feed on dragonfly larvae.

**Canadian Occurrence:** Ontario

**COSEWIC Status History:** Designated Endangered in November 2012.

\* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

## 2. Species Status Information

Riverine Clubtail is separated into three populations in Canada by COSEWIC: (1) the Ottawa River and St. Lawrence River valleys of Quebec; (2) the central north shore of Lake Erie in Ontario and (3) southcentral Manitoba which contain the Boreal, Great Lakes Plains and Prairie populations respectively. The Boreal and Prairie populations, which are not addressed in this federal addition, are both designated data deficient<sup>10</sup> (COSEWIC 2012).

Riverine Clubtail, Great Lakes Plains population, is listed as Endangered<sup>11</sup> on Schedule 1 of the *Species at Risk Act* (SARA) (S.C. 2002, c. 29). In Ontario, the species is also listed as Endangered<sup>12</sup> under the *Endangered Species Act, 2007* (ESA) (S.O. 2007, c. 6) and receives species and habitat protection under the ESA. The global rank for the species is Apparently Secure (G4). It is considered Vulnerable (N3) in Canada, Critically Imperiled (S1) in Ontario and Vulnerable (S3) in Manitoba and Quebec (NatureServe 2019; Appendix C). Approximately 5% of the global range for the species occurs in Canada (COSEWIC 2012).

<sup>10</sup> Data Deficient : A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

<sup>11</sup> A wildlife species facing imminent danger of extirpation or extinction.

<sup>12</sup> A species that lives in the wild in Ontario but is facing imminent danger of extirpation or extinction.

Since the development of the COSEWIC (2012) report, two new locations for Riverine Clubtail have been discovered in northern Ontario, in Chutes Provincial Park (River aux Sables) and on the Spanish River near Webbwood, Ontario (NHIC 2016). It is currently not known if they would be recognized as part of the existing Boreal population (since it occurs within the Boreal COSEWIC National Ecological Area<sup>13</sup>) or whether they would become part of a new population of their own. While an assessment by COSEWIC would be required to confirm population delineation, these locations are not expected to be included in the Great Lakes Plains population, and are consequently not included in this federal addition. However, the provincial recovery strategy and government response statement apply to the species in Ontario, including these new locations, as a whole.

### **3. Threats**

#### **3.1 Threat Assessment**

Threats for the Riverine Clubtail, Great Lakes Plains population, are assessed based on the IUCN-CMP (International Union for Conservation of Nature–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For the purpose of threat assessment, only present and future threats are considered. Threat information in Table 2 is based on the COSEWIC assessment and status report for the species (COSEWIC 2012). Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section (Section 3.2).

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<sup>13</sup> National Ecological Areas were part of the basis for COSEWIC's recognition of three DUs (COSEWIC 2012).

**Table 2. Threat Classification Table for Riverine Clubtail, Great Lakes Plains population.**

Threat # <sup>a</sup>	Threat Description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>f</sup>
<b>1</b>	<b>Residential &amp; commercial development</b>	Medium	Restricted	Moderate	High
1.1	Housing & urban areas	Medium	Restricted	Moderate	High
<b>2</b>	<b>Agriculture &amp; aquaculture</b>	Low	Restricted	Moderate	High
2.1	Annual & perennial non-timber crops	Low	Restricted	Moderate	High
<b>4</b>	<b>Transportation &amp; service corridors</b>	Unknown	Restricted	Unknown	High
4.1	Roads & railroads	Unknown	Restricted	Unknown	High
<b>5</b>	<b>Biological resource use</b>	Unknown	Restricted	Unknown	High
5.4	Fishing & harvesting aquatic resources	Unknown	Restricted	Unknown	High
<b>7</b>	<b>Natural system modifications</b>	High	Large	Serious	High
7.2	Dams & water management/use	High	Large	Serious	High
<b>8</b>	<b>Invasive &amp; other problematic species &amp; genes</b>	Unknown	Large	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Large	Unknown	High
8.2	Problematic native species	Low	Restricted	Moderate	High
<b>9</b>	<b>Pollution</b>	High	Large	Serious	High
9.1	Household sewage & urban areas that include nutrients, toxic chemicals, and/or sediments	Low	Restricted	Slight-Moderate	High
9.3	Agricultural & forestry effluents	High	Large	Serious	High

<sup>a</sup>**Threat #** - Threats are numbered using the IUCN Classification System. Only those threats relevant to Riverine Clubtail, Great Lakes Plains population, are presented in this table and in Section 3.2. Description of Threats and Part 2 (*Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario*).

<sup>b</sup>**Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

<sup>c</sup>**Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

<sup>d</sup>**Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

<sup>f</sup>**Timing** – High = continuing; Moderate = only in the future (could happen in the short term [ $< 10$  years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

### **3.2 Description of Threats**

The overall threat impact for this species is Very High.<sup>14</sup> This overall threat considers the cumulative impacts of multiple threats. Threats are listed in order as they appear in the Threats Classification Table (Table 2).

See Section 1.6 (Threats to Survival and Recovery) in the provincial recovery strategy for more information on threats. The list below identifies how the IUCN threat categories used in Table 2 correspond to the threat categories used in section 1.6 of the provincial recovery strategy. Threat #5.4 Fishing & harvesting aquatic resources and #8.2 Problematic native species from Table 2 are identified in COSEWIC 2012 and were not addressed in the provincial recovery strategy and may also affect the Riverine Clubtail, Great Lakes Plains population.

#### **IUCN Threat #1. Residential & commercial development:**

See Section 1.6 of the provincial recovery strategy: '*Habitat loss and degradation*'

#### **IUCN Threat #2. Agriculture & aquaculture:**

See Section 1.6 of the provincial recovery strategy: '*Habitat loss and degradation*'

#### **IUCN Threat # 4. Transportation and service corridors:**

See Section 1.6 of the provincial recovery strategy: '*Road mortality*'

#### **IUCN Threat #5. Biological resource use:**

##### ***IUCN Threat 5.4 Fishing & harvesting aquatic resources***

Since 1986-87, about 75 km of Big Creek and Big Otter Creek have been treated with TFM (3-trifluoromethyl-4-nitrophenol) every 3-4 years in order to control Sea Lamprey (*Petromyzon marinus*) populations (COSEWIC 2012). Dragonfly larvae appear to be fairly resistant to TFM, but the impacts that this lampricide may have on prey species and overall stream ecosystem health are not known (COSEWIC 2012).

#### **IUCN Threat #7. Natural system modifications:**

See Section 1.6 of the provincial recovery strategy: '*Habitat loss and degradation*'

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<sup>14</sup> The overall threat impact was calculated following Master et al. (2012) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 3 High, 2 Low (Table 2). The overall threat considers the cumulative impacts of multiple threats.



## **IUCN Threat #8. Invasives & other problematic species & genes:**

### ***IUCN Threat 8.1 Invasive non-native/alien species***

See Section 1.6 of the provincial recovery strategy: *'Invasive and introduced species'*

### ***IUCN Threat 8.2 Problematic native species***

The modified landscape associated with residential and commercial development may lead to increased mortality rates for the Riverine Clubtail, Great Lakes Plains population, via increased exposure to predators (COSEWIC 2012). Predators such as raccoons, grackles, swallows, martins and starlings are subsidized in urbanized areas which causes their populations to increase. These species have the ability to find dragonfly larvae along streams, especially during periods of emergence, leading to increased mortality for the dragonfly (COSEWIC 2012). This threat has the capacity to affect both terrestrial and aquatic habitat components.

## **IUCN Threat #9. Pollution:**

See Section 1.6 of the provincial recovery strategy: *'Habitat loss and degradation'* and *'Pesticides and other toxins'*

## **4. Population and Distribution Objectives**

Under SARA, a population and distribution objective must be established for listed Endangered, Threatened and Extirpated species when recovery is deemed feasible. The population and distribution objective established by Environment and Climate Change Canada for the Riverine Clubtail, Great Lakes Plains population, is:

- To maintain the two existing local populations and the current distribution of the species in Canada, as well as any newly discovered local populations.

The Riverine Clubtail, Great Lakes Plains population, was assessed as Endangered by COSEWIC due to its small distribution range in Canada, small number of known locations and declining habitat quality. Given the population's limited distribution and apparent rarity, it would be inappropriate to focus recovery efforts on expanding the population beyond the known historical context. Nevertheless, if the population naturally expands, or if previously established populations are discovered, they are specifically included in the population and distribution objective. As the population size and trends for this population in Canada are unknown, setting a quantitative objective is not possible for this population at present. However, maintaining functional local populations over the long-term is likely to require stabilizing or increasing population sizes at each local population. In Canada, the two local populations are found at Big Otter Creek and at Big Creek on Lake Erie. Since little is known about the current status of Riverine Clubtail across its Canadian range and the effect that various threats may have on the species, recovery efforts

should include species-specific and broader habitat surveys to estimate the population abundance, survey for potential presence at additional sites, and monitor trends over time.

Maintaining the existing local populations of the Riverine Clubtail, Great Lakes Plains population, will require protection and management, including the identification of threats at a watershed scale, and the mitigation or removal of threats to the population, especially those related to water quality and water level management. Recovery efforts focus on working with partners and landowners to implement best management practices within watersheds, promoting the maintenance of healthy aquatic ecosystems, and conducting surveys to improve knowledge on the distribution and abundance of the population. The effects of certain potential threats on this population (e.g. invasive aquatic species, road collisions) are not well understood. Although these threats may affect the population, activities that can be undertaken to reduce their effects are much less clear and require further study.

This federal population and distribution objective is consistent with the province of Ontario's Government Response Statement developed under the provincial ESA, which outlines the provincial government's goal for the recovery of the species and summarizes the prioritized actions the government intends to take and support (see Part 3 for more information). The government of Ontario's goal for the recovery of the Riverine Clubtail in Ontario is to maintain viable, self-sustaining populations across the existing range of the species in Ontario. However, given that the federal population and distribution objective does not include the newly discovered locations in northern Ontario, there is a key difference in the geographic scope to which the provincial goal and federal objective apply.

## **5. Broad Strategies and General Approaches to Meet Objectives**

The government-led and government-supported action tables from the *Riverine Clubtail: Ontario Government Response Statement* (Part 3) are adopted as the broad strategies and general approaches to meet the population and distribution objective. Environment and Climate Change Canada is not adopting the approaches identified in Section 2 of the *Recovery Strategy for the Riverine Clubtail (Stylurus amnicola) in Ontario* (Part 2).

In addition to the above, and to address the two additional threats from COSEWIC 2012 (see section 3. Threats above) not specifically addressed in *Riverine Clubtail: Ontario Government Response Statement* (Part 3), threats from problematic native plants and animals can be mitigated by restoring natural vegetation along shorelines, removing invasive terrestrial and aquatic species and promoting landowner stewardship programs and best management practices at all known locations where required and thereby overall increasing the amount of native habitat for the population. Further investigation of the potential impacts of lampricide on dragonfly prey species and overall stream health will also need to be investigated.

## 6. Critical Habitat

### 6.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under Section 2(1) of SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species".

Identification of critical habitat is not a component of provincial recovery strategies under the Province of Ontario's ESA. Under the ESA, when a species becomes listed as Endangered or Threatened on the Species at Risk in Ontario List, it automatically receives general habitat protection. The Riverine Clubtail, Great Lakes Plains population, currently receives general habitat protection under the ESA. In some cases, a habitat regulation may be developed that replaces the general habitat protection. A habitat regulation is a legal instrument that prescribes an area that will be protected<sup>15</sup> as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for the Riverine Clubtail; however, the provincial recovery strategy for Riverine Clubtail includes a recommendation on the area that should be considered in developing a habitat regulation for the species (see Part 2, Section 2.4).

Critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is identified as the extent of habitat that contains the biophysical attributes (see Section 6.1.2) wherever they occur within the areas described in Section 6.1.1 below. Areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, are presented in Appendix B (Figures B-1 to B-1F). The UTM grid squares are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes.

Critical habitat is identified in this federal recovery strategy for the two local populations of Riverine Clubtail, Great Lakes Plains population, in Canada and is considered sufficient to achieve the population and distribution objectives; therefore no schedule of studies has been developed. If new or additional information becomes available, refinements to, or additional critical habitat may be identified in an amendment to this recovery strategy. For more information on critical habitat identification, contact Environment and Climate Change Canada – Canadian Wildlife Service at [ec.planificationduretablissement-recoveryplanning.ec@canada.ca](mailto:ec.planificationduretablissement-recoveryplanning.ec@canada.ca).

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<sup>15</sup> Under the federal Species at Risk Act (SARA), there are specific requirements and processes set out regarding the protection of critical habitat. Protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

### **6.1.1 Areas Containing Critical Habitat**

In Canada, the presence and persistence of Riverine Clubtail, Great Lakes Plains population, depends on an area greater than that occupied by individuals of the population. It requires ecological or landscape features that promote and maintain suitable habitat<sup>16</sup> for the dragonfly and allow for natural processes related to population dynamics and reproduction (e.g., foraging and migration/emigration) to occur.

The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, (Appendix B (Figures B-1 to B-1F)) are:

- 1) The portion of a river, stream or other watercourse 200 metres<sup>17</sup> upstream and downstream of a known observation of Riverine Clubtail, Great Lakes Plains population,; AND
- 2) The terrestrial habitat within 200 metres<sup>18</sup> of the portion of the river, stream or other watercourse described in 1).

### **6.1.2 Biophysical Attributes of Critical Habitat**

The Riverine Clubtail, Great Lakes Plains population, is found in both freshwater and terrestrial habitats. As larvae, the Riverine Clubtail, Great Lakes Plains population, requires streams or rivers with sandy bottoms in which to burrow for protection against predators and freshly emerged adults require trees and shrubs as perching locations within 200 m of a stream for foraging and mating (Mlynarek 2015). The biophysical attributes of the critical habitat for Riverine Clubtail, Great Lakes Plains population, are described in Table 3.

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<sup>16</sup> Suitable habitat is composed of the biophysical attributes (e.g. soil type, turbidity, species composition and species interactions) that provide individuals of the species the necessary conditions to carry out essential life processes.

<sup>17</sup> The 200 m distance is derived from the average daily distance dragonflies are known to travel (Mlynarek 2015).

<sup>18</sup> Due to the sinuosity of the watercourses, this distance is measured along the watercourse as well as a radial distance from its endpoints.

**Table 3. The area and associated biophysical attributes required for Riverine Clubtail to carry out stages of its life cycle.**

<b>Life Stage</b>	<b>Life Process</b>	<b>Area or Type of Site</b>	<b>Biophysical Attributes</b>
Larvae (nymphs)	Foraging (spring to fall) and emergence (late June to early July)	Freshwater stream or river habitats	<ul style="list-style-type: none"> <li>• Sandy or silty bottom</li> <li>• Predominately native vegetation along stream or river banks;</li> <li>• Shallow water, generally 0.5-1 m in depth;</li> <li>• Mix of slow and moderately flowing water for forming riffles and pools.</li> </ul>
Adult	Breeding and egg laying (early to mid July)		
Larvae	Emergence (late June to early July)	Terrestrial deciduous habitats	<ul style="list-style-type: none"> <li>• Broad-leaved vegetation such as trees, scattered shrubs and thickets along stream or river banks.</li> </ul>
Adult	Breeding and Foraging (late June to August)		

## 6.2 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Activities described in Table 4 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

**Table 4. Activities Likely to Result in the Destruction of Critical Habitat**

<b>Description of Activity</b>	<b>Description of Effect (biophysical attribute or other) in Relation to Function Loss</b>	<b>Details of Effect</b>
Alteration of hydrology (e.g. residential or agricultural development in groundwater recharge areas, building and operation of water control structures (such as dams) and extensive water taking).	The alteration of hydrology associated with residential development and agricultural development or agricultural activities would likely reduce the amount of groundwater reaching the watercourses. This could happen either through increased impermeable surfaces or loss of groundwater recharge through use for row crops. These changes could reduce the amount of habitat available to Riverine Clubtail at all life stages through a reduction of water flow leading to an overall loss of aquatic habitat, changes to shoreline vegetation (such as removal and/or introduction of invasive non-native plant species), changes to natural patterns of sediment accumulation, changes to temperature regimes (likely increases) and decreasing water quality by concentrating contaminants. Reductions in water flow could also lead to changes in shoreline vegetation reducing the habitat available for both larvae and breeding adults.	If this activity were to happen at any time of year, particularly in spring or summer, within, adjacent to or upstream of critical habitat it is likely to result in destruction of critical habitat.
Contamination of groundwater and surface water (e.g. large scale agricultural activities, use of road salt or urban contaminants).	Riverine Clubtail appears to have some pollution tolerance, however contamination (e.g. pesticides and herbicides, heavy metals and pharmaceuticals and phosphorus) of ground and surface water could impact reproductive success, reduce prey abundance or promote eutrophic conditions which could threaten the larval stage of the species.	If this activity were to occur at any time of the year, within or adjacent to critical habitat, it would be likely to result in the destruction of critical habitat.
Development and conversion of lands (e.g., shoreline alteration, creation of quarries, conversion of land to residential or commercial properties or agriculture such as intensive cropping).	Results in direct loss of vegetation (broad-leaved trees and other plants) which is used by adults for foraging, perching, roosting and reproduction. Conversion of land use may also result in a deterioration of water quality as a result of sedimentation, pollution, pesticides and nutrient loading, such that egg and larval habitat becomes unsuitable. The loss of vegetation may also increase the risk of predation of adults and juveniles by birds, mammals and other dragonflies. Loss of shoreline vegetation may alter bank stability, and increase both water temperature and sedimentation rates, making habitat unsuitable for eggs and larvae. The result of combined changes may lead to the loss of part or all of a population.	This activity when conducted within or near to the bounds of critical habitat, at any time of the year, is likely to result in destruction of critical habitat by removing foraging, perching, roosting, breeding and emerging habitat.

Description of Activity	Description of Effect (biophysical attribute or other) in Relation to Function Loss	Details of Effect
<p>Introduction of invasive species and activities that promote the expansion of invasive species (e.g. activities that introduce non-native plant seeds).</p>	<p>The introduction or expansion of species such as Curly Pondweed (<i>Potamogeton crispus</i>), which can form dense mats and change stream community structure, can reduce the flow rates necessary for oxygen intake, and can prevent larval burrowing. Curly Pondweed can be spread to new waterbodies by clinging to boats, boat trailers and equipment used in water, it can also spread if plant pieces are broken off and float downstream. The invasive vine Kudzu (<i>Pueraria lobata</i>) can cover shorelines and be too dense to be suitable habitat for Riverine Clubtail or its prey. Kudzu can be spread through introduction and escape of the rapidly growing plants or through dumping of soil containing plant material. Species such as Round Goby (<i>Neogobius melanostomus</i>) and Rusty Crayfish (<i>Oronectes rusticus</i>) can prey on eggs or larval dragonflies. Larvae may be particularly susceptible to non-native invasive species as invasives may not be recognized as predators. Rusty Crayfish are spread through use as bait. Round Goby can be spread through dumping of baitfish buckets or accidental transport in boats.</p>	<p>If this activity were to occur at any time of the year within or adjacent to critical habitat, it is likely to result in the destruction of critical habitat.</p>

## **7. Measuring Progress**

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Every five years, success of recovery strategy implementation will be measured against the following performance indicators:

- The existing local populations of the Riverine Clubtail, Great Lakes Plains population, and the current distribution of the species in Canada have been maintained, including any newly discovered local populations.

## **8. Statement on Action Plans**

One or more action plans will be completed and posted on the Species at Risk Public Registry for Riverine Clubtail, Great Lakes Plains population, by December 2027.



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## **Appendix A: Recovery Feasibility for Riverine Clubtail, Great Lakes Plains population**

### **Extent of Irreversible Change**

Throughout its life processes, the Riverine Clubtail uses streams or rivers and nearby riparian habitat. In southern Ontario, these habitats have been degraded and altered due to large scale landscape alteration for residential, commercial and agricultural development. This trend of habitat alteration for development began during European settlement, when riparian habitat was lost or fragmented due to alteration for agricultural and housing development. However, it is worth noting that compared to many streams in southern Ontario, the two creeks occupied by the Great Lakes Plains population (Big Otter Creek and Big Creek) in Elgin and Norfolk counties are relatively intact; the stream banks are primarily forested and unaltered by channelization and there has not been any large urban or industrial development in the watersheds (COSEWIC 2010). Despite this, aquatic habitat quality in this area appears to be declining with trends towards increased pollution from chloride, nitrate and phosphorus, exacerbated by ongoing water removal for irrigation (COSEWIC 2010). Elevated concentrations of phosphorus and nitrate are likely associated with intensive agriculture and fertilizer application in these watersheds, and represent the greatest source of these nutrients (COSEWIC 2010; COSEWIC 2012). Riverine Clubtail requires well-vegetated riparian habitat with trees and shrubs for perching. Although efforts have been made to restore and manage remaining suitable habitat, much of the surrounding potential suitable habitat for Riverine Clubtail is severely fragmented or has been destroyed by development. However, more effort can be made to improve the quality and quantity of habitat at extant locations and to promote surveys in suitable habitat to increase accurate reporting of this species across Canada.

### **Historical Context**

The first step in determining the recovery feasibility of Riverine Clubtail, Great Lakes Plains population, is to establish the historical context (whether the population's existence in Canada was historically precarious<sup>19</sup> or not precarious). To make this determination, Environment and Climate Change Canada uses the four criteria outlined below. A species (in this case a population) is considered to have been historically precarious if any of the following are known or likely to have been true in Canada, prior to significant effects from human activity:

1. The species was undergoing a long-term natural decline;
  - Unknown. The species has only been known in Canada since 1999 and no trend data on the Canadian populations exist.

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<sup>19</sup> A species that, prior to significant effects from human activity, was below the survival threshold or was dependent on demographic connectivity with outside populations for the long-term presence in Canada according to the best available information on the species population in Canada. Such a species may be recovered by achieving a condition that approximates its historical state.

2. The species consisted of fewer than 1,000 mature individuals;
  - Unknown. The exact number of mature individuals at each known location is unknown, and recent observations (e.g., within the past 10 years) have been of single or a small number of individuals. The species as a whole is considered rare in Canada with fewer than 100 mature individuals recorded in the country. However it inhabits a wide variety of riverine habitats that vary in size, flow rate, substrate and water quality (COSEWIC 2012) and is known to be elusive. The Great Lakes Plains population is found at only 2 locations in southern Ontario. It is unknown if the species historically previously existed in higher numbers.
3. The species existed at five or fewer locations or less than 20 km<sup>2</sup> index of area of occupancy<sup>20</sup> (IAO);
  - Unknown. The Great Lakes Plains population was first discovered in southern Ontario in 1999 and only two locations have been documented. The species as a whole is rare in Canada (fewer than 100 adults and 100 exuviae<sup>21</sup> found) and has not been found in any other potentially suitable watercourses in southern Ontario (COSEWIC 2012). So although the species is also found in small numbers in Quebec and Manitoba and recently at two additional locations in northern Ontario, it is not known to have existed at more than two locations in southern Ontario, despite a significant amount of surveying. While the historical IAO of Riverine Clubtail, Great Lakes Plains population, is unknown, it currently has an IAO of 48 km<sup>2</sup> between the two locations (COSEWIC 2012).
4. The species was dependent on connectivity with populations outside Canada for its long term presence in Canada.
  - Unknown. There is no evidence to suggest that Riverine Clubtail, Great Lakes Plains population, was connected to populations in the United States. The closest population in the United States is more than 300 km away in northwestern Ohio (COSEWIC 2012). Given the species' limited dispersal and the vast geographic separation between the Great Lakes Plains population and other populations in Canada and the U.S. it is unlikely that the Riverine Clubtail, Great Lakes Plains population, was dependent on connectivity with populations outside Canada, but the connectivity or lack of it cannot be determined with certainty.

Based on this assessment, Riverine Clubtail, Great Lakes Plains population, was never particularly widespread or abundant within Canada and is therefore considered to have been historically precarious.

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<sup>20</sup> A biologically defensible estimate of the occupied habitat within a wildlife species' range. Measured by an estimate of the number of grid squares occupied by extant populations (<https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/guidelines-index-area-occupancy.html>).

<sup>21</sup> An animal's cast or sloughed skin, especially that of an insect larva.

### ***Population Trend***

For the purposes of determining recovery feasibility, the population trend refers to whether a population can become stable or increase over a biologically relevant timeline. The Riverine Clubtail was first reported in Ontario in 1999, consequently there is no information on the population trend prior to that time nor currently.

Riverine Clubtail is typically observed in low numbers in southern Ontario though exact numbers of individuals are unknown. The maximum number of individuals observed in a single survey was 25 adults along a 250 m stretch of Big Otter Creek (Catling et al. 1999). However, most survey records report six or fewer adults and/or emerging larvae (COSEWIC 2012). Without a population estimate it is not possible to determine whether the Great Lakes Plains population is currently stable or declining.

### ***Resilience (Population size)***

Resilience is the species' ability to recover after a disturbance and is critical to the survival of a species that is historically precarious. Although a larger population size does not protect against all threats, it is a strong predictor of resilience against increasing rates of decline due to inbreeding or chance events (Elphick et al. 2001; McGowan et al. 2014).

The minimum viable population<sup>22</sup> size for Riverine Clubtail is not currently known; however determining this will provide necessary information on the number of individuals needed to maintain a self-sustaining population that is resilient against chance weather events (e.g., early frost, severe drought), and will aid in determining if recovery of the Great Lakes Plains population is technically and biologically feasible.

### ***Redundancy (Population size and distribution)***

Redundancy refers to the number of local populations and their distribution. If one location is damaged or destroyed, others can act as a source to restore this missing population. Persistence of Riverine Clubtail, Great Lakes Plains population, is governed by the survival of the population at its only two known locations. This makes the population particularly sensitive to habitat fragmentation, as isolated locations are less likely to be recolonized through natural dispersal.

The historical condition of Riverine Clubtail in Canada is not well documented, although historical observation and collection of data over the past twenty years suggest that the species has always been reported to occur in small numbers (COSEWIC 2012).

The distribution of Riverine Clubtail is very localized and limited to rivers and riparian zones. While the distribution is localized, Riverine Clubtail inhabits a wide variety of riverine habitat across its range in Canada, including small to large rivers with nearby well vegetated riparian forest. The Great Lakes Plains population is surrounded by

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<sup>22</sup> An estimate of the number of individuals required for a high probability of survival of a population over a given period of time.

agricultural land and has increased pressures of nutrient loading, pollution and development. These pressures isolate the population, and as a result, the existing suitable habitat is essential to maintain the presence of Riverine Clubtail.

### ***Population Connectivity***

Connectivity between sites within a location can be important in naturally restoring depleted populations. If connectivity between habitat patches is decreased (e.g. through habitat loss or population declines), remaining locations may be too small to be viable on their own, or may become inbred due to a lack of gene dispersal. In determining the appropriate level of population connectivity required to ensure survival or recovery of the Great Lakes Plains population in Canada, it is important to consider the historical level of connectivity to which the species is adapted.

Riverine Clubtail is associated with water courses and riparian habitat, many of which are degraded or fragmented in southern Ontario. It is dependent on its ability to disperse upstream and downstream along continuous suitable habitat. As stream and riparian areas decline in size and quality due to development and other threats the amount of continuous suitable habitat that Riverine Clubtail can use to conduct its life processes will be reduced.

The Great Lakes Plains population currently exists in two locations in southern Ontario which are close enough (5 km at one location) to allow for potential connectivity/colonization between them. The Great Lakes Plains population as a whole, however, will likely continue to occur as a highly isolated population in Canada.

### ***Mitigation of Human-caused Threats***

This criterion refers specifically to those threats that significantly increase risk to the population as a result of human activity. While there is uncertainty around the effects of some of the major threats to Riverine Clubtail, it is expected that most can be addressed through previously identified recovery actions which target the Endangered Laura's Clubtail (*Stylurus laurae*) which also occurs in Big Otter and Big creeks (COSEWIC 2010; Pulfer et al. 2011; COSEWIC 2012). Others are addressed in *Riverine Clubtail: Ontario Government Response Statement* and this recovery strategy. An appropriate level of habitat conservation and threat mitigation may reduce the risk associated with these threats; however some threats are ongoing and are not considered reversible. Maintaining and restoring suitable habitat within and around the two remaining locations is considered the most effective method to mitigate development threats. Ongoing best management practices to maintain appropriate water quality and river morphology will be essential to maintaining quality habitat within Big Otter Creek and Big Creek in the future.

### ***Representation in Appropriate Ecological Communities***

The distribution of Riverine Clubtail is limited to rivers and riparian zones. While the distribution is localized, Riverine Clubtail inhabits a wide variety of riverine habitat across its range in Canada, including small to large rivers with nearby well-vegetated riparian forest. Riverine Clubtail has been recorded consistently throughout Big Otter

Creek and Big Creek since first observed in 1999 and 2000 respectively (COSEWIC 2012).

Although there are only two known locations of the Great Lakes Plains population, there have been several new locations for Riverine Clubtail discovered since 1999 in Quebec, Manitoba, and northern Ontario, suggesting that there may be additional locations for the species near the Boreal and Prairie populations.

***Independent of Connectivity with Populations Outside of Canada***

The Riverine Clubtail lives in relatively stable habitats where the need for dispersal is lower (COSEWIC 2012). The presence of the Great Lakes and the large distances between existing Canadian populations make it highly unlikely that the Great Lakes Plains population of Riverine Clubtail was historically reliant on populations outside southern Canada for survival. Additionally, in the United States, the species is imperiled in each of the states adjacent to southern Ontario (see Appendix C for specific ranks): further decreasing the likelihood of dispersal between populations resulting in a rescue effect (COSEWIC 2012).

***Independent of Species Interventions***

It is expected that the persistence of Riverine Clubtail, Great Lakes Plains population, will be independent of continuous human interventions; however, habitat management, such as controlling invasive species (e.g. Round Goby (*Neogobius melanostomus*); Zebra Mussel (*Dreissena polymorpha*)(Mlynarek 2015)) will likely be periodically required to help maintain habitat suitability.

## Appendix B: Critical Habitat for the Riverine Clubtail, Great Lakes Plains population, in Canada

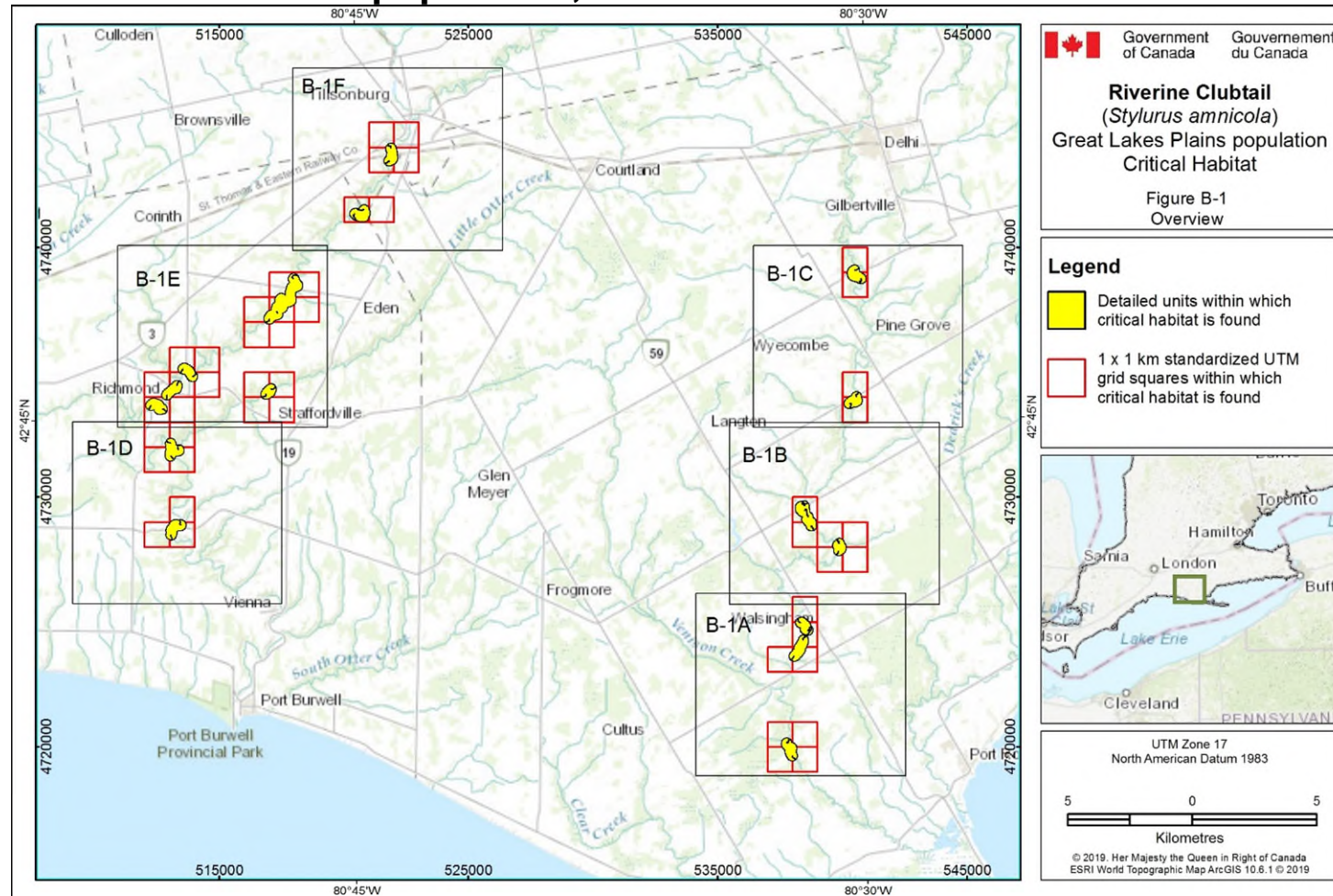


Figure B-1. Key overview map for areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Figures B-1A to B-1F. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.



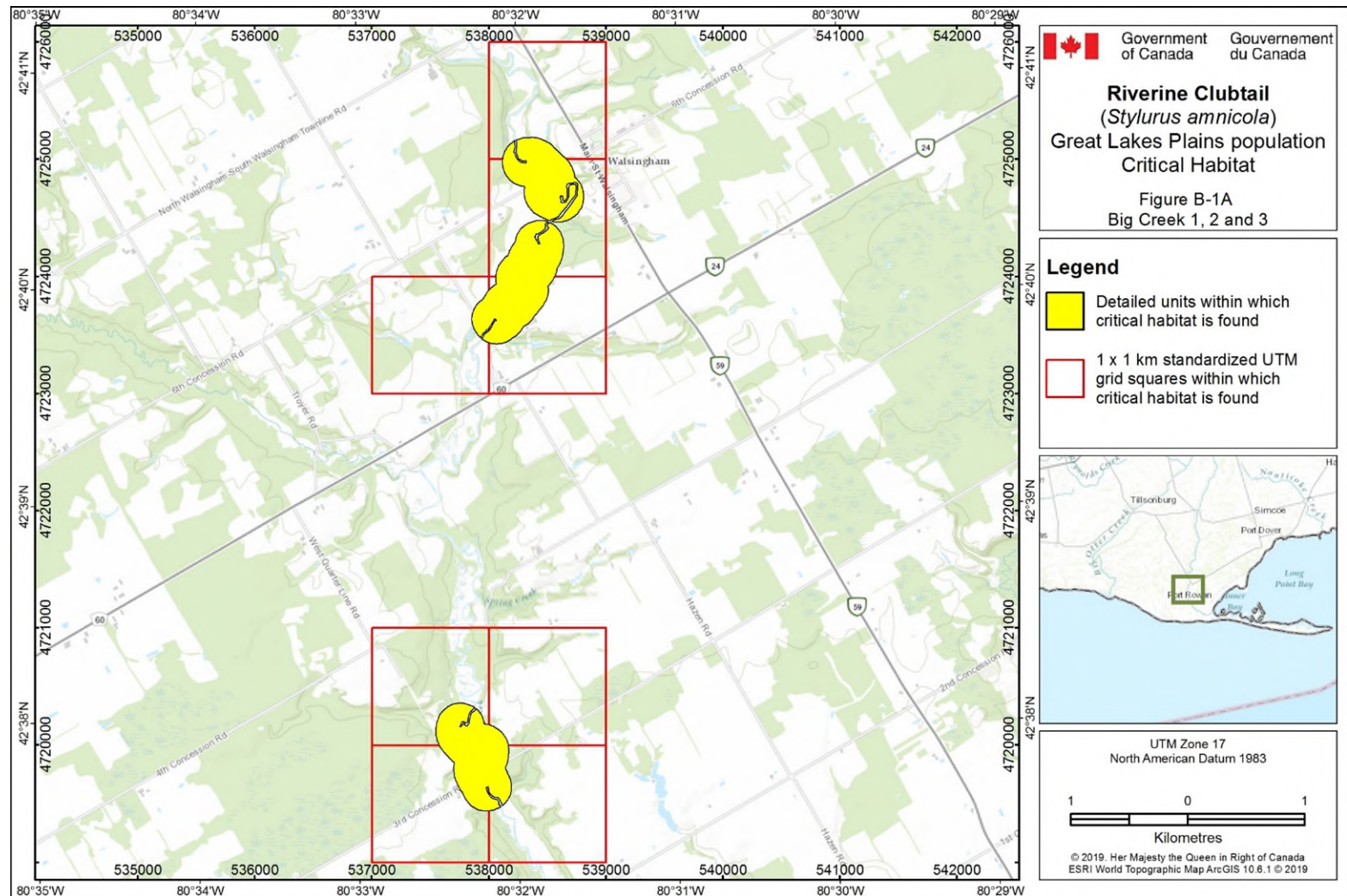


Figure B-1A. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.

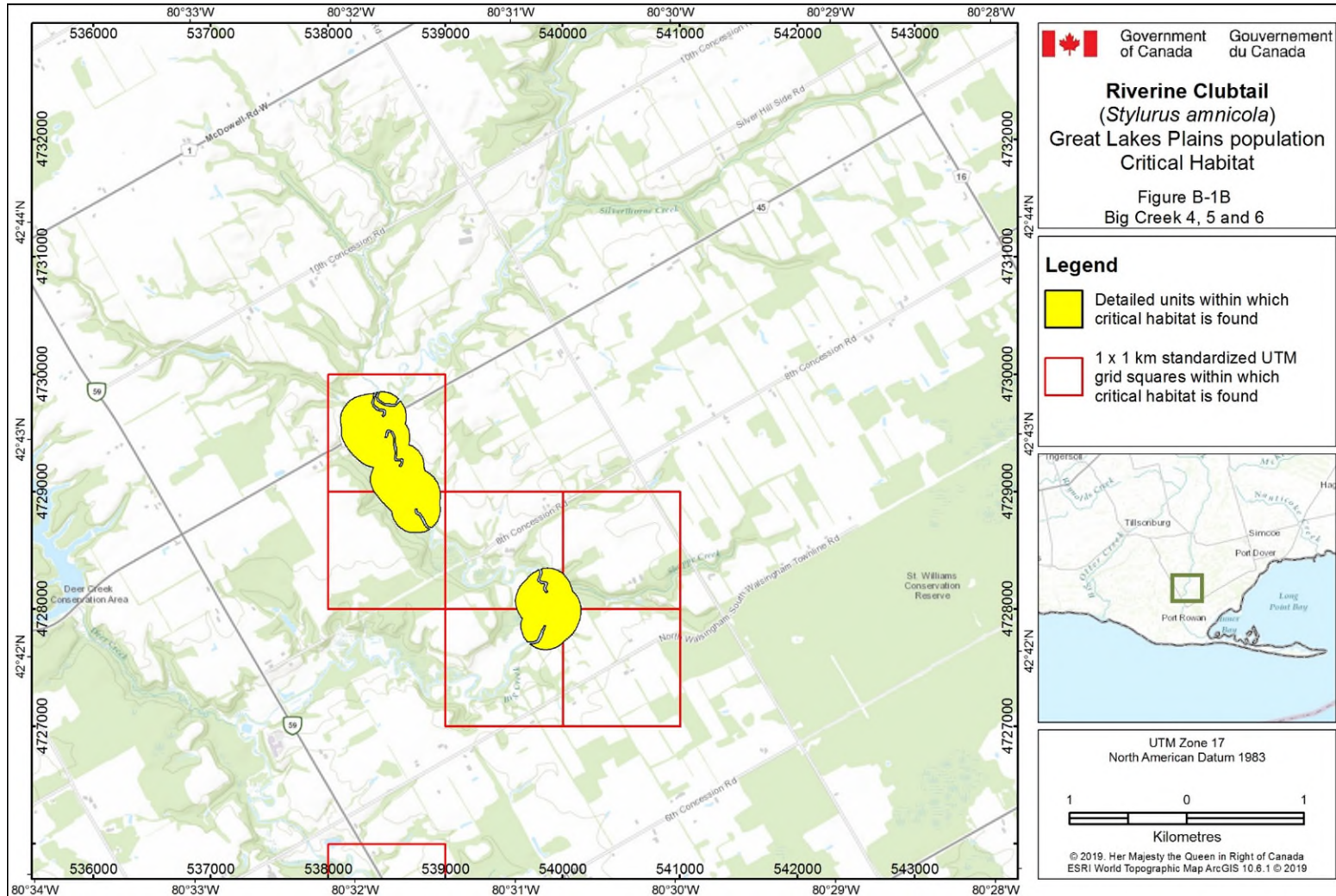


Figure B-1B. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat

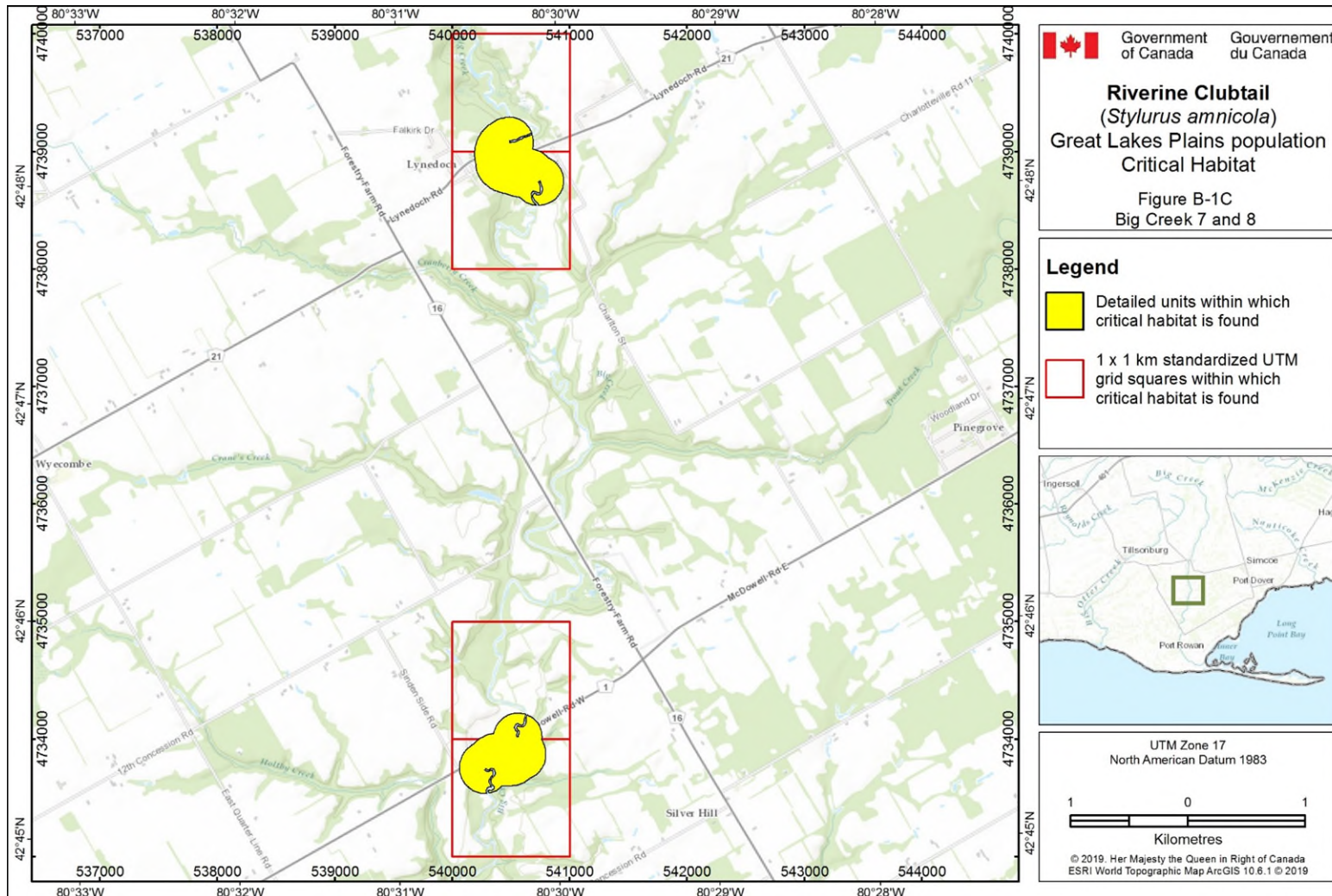


Figure B-1C. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.

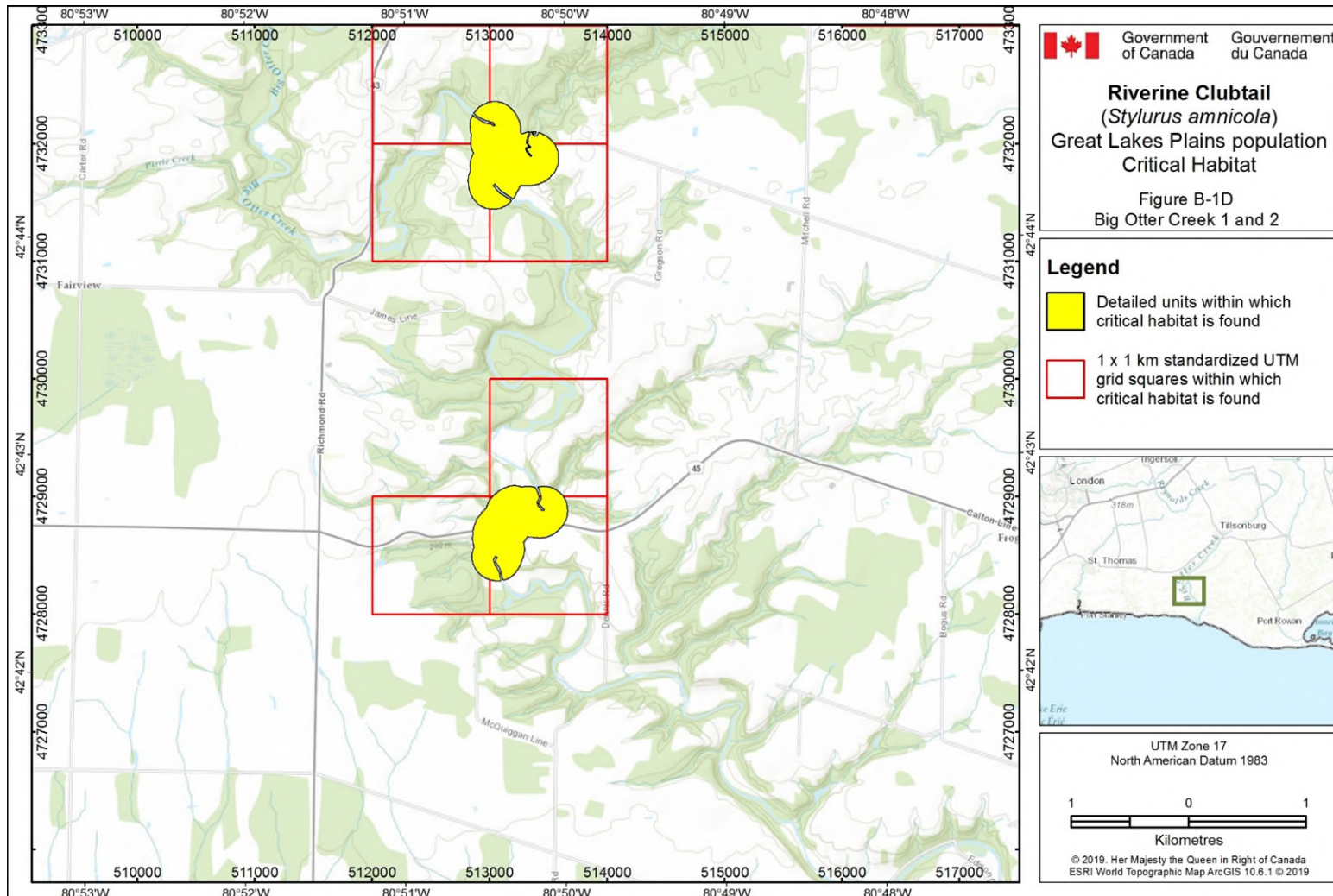


Figure B-1D. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.

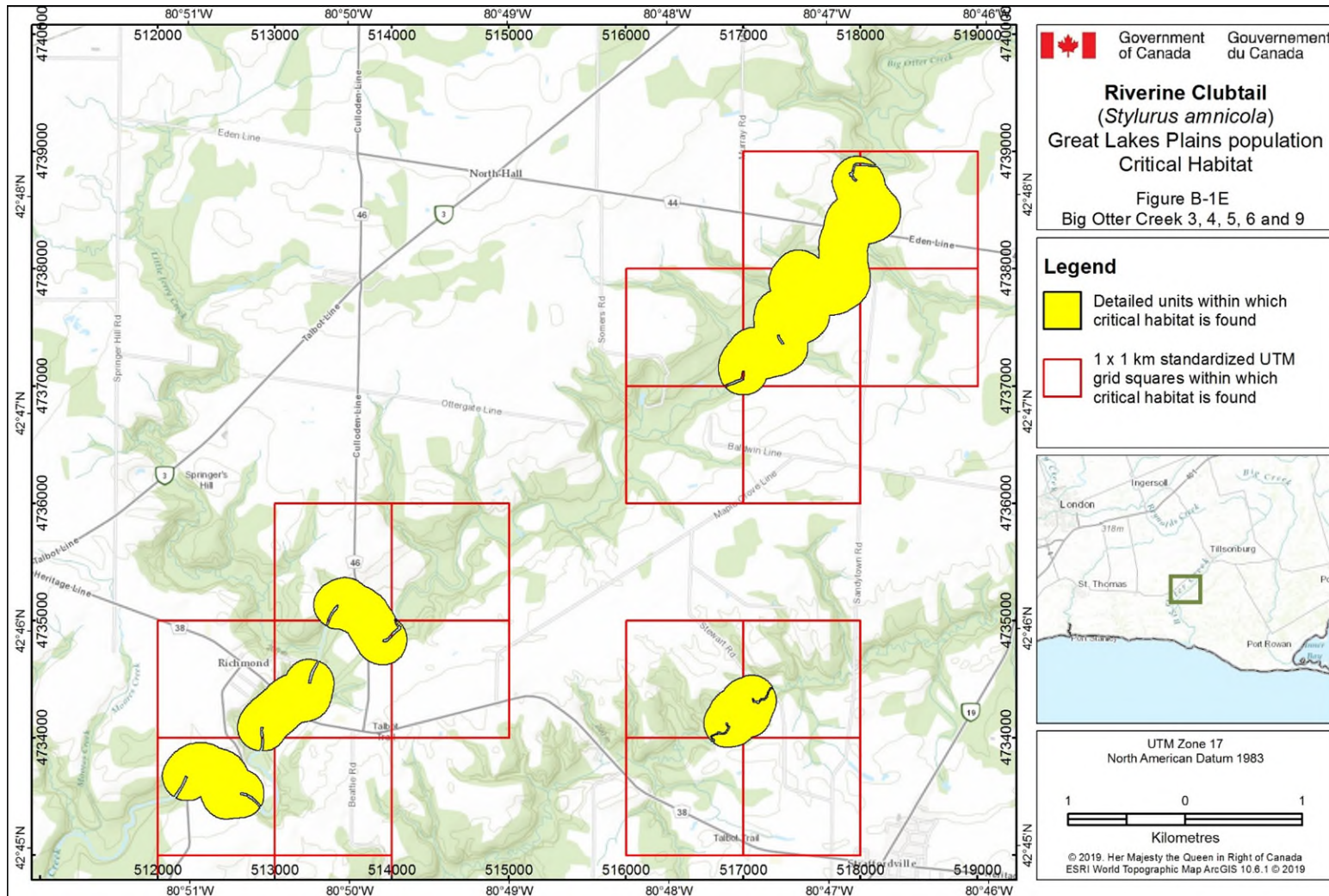


Figure B-1E. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.

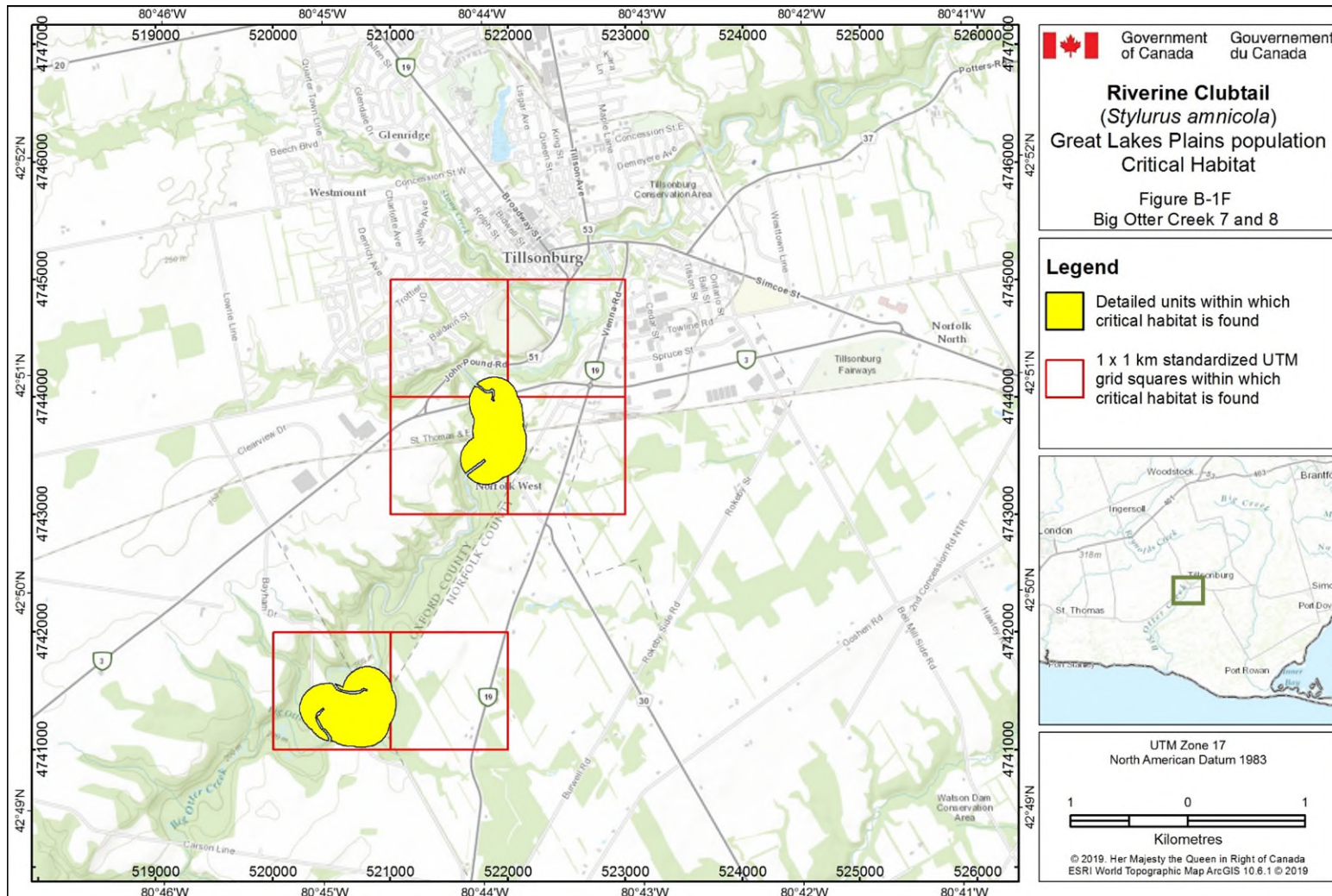


Figure B-1F. The areas containing critical habitat for Riverine Clubtail, Great Lakes Plains population, in Canada is represented by the yellow shaded units. Within these areas, critical habitat only occurs where the biophysical attributes described in section 6.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on the figure is a standardized national grid system used to indicate the general geographic extent containing critical habitat.

## Appendix C: Conservation Status Ranks of Riverine Clubtail (*Stylurus amnicola*)

Riverine Clubtail ( <i>Stylurus amnicola</i> )	
Rank	State or Province (S Rank)
Global (G4)	
Canada (N3)	Ontario (S1), Manitoba (S3), Quebec (S3)
United States (N4)	Connecticut (S2), Georgia (S1), Illinois (S2), Indiana (S1S2), Iowa (S3), Kansas (SNR), Kentucky (S2), Louisiana (SNR), Maryland (SH), Massachusetts (S2), Michigan (S2S3), Minnesota (SNR), Missouri (SNR), Nebraska (SNR), New Hampshire (S3), New York (SH), North Carolina (S3), Pennsylvania (SX), South Carolina (SNR), South Dakota (SNR), Tennessee (S2S3), Vermont (S1), Virginia (S1), Wisconsin (S3S4)

(NatureServe 2019)

### Definitions of Global (G), National (N) and Subnational (S) Conservation Status Ranks (Master et al. 2012).

Rank	Definition
G1 N1 S1	Critically Imperiled- At very high risk of extinction or elimination (G1), or at very high risk of extirpation in the jurisdiction (N1, S1), due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
G2 N2 S2	Imperiled- At high risk of extinction or elimination (G2), or at high risk of extirpation in the jurisdiction (N2, S2), due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
G3 N3 S3	Vulnerable- At moderate risk of extinction or elimination (G3), or extirpation in the jurisdiction (N2, S3), due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
G4 N4 S4	Apparently Secure- At a fairly low risk of extinction or elimination (G4), or extirpation in the jurisdiction (N4, S4), due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5 N5 S5	Secure- At very low risk of extinction or elimination (G5), or at very low or now risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
N#N# S#S#	Range Rank- A numeric range rank (e.g. S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
SNR	Unranked- State/province conservation status not yet assessed.
SH	Possibly Extirpated- Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
NX SX	Presumed Extirpated- Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. [Equivalent to "Regionally Extinct" in IUCN Red List terminology]

## Appendix D: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)<sup>23</sup>. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s<sup>24</sup> (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

In general, protecting the habitat of the Riverine Clubtail, Great Lakes Plains population, will benefit other native plant and animal species, both aquatic and terrestrial, including other species at risk such as the Laura's Clubtail (*Stylurus laurae*) which uses similar habitats in both Big Otter Creek and Big Creek. Other species at risk may also be found in Riverine Clubtail, Great Lakes Plains population, habitat such as Acadian Flycatcher (*Empidonax virescens*), Eastern Whip-poor-will (*Antrostomus vociferus*), Blanding's Turtle (*Emydoidea blandingii*), Eastern Foxsnake (*Pantherophis gloydi*), Gray Ratsnake (*Pantherophis spiloides*), American Chestnut (*Castanea dentata*), Cucumber Tree (*Magnolia acuminata*), Eastern Flowering Dogwood (*Cornus florida*), Round-leaved Greenbriar (*Smilax rotundifolia*) and Eastern Sand Darter (*Ammocrypta pellucida*). The Riverine Clubtail, Great Lakes Plains population, is also both predator and prey for a number of species (e.g., it provides an important component of a healthy ecosystem, food for some species, and a form of natural population control for others). Protection of natural features in the Carolinian region in particular will be of benefit to many species as the natural habitat in that region is already quite fragmented. The Carolinian ecosystem itself is one of the most threatened in Ontario and supports over 125 species at risk.

Measures recommended in the *Riverine Clubtail: Ontario Government Response Statement* (Part 3) and adopted by Environment and Climate Change Canada will benefit other species and habitats as noted above, through the development of best management practices to promote protection of riverine ecosystems, controlling invasive species and development and implementation of habitat monitoring (as outlined in the provincial Government Response Statement for this species).

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<sup>23</sup> [www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html](http://www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html)

<sup>24</sup> [www.fsds-sfdd.ca/index.html#/en/goals/](http://www.fsds-sfdd.ca/index.html#/en/goals/)



The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. None of the management activities proposed are activities that would negatively affect other species. The SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects.

**Part 2 – *Recovery strategy for the Riverine Clubtail*  
(*Stylurus amnicola*) in Ontario, prepared by Mlynarek (2015)  
for the Ontario Ministry of Natural Resources and Forestry**



## Riverine Clubtail (*Stylurus amnicola*) in Ontario

### Ontario Recovery Strategy Series

Recovery strategy prepared under the *Endangered Species Act, 2007*

*Natural. Valued. Protected.*

# About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the Endangered Species Act (ESA) and the Accord for the Protection of Species at Risk in Canada.

## What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

## What is a recovery strategy?

Under the ESA a recovery strategy provides the best available scientific knowledge on what is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. There was a transition period of five years (until June 30, 2013) to develop recovery strategies for those species listed as endangered or threatened in the schedules of the ESA. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

## What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

## For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources and Forestry Species at Risk webpage at: [www.ontario.ca/speciesatrisk](http://www.ontario.ca/speciesatrisk)

## RECOMMENDED CITATION

Julia J. Mlynarek. 2015. Recovery Strategy for the Riverine Clubtail (*Stylurus amnicola*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. v + 22 pp.

**Cover illustration:** Deanna Dodgson

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ISBN 978-1-4606-5721-8

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*Cette publication hautement spécialisée « Recovery strategies prepared under the Endangered Species Act, 2007 », n'est disponible qu'en anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec [recovery.planning@ontario.ca](mailto:recovery.planning@ontario.ca).*

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## **ACKNOWLEDGMENTS**

The author thanks the collection managers of the Canadian National Collection (Dr. Owen Lonsdale), the Royal Ontario Museum (Brad Hubley), the Lyman Entomological Museum and Research Laboratory (Dr. Terry Wheeler), Ouellet-Robert Collection (Louise Cloutier) and Colin Jones, Ontario Ministry of Natural Resources and Forestry, for specimen record data. I thank the reviewers for comments on the first drafts of the strategy.

## **DECLARATION**

The recovery strategy for the Riverine Clubtail was developed in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all of the individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

## **RESPONSIBLE JURISDICTIONS**

- Ontario Ministry of Natural Resources and Forestry
- Environment Canada – Canadian Wildlife Service

## EXECUTIVE SUMMARY

The Riverine Clubtail (*Stylurus amnicola*) is a dragonfly in the family Gomphidae, commonly referred to as the clubtails. The genus *Stylurus*, commonly called the hanging clubtails, differ from other clubtails in that they have relatively short hind legs and, when perched, typically “hang” vertically from vegetation with their abdomen pointing downwards. Most other clubtails typically perch horizontally on the ground or upon vegetation and have longer hind legs.

Its distribution ranges from Georgia and Louisiana to southern Manitoba and Quebec (although it is quite localized in portions of this range) and from the eastern coast of North America to eastern Nebraska and Manitoba. There are three main populations of the Riverine Clubtail in Canada: Boreal (Quebec), Great Lakes Plains (Ontario) and Prairie (Manitoba). The Great Lake Plains population, which occurs in Ontario, has been assessed as endangered by COSEWIC and COSSARO, and is currently listed as endangered under the *Endangered Species Act, 2007*. Within Ontario, this species has only been collected at three localities: Big Creek and Big Otter Creek, two tributaries of Lake Erie, and Aux Sables River in Chutes Provincial Park. The Riverine Clubtail was first recorded in the summer of 1999 at Big Otter Creek.

There are knowledge gaps in knowing and understanding the threats for this species. However, it is believed that the main threats to the survival of the Riverine Clubtail are habitat loss and degradation, pesticides, road mortality, invasive/introduced species and climate change.

The goals of the Recovery Strategy for the Riverine Clubtail are to ensure a viable, self-sustaining population in Ontario and maintain the Riverine Clubtail’s existing range of occurrence in Ontario. The objectives of the Recovery Strategy are to:

1. protect, maintain and, where appropriate, enhance the quantity and quality of existing Riverine Clubtail habitat.
2. increase knowledge of Riverine Clubtail biology in Ontario including distribution, abundance, life history and habitat needs.
3. reduce and mitigate threats to the Riverine Clubtail and its habitat.

It is recommended that the streams currently occupied by the Riverine Clubtail, previously-inhabited streams with suitable habitat, and select habitat surrounding such streams extending inland 200 metres (the typical distance the dragonflies travel between reproductive and roosting habitats) be prescribed as habitat under Ontario’s *Endangered Species Act, 2007*.



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## 1.0 BACKGROUND INFORMATION

### 1.1 Species Assessment and Classification

COMMON NAME: Riverine Clubtail

SCIENTIFIC NAME: *Stylurus amnicola*

SARO List Classification: Endangered

SARO List History: Endangered (2014)

COSEWIC Assessment History: Endangered (2012) - Great Lakes Plains (Ontario)

SARA Schedule 1: No Schedule, No Status

CONSERVATION STATUS RANKINGS:

GRANK: G4

NRANK: N3

SRANK: S1

The glossary provides definitions for the abbreviations above and for other technical terms in this document.

### 1.2 Species Description and Biology

#### Species Description

The Riverine Clubtail (*Stylurus amnicola*) is a dragonfly in the family Gomphidae, commonly referred to as the clubtails. Species of the family Gomphidae, including the Riverine Clubtail, can be recognized because their eyes do not meet at the top of their head (Dunkle 2000, Mead 2009) and most have a widening at the end of the abdomen known as the club (Paulson 2012). The Riverine Clubtail is one of the smallest members of its genus *Stylurus* measuring between 4.3 and 5.2 cm in length, from tip of head to tip of abdomen (Walker 1958). The Riverine Clubtail has turquoise-coloured eyes and a pale face with dark lines along the sutures. The male of this species is mostly black with distinctive yellow stripes on the thorax; the pattern on the back of the thorax is diagnostic of the species because of its unique three-pointed star (COSEWIC 2012). The females are very similar to the males, with the same pattern on the back but with somewhat more extensive yellow on the abdomen and paler stripes on the thorax. The club of the Riverine Clubtail is among the widest and most boldly marked of its genus (Mead 2009). The Riverine Clubtail can be confused with the Black-shouldered Spinyleg (*Dromogomphus spinosus*) because of the colours on the thorax, although the Riverine Clubtail is smaller with shorter legs, or the Elusive Clubtail (*Stylurus notatus*), but the thoracic pattern is different.

Dragonfly larvae (also known as nymphs) are difficult to identify to species and should be verified by an expert odonatologist. The larvae of the Riverine Clubtail tend to be

smaller than most species of its genus measuring between 2.8 and 2.9 cm in length (Walker 1958) but can be confused with other species of the genus. They are slender, pale brown with the head as wide as the abdomen (Walker 1958). The most diagnostic characters are the abdominal segments evenly taper from the thorax to the tip and the very hairy legs (Walker 1958).

### Species Biology

There is little information about the biology of the Riverine Clubtail. There are no known scientific studies on this species and all information is derived from direct observation during specimen collection or from our understanding of closely related species, like Laura's Clubtail (*Stylurus laurae*), which inhabit the same types of habitats. Laura's Clubtail is listed as endangered under Ontario's *Endangered Species Act, 2007* (Pulfer et al 2011). Most of the following information is based on the COSEWIC (2012) report for the Riverine Clubtail and on its similarities to Laura's Clubtail (P.M. Catling, pers. comm. 2014).

As its name suggests, the Riverine Clubtail is present in a variety of riverine habitats. The life cycle of the Riverine Clubtail consists of three stages: egg, larva and adult. It is unknown how many eggs are laid by females or the timing of egg laying. Little is also known about egg development other than females deposit them in the current of the shallow, fast-flowing areas of open streams or rivers (Corbet 1999). Larvae develop in the fine sand and silt substrates in slow to moderate flow streams and rivers (Walker 1958, Needham et al 2000). The development time of the larva has not yet been determined but based on the biology of other Clubtail species the larval stage probably lasts two or more years (COSEWIC 2012). Larvae of certain European members of the genus *Stylurus* take three to four years to develop (Corbet 1999). During their larval stage in the water, the main predators of Riverine Clubtail are likely other dragonfly larvae, tadpoles, fish and waterbirds. Adults emerge in late June to early July. As they emerge in adult form, the exuviae (cast off larval skin) are left behind, attached to vegetation surrounding the stream. The young adult dragonflies can fly an unknown distance away from the stream and into the surrounding forest habitat to avoid predation until their exoskeleton hardens in about 24 hours (Corbet 1999). At this stage they are particularly vulnerable to predation. Once they are sexually mature, they return to the stream where they rest on the leaves of trees surrounding the streams or rivers, looking for flying prey or mates. Males can sometimes be seen cruising swiftly over the stream looking for females (Catling and Brownell 1999). The main predators of adult Riverine Clubtail are likely other dragonflies and birds (Corbet 1999, COSEWIC 2012). Based on Walker's (1958) assessment of U.S. populations of Riverine Clubtail, adults of this species are generally in flight from the start of July to sometime in August. It is not known what time(s) of day adults are most active.

Riverine Clubtails are believed to be generalist predators, as are most dragonflies. As larvae, dragonflies feed on aquatic invertebrates. As adults, dragonflies are primarily predators of flying insects, with Riverine Clubtails likely hunting prey either above the water or in the surrounding forest habitat (COSEWIC 2012).

### 1.3 Distribution, Abundance and Population Trends

Riverine Clubtail is one of the most northerly distributed species of the *Stylurus* genus. It occurs throughout eastern North America, extending from South Carolina to southern Ontario and from the eastern coast of North America (Robert 1963) to eastern Nebraska (Figure 1, Abbott 2014). In some parts of its range, as in Ontario, there are only sparse records (Figure 2) so it is unknown whether the species exists in other areas.



Figure 1. Distribution of Riverine Clubtail in North America. Black triangles represent areas where the Riverine Clubtail has been reported according to OdonataCentral (2014). Map generated using Simplemappr (Shorthouse 2010).



Figure 2. Distribution of Riverine Clubtail in Ontario. Black triangles represent areas where the Riverine Clubtail has been reported according to OdonataCentral (2014). Map generated using Simplemappr (Shorthouse 2010).

The global population size of the Riverine Clubtail is estimated at 2,500 to 10,000 individuals (NatureServe 2014). The global population trend is believed to be stable at this time (Paulson 2009). The Riverine Clubtail is considered rare in the northern states of the United States adjacent to Ontario (Paulson and Dunkle 1999, Paulson and Dunkle 2009).

There are three populations of the Riverine Clubtail in Canada (COSEWIC 2012). The population size and trend for the Canadian populations is unknown. Additionally, too little is known about the other two Canadian populations, the Prairie population in Manitoba and the Boreal population in Quebec, to allow conservation assessment, thus they are currently considered data deficient (COSEWIC 2012). The Ontario population is known as the Great Lakes Plains population.

The Riverine Clubtail from the Great Lakes Plains population was first recorded in Ontario at Big Creek in 1999 (Catling and Brownell 1999, Pratt 1999). Since that time it has been recorded fewer than one hundred times along two major tributaries of Lake Erie (Figure 2) in Elgin and Norfolk Counties: Big Otter Creek and Big Creek (Catling and Brownell 1999, COSEWIC 2012, Natural Heritage Information Centre 2014) and a single specimen was collected in Chutes Provincial Park, North of Lake Huron, in July 2014, but more were observed (B. Korol pers. comm.). The population trends in Ontario are currently unknown (COSEWIC 2012).

One of the challenges of observing the Riverine Clubtail is its habit of perching on the leaves of high branches of trees surrounding the flowing water body from which it has emerged (Mead 2009). The height of its perch can result in the species being rarely observed or documented.

## 1.4 Habitat Needs

The Riverine Clubtail, like other dragonflies, requires an aquatic environment for its larval stage and a terrestrial environment for its adult stage. Overall this species requires sandy- or silty-bottomed streams with continuous vegetation along the river bank (Walker 1958). The first time Riverine Clubtails were documented in Ontario at Big Otter Creek, they were flying 30 cm above the water surface and flew into the surrounding vegetation (Catling and Brownell 1999). The creek at that location was sandy-bottomed, shallow (0.5 - 1 m) and clear with a fairly rapid flow (Catling and Brownell 1999). The habitat where the Riverine Clubtail was collected from the Chutes Provincial Park was very similar to those of Big Otter Creek and Big Creek: vegetated shoreline and sandy bottom stream. The characteristics of these sites are representative of the preferred habitat of the Riverine Clubtail throughout its global distribution (K. Mead, pers. comm).

As a larva, the Riverine Clubtail requires streams or rivers with sandy bottoms in which to burrow for protection against predators. Clubtail larvae tend to move away from very shallow water and into deeper pools for protection from predators (Corbet 1999).

Freshly emerged adults (i.e., teneral) require trees and shrubs as perching locations within 200 m of the stream for about 24 hours, the time it takes for their exoskeletons to harden (Corbet 1999), during which time adults are poor fliers and are vulnerable to predation (Paulson 2012). Sexually mature male and female Riverine Clubtails perch high in the tree canopy on broad leaves along the shore of the stream to bask and to find prey. Males additionally find mates by patrolling the tree canopies. The Riverine Clubtail requires large-leaved vegetation and would not use anthropogenic areas such as croplands or pastures. They can also be seen coasting above riffles in the water catching insect prey (Catling and Brownell 1999).

In general, Riverine Clubtails require slow to fast flowing streams or rivers that are wide enough so that the canopy does not completely cover the width of the stream (Catling et al 1999). The streams generally have fast flowing areas in which adults lay their eggs and wider stretches with slower moving water, such as pools in the streams, where larvae can develop (Catling et al 1999). The Riverine Clubtails prefer stream habitats with a mix of slow and fast (e.g., riffle forming) moving water. Information on home range size, foraging distances, and several other aspects of movement behaviour are not yet known for this species.

## 1.5 Limiting Factors

The Riverine Clubtail requires a specific combination of habitat characteristics, wide stream with thicket or wooded riparian vegetation, which is uncommon in southern Ontario. Dragonflies will, depending on their size, disperse on average 200 m from where they emerged to sexually mature (Corbet 1999, Rouquette and Thompson 2007, Keller et al 2010). Smaller dragonflies, those with smaller wings, tend to disperse shorter distances than larger dragonflies because the wing aspect ratio is greater in

smaller dragonflies, which means that they have to expend more energy to disperse greater distances (McCauley 2013). This distance is also needed for sexually mature adults of this genus to move between breeding grounds and roosting grounds (Pulfer et al 2011). It is unlikely that local populations could be supplemented by immigration if the Riverine Clubtail were extirpated from these two sites. Dispersal between local populations of Riverine Clubtail may be restricted due to the limited availability of continuous suitable aquatic and terrestrial habitat. The northern range limit of the Riverine Clubtail may be restricted by water temperature, although this is uncertain.

## **1.6 Threats to Survival and Recovery**

We do not know with certainty what threatens the Riverine Clubtail in Ontario, or the impact of those threats. Therefore, potential threats based on expert opinion and other closely related species with similar life histories and overlapping ranges (e.g., Laura's Clubtail) are presented (P.M. Catling pers. comm., Pulfer et al 2011).

### Habitat loss and degradation

Dragonflies can be good indicators of environmental health in aquatic habitats e.g. whether the water is clean for their survival (Corbet 1999). Fluctuations in pH, dissolved oxygen, temperature and nutrients could result in habitat being uninhabitable by the Riverine Clubtail if the dragonflies or their prey cannot survive the new concentrations or their rate of change (COSEWIC 2012). Dragonflies, such as the Riverine Clubtail, are believed to be sensitive to changes in water quality, habitat loss and degradation through excessive human alterations that reduce the suitability of habitat (Samways and Steytler 1996).

The Riverine Clubtail is currently reported from areas where its habitat is threatened by various types of development (e.g., road maintenance, wood cutting, and damming activities around streams). These activities can alter water quality, temperature, flow rate, depth, and increase sedimentation (i.e. more particles falling to the stream bottom; Williams et al 1999, Helmreich et al 2010), which could hinder the development of the immature stages of the Riverine Clubtail (COSEWIC 2012).

Damming of streams is a potential threat to the Riverine Clubtail. Damming and surrounding agricultural use can change flow rate, water depth and sedimentation, resulting in alteration of the preferred shallow, medium to fast flowing water needed for egg laying by Riverine Clubtail (Catling and Brownell 1999). Upstream of a dam, water flow is slowed and depth is increased, resulting in conditions that might not be suitable for females to lay their eggs in, and silt accumulation could result in a lack of oxygen to developing larvae. Downstream of a dam, flow is controlled which may be detrimental to Riverine Clubtail larvae if they are not able to adjust to frequently changing water speed and depth. Riverine Clubtails inhabit areas downstream of the dam on Big Creek and downstream of the three dams on Big Otter Creek. There are no dams at the location of the Chutes population. Drawdown of water levels from agricultural uses may also pose a threat in a similar way to dams.

### Pesticides and other toxins

This species seems to be quite tolerant to pollution as the agricultural runoff levels exceed the Canadian guidelines in Big Creek and Big Otter Creek (COSEWIC 2012). Even though the tolerance level for pH, dissolved oxygen and temperature are unknown for the Riverine Clubtail, pollution from runoff and other sources could threaten the larval stage of the Riverine Clubtail by promoting eutrophication, which could exceed their tolerance levels, and decreasing dissolved oxygen. Use of pesticides and especially insecticides on surrounding agricultural lands and golf courses can have an effect on the reproductive success of the Riverine Clubtail. Neonicotinoids, such as imidacloprid, are of increasing concern to the conservation of insects in North America (Pisa et al 2014). Neonicotinoid pesticides are widely used in Ontario agriculture, and can leach into local water. Neonicotinoids can alter water chemistry in a way that makes it less habitable by some aquatic invertebrates (Morrissey et al 2015). Neonicotinoids can reduce dragonfly larval survival, emergence into adults, and abundance of prey insects (Jinguji et al 2013, Van Dijk et al 2013).

Various other pollutants negatively affect dragonflies (Johnson 1991, Campero et al 2007, Van Gossum et al 2009). Dragonflies are sensitive to copper exposure and they bioaccumulate cadmium, lead, copper and other heavy metals (Tollett et al 2009). Dragonflies can also bioaccumulate pharmaceuticals including antihistamines (De Lange et al 2006, Jonsson et al. 2014). Although insecticides, such as organochlorines, may not have as strong an effect on dragonflies as they do on other insects, the abundance of prey may be reduced so dragonflies will not have enough food (Brewer and Atchison 1999). Phosphorous is also of concern in many Ontario streams, where levels often exceed provincial objectives (Ontario Ministry of the Environment 2013). Phosphorous can reduce the diversity of benthic invertebrates (Ontario Ministry of the Environment 2013). The levels of pesticides are continuously changing as their popularity changes with time (Stone et al 2014), and their full effects on the Riverine Clubtail remain unknown.

### Road mortality

Road mortality affects dragonflies much more than other insects because of their daily movements and low flight behavior (Riffel 1999, Soluk et al 2011). Young adult dragonflies, in general, move away from the water during their pre-reproductive stage and return to the water later once they are ready to mate (Corbet 1999). If roads run parallel to streams at a distance of less than one kilometer in some places, as they do near Big Creek and Big Otter Creek, the Riverine Clubtail will have to frequently cross the road to go between the stream and forest. This frequent movement increases the risk of road mortality if there are many roads in the surrounding areas. While flying low above the road, dragonflies are at an increased risk of getting hit by passing vehicles although it is currently unknown how high this species flies above the road. If they do not die right away, they may be disoriented and get hit by a subsequent vehicle (Riffel 1999). As urban and agricultural development increase in the areas surrounding current Riverine Clubtail habitat, so will the number of roads, which may increase rates of collision.



### Invasive and introduced species

Invasive and introduced species can either alter the habitat [e.g., Zebra Mussel (*Dreissena polymorpha*) and Kudzu (*Pueraria lobata*)] or be novel predators [e.g., Round Goby (*Neogobius melanostomus*), Rusty Crayfish (*Orconectes rusticus*)] to the Riverine Clubtail. The effects of these invasive and introduced species on the Riverine Clubtail are unknown (COSEWIC 2012) because there have been no known studies to directly compare the effects of invasive and introduced species on the Riverine Clubtail.

Zebra Mussels can alter habitat by changing water chemistry, water clarity, and species composition (Bulté et al 2012). Kudzu is an invasive vine spreading northward from the United States and present on the shore of Lake Erie (Waldron and Larson 2012), which can cover and choke shorelines and riparian vegetation (OFAH/OMNR 2012). Kudzu could be an issue if its leaves are too dense for the Riverine Clubtails to perch on and because dragonfly prey are often less abundant in habitats dominated by invasive plants (Litt et al 2014). If these invasive species are present in Riverine Clubtail habitat, they may indirectly affect Riverine Clubtail survival.

Other predatory invasive/introduced species (Round Goby, Rusty Crayfish) may be present in the streams surrounding the Great Lakes and can potentially impact egg or larval stages of the Riverine Clubtail through predation (Jude 2001, Cox and Lima 2006, Gunderson 2008). Dragonfly larvae bury themselves in the sandy bottom to hide from predators, but if they do not recognize an invasive species as a predator they will not hide and will be prone to higher predation pressure (Polis et al 1989). It may require the consumption of naïve individuals for a species to evolve the ability to recognize and cue in on a novel predator such as Round Goby or Rusty Crayfish (Wisenden et al 1997).

Invasive and introduced species that have the potential to threaten the Riverine Clubtail should be assessed regularly as they become established in areas identified as habitat for the Riverine Clubtail, especially the streams where the Riverine Clubtail is currently known to occur.

## **1.7 Knowledge Gaps**

There are gaps in our knowledge of the Riverine Clubtail. The factors affecting the distribution of this species are very poorly understood for Ontario populations. Knowledge gaps for this species may hinder efforts to protect it. Research on the following knowledge gaps would contribute to a more complete understanding of the threats to the Riverine Clubtail and the effectiveness of protection and recovery of the species and its habitat.

1. General natural history and ecology information for the Riverine Clubtail.
2. Tolerance of each life stage to environmental changes (e.g., sensitivity to pesticides and flow changes).
3. Population sizes of known Riverine Clubtail populations.
4. Distribution within Ontario.
5. Extent of road mortality.

6. Effect of invasive and introduced species on the Riverine Clubtail.

## 2.0 RECOVERY

### 2.1 Recovery Goal

The recovery goal for the Riverine Clubtail is to ensure viable, self-sustaining populations in Ontario by increasing our knowledge of the Riverine Clubtail and maintaining and, where appropriate, enhancing the quality of existing Riverine Clubtail habitat.

### 2.2 Protection and Recovery Objectives

Table 1. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Protect, maintain and, where appropriate, enhance the quantity and quality of existing Riverine Clubtail habitat.
2	Increase knowledge of Riverine Clubtail biology in Ontario including distribution, abundance, life history and habitat needs.
3	Reduce threats to Riverine Clubtail and its habitat.

## 2.3 Approaches to Recovery

Table 2. Approaches to recovery of the Riverine Clubtail in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
<b>1. Protect, maintain and, where appropriate, enhance the quantity and quality of existing Riverine Clubtail habitat.</b>				
Necessary	Ongoing	Protection and Stewardship	<b>1.1</b> Protect known terrestrial and aquatic Riverine Clubtail habitats through: <ul style="list-style-type: none"> <li>- planting native broad-leaved trees where appropriate; and</li> <li>- preserving and, where appropriate, restoring the state of the streams.</li> </ul>	Threats: <ul style="list-style-type: none"> <li>• Habitat loss and degradation</li> </ul>
Beneficial	Long-term	Stewardship, Education and Outreach	<b>1.2</b> Develop, implement and support education and stewardship programs at known sites of Riverine Clubtail.	Threats: <ul style="list-style-type: none"> <li>• All</li> </ul>
<b>2. Increase knowledge of Riverine Clubtail biology in Ontario including distribution, abundance, life history and habitat needs.</b>				
Critical	Ongoing	Monitoring, Assessment and Research	<b>2.1</b> Report observations of Ontario dragonflies for inclusion in the Ontario Odonata Atlas Database and the Natural Heritage Information Centre (NHIC).	Knowledge gaps: <ul style="list-style-type: none"> <li>• Distribution</li> </ul>
Critical	Ongoing	Monitoring, Assessment and Research	<b>2.2</b> Monitor the Riverine Clubtail. <ul style="list-style-type: none"> <li>- Conduct presence/absence surveys for the species to determine whether the species exists at other sites within Ontario.</li> <li>- Monitor abundance at known locations (population size).</li> </ul>	Knowledge gaps: <ul style="list-style-type: none"> <li>• Population sizes of known populations</li> <li>• Distribution</li> </ul>

<b>Relative Priority</b>	<b>Relative Timeframe</b>	<b>Recovery Theme</b>	<b>Approach to Recovery</b>	<b>Threats or Knowledge Gaps Addressed</b>
Critical	Short-term	Research	<b>2.3</b> Carry out research on the biology of the Riverine Clubtail to determine aspects of its natural history and ecology including: <ul style="list-style-type: none"> <li>- microhabitat requirements depending on age of individuals; and</li> <li>- duration of each life stage.</li> </ul>	Knowledge gaps: <ul style="list-style-type: none"> <li>• All</li> </ul>
Beneficial	Short-term	Monitoring and Research	<b>2.4</b> Sequence Riverine Clubtail genes to allow identification of the species in DNA-based monitoring programs.	Knowledge gaps: <ul style="list-style-type: none"> <li>• Distribution</li> </ul>
Beneficial	Short-term	Research	<b>2.5</b> Investigate the sensitivity of Riverine Clubtail to anthropogenic factors. <ul style="list-style-type: none"> <li>- Research on the effects of pesticides, toxins, and other aspects of water quality on larval Riverine Clubtail health and survival.</li> <li>- Research on the effects of pesticides, toxins, and other aspects of volatiles on adult Riverine Clubtail health and survival.</li> <li>- Research on the flight elevation and extent of road mortality for adult Riverine Clubtail.</li> </ul>	Threats: <ul style="list-style-type: none"> <li>• Pesticides and other toxins</li> <li>• Road mortality</li> </ul> Knowledge gaps: <ul style="list-style-type: none"> <li>• Natural history</li> <li>• Tolerance to environmental changes</li> <li>• Extent of road mortality</li> </ul>
Beneficial	Short-term	Research	<b>2.6</b> Investigate the sensitivity of Riverine Clubtail to introduced and invasive species.	Knowledge gaps: <ul style="list-style-type: none"> <li>• Invasive and introduced species</li> </ul>

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
<b>3. Reduce threats to Riverine Clubtail and its habitat.</b>				
Critical	Long-term	Stewardship and Protection	<p><b>3.1</b> Work with local partners (municipalities and conservation authorities) and the Ministry of Environment and Climate Change to monitor water quality of Riverine Clubtail habitat.</p> <ul style="list-style-type: none"> <li>- Work with municipalities to mitigate impacts from land use.</li> <li>- Work with municipal road maintenance departments regarding salting and sedimentation mitigation.</li> <li>- Work with conservation authorities, stewardship councils and the Ontario Ministry of Agriculture, Food and Rural Affairs to promote stream buffers of native vegetation.</li> </ul>	<p>Threats:</p> <ul style="list-style-type: none"> <li>• Habitat loss and degradation</li> <li>• Pesticides and other toxins</li> </ul>
Beneficial	Ongoing	Education and outreach	<p><b>3.2</b> Work with partners to develop an outreach strategy to mitigate and prevent the spread of invasive species:</p> <ul style="list-style-type: none"> <li>- prevent bait dumping at creek access points;</li> <li>- check boats for invasive species; and</li> <li>- educate anglers on what to do if they find or catch an invasive species.</li> </ul>	<p>Threats</p> <ul style="list-style-type: none"> <li>• Invasive and introduced species</li> </ul>
Beneficial	Short-term	Research	<p><b>3.3</b> Quantify the threat of road mortality to the Riverine Clubtail and, if appropriate, explore tactics for mitigation.</p>	<p>Threats:</p> <ul style="list-style-type: none"> <li>• Road mortality</li> </ul>

### Narrative to Support Approaches to Recovery

It is recommended that recovery efforts for the Riverine Clubtail be coordinated with the recovery efforts for Laura's Clubtail (*Stylurus laurae*) where occurrences overlap since they share similar habitats and threats (Pulfer et al 2011).

## 2.4 Area for Consideration in Developing a Habitat Regulation

*Under the ESA, a recovery strategy must include a recommendation to the Minister of Natural Resources and Forestry on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the author will be one of many sources considered by the Minister when developing the habitat regulation for this species.*

The Riverine Clubtail requires both freshwater and terrestrial habitats to complete its life cycle. Even though further research is required to document its distribution, dispersal, population size, and life history, it is recommended that the area prescribed as habitat in a habitat regulation include the locations occupied by the species or those that were occupied by the species but still might be re-colonized because of suitable habitat.

Aquatic habitat suitability should be assessed according to the following guidelines, and extend up to the high water mark.

- Riffles (important for adult egg-laying and male mate-finding flights).
- Pools below riffles (important for egg and larval growth) with a depth of 60 cm for larval growth (P.M. Catling pers. comm). It should be noted that areas deeper than 60 cm can be used as movement habitat for eggs or larvae just passing through.

It is recommended that regulated habitat under the ESA include the following terrestrial features.

- Up to 30 m of natural vegetation inland to: 1) maintain river quality (Sweeney and Newbold 2014); and 2) allow teneral dragonflies to find refuge near emergence sites (*c.f.* Eastern Sand Darter; Fisheries and Oceans Canada 2012).
- Broad-leaved vegetation such as trees, shrubs and thickets extending inland 200 m (the typical distance dragonflies travel between reproductive and roosting habitats; Corbet 1999) used for: 1) foraging; 2) roosting; and 3) reproduction habitat. Coniferous vegetation should be excluded from habitat protection since Riverine Clubtails are not known to perch on conifers.

Should additional occupied areas be found in the future, habitat should automatically be prescribed under the ESA. It is also recommended that the area prescribed as habitat for the species is re-evaluated as new information is gathered, given that there are extensive knowledge gaps.

Additionally, it is important to acknowledge that the health of the entire watershed, especially upstream, could have an effect on river life downstream (Sweeney and Newbold 2014). An activity that occurs beyond the area of regulated habitat, and has the potential to adversely affect the regulated habitat, may require authorization under the ESA.

## **GLOSSARY**

**Committee on the Status of Endangered Wildlife in Canada (COSEWIC):** The committee established under section 14 of the Species at Risk Act that is responsible for assessing and classifying species at risk in Canada.

**Committee on the Status of Species at Risk in Ontario (COSSARO):** The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

**Conservation status rank:** A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

- 1 = critically imperilled
- 2 = imperilled
- 3 = vulnerable
- 4 = apparently secure
- 5 = secure

***Endangered Species Act, 2007 (ESA):*** The provincial legislation that provides protection to species at risk in Ontario.

**Exuviae:** Cast-off skins or coverings. For the Riverine Clubtail, refers to the cast off covering of the dragonfly larva, shed after the larva emerges from the water to molt into the adult life stage.

**Larva (pl. larvae):** The immature form of an insect that is active and differs greatly from the adult form.

**Odonata:** The taxonomic order comprising dragonflies and damselflies.

**Nymph:** A larva of an insect that resembles the adult somewhat but needs to transform into the adult form to breed.

**Riffles:** Areas of relatively fast, turbulent flow, where the water's surface is typically broken.

**Riparian:** Terrestrial area directly adjacent to a water body.

***Species at Risk Act (SARA):*** The federal legislation that provides protection to species at risk in Canada. This act establishes Schedule 1 as the legal list of wildlife species at risk. Schedules 2 and 3 contain lists of species that at the time the Act came into force needed to be reassessed. After species on Schedule 2 and

3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

Thorax: Division of an animal's body that lies between the head and the abdomen.

Teneral: The period when the adult insect is newly emerged from its larval skin. During the teneral period, the insect's exoskeleton has not hardened or darkened, leaving it vulnerable to predators.



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**Part 3 – *Riverine Clubtail* – Ontario Government Response  
Statement, prepared by the Ontario Ministry of  
Natural Resources and Forestry**

*Natural. Valued. Protected.*

# Riverine Clubtail

## Ontario Government Response Statement



Photo: Deanna Dodgson

### PROTECTING AND RECOVERING SPECIES AT RISK IN ONTARIO

Species at risk recovery is a key part of protecting Ontario's biodiversity. Biodiversity – the variety of living organisms on Earth – provides us with clean air and water, food, fibre, medicine and other resources that we need to survive.

The *Endangered Species Act, 2007* (ESA) is the Government of Ontario's legislative commitment to protecting and recovering species at risk and their habitats. As soon as a species is listed as extirpated, endangered or threatened under the ESA, it is automatically protected from harm or harassment. Also, immediately upon listing, the habitats of endangered and threatened species are protected from damage or destruction.

Under the ESA, the Ministry of Natural Resources and Forestry (the Ministry) must ensure that a recovery strategy is prepared for each species that is listed as endangered or threatened. A recovery strategy provides science-based advice to government on what is required to achieve recovery of a species.

### GOVERNMENT RESPONSE STATEMENTS

Within nine months after a recovery strategy is prepared, the ESA requires the Ministry to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The recovery strategy for the Riverine Clubtail (*Stylurus amnicola*) in Ontario was completed on June 25, 2015 (<http://www.ontario.ca/document/riverine-clubtail-recovery-strategy>).

The response statement is the government's policy response to the scientific advice provided in the recovery strategy. All recommendations provided in the recovery strategy were considered and this response statement identifies those that are considered to be appropriate and necessary for the protection and recovery of the species. In addition to the strategy, the response statement is based on input from stakeholders, other jurisdictions, Aboriginal communities and members of the public. It reflects the best available traditional, local and scientific knowledge at this time and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the Ministry to determine what is feasible, taking into account social and economic factors.

The Riverine Clubtail is one of the smallest members of the Clubtail family of dragonflies measuring between 4.3 and 5.2 cm in length. It has a unique three-pointed star pattern on the back of the thorax and lives in rivers and the surrounding vegetation.

## MOVING FORWARD TO PROTECT AND RECOVER RIVERINE CLUBTAIL

The Riverine Clubtail is listed as an endangered species under the ESA, which protects both the insect and its habitat. The ESA prohibits harm or harassment of the species and damage or destruction of its habitat without authorization. Such authorization would require that conditions established by the Ministry be met.

Globally, the distribution of Riverine Clubtail is limited to central and eastern North America. The global population of the species is thought to be stable and in 2014, global population levels were estimated to be between 2,500 and 10,000 individuals. The Riverine Clubtail has been found in three Canadian provinces (Ontario, Quebec and Manitoba) and ranges across 25 states of the United States. In states of the U.S. that are adjacent to Ontario, the species is considered rare. In Canada, three populations of Riverine Clubtail have been identified, and the Great Lakes Plains population (the only one in Ontario) was assessed as endangered by both the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Committee on the Status of Species at Risk in Ontario (COSSARO).

Population trends for Riverine Clubtail in Ontario are currently unknown due to limited records of the species. In Ontario, the Riverine Clubtail has only been found at three locations: Big Creek and Big Otter Creek, two major streams that flow into Lake Erie, and Aux Sables River in Chutes Provincial Park. The Riverine Clubtail was first recorded in Ontario in the summer of 1999 at Big Otter Creek and since that time, the species has been recorded less than one hundred times at Big Creek and Big Otter Creek. In 2014, multiple individuals were observed in Chutes Provincial Park for the first time.

As the name suggests, Riverine Clubtail is found in a variety of riverine habitats. The species prefers river habitats with sandy or silty bottoms, a mix of slow and fast moving water, and continuous vegetation along the bank. Like other dragonflies, this species requires an aquatic environment for its larval stage and a terrestrial environment for its adult stage. There are substantial knowledge gaps associated with the distribution, abundance and biology of Riverine Clubtail in Ontario. This absence of information, and the fact that there are no known scientific studies on Riverine Clubtail, make it difficult to identify specific threats to the species. Additionally, Riverine Clubtail is a difficult species to detect as it has a tendency to perch on high branches of trees surrounding the flowing water bodies it inhabits.

Based on the biology of other closely related species and the limited knowledge available related to Riverine Clubtail, it is thought that the main threats to the species are habitat loss and degradation, road mortality, invasive species, and environmental contaminants. According to COSEWIC, activities that alter water quality, pH, dissolved oxygen, temperature, flow rate, depth, and/or the amount of sedimentation may hinder the species development. Loss or degradation of terrestrial habitat (i.e., vegetated shorelines) can also pose a threat. Invasive species can threaten both aquatic and terrestrial life stages of Riverine Clubtail. For example, Round Goby (*Neogobius melanostomus*) and Rusty Crayfish (*Orconectes rusticus*) may prey on the egg and larval stages of the species and Zebra Mussels (*Dreissena polymorpha*) can affect the aquatic and terrestrial stages of Riverine Clubtail by altering its habitat. The bioaccumulation of environmental contaminants such as heavy metals and pharmaceuticals present in occupied water streams can also pose a threat to the species. Approaches to recover the species in Ontario will focus on conducting inventory and monitoring activities to gain a better understanding of the species distribution, biology, population levels, and potential threats, and on managing existing habitat to reduce threats to the species.



**The government's goal for the recovery of the Riverine Clubtail is to maintain viable, self-sustaining populations across the existing range of the species in Ontario.**

Protecting and recovering species at risk is a shared responsibility. No single agency or organization has the knowledge, authority or financial resources to protect and recover all of Ontario's species at risk. Successful recovery requires inter-governmental co-operation and the involvement of many individuals, organizations and communities.

In developing the government response statement, the Ministry considered what actions are feasible for the government to lead directly and what actions are feasible for the government to support its conservation partners to undertake.

### **GOVERNMENT-LED ACTIONS**

To help protect and recover the Riverine Clubtail, the government will directly undertake the following actions:

- Continue to manage the habitat of Riverine Clubtail in provincially protected areas to maintain the ecological integrity of its habitat and to minimize the threat of recreational pressures and impacts.
- Continue to implement the Ontario Invasive Species Strategic Plan to address the invasive species (e.g., Round Goby, Rusty Crayfish, Zebra Mussels) that threaten Riverine Clubtail.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Riverine Clubtail data to the Ministry's central repository at the Natural Heritage Information Centre.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario.
- Protect the Riverine Clubtail and its habitat through the ESA.
- Support conservation, agency, municipal and industry partners, and Aboriginal communities and organizations to undertake activities to protect and recover the Riverine Clubtail. Support will be provided where appropriate through funding, agreements, permits (including conditions) and/or advisory services.
- Encourage collaboration, and establish and communicate annual priority actions for government support in order to reduce duplication of efforts.

## GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions as being necessary for the protection and recovery of the Riverine Clubtail. Actions identified as “high” will be given priority consideration for funding under the ESA. Where reasonable, the government will also consider the priority assigned to these actions when reviewing and issuing authorizations under the Endangered Species Act. Other organizations are encouraged to consider these priorities when developing projects or mitigation plans related to species at risk. The government will focus its support on these high-priority actions over the next five years.

**Focus Area:** **Monitoring and Research**

**Objective:** Determine the distribution, abundance, and habitat needs of Riverine Clubtail and increase knowledge of the species’ life processes and its threats.

*Little is known about the current status of Riverine Clubtail across Ontario and the impact that various threats may have on the species. Determining the habitat requirements for the species will assist in monitoring current populations and informing surveys for suitable habitat. Through species-specific and broader benthic inventory programs, it will be possible to estimate the population abundance, survey for potential presence at additional sites, and monitor trends over time. By filling knowledge gaps, Ontario will be better equipped to support the protection and recovery of Riverine Clubtail.*

**Actions:**

1. **(HIGH)** Develop and implement a standardized survey and monitoring protocol to:
  - conduct presence/absence surveys for Riverine Clubtail in areas of suitable habitat where observations of the species have not been made;
  - estimate the abundance of Riverine Clubtail at existing locations;
  - identify the structure of the vegetation community present at existing locations; and,
  - monitor the extent of road mortality at existing locations.
2. **(HIGH)** Determine the species’ tolerance to threats such as changes to its aquatic habitat, environmental contamination, and invasive species.
3. Integrate searches for Riverine Clubtail into ongoing benthic inventory programs in streams across Ontario.
4. Undertake research to determine the species’ life processes and habitat needs (e.g., home range size and foraging distances) at each of its developmental stages (i.e., egg, larval, and adult stages) to better implement protection and recovery actions for the species.

**Focus Area:** **Habitat Management and Awareness**

**Objective:** Maintain and enhance the quality of existing Riverine Clubtail habitat.

*It is important to work collectively to maintain habitat at current sites and ensure that natural vegetation continues to exist along occupied streams. As further information becomes available, additional steps can be taken to reduce threats to the species and its habitat. As a result, collective efforts to protect, maintain, and enhance identified habitat will be of increased relevance and importance.*

**Actions:**

5. Maintain and enhance habitat for Riverine Clubtail at existing locations in collaboration with local partners, municipalities and conservation authorities by:
  - restoring natural vegetation bordering along occupied reaches of streams; and,
  - removing both aquatic and terrestrial invasive species that pose a threat to Riverine Clubtail habitat using appropriate methods.
6. Conduct outreach activities to raise awareness amongst landowners, land managers and municipalities about Riverine Clubtail, its habitat, and strategies to prevent the spread of invasive species in existing locations.

## IMPLEMENTING ACTIONS

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Fund, Species at Risk Research Fund for Ontario, or the Species at Risk Farm Incentive Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with the Ministry. The Ministry can also advise if any authorizations under the ESA or other legislation may be required to undertake the project.

Implementation of the actions may be subject to changing priorities across the multitude of species at risk, available resources and the capacity of partners to undertake recovery activities. Where appropriate, the implementation of actions for multiple species will be coordinated across government response statements.

## REVIEWING PROGRESS

The ESA requires the Ministry to conduct a review of progress towards protecting and recovering a species not later than five years from the publication of this response statement. The review will help identify if adjustments are needed to achieve the protection and recovery of the Riverine Clubtail.

## ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the Recovery Strategy for the Riverine Clubtail (*Stylurus amnicola*) in Ontario for their dedication to protecting and recovering species at risk.

**For additional information:**

Visit the species at risk website at [ontario.ca/speciesatrisk](http://ontario.ca/speciesatrisk)

Contact your MNRF district office

Contact the Natural Resources Information Centre

1-800-667-1940

TTY 1-866-686-6072

[mnr.nric.mnr@ontario.ca](mailto:mnr.nric.mnr@ontario.ca)

[ontario.ca/mnrf](http://ontario.ca/mnrf)