Final

Species at Risk Act
Action Plan Series

Multi-species Action Plan for the Richelieu River Watershed in Canada

Richelieu River

2025

Canada

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For copies of the action plan or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report, and other related recovery documents, please visit the Species at Risk Public Registry.

Cover illustration: © Photo by Claude Duchaîne; Richelieu River with Île de Jeannotte and Île aux Cerfs in the foreground.

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Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[1] 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 action plans for species listed as extirpated, endangered, or threatened for which recovery has been deemed feasible. They are also required to report on progress 5 years after the publication of the final document on the Species at Risk Public Registry until the recovery strategy is no longer required under SARA or the species' recovery is no longer feasible.

The Minister of Fisheries and Oceans and the Minister responsible for Parks Canada are the competent ministers under SARA for the Copper Redhorse. The Minister of Fisheries and Oceans is also the competent minister under SARA for the Eastern Sand Darter, the Hickorynut and Striped Bass. Fisheries and Oceans Canada (DFO) has prepared this "Multi-species Action Plan for the Richelieu River Watershed in Canada" to implement the recovery strategies for these species, as per section 47 of SARA. This action plan will also support the management plans applicable to species of special concern in the Richelieu River. In preparing this action plan, the competent ministers have considered, as per section 38 of SARA, the commitment of the Government of Canada to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to the listed species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty. To the extent possible, this action plan has been prepared in cooperation with the relevant federal and Government of Quebec departments, Indigenous Nations (W8banaki and Mohawk Council of Kahnawà :ke), the Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR), the regional county municipalities (RCMs) in the watershed, the Fédération de l'Union des producteurs agricoles de la Montérégie (UPA) and several other community stakeholders as per subsection 48(1) of SARA.

As stated in the preamble to SARA, success in the recovery of the species covered in this plan depends on the commitment and cooperation of many different groups that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by DFO, Parks Canada (PC), or any other jurisdiction alone. The cost of conserving species at risk is shared among different constituencies. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the aquatic species at risk in the Richelieu River and Canadian society as a whole.

Under SARA, an action plan provides the detailed recovery planning that supports the strategic directions set out in the recovery strategies for the targeted aquatic species at risk. This plan focuses more specifically on the threats to the quality of the aquatic environment in the Richelieu River watershed and outlines recovery measures that could be taken by DFO, PC and other jurisdictions and/or organizations. Implementation of this action plan is subject to appropriations, responsibilities, priorities, and budgetary constraints of the participating jurisdictions and organizations.

[1] The Quebec government has not signed the 1996 Accord for the Protection of Species at Risk. In addition, the Canada-Quebec Accord for the Protection of Species at Risk expired on March 31, 2022.

Acknowledgements

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DFO would also like to thank any other individuals or organizations who contributed to the preparation of this action plan.

Executive summary

The purpose of this multi-species Richelieu River watershed action plan is to assist in the recovery and conservation of 10 aquatic species listed under SARA, and 2 species assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in the Richelieu River (table 1). The plan targets the aquatic ecosystem in the Richelieu River watershed due to its importance to a large number of species at risk and the strong anthropogenic pressures that exist there. The plan sets out actions that will help improve the quality of the aquatic environment.

The Richelieu River is the largest tributary on the south shore of the St. Lawrence River. Both the urban and agricultural environments exert significant pressure on the river's watershed. Agriculture dominates land use in the watershed, representing close to 70% of land occupancy. Forested areas occupy less than 16% of the territory; major urban centres, 10%; and water bodies and wetlands, less than 5%. The watershed is also used extensively for recreational purposes and as a source of drinking water.

Pervasive water pollution, caused by excessive inputs of sediments, nutrients and contaminants in the Richelieu River, raises major concerns for the survival of a number of aquatic species at risk, as set out in the recovery documents published in 2012 and 2014, (DFO 2012, DFO 2014). This action plan addresses the degradation of the overall aquatic environment, since water quality is intimately linked to the conservation of natural environments. Any improvement in the quality of the aquatic environment will not only benefit aquatic and terrestrial species at risk, but will also be beneficial to biodiversity, as well as land users and residents of the watershed, a large percentage of whom obtain their drinking water from the Richelieu River. This plan takes into account complementary documents published by the Government of Quebec, which is responsible for monitoring and maintaining the quality of water resources, particularly by implementing the Quebec Water Strategy developed by the MELCCFP (MELCCFP 2018) and COVABAR water master plan published in 2015 (COVABAR 2015a in French only). This action plan outlines 20 measures that provide the best chance of achieving the general objective of improving the quality of the aquatic environment. The measures to be undertaken are grouped under 4 strategies, depending on the target groups to address:

- **Strategy 1**: reduce the degradation in the quality of the aquatic environment linked to **agricultural activities**
- **Strategy 2**: reduce the degradation in the quality of the aquatic environment linked to **urban and industrial wastewater**
- **Strategy 3**: reduce the degradation of the aquatic environment linked to **recreational uses**
- **Strategy 4**: **Acquire knowledge**

This action plan is considered to be 1 in a series of linked recovery documents that have a scope extending beyond the quality of the aquatic environment in the Richelieu River watershed. Other concerns for species at risk in the watershed include barriers to fish passage, the introduction of invasive species, decreased prey availability, the presence of host fish species, bycatch and climate change. This plan does not address these threats directly and therefore complements other programs and plans that recommend measures and approaches specific to these threats. An evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation is provided in section 5.

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1. Recovery actions

The Richelieu River is the watercourse with the second-highest aquatic biodiversity in Quebec. It supports an extremely rich fish community composed of more than 60 of the 118 species of freshwater fish found in the province. The “Multi-species Action Plan for the Richelieu River Watershed in Canada” targets this zone, due to its importance to many aquatic species at risk.

1.1 Context and scope of the action plan

The purpose of this multi-species Richelieu River watershed action plan is to assist in the recovery and conservation of 10 aquatic species listed under SARA including 3 species with endangered status (Copper Redhorse, Hickorynut and Striped Bass), 1 threatened species (Eastern Sand Darter) and 6 special concern species (River Redhorse, Channel Darter, Bridle Shiner, Northern Brook Lamprey, Silver Lamprey and Cutlip Minnow). In addition, 2 other species included in this Action Plan (American Eel and Lake Sturgeon) have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and are found in the Richelieu River (table 1), but there has not been a listing decision with respect to them. The plan uses an ecosystem-based approach to address a threat faced by several species at risk, the degradation in the quality of the aquatic environment.

Fisheries and Oceans Canada (DFO) is responsible for aquatic species at risk pursuant to the *Species at Risk Act* (SARA) and therefore has a role to play in their recovery. Parks Canada (PC) is responsible for individuals in or on lands administered by that Agency. PC thus has a role to play given that this action plan includes Copper Redhorse. Under section 47 of SARA, the competent minister must prepare 1 or more action plans based on the recovery strategy. Therefore, action planning for species at risk recovery is an iterative process. The implementation schedule, including the recovery measures outlined in this action plan, may be updated in the future through an amendment to this action plan or the development of another action plan, depending on the progression towards recovery. This action plan builds on a series of recovery documents on Copper Redhorse (DFO 2012) and Eastern Sand Darter (DFO 2014), Hickorynut (DFO in prep a), Striped Bass (DFO 2021) and reports by COSEWIC for Hickorynut (COSEWIC 2011), Striped Bass (COSEWIC 2012), Copper Redhorse (COSEWIC 2014) and Eastern Sand Darter (COSEWIC 2022a).

The measures in this action plan are not the only ones to be undertaken to assist in the recovery of species at risk. The plan is part of, and iteratively builds on, a series of documents produced under SARA, including management plans and recovery strategies, as well as the recovery plans produced by the Government of Quebec under the *Act Respecting Threatened or Vulnerable Species* (ARTVS).

Several strategic documents have been developed to preserve the Richelieu River and its tremendous biodiversity through conservation, restoration, and improvement of watershed management (appendix A). This plan takes into account complementary documents published by the Government of Quebec, which is responsible for monitoring and maintaining the quality of water resources, particularly by implementing the Quebec Water Strategy developed by the Ministère de l’Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) (MELCCFP 2018) and Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) water master plan published in 2015 (COVABAR 2015a in French only).

1.2 Main stakeholders and measures in progress

The stakeholders consulted in the development of this action plan are those engaged in conservation activities or that have regulatory authority in the Richelieu River watershed in Quebec, and that may represent potential partners in the implementation of the plan (appendix B). DFO and the MELCCFP will promote the implementation of the measures in the plan, notably through the Copper Redhorse and the Cyprinidae and small Percidae recovery teams.

Fisheries and Oceans Canada (DFO)

In order to protect and assist in the recovery of aquatic species at risk, DFO oversees the administration and enforcement of SARA (related to aquatic species at risk) and the *Fisheries Act* in Quebec's fresh and marine waters. Through the provisions related to the protection of fish and fish habitat in these federal statutes, DFO, during the regulatory review of works, undertakings and activities near water, ensures that adequate avoidance, mitigation and offsetting measures are implemented by the proponent to manage the risk to fish and fish habitat, including aquatic species at risk, their residence and critical habitat. Aside from its regulatory role, DFO also supports the protection and improvement of aquatic habitats of species at risk through scientific research and funding programs such as the Habitat Stewardship Program for Species at Risk, the Aboriginal Fund for Species at Risk, and the Canada Nature Fund for Aquatic Species at Risk.

Parks Canada (PC)

Under SARA, the role of PC is to protect species at risk and their habitats located on federal lands administered by the agency. PC's Quebec Waterways Management Unit is responsible for the Vianney-Legendre fish ladder used by Copper Redhorse and other species at risk to bypass the Saint-Ours Dam, which is part of the Saint-Ours Canal National Historic Site. Under SARA, the Minister responsible for PC is the competent minister with respect to individuals of Copper Redhorse, which use the fish ladder. PC also plays a key role in the recovery of Copper Redhorse by making its facilities available to MELCCFP for the implementation of the artificial reproduction program for the species. In addition, PC's Mauricie and Western Quebec Field Unit manages 2 national historic sites (NHS), Fort Chambly and Fort Lennox, which are used or are adjacent to the habitat of aquatic species targeted by the current plan.

Transport Canada (TC)

TC controls recreational boating on the Richelieu River. TC administers the *Vessel Operation Restriction Regulations*, which make it possible to address issues related to safety, environmental protection or the public interest in cases where no other act, regulation or regulatory system applies, and where the only solution is to impose navigation restrictions on a body of water. In this context, 4 municipalities submitted a plan to limit vessel speed and tow sports on the Richelieu River in 2019.

Environment and Climate Change Canada (ECCC)

The Minister responsible for ECCC is the competent minister for terrestrial species at risk, including those located in the Richelieu River watershed. As such, ECCC is responsible for preparing the recovery documents for those species. The implementation of the measures in these documents is supported in part by funding programs. ECCC is a leader in the ecosystem-based approach, as exemplified by the adoption of the place-based methodology in the Atlas of

Sites of Conservation Interest in the St. Lawrence Lowlands, which is based on the mapping carried out in accordance with the Open Standards for the Practice of Conservation.[2]

Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP)

MELCCFP implements policies, laws, regulations and programs that aim to conserve biodiversity, and protect the environment. In 2017, the National Assembly passed the *Loi concernant la conservation des milieux humides et hydriques* [*Act respecting the conservation of wetlands and bodies of water*], which amended five Acts: la *Loi sur l'aménagement et l'urbanisme* [*Act respecting land use planning and developtment*], la *Loi affirmant le caractère collectif des ressources en eau et visant à renforcer leur protection* [*Act to affirm the collective nature of water resources and provide for increased water resource protection*], la *Loi sur la conservation du patrimoine naturel* [*Natural Heritage Conservation Ac*t], la *Loi sur le ministère du Développement durable, de l'Environnement et des Parcs* [*Act respecting the Ministère du Développement durable, de l'Environnement et des Parcs*], *and la Loi sur la qualité de l'environnement* [*Environment Quality Act*]. All but one of these Acts (*Loi sur l'aménagement et l'urbansime*) are administered by MELCCFP and have more or less direct implications for the protection of the quality of the aquatic environment. MELCCFP is also responsible for the Quebec government's Régime transitoire de gestion des zones inondables, des rives et du littoral [Transitional regime for the management of flood zones, shorelines and littoral zones] (municipal authorization, regulation of activities based on their impact on the environment and regulation on activities in wetlands, bodies of water and sensitive environments). This departmement is also charged with monitoring the effectiveness of municipal wastewater treatment works (MWTW) and has developed a substantial water quality monitoring network that includes the Richelieu River. The Quebec Water Strategy (MELCCFP 2018) and resulting action plans provide broad policy guidelines, as well as specific measures, to improve water quality.

MELCCFP also has regional expertise in freshwater aquatic species at risk. Its mandate includes implementing the ARTVS and the *Act Respecting the Conservation and Development of Wildlife*. Under provincial legislation, it is also responsible for wildlife refuges and other types of protected areas on public land, including the Pierre-Étienne-Fortin Wildlife Preserve, a key element in the conservation of the Copper Redhorse. MELCCFP is also responsible for the artificial reproduction program for this species.

Ministère des Affaires Municipales et de l'Habitation (MAMH)

MAMH is mandated by the Government of Quebec to prepare and develop government policies, documents, notices, decrees and government actions pursuant to the various sections of the *Act Respecting Land Use Planning and Development*. Consequently, the department is responsible, with the collaboration of the other departments and agencies involved, for informing RCMs about whether their land use and development plans respect government policies, plans and initiatives. In addition, MAMH administers funding programs for the construction, maintenance, and expansion of municipal drinking water and wastewater infrastructure.

[2] The purpose of the Open Standards for the Practice of Conservation is to guide key project management decisions in conjunction with other decision support tools, as well as to facilitate collaboration and provide a transparent basis for shared decision-making and learning. The Conservation Measures Partnership is a partnership of conservation-oriented NGOs, government agencies, and funders that work collectively to achieve a greater impact.(Conservation Measures Partnership 2020).

Indigenous Peoples

Two Indigenous Nations are present on the territory of the Richelieu River watershed: the W8banaki Nation and the Kanien'kehá:ka (Mohawks) of Kahnawà:ke.

The W8banaki Nation accounts for over 3,000 members divided into 2 communities: Odanak and Wôlinak. The first group is located on the shores of the Alsig8ntegw (the Saint-François River) near the municipality of Pierreville, and the second 1 is on the shores of the W8linaktegw (the Bécancour River). These 2 communities have a rich historical and cultural heritage, and today are located on reserve lands that are respectively about 5.7 km^2 and 0.75 km^2. The vast majority of the W8banakiak today live off reserve, in both Quebec and Ontario, and in the United States.

The traditional territory of the Haudenosaunee (Iroquois Confederacy) includes the Kaniatarowanenne (St. Lawrence River), the Richelieu River (featured on many historical maps as the "Iroquois River"), Regioghne (Lake Champlain), and the Hudson and Mohawk Rivers. Collectively, these bodies of water are the entrance or the "Eastern Door" to Haudenosaunee territory. Within the Iroquois Confederacy, the Mohawks were and continue to be recognized as the keepers of the Eastern Door. The majority of the Mohawks of Kahnawà:ke live on reserve lands located on the south shore of the Kaniatarowanenne, just west of the Richelieu watershed.

Stakeholders in the agricultural sector

Agriculture and Agri-Food Canada (AAFC), the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ), Fédération de l'Union des producteurs agricoles de la Montérégie (UPA), agri-environmental advisory clubs (AACs), agricultural producers and agronomists are key partners in preserving water quality in the agricultural environment. MAPAQ's 2020-2030 sustainable agriculture plan aims to accelerate the adoption of effective agri-environmental practices (appendix A) and several of its objectives will contribute to this action plan. Examples include doubling the area of agricultural enhancements (such as windbreaks and expanded riparian strips); improving fertilizer management, soil conservation and soil health; and reducing pesticides. In addition, MAPAQ's funding programs, notably the Prime-Vert scheme, encourage the adoption of agri-environmental practices.

RCMs, Municipal sector and the general public

The RCMs (regional county municipalities) and the municipal sector (includes urban agglomerations, municipalities and municipal organizations, notably the Fédération québécoise des municipalités (FQM) and Union des municipalités du Québec (UMQ)) play a decisive role in preserving the quality of water and the aquatic environment. They also regulate and manage land use and development. Land-use planning can also play an important role in improving water quality. RCMs are also responsible for the planning and maintenance activities associated with agricultural watercourses pursuant to the *Municipal Powers Act* and for carrying out monitoring activities to enforce the Quebec government's Régime transitoire de gestion des zones inondables, des rives et du littoral [Transitional regime for the management of flood zones, shorelines and littoral zones]. These 2 responsibilities have a considerable impact on the quality of aquatic habitats and the maintenance of their integrity.

Municipalities can also engage citizens and get them directly involved in reducing water use, runoff, and pollutant loads (a number of pollutants such as pesticides are not treated by

municipal wastewater treatment works) at the source. For example, some municipalities have passed bylaws on disconnecting gutters from sewer systems and correcting reversed connections. Other municipalities limit development in their jurisdictions based on water availability or wastewater treatment plant capacity.

Universities

Academic institutions carry out research and development projects that encourage the adoption and integration of agricultural practices that limit impacts on the aquatic environment and species at risk. For example, a research project is currently underway at McGill University to determine if water quality of the Richelieu River affects egg hatching and larval survival of Copper Redhorse.

COVABAR, Nature Conservancy of Canada (NCC) and other environmental non-governmental organizations (ENGOs)

COVABAR is a watershed management organization that coordinates the integrated management of water resources in the Richelieu River watershed. Its mandate includes the development and implementation of a water master plan in collaboration with community stakeholders.

The NCC is a key organization in the conservation of the aquatic environment. It owns a 21 km section of the Richelieu River riverbed upstream of the Chambly Basin. Recently, it transferred ownership of Île de Jeannotte and Île aux Cerfs to MELCCFP so that these islands can be included in the Pierre-Étienne-Fortin Wildlife Preserve.

Several other ENGOs also contribute to the conservation of fish habitat in the Richelieu River watershed. They have the expertise needed to participate in implementing 1 or more of the strategies in this action plan, particularly outreach and knowledge acquisition.

1.3 Description of geographic area

The Richelieu River, located in the Montérégie region, flows northward from Lake Champlain across the St. Lawrence Lowlands and east of the urban agglomeration of Montreal into Saint-Pierre Lake, 1 of the fluvial lakes in the St. Lawrence River. With an average annual flow of nearly 500 m^3/s, the Richelieu River is the largest tributary on the south shore of the St. Lawrence River. The Quebec portion of the river's watershed (figure 1) is equivalent in area to roughly 10% of the drainage basin of the Richelieu River and Lake Champlain (ECCC and MDDELCC 2018). The United States (U.S.) portion of the watershed corresponds to almost all (90%) of the Richelieu River's drainage basin, which extends into Vermont and New York State. From the outlet of Lake Champlain near the U.S.-Canada border, the river flows 124 km to its mouth in Saint-Pierre Lake. Along the way, water from over 3,500 km of watercourses drains into its 2,546 km^2 watershed. There are 2 dams on the river, the Saint-Ours and Chambly dams. Upstream, the watershed also contains most of the Quebec portion of the drainage basin of Brochets River, which flows into Missisquoi Bay, which in turn empties into Lake Champlain (figure 1). The largest sub-watersheds are those of the L'Acadie (530 km^2), Hurons (334 km^2), Rivière du Sud (145 km^2) and Lacolle (126 km^2) rivers. The Richelieu River also drains streams with significant watersheds such as Laplante (112 km^2), Belœil (103 km^2) and Amyot (94 km^2) streams.

1.4 Land use

Figures 2a and 2b show land use in the Quebec portion of the Richelieu River watershed. Approximately 710,000 people in 65 municipalities live in the watershed, with 45 of these municipalities sourcing their drinking water directly from the surface water of the Richelieu River. Agriculture (primarily soybean and corn crops) is the predominant land use in the watershed, representing nearly 70% by area, followed by woodland areas (less than 16%), urban areas (10%), and wetlands and water bodies (5%) (figures 2a and 2b). Protected areas account for 0.78% of the territory, the largest of which are the (1) Pierre-Étienne-Fortin Wildlife Preserve, (2) NCC properties (15 km of shoreline along the Richelieu Riverand the Green Mountains Nature Reserve), (3) numerous other privately owned nature reserves, and (4) Mont-Saint-Bruno provincial park. The aquatic ecosystem of the entire Richelieu River watershed has undergone significant anthropogenic modifications and is heavily altered.

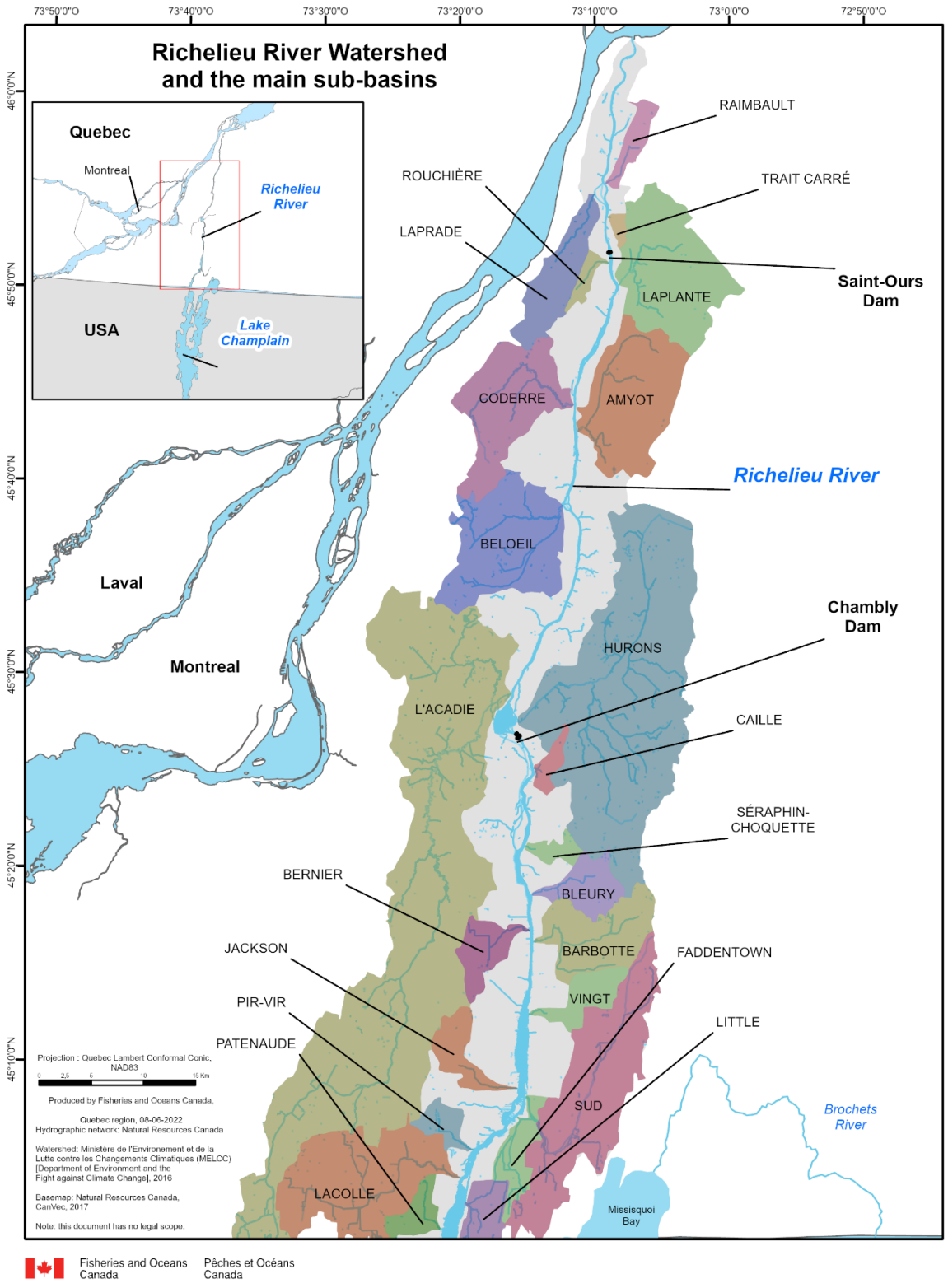

Figure 1. Map of the Quebec portion of the Richelieu River watershed, including its main sub-watersheds.

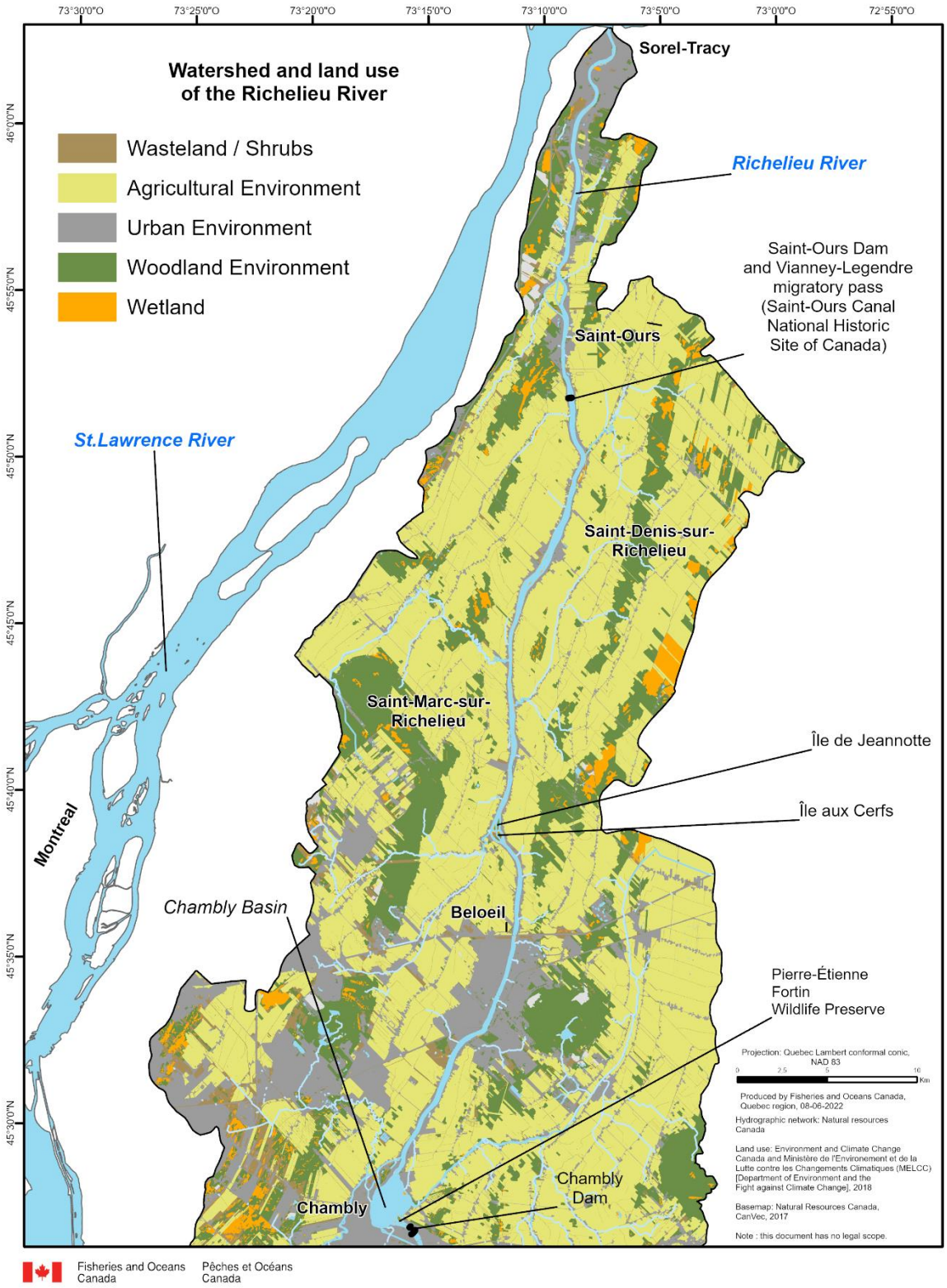

Figure 2a. Land use in the northern part of the Richelieu River watershed in Quebec.

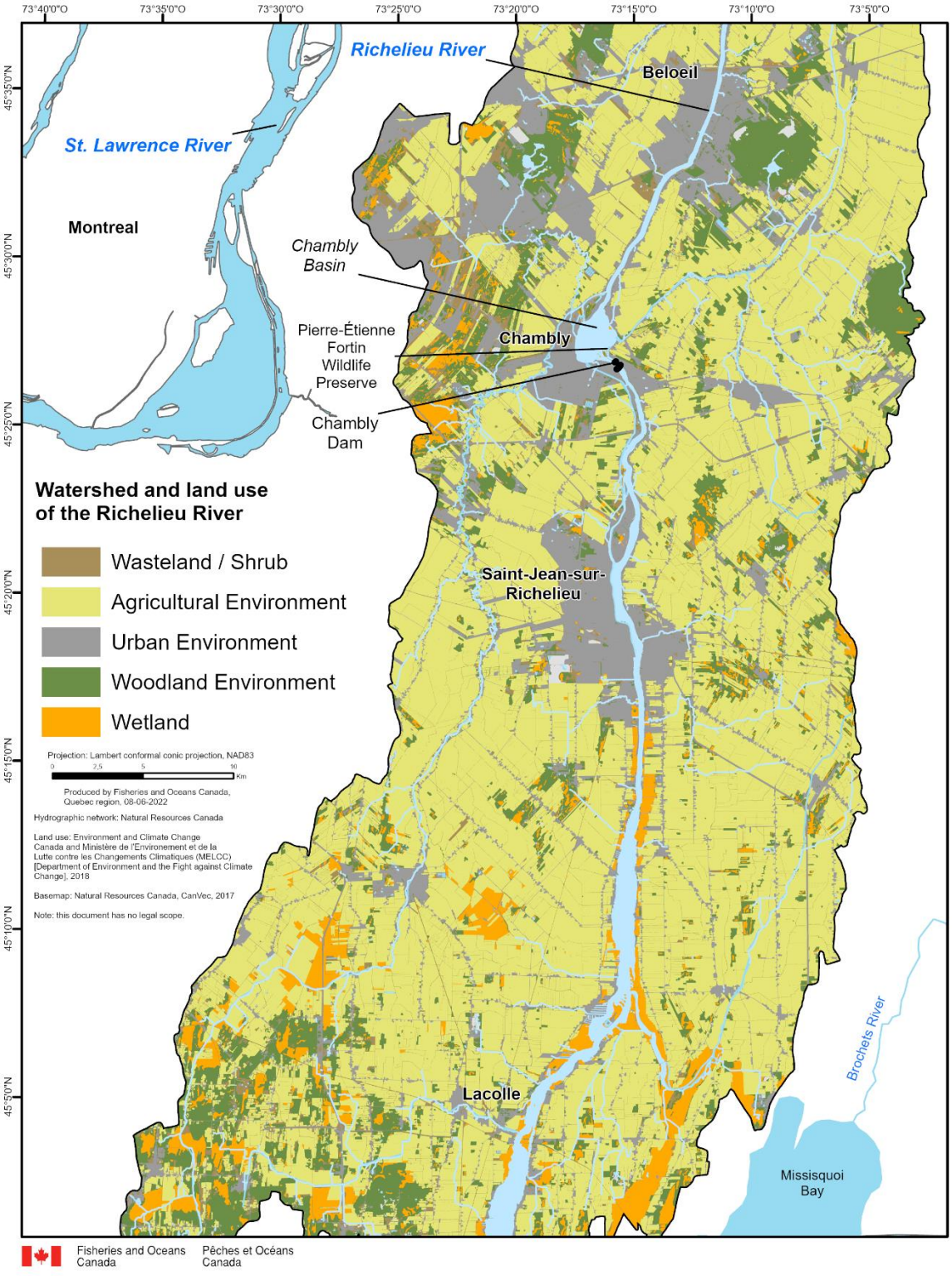

Figure 2b. Land use in the southern part of the Richelieu River watershed in Quebec.

1.4.1 Land use by Indigenous Nations

Two Indigenous Nations are present on the territory and have been using it since time immemorial. In order to include the perspectives of Indigenous Peoples, DFO proposed to the Bureau du Ndakina de W8banaki and the Mohawk Council of Kahnawà:ke to draft a text presenting their respective Nations. This text is included below.

W8banaki Nation (Contributed by Bureau du Ndakina de W8banaki)

The W8banaki ethnonym is the result of a contraction of the words *W8ban* (First Light) and *Aki* (land) which, when joined together, mean by extension People of the First Light or People of the East. The significance of this ethnonym can be explained by the geographic location of the W8banakiak, both currently and historically. Prior to the current state borders, the ancestral land of the W8banaki, Ndakina, included all or part of southern Quebec, Maine, New Hampshire, Vermont, and Massachusetts. In this regard, Pnapskw (the Penobscot River) and Akigwitegw (the Etchemin River) together form the eastern boundary of Ndakina, while the Merrimack River and the line formed by the Masesoliantegw (the Richelieu River) and the Pitawbagw (Lake Champlain) form the western boundary of the land and thus constitute an area shared with the Kanien'kehá:ka Nation. To the north, the Kchitegw (the St. Lawrence River) primarily serves as a boundary for this vast territory that extends to the south as far as the Gulf of Maine. In this sense, Ndakina borders the ancestral lands of the Atikamekw Nehirowisiwok, the Wolastoqiyik Wahsipekuk, the Penobscot and the Kanien'kehá:ka.

Masesoliantegw is the name currently given to the Richelieu River in Aln8ba8dwaw8gan, the language of the W8banakiak, and it means "river with a lot of silver." However, the W8banakiak have known this river since time immemorial and it bore a number of distinct names throughout the eras. This river is of high cultural, archeological and historical importance to the Nation because of its key role in the settlement, moving and ancestral occupation trends of the Nation on the Ndakina, its strategic value during colonial times, but also its contemporary use by the W8banakiak for traditional purposes. This importance is illustrated by the richness of the pre-contact archeological heritage that the Masesoliantegw offers.

To this day, the W8banakiak continue to frequent and occupy the Masesoliantegw for the practice of traditional food, social and ritual activities. In addition to navigation for purposes of transportation and sites of cultural and spiritual importance, hunting, fishing, trapping, and gathering are part of the activities practiced by the W8banakiak on the Masesoliantegw and its surroundings. As a result of these activities that underlie the occupation of the river and of Ndakina, the W8banakiak continue to fulfill their stewardship responsibility, that is, the capacity to implement in a consistent manner their responsibility to the land in a reciprocal relationship, as well as to the Aboriginal and Treaty Rights they hold under the 1982 *Constitution Act* and the *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP). In this sense, the fauna and flora, the components of the natural environment and their related planning have significant social, cultural, spiritual, linguistic, and political impacts for the members of the W8banaki Nation.

In the watershed of the Richelieu River, the W8banaki Nation particularly values 3 species of fish on this territory.

Striped Bass

As part of this Action Plan, some of the species its features are of fundamental importance to the W8banaki Nation and its members, as their health and access are critical conditions to the exercise of the rights of the W8banakiak. This is especially the case for striped bass, which is currently the subject of research studies and significant measures developed by the Nation in anticipation of its reintroduction into the Kchitegw (the St. Lawrence River) and its tributaries. Striped bass, which was traditionally fished by the W8banakiak, today represents a future fishing opportunity for the latter, once the population recovery will make it possible. The Environment and Land Office of Odanak (ELOO) and the Environment Office of W8linak (EOW) are very actively involved in the monitoring of this species. However, the increased pressure (commercial and sport fishing, industrial and recreational/tourism development, access issues due to the privatization of river banks, climate change, etc.) on the waterways of the Ndakina could destroy the monitoring and recovery efforts regarding this species, including those made by the Nation.

Copper Redhorse

The Copper Redhorse is also a species whose status remains a concern for the Nation. As it is very fragile, the species is listed as endangered under the *Federal Species at Risk Act* and has the status of endangered species under the Quebec Government's *Act respecting threatened or vulnerable species*. While it is not fished by the W8banakiak for reasons of stewardship and ethics, its survival is important to the Nation. Many recovery efforts have been implemented for this reason, and the Environment Offices of Odanak and W8linak are conducting studies and monitoring activities on this species. In such a context, any negative impact on the habitat of this species must be viewed as an additional and cumulative pressure that could result in profound consequences.

Sturgeon

Lastly, the sturgeon is of significant cultural importance to the W8banaki Nation. The sturgeon is the emblem of the Odanak community, and it is widely present at community meals, where it is smoked. Its preservation and removal are sensitive issues that are the subject of differences of opinion within the Nation and even within some families. To preserve the species, a self-imposed limit by the Nation on daily catches has been set at one per individual. Despite this measure, a research study by the Ndakina Office has revealed that some members have even stopped fishing and consuming this species in the interest of conservation, and they are managing the land ethically. To them, this principle overrides the principle of the ancestral traditions of their practice. Therefore, the Nation accepts deprivation measures that go even beyond a restriction on the number of catches, and whose impacts could be eliminated as a result of an increase in pressure on the species owing to various cumulative impacts.

The Masesoliantegw is thus of major importance to the W8banaki Nation and its members. The status of the species that it contains and of their habitat is therefore a determining component in the exercise of the stewardship responsibility of the W8banakiak regarding them and their related rights. The actions and mechanisms to protect species culturally valued by the W8banakiak and their habitats, regarding the rights and values of the Nation, are a priority for the W8banaki Nation.

The Mohawks of Kahnawà:ke Nation (Contributed by Mohawk Council of Kahnawà :ke)

The traditional territory of the Haudenosaunee (Iroquois Confederacy) includes the Kaniatarowanenne (St. Lawrence River), Richelieu (featured on many historical maps as the

"Iroquois River"), Hudson and Mohawk Rivers, as well as Regioghne (Lake Champlain). Collectively, these bodies of water are the entrance or the "Eastern Door" to Haudenosaunee territory. Today, the reserve lands of the Mohawks of Kahnawà:ke are located on the south shore of the Kaniatarowanenne, just west of the Richelieu watershed.

Within the Iroquois Confederacy, the Kanien'kehá:ka (Mohawks) were and continue to be recognized as Keepers of the Eastern Door and are responsible for addressing issues that arise from the east, from the mouth of the Kaniatarowanenne to the Great Lakes. Part and parcel of this role, the Kanien'kehá:ka assert governance rights which include a responsibility, as stewards of the lands and waters, to care for and protect these ecosystems for future generations. The Kanien'kehá:ka do this by applying our own traditional laws and practices. The Ohén:ton Karihwatéhkwen (the words that come before all else) is an environmental and spiritual code based on traditional laws and practices. It encompasses principles that lead us to carefully considering intricate ecological connections that may not be readily apparent when evaluating a single area, species or activity. The application of the Ohén:ton Karihwatéhkwen serves as an expression of our custodial rights and demonstrates to all the importance of human responsibility in ensuring that relationships with all living beings are well balanced and all environmental aspects are considered.

Within this web, the Richelieu River continues to be an important area for the continued practice and passing on of traditional knowledge. Two species at risk that are found in the Richelieu River are of particular importance to the Mohawks of Kahnawà:ke.

The eel, or tiawerón:ko as it is known in Kanien'kéha, is an important food fish and is used as medicine by the Kanien'kehá:ka. Both overharvesting through commercial fisheries and increased mortality by hydroelectric power generating structures have resulted in large declines in eel populations and threatens the continuation of cultural practices that use tiawerón:ko.

The sturgeon, or teiotién:taron as it is known in Kanien'kéha, is a sacred and highly prized food fish for the Kanien'kehá:ka. Its properties, such as its size and oily flesh, have made it a staple and nutritious food. The Kanien'kehá:ka have always adapted fishing practices to fluctuations in the populations of teiotién:taron maintaining populations over time. However, colonization resulted in the overharvesting of teiotién:taron, and the construction of water control structures, destroying spawning and feeding habitats.

The cumulative impacts of overharvesting and habitat modifications have resulted in negative impacts on the ability of community members to practice rights and continue cultural practices. The Mohawk Council of Kahnawà:ke supports the recovery of species at risk through monitoring and restoration programs conducted through the Kahnawà:ke Environment Protection Office and continues to advocate for the protection and recovery of species at risk across the territory.

The network of waterways, of which the Richelieu is a part, have long served as the "highways" connecting the Kanien'kehá:ka to trade, hunting, and travel to other parts of the traditional territory. Today, community members from Kahnawà:ke continue to travel by boat from Kahnawà:ke to various locations on Regioghne via the Kaniatarowanenne and the Richelieu River. Activities in the area include fishing (including sturgeon, trout, walleye, perch, pike, carp, and bass); hunting of white-tailed deer, moose, muskrat, hare, Canada geese, white goose, and different species of duck; gathering of medicines, mushrooms, sweetgrass, berries, and other plants; camping, hiking, canoeing, boating, kayaking; and some harvesting of feathers and visiting historical sites.

2. Species at risk and their critical habitats

The Richelieu River ranks second among Quebec's watercourses in terms of aquatic biodiversity. It supports an extremely rich fish community, composed of more than 60 of the 118 species of freshwater fish that occur in Quebec, including 12 aquatic species at risk. Table 1 lists all the aquatic species considered to be at risk by COSEWIC that occur in the Richelieu River. Figure 3 illustrates critical habitats and distribution areas of these species.

Table 1. Aquatic species at risk in the Richelieu River along with the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment, status[3] under *Species at Risk Act* (SARA) and the *Act Respecting Threatened or Vulnerable Species* (ARTVS), and applicable recovery documents.

Species	Last COSEWIC assessment	Status under Schedule 1 of SARA	Status under ARTVS	Recovery documents
Copper Redhorse[4]	Endangered (2014)	Endangered	Threatened	DFO 2012, MRNF 2012, COSEWIC 2014
Eastern Sand Darter[3] (Quebec populations)	Special concern (2022)	Threatened	Threatened	Équipe de rétablissement des cyprinidés et petits percidés 2020 COSEWIC 2022a
Striped Bass (St. Lawrence River population)	Extinct (2019)	Endangered (2019)	None	COSEWIC 2012a DFO 2021
River Redhorse	Special concern (2015)	Special concern	Vulnerable	COSEWIC 2015 DFO 2018a
Channel Darter (St. Lawrence populations)	Special concern (2016)	Special concern	Vulnerable	DFO 2013a, COSEWIC 2016, DFO in prep. b, Équipe de rétablissement des cyprinidés et petits percidés 2019

[3] Status is defined differently under SARA and Quebec's ARTVS. Under SARA, endangered refers to a wildlife species that is facing imminent extirpation or extinction; threatened, to a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction; and special concern, to a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. Under ARTVS, threatened means that the extirpation or extinction of a species, subspecies or population is feared; and, vulnerable, that the survival of the species, subspecies or population is deemed to be at risk even though it is not likely to become extinct or extirpated in the short or medium term.

[4] Species for which critical habitat has been identified in the Richelieu River and are protected under SARA.

Species	Last COSEWIC assessment	Status under Schedule 1 of SARA	Status under ARTVS	Recovery documents
Bridle Shiner	Special concern (2013)	Special concern	Vulnerable	Boucher et al. 2011, Équipe de rétablissement des cyprinidés et petits percidés 2012 COSEWIC 2013a
Northern Brook Lamprey (Great Lakes–Upper St. Lawrence populations)	Special concern (2020)	Special concern	Threatened	DFO 2018b COSEWIC 2020
Silver Lamprey	Special concern (2020)	Special concern	None	COSEWIC 2020
Cutlip Minnow	Special concern (2013)	Special concern	None	COSEWIC 2013b
Lake Sturgeon (Great Lakes–Upper St. Lawrence populations)	Threatened (2017)	None	Likely to be designated as threatened or vulnerable	COSEWIC 2017
American Eel	Threatened (2012)	None	Likely to be designated as threatened or vulnerable	COSEWIC 2012b MFFP 2022
Hickorynut	Endangered (2011)	Endangered	Threatened	COSEWIC 2011

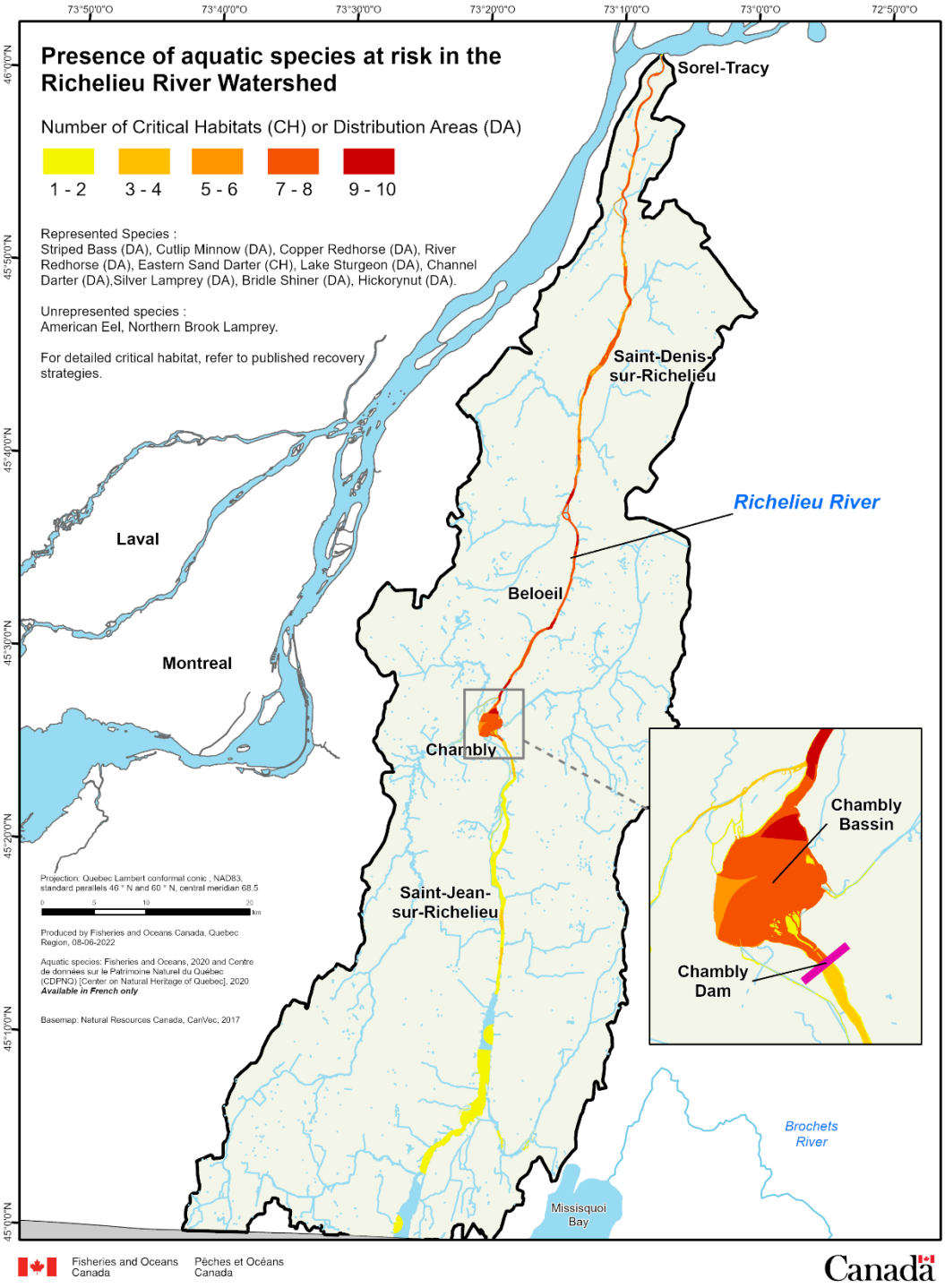

Figure 3. Locations of critical habitat and distribution areas of the Copper Redhorse, Eastern Sand Darter, Hickorynut, Striped Bass and other aquatic species at risk in the Richelieu River watershed in Quebec.

2.1 Copper Redhorse

The Copper Redhorse (*Moxostoma hubbsi*) is found exclusively in Quebec and has been listed under SARA since 2007 (figure 4). Its endangered status was re-examined by COSEWIC in 2014 and maintained. The species' range is restricted to the St. Lawrence River, Saint-Louis Lake, Saint-Pierre Lake and the Mille Îles, Prairies and Richelieu rivers (figure 5). It is found in aquatic grass beds in shallow water around islands and archipelagos in the St. Lawrence River and in fluvial lakes. These grass beds contain an abundance of gastropods, which make up 90% of the species' diet. The species' known spawning grounds are located at the foot of Saint-Ours Dam and in the Chambly Rapids in the Richelieu River. After hatching, larval Copper Redhorse use the grass beds all along the Richelieu River for shelter and food.

The critical habitat of the Copper Redhorse is described in the recovery strategy for the species (DFO 2012). The Richelieu River portion of the species' critical habitat includes the 2 known spawning grounds of the species. This critical habitat also includes the river's littoral zone (the strip along the shore with a depth between 0 m and 4 m), from the Chambly Dam to its mouth in Saint-Pierre Lake. Aquatic grass beds in the Richelieu River play a determining role in the Copper Redhorse's growth and feeding, while the river's rapids are used as spawning grounds. Connectivity is maintained as far as the Chambly Basin due to the Vianney-Legendre fish ladder, which allows Copper Redhorse to pass around the Saint-Ours Dam.

Figure 4. Copper Redhorse (*Moxostoma hubbsi*). Illustration by Nathalie Vachon, Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP).

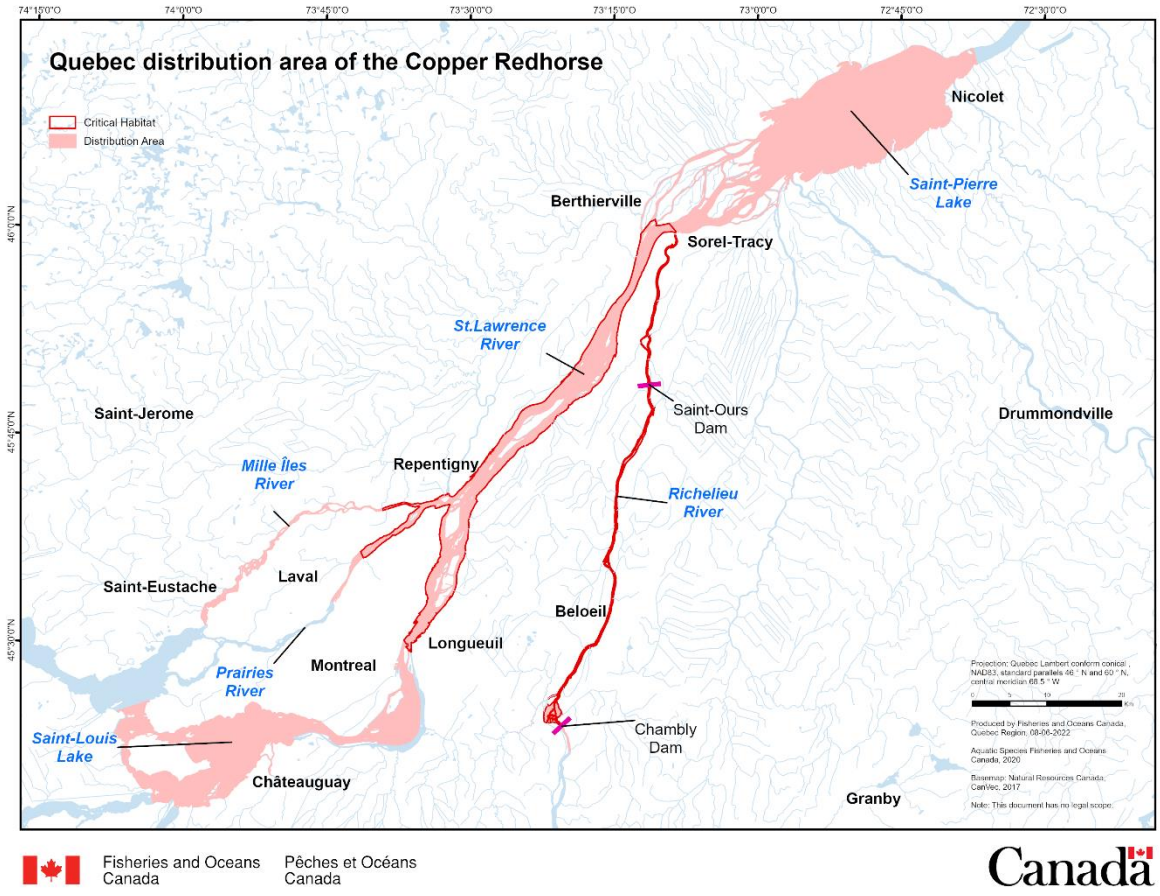

Figure 5. Area within which critical habitat[5] is found and distribution area of the Copper Redhorse.

The most significant threats to the species are erosion, shoreline alteration, eutrophication, contaminants and dams. The COSEWIC status report (COSEWIC 2014) and the federal and provincial recovery and implementation documents for the Copper Redhorse (DFO 2012, MRNF 2012, DFO 2022a) provide more details on the species' distribution, biology and the threats it faces.

2.2 Eastern Sand Darter

The Eastern Sand Darter (*Ammocrypta pellucida;* figure 6) has been listed under SARA since 2003. The species was considered a single designatable unit (DU) and was assessed and designated as threatened by COSEWIC in April 1994 and again when it was reassessed November 2000. When the species was split into separate DUs in November 2009, the "Quebec populations" unit was designated as threatened. The DU name changed to "Quebec population" in May 2022. The species' status was re-examined and reclassified as special concern in May 2022 (COSEWIC 2022b). The COSEWIC status report (COSEWIC 2022a) and federal and

[5] Two conditions must be met in order for a site to be considered Critical Habitat: 1. It must be within the bounding box (in red); and 2. The feature(s) as described in Table 3 of the Recovery strategy for the Copper Redhorse (*Moxostoma hubbsi*) in Canada must be present and describable.

provincial recovery documents for the species (Équipe de rétablissement des cyprinidés et des petits percidés du Québec 2008, DFO 2014) provide information on what is known of the species' distribution, biology and the threats it faces.

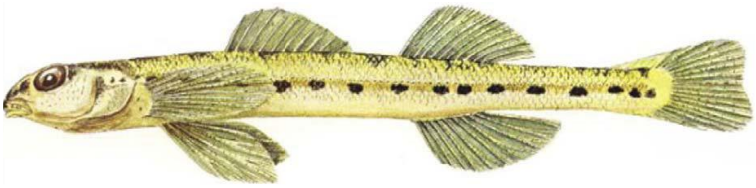

Figure 6. Eastern Sand Darter (*Ammocrypta pellucida*). Illustration by E. Edmonson and H. Chrisp (New York State Department of Environmental Conservation).

In Quebec, Eastern Sand Darter populations occur in the St. Lawrence River and several of its north and south shore tributaries between Deux-Montagnes Lake and Leclercville (downstream of Saint-Pierre Lake). Sampling operations since the publication of the recovery strategy have allowed the species' distribution in Quebec to be more accurately described (DFO 2022b, Équipe de rétablissement des cyprinidés et petits percidés du Québec 2020).

The critical habitat of the Eastern Sand Darter is defined to the extent possible in the recovery strategy (DFO 2014). Part of the species' critical habitat extends along a 71 km stretch in the Richelieu River from a point downstream of the Chambly Basin to near the river mouth in the St. Lawrence River, covering a total area of 18.8 km^2 (figure 3). The Eastern Sand Darter may also be present upstream of the Chambly Basin, since the species has been observed in Missisquoi Bay.

The recovery strategy for the species (DFO 2014) also provides a schedule of studies needed to complete the identification of the species' critical habitat, but does not include a specific study in the Richelieu River for this purpose. However, surveys by MELCCFP and DFO (DFO in prep. b) have documented the stretches of the Richelieu River with habitat characteristics suitable for the species, as well as the species' use of deep areas (> 2 m).

2.3 Hickorynut

The Hickorynut (*Obovaria olivaria;* figure 7) is 1 of 54 species of freshwater mussels in Canada and 1 of the 2 representatives of the genus *Obovaria* in Canada. In 2011, COSEWIC assessed the Hickorynut as endangered. The species has been listed under SARA since 2019. The status report on the species (COSEWIC 2011) and the 2013 recovery potential assessment (DFO 2013b) provide information on what is known of the Hickorynut's distribution, biology, and the threats it faces. DFO's action plan and recovery strategy (DFO in prep. a) will address the actions to be undertaken throughout its range and will complement the current action plan.

Figure 7. Hickorynut (*Obovaria olivaria*). Photo by Shelly Dunn, DFO.

Currently, the only known Hickorynut populations in Canada are in the Great Lakes and St. Lawrence River system, from Lake Huron in southern Ontario to Quebec, and in some rivers and their tributaries, including the Mississagi, Ottawa, Saint-François and Richelieu rivers.

The larvae (glochidia) of freshwater mussels attach to the gills of a host fish prior to transforming into juveniles. Evidence points to the Lake Sturgeon (*Acipenser fulvescens*) may be the main host fish for Hickorynut larvae.

The main threats to Hickorynut populations are introduced Zebra (*Dreissena polymorpha*) and Quagga (*D. bugensis*) mussels, dams that limit Lake Sturgeon movements, and pollution from industrial and agricultural activities. The status report (COSEWIC 2011) and the Recovery Potential Assessment (DFO 2013b) provide more information on threats to this species.

2.4 Striped Bass

The Striped Bass (St. Lawrence River population) (*Morone saxatilis;* figure 8) was extirpated from the St. Lawrence River in the 1960s due to overfishing and the destruction of its habitat. The species was reintroduced in the river through a stocking program that began in 2002 using individuals from the southern Gulf of St. Lawrence population. Since August 2019, the St. Lawrence River population of the Striped Bass has been listed under SARA as an endangered species, based on a 2012 COSEWIC assessment (COSEWIC 2012a) that considered the reintroduced population to be the St. Lawrence River population.

In November 2019, COSEWIC re-examined the status of the Striped Bass, St. Lawrence River population, and designated it extinct. This analysis was based solely on the historical population that existed prior to the reintroduction program. The COSEWIC assessment does not automatically result in a change in the species' legal status, which would require a subsequent decision by the Governor in Council. In July 2021, the Governor in Council asked COSEWIC to provide more information on the current status of the Striped Bass population present in the St. Lawrence River. A complete re-assessment of the status of Canadian Striped Bass populations is expected soon. The Striped Bass remains listed under SARA as an endangered species.

Figure 8. Striped Bass (*Morone saxatilis*). Source: Fédération québécoise des chasseurs et pêcheurs.

The "Recovery Strategy and Action Plan for the Striped Bass (*Morone saxatilis*), St. Lawrence River population, in Canada" (DFO 2021) identifies the species' critical habitat. This document also outlines the state of knowledge on the species' distribution and biology and the threats to the species, including sediment and nutrient loading and inputs of pesticides in watercourses.

The critical habitat of the Striped Bass, identified in the recovery strategy and action plan, excludes the Richelieu River. Nevertheless, the upstream limit of the main range of the St. Lawrence River population of the Striped Bass is identified as the entrance of Saint-Pierre Lake (at Sorel) and includes the Richelieu River (DFO 2021).

The presence of Striped Bass in the Richelieu River is confirmed by angling records, telemetry studies and the direct observation of individuals in the Vianney-Legendre fish ladder (at Saint-Ours Dam), particularly between 2017 and 2019. According to the information available, part of the Striped Bass population now overwinters in an area that includes Saint-Pierre Lake and its islands as well as the Richelieu River.

2.5 Other listed aquatic species at risk

The River Redhorse (*Moxostoma carinatum*), Channel Darter (*Percina copelandi*), Northern Brook Lamprey (*Ichthyomyzon fossor*), Silver Lamprey (*Ichthyomyzon unicuspis*), Bridle Shiner (*Notropis bifrenatus*) and Cutlip Minnow (*Exoglossum maxillingua*), are all listed as special concern under SARA and are found in the Richelieu River (table 1).

The COSEWIC status reports and federal and provincial recovery documents for these species outline the state of knowledge on their distribution and biology, the threats they face, and the actions to be undertaken to assist in their recovery. According to these documents, habitat degradation, mainly due to nutrient, contaminant and sediment loading, poses a threat to these species.

Management plans have been published for the Bridle Shiner (Boucher et al. 2011), Northern Brook Lamprey (DFO 2018b) and River Redhorse (DFO 2018a). Management plans for Silver Lamprey, Cutlip Minnow and Channel Darter populations of the St. Lawrence River are in preparation. Quebec's Cyprinidae and small Percidae recovery team has also published recovery documents for the Channel Darter, Eastern Sand Darter and Bridle Shiner (Équipe de rétablissement des cyprinidés et petits percidés 2012, 2019, 2020).

Aside from the SARA-listed species mentioned above, 2 species have been designated as threatened by COSEWIC, the American Eel (*Anguilla rostrata*) and Lake Sturgeon, Great Lakes–Upper St. Lawrence populations (COSEWIC 2012b, COSEWIC 2017). The Governor in Council has not made a decision with respect to these species, however they are included in this document so that an ecosystem approach can be adopted in the planning of measures for the Richelieu River. The COSEWIC status reports mention in particular poor water quality, barriers to fish passage, hydroelectric turbines and fisheries as common threats to these species.

2.6 Proposed measures to protect critical habitat

Critical habitat is defined in SARA as "…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 a recovery strategy or in an action plan for the species." [subsection 2(1)] Also, SARA defines habitat for aquatic species as "… spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced." [subsection 2(1)]. Critical habitat is identified for species listed as threatened or endangered. Under SARA, critical habitat must be legally protected within 180 days after the

recovery strategy or action plan is published in the Species at Risk Public Registry. Note that no new critical habitat is identified in this action plan.

Aquatic species at risk in the Richelieu River occur as migrants or residents in the river. Of the species included in this plan, 2 have been identified as having part of their critical habitats in the Richelieu River: the Copper Redhorse and Eastern Sand Darter. The critical habitats of these species have been identified in recovery strategies and are protected by critical habitat orders pursuant to section 58 of SARA: Canada Gazette, Part II, Volume 155, Number 11: Critical Habitat of the Copper Redhorse (*Moxostoma hubbsi*) Order and Critical Habitat of the Eastern Sand Darter (*Ammocrypta pellucida*) Quebec Populations Order. The orders trigger the prohibition against the destruction of any part of the critical habitat (figure 3). The critical habitat of the Hickorynut has not yet been identified but is expected to be with the publication of a recovery strategy and in an action plan for this species (DFO in prep. a). The critical habitat of Striped Bass, identified in the recovery strategy and action plan, excludes the Richelieu River (DFO 2021).

As mentioned in section 1.2 of this action plan, DFO is also responsible for administering the *Fisheries Act*, which uses the same definition for the habitat of fish as SARA does for the habitat of an aquatic species at risk and provides a framework for the conservation and protection of fish and fish habitat.

Transport Canada's Office of Boating Safety administers the *Vessel Operation Restriction Regulations.* These regulations enacted under the *Canada Shipping Act, 2001* (S.C. 2001, c.26) make it possible to address issues related to safety and environmental protection. Restrictions on navigation may be imposed to limit vessel speed and wave action, for example. As such, the Regulations Amending the Vessel Operation Restriction Regulations came into force on December 20, 2023. These regulations introduce a reduction in speeds for vessels powered by mechanical or electric propulsion between Saint-Denis-sur-Richelieu and Saint-Marc-sur-Richelieu. The Regulations also prohibit power-driven and electric propulsion vessels from Jeannotte Island to Cerfs Island.

Along with the protection of critical habitats under SARA, other protection measures apply to these species. The Pierre-Étienne-Fortin Wildlife Preserve is a protected area under the responsibility of MELCCFP (figures 2a and 2b). Owing to its location in the Chambly Basin, it is a key element in the conservation of the Copper Redhorse. A provincial regulation (*Regulation Respecting the Pierre-Étienne-Fortin Wildlife Preserve*) prohibits activities that may alter any habitats of the Copper Redhorse, River Redhorse or the Eastern Channel Darter and prohibits entering, staying in, travelling about or engaging in any activity in much of the preserve between June 20 and July 20. MELCCFP wildlife protection officers have the authority to control uses in the preserve. In addition, the privately owned Île de Jeannotte and Île aux Cerfs nature reserve, which includes the grass beds where larvae and young-of-the-year feed, is 1 of the sites protected by the Nature Conservancy of Canada. These islands will likely be integrated into the Pierre-Étienne-Fortin Wildlife Preserve in the coming years.

2.7 Species associated with the aquatic environment and under the responsibility of ECCC and MELCCFP that may benefit from the implementation of the action plan

The Richelieu River is at the heart of the Montérégie region, which is a key area for biodiversity and species at risk in Quebec. Although this action plan first and foremost targets aquatic

species identified under SARA, a number of the proposed measures will also help semi-aquatic and terrestrial species at risk that are the responsibility of ECCC and the provincial government (for example, plants, birds and turtles). Table 2 identifies other species at risk associated with wetlands and aquatic habitats that are found in the watershed. The degradation of habitats, particularly the shorelines of watercourses affected by agriculture and urban development, as well as the presence of contaminants, are common threats to these species.

Table 2. List of aquatic or semi-aquatic amphibian, reptile, bird and plant species at risk present in the Richelieu River watershed, along with their Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment, status under *Species at Risk Act* (SARA) and the *Act Respecting Threatened or Vulnerable Species* (ARTVS), and applicable recovery documents.

Species	Most recent COSEWIC assessment	SARA Schedule 1 status	Status under ARTVS	Recovery documents
Western Chorus Frog (Great Lakes / St. Lawrence–Canadian Shield population) (amphibian)	Threatened (2008)	Threatened	Vulnerable	Environment Canada 2015, Équipe de rétablissement de la rainette faux-grillon de l'Ouest 2019
Spiny Softshell (reptile)	Endangered (2016)	Endangered	Threatened	ECCC 2018, Galois 2007
Wood Turtle (reptile)	Threatened (2018)	Threatened	Vulnerable	ECCC 2020a, Équipe de rétablissement des tortues du Québec 2005
Snapping Turtle (reptile)	Special concern (2008)	Special concern	None	ECCC 2020b
Northern Map Turtle (reptile)	Special concern (2012)	Special concern	Vulnerable	ECCC 2019, Équipe de rétablissement des tortues du Québec 2005
Midland Painted Turtle (reptile)	Special concern (2018)	Special concern	None	PC 2022
Spring Salamander (Adirondack / Appalachian population) (amphibian)	Threatened (2011)	Threatened	Vulnerable	Environment Canada 2014a

Least Bittern (bird)	Threatened (2009)	Threatened	Vulnerable	Environment Canada 2014b
Yellow Rail (bird)	Special concern (2009)	Special concern	Threatened	Environment Canada 2013a
False Hop Sedge (plant)	Endangered (2011)	Endangered	Threatened	Environment Canada 2014c

3. Degradation of the quality of the aquatic environment in the Richelieu River watershed: a common threat to species at risk

3.1 Threats

In the Richelieu River, water quality deteriorates progressively downstream of the outlet of Lake Champlain. Downstream of the Chambly Basin, aquatic species at risk are also exposed to degraded water quality in the major tributaries, particularly the Hurons and L'Acadie rivers; these are the most degraded rivers in the watershed as well as being major tributaries of the Richelieu River (MELCCFP 2019, Giroux 2019). The water quality is also degraded in some smaller tributaries, which affects the overall quality of the aquatic environment in the Richelieu River; this includes Beloeil Stream which has its outlet near Île de Jeannotte and Île aux Cerfs, areas that contain a number of species at risk.

The main threats to aquatic species at risk related to the quality of aquatic environment in the Richelieu River are:

- degradation in water quality
- loss or degradation of natural habitats (including riparian strips, wetlands and forests)
- modification of flow regimes

The anthropogenic activities that are at the source of these threats are:

- agriculture
- roads, residential, industrial and urban development
- water activities

Other threats to species at risk are barriers that prevent fish from easily migrating, regulation of flow-through dams, invasive species, the decline of prey populations, access to fish hosts for molluscs, accidental harvesting and climate change. This plan does not address these latter threats directly. Therefore, this action plan is complementary to other programs and plans that advocate specific measures and approaches for these threats.

3.1.1 Agriculture

Despite some progress made in improving agricultural practices, agriculture is the main source of pollution in the Richelieu River. Agriculture is a significant threat to water quality and natural habitats, including riparian strips, wetlands and forests, as well as causing altered flow regimes. Agriculture is the dominant activity in the watershed, representing 70% of land use (figure 1), with 78% of agricultural land used for the cultivation of annual corn, wheat and soybean crops. Owing to the large areas devoted to wide-row crops, a practice associated with soil compaction

and the presence of bare soil between rows, these areas are even more vulnerable to erosion (Racine 1999) and runoff. With this type of cropping, pesticides, nutrients and sediments find their way more easily into watercourses. The problem is aggravated by stream cleaning and straightening (for agricultural drainage purposes), the destruction of riparian strips, and wind erosion.

This alteration of rivers, combined with the destruction of riparian strips, leads to an ecological regime shift. After a rainfall or during the spring snowmelt, flow velocity increases and can cause banks to erode more rapidly and collapse (FAPAQ 2002). Flows are also increased by deforestation and the removal of riparian strips, in order to increase crop acreage, particularly for corn cultivation. This leads to higher water temperatures, increased runoff, sedimentation and nutriment enrichment in streams and rivers (FAPAQ 2002, Vachon 2003).

These pressures are felt throughout the watershed but most intensively in the Hurons and L'Acadie rivers (COVABAR 2015b in French only). Among all the Saint-Pierre Lake tributaries, the Richelieu River has the highest nutrient load in terms of phosphorous and nitrogen (Patoine 2017). In addition, pesticide levels in the river remain elevated, frequently exceeding chronic aquatic life criteria (CALC).[6] However, since the flow in the Richelieu River is roughly 20 times greater than that in the Yamaska River, the pesticide concentrations detected in the former are typically lower than in the latter (Giroux 2019).

In addition, the alteration of the riparian environment promotes the leaching of pollutants into ditches, streams and rivers in the Richelieu River watershed. Environment Canada (2013b) recommends that both sides of streams have a naturally vegetated riparian area at least 30 metres wide along 75% of their length to maintain the functions of aquatic habitats. The nonexistent or inadequate riparian strips in both the urban and agricultural environments in the Richelieu River watershed exacerbate the threats to the quality of the aquatic environment.

According to Pépin (2016) and Hetsch (2010), enforcing shoreline protection poses significant challenges. Indeed, despite the interest in riparian vegetation, riparian strips in the agricultural environment are often less than 3 metres wide or are absent altogether. This situation is particularly serious in the Montérégie region (Pépin 2016). The cleaning of low-order streams (ditches) for agricultural drainage often requires the destruction of riparian strips, which exacerbates the problem. However, some municipalities and RCMs are now taking the initiative to characterizethe riparian strips in their territory and increasing numbers of producers are establishing or restoring riparian strips (Durand and Risse 2018).

3.1.2 Roads, residential, industrial and urban development

Provincial highways 133 and 233 run parallel to the Richelieu River less than 50 m from the shoreline, where the most important habitats for species at risk are found. To ensure the integrity of highway infrastructure, artificial structures (mainly retaining walls and riprap) have been constructed along 68% of the bank of the Richelieu River between Chambly Basin and the Saint-Ours Canal. The remaining riparian strip along the river generally has a sparse vegetation cover (less than 30% cover), except for 4.3% of the bank, where the vegetation is abundant (over 70% cover; Largaespada et al. 2016). Under these circumstances, the bank stability is at risk. Hence, it aggravates the loss of soil and erosion and may also cause an increase in peak flow. Shoreline development in the form of residential, cottage and resort uses, which are

[6] CALC refers to the maximum concentration of a contaminant that must not be exceeded to protect organisms during long-term exposure.

sometimes combined with the use of fertilizers or pesticides, have an impact on water quality in the watershed. In addition, shoreline alteration and hardening on the Richelieu River resulting from the installation of fill materials, retaining walls and riprap near homes contributes to the input of pollutants and suspended solids in watercourses in the watershed.

Another source of pollution in the watershed is private and municipal wastewater and stormwater. Although the Richelieu River watershed is dotted with some 99 wastewater treatment plants (COVABAR 2016), the achievement of environmental objectives is still sometimes jeopardized by discharges of urban wastewater during rain events, overflows from combined sewers and stormwater outfalls, and residual toxicity in some effluents (Simoneau pers. comm. 2017).

Stormwater drainage in the municipal sector could be improved by land-use planning practices that aim to reduce runoff volume, flow velocity, and pollution load. Contrary to non-point source pollution (such as agricultural sources), any corrective measures to improve the performance of municipal wastewater treatment facilities will have a direct effect on the health of aquatic environments. Annual inputs from municipal point sources are smaller than those from non-point sources in the agricultural environment, particularly in the agricultural sub-watersheds of the Hurons and L'Acadie rivers. However, excluding overflow events from municipal sewer systems, point-source contributions are regular and have a significant impact during the low-water period when watercourses have a low dilution capacity (Simoneau pers. comm. 2017).

3.1.3 Water activities

The Richelieu River is a popular spot for recreational boating, and is a key waterway linking Lake Champlain and the St. Lawrence River. Wave action[7] caused by boating is one of the main sources of bank erosion along the Richelieu River (COVABAR 2015b in French only) and also affects the natural resources of the river. Wave action also causes the resuspension of riverbed sediments. In summer, the low flow velocity in the Richelieu River results in sediments being suspended in the water for several hours at a time. In a context where boats are travelling up and down the river all day, the aquatic grass beds are constantly subjected to increased turbidity, which can have significant impacts on the health of the Copper Redhorse, Eastern Sand Darter, Hickorynut and several other species at risk that use the grass beds during their life cycles. In addition, suspended sediments lead to the siltation of the riverbed, clogging the substrate and covering spawning grounds.

The intensive use by recreational boaters of areas supporting a number of species at risk is problematic, particularly in the Pierre-Étienne-Fortin Wildlife Preserve and the Île de Jeannotte and Île aux Cerfs nature reserve (SQ Vallée-du-Richelieu 2018). However, some protection measures, including prohibiting boats from accessing and landing at these sites have been implemented in these areas where larval and young-of-the-year Copper Redhorse feed. In addition, a warden and outreach program is being carried out by COVABAR, Quebec wildlife protection officers and sometimes DFO fishery officers in these sectors. Furthermore, 4 municipalities upstream of the Chambly Basin submitted a request to TC in 2021 for regulations to be enacted to implement speed restrictions on the Richelieu River. These regulations, which are called the *Regulations Amending the Vessel Operation Restriction Regulations,* came into force on December 20, 2023, and require a reduction in speeds between Saint-Denis-sur-Richelieu and Saint-Marc-sur-Richelieu. The Regulations also prohibit power-driven and electric propulsion vessels from Jeannotte Island to Cerfs Island. Recreational boaters and marinas are

[7] Wave action is defined as all the waves generated by the wake of a boat that break on the shore.

offered incentives to minimize erosion and pollution all along the river (for example, under Nautisme Québec's *Éco-Marina* environmental certification program). Lastly, recreational boating is also likely to introduce aquatic invasive species and various pollutants in the environment (Asplund 2000).

4. Recovery actions

4.1 Measures to be taken and implementation schedule

The successful recovery of the species at risk in the Richelieu River is dependent on the actions of many different jurisdictions, industries, non-governmental organizations, Indigenous partners, and Canadians in general. It requires the commitment and cooperation of the constituencies that will be involved in implementing the strategies and measures set out in this action plan.

This action plan provides a description of the measures to be taken to improve the quality of the aquatic environment, as well as to monitor their implementation. Since the conservation of the aquatic environment is a responsibility shared by several jurisdictions, this plan aims to guide not only the activities that could be carried out by DFO, but also those in which other partners have a role to play. As new information becomes available, these measures and their order of priority may change. DFO recognizes the need for the participation of various jurisdictions, organizations, and individuals involved in the planning and implementation of measures for the recovery of species at risk in the Richelieu River to participate in the implementation of the measures listed in this action plan as well as in the recovery documents previously published. DFO strongly encourages all Canadians to participate in order to contribute to the conservation of the species at risk in the Richelieu River.

Tables 3.1 to 3.5 identify the measures to be implemented collaboratively by DFO and its partners, other agencies, organizations or individuals. The implementation of these measures will be dependent on a collaborative approach, in which DFO is a partner in recovery efforts. As all Canadians are invited to join in supporting and implementing this action plan, the proposed measures represent opportunities for other jurisdictions, organizations or individuals to support the recovery of the species at risk in the Richelieu River. If your organization is interested in participating in one of these measures, please contact the Species at Risk Management Program in Quebec at DFO.QUESARA-LEPQUE.MPO@dfo-mpo.gc.ca or 1-877-775-0848.

The implementation of the measures in this action plan to improve the quality of the aquatic environment involves the following strategies, depending on the target groups involved:

Strategy 1: Reduce the degradation in the quality of the aquatic environment linked to **agricultural activities** (table 3.2)
Strategy 2: Reduce the degradation in the quality of the aquatic environment linked to **urban and industrial wastewater** (table 3.3)
Strategy 3: Reduce shoreline degradation and pollution linked to **recreational uses** (table 3.4)
Strategy 4: Acquire knowledge (table 3.5)

The measures proposed for each strategy are described in tables 3.2 to 3.5; table 3.1 presents broad measures applicable to all the strategies. For each measure, objectives, priorities, timeline and potential partners are identified.

The priority reflects the degree to which the measure contributes directly to the recovery of the species at risk or is an essential precursor to a measure that contributes to the recovery of the species. There are 3 levels of priority:

- High: measures considered likely to have an immediate and/or direct influence on the recovery of the species;
- Medium: measures that are important but considered to have an indirect or less immediate influence on the recovery of the species;
- Low: measures that are considered important contributions to the knowledge base of the species and mitigation of threats but do not directly influence the recovery of the species.

The timeline represents the time frame anticipated to complete the implementation of the measure. There are 4 time frames: short (0 to 5 years), medium (up to 10 years), long (up to 25 years) and continuous (to be repeated every year). If some measures are already in progress, this is also noted. Establishing an action plan for the recovery of a species at risk is an iterative process. The implementation schedule for this action plan could be subject to modifications in the future, depending on the progress made toward the recovery of the species. The measures included in this action plan that are to be implemented by DFO will be subject to the availability of funding and other required resources. As indicated in the tables below, partnerships with specific organizations will be sought to provide expertise and capacity to carry out some of the listed recovery measures. For other responsible authorities and organisations, the partners are designated for information purposes only and the implementation of these measures will be subject to each group's priorities and budgetary constraints.

4.2 Priority setting

To increase the chances of achieving the recovery of the species at risk and to alleviate threats in the 2,546 km^2 drainage basin in the Richelieu River watershed, stewardship measures must be focused where they will most benefit the species at risk. Most of the species at risk and the critical habitats of the Copper Redhorse and Eastern Sand Darter occur downstream of Chambly Dam (figure 3). The Hurons river empties into the Chambly Basin and L'Acadie river flows at the downstream limit (figure 1). Measures in the watersheds associated with these rivers (sub-watersheds of the Richelieu River), owing to their location, size, and pollutant and sediment loads, are expected to have an impact on species at risk and are therefore considered a priority. In addition, an analysis of the priority sub-watersheds of the Richelieu River could be carried out to identify priority areas for habitat stewardship and conservation measures, as was done in the action plans for the Ausable (DFO 2020) and Sydenham (DFO 2018c) rivers, both of which use an ecosystem approach.

It is also important to prioritize the actions that have the greatest probability of achieving the objective of this plan, specifically to improve the quality of the aquatic environment in order to recover and conserve species at risk, while considering the feasibility of these measures. For example, restoring riparian strips and reducing vessel speeds for boating and water sports are measures that will reduce suspended solids in aquatic habitats and these measures are considered both effective and feasible. Additional details are included in the implementation tables below.

Table 3.1. Broad measures applicable to all strategies to be implemented by Fisheries and Oceans Canada (DFO) and/or its partners to reduce the degradation in the quality of the aquatic environment in the Richelieu River watershed.

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
#1	**Establish a process to support, coordinate and prioritize the implementation of measures in the Richelieu River watershed:** • Create an implementation team to include the various partners involved in implementing the action plan measures • Facilitate discussions among partners • Promote available short term (1 to 3 years) and long term (3 to 5 years funding programs • Synthesize and prioritize the actions to be taken (priority places and threats)	**Coordination, engagement and monitoring** Implementation of plan	High	Long term	**DFO, Environment and Climate Change Canada (ECCC), Other government authorities**
#2	**Ensure the conservation of natural riparian strips and the restoration of degraded riparian strips throughout the Richelieu River watershed:** • Encourage compliance with regulations on the width of the riparian strip and other provincial and municipal regulations in effect • Conserve and increase the presence of riparian strips that fulfill the desired ecological functions • Characterize and assess the state of existing riparian strips	**Land-use planning** Conservation of natural environments Protection of riparian strips	High	Continuous	**DFO, Municipal sector,** Environmental non-governmental organizations (ENGOs), Other government authorities, Citizens

[8] Potential partners in bold are identified as the lead partners for the implementation of the proposed recovery measure.

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
	• Map restored riparian strips and those with restoration potential, as well as ongoing and completed conservation projects • Review bank stabilization practises for countering erosion and promote soil bioengineering or mixed techniques that incorporate a significant vegetation component • Devise guidelines and strategies for restoring, monitoring and maintaining expanded riparian strips • Preserve a diverse permanent vegetation cover in riparian strips • Structure the shoreline (for example: terraces, gentler slopes, two-stage channels) • Plant native herbaceous vegetation, shrubs and trees on the shoreline and in the riparian strip • Raise the awareness of and provide technical support to waterfront residents (agricultural producers, homeowners and cottagers) regarding the conservation, restoration, monitoring and maintenance of riparian strips				
#3	**Conserve natural environments (for example: critical habitats, wooded shorelines, old fields/shrubland and wetlands) using legal, administrative and private land stewardship tools:** • Legally protect aquatic and riparian habitats (for example: through property acquisition and land	**Habitat protection** Conservation and restoration of natural environments	Medium	Long term	**DFO, ENGOs,** Other government authorities, Municipal sector, Indigenous groups,

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
	gifts, natural reserves on private land, wildlife refuges, etc.) • Support and encourage property owners in undertaking voluntary conservation efforts (for example: landowner guides) • Integrate areas that are identified as critical habitat and other natural environments of interest to species at risk in bylaws and land use and development plans • Find a mechanism to allow a change in use of a subdivision or agricultural land, for protection and conservation purposes • Support the municipal sector in conserving and restoring aquatic environments[9] • Assess the feasibility of implementing land guardian programs for aquatic species at risk				PC

[9] Source: MELCCFP 2018, *2018–2023 Action Plan for the 2018–2030 Quebec Water Strategy* (appendix A).

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
#4	**Facilitate the implementation of measures through incentives and contribution funding programs:** • Provide incentives and financial contributions • Propose remuneration[10] or compensation measures for the provision of ecological services that exceed legal requirements (for example: through the Alternative Land Use Services [ALUS] program[11]) • Disseminate and promote recovery documents to stakeholders and general public • Communicate results, summaries, follow-ups and recognition of projects carried out • Engage the municipal sector through programs combining support, incentives, monitoring and recognition (for example: Réseau Environnement's Programme d'excellence en eaux usées [wastewater excellence program] and Programme Villes et villages à la rescousse [cities and towns to the rescue][12])	**Incentives, funding and recognition programs** Implementation of plan	High	Continuous	**DFO, Municipal sector,** ECCC, Other government authorities, ENGOs

[10] The purpose of remuneration is to recognize agricultural producers' adoption of agri-environmental practices that exceed regulatory requirements and provide significant environmental gains.

[11] ALUS is an innovative program developed by communities and implemented by farmers. Farmers may be compensated for the ecosystem services that their land provides to communities.

[12] The purpose of the Villes et village à la rescousse [cities and towns to the rescue] program is to highlight the efforts of Quebec municipalities in the conservation of species at risk.

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
#5	**Develop and implement a social marketing-based outreach strategy:** • Educate and support target audience (recreational boaters, anglers, farmers, riverfront property and industrials owners) to make appropriate behaviour changes • Disseminate the strategy to community organizations and other partners	**Implementation and outreach** Change in behaviour	High	Short term	**DFO,** PC, ENGOs, Non-profit organizations (NPOs), Other government authorities Industries
#6	When analyzing regulatory compliance requests for projects in or near water, **encourage and coordinate actions by government and non-government entities to reduce negative impacts on species at risk and their habitat:** • Carry out the integrated planning of fish habitat enhancements by identifying a bank of restoration projects • When offsetting is required: - Identify habitat bottlenecks, prioritize bank restoration locations and other projects meeting the 4 strategies developed in this action plan; - Connect proponents seeking authorizations and permits with organizations/partners supporting this action plan to seek innovative offsetting options	**Regulatory enforcement** Integrated planning Protection and restoration of priority areas	High	Continuous	**DFO,** Other government authorities

Nº	Recovery measures	General approach Objectives	Priority	Timeline	Potential partners[8]
#7	**Engage regional county municipalities (RCMs) and municipalities to ensure compliance (regulatory enforcement) with riparian strip regulations**: • Delineate riparian strips (to facilitate outreach and regulatory enforcement) • Hold targeted outreach meetings and carry out monitoring and surveillance • Provide training, tools and support to personnel involved (for example: municipal inspectors)	**Regulatory enforcement and outreach** Protection of riparian strips	High	Medium term	ENGOs, RCMs, Municipal sector, DFO, Other government authorities

Table 3.2. Measures linked to agricultural activities to be implemented by Fisheries and Oceans Canada and/or its partners to reduce the degradation in the quality of the aquatic environment in the Richelieu River watershed.

Nº	Recovery measures	Approach Objectives	Priority	Timeline	Potential partners[13]
#8	**Support a reduction in maintenance operations in ditches and watercourses:** • Carry out studies to map and plan the maintenance of watercourses • Implement drainage practices that preserve riparian vegetation (for example: lower third method,[14] development of watercourses incorporating two-level channels or widening of the channel base (self-forming channel), etc.) • Enhance interfaces between watercourses and crops (disconnected ditches, riser inlets at ditch outlets, diversion boxes or water-level control boxes at tile drain outlets, saturated buffers at tile drain system outlets, etc.) • Demonstrate the benefits of improved agricultural and agri-environmental practices (for example: drainage systems do not always improve crop yields) • Promote and update decision support tools for analysts and best practice tools for RCMs (for example: DFO's guide on maintaining agricultural watercourses)	**Planning of watercourse maintenance** Reduction in stream cleaning and associated impacts	High	Medium term	Government authorities, RCMs, Municipal sector, Agricultural sector partners (for example: farm producers, agri-environmental advisory clubs (AACs), Union des producteurs agricoles (UPA), Environmental non-governmental organizations (ENGOs), Non-profit organizations (NPOs), Universities

[13] Potential partners in bold are identified as the lead partners for the implementation of the proposed recovery measure.
[14] Method consisting of excavating only the lower third of the ditch, leaving the vegetation on the sides intact.

Nº	Recovery measures	Approach Objectives	Priority	Timeline	Potential partners[13]
#9	**Improve agricultural and agri-environmental practices:**[15] • Protect expanded riparian strips and shorelines (see measure #2 for more details) • Conserve natural environments on agricultural land (woodlots, fallow fields, shrubland, wetlands, riparian strips) • Plant windbreaks • Reduce pesticide use • Reduce fertilizer and manure inputs • Improve soil health and conservation • Prioritize the use of winter cover crops, intercropping and direct seeding • Use crop residues to cover soils in winter • Prioritize perennial crops (versus annual crops like corn and soybeans) • Carry out enhancements that integrate climate change adaptation designs (for example: retention ponds, two-stage channels)	**Improvement of agricultural practices** Reduction in erosion and sediment, fertilizer and pesticide inputs	High	Medium term	**ENGOs,** Agricultural sector partners (for example, farm producers, AACs, UPA), DFO, RCMs, Municipal sector, Other government authorities

[15] Source: MAPAQ 2020, *Plan d'agriculture durable 2020 to 2030* (appendix A).

Table 3.3. Measures linked to urban wastewater to be implemented by Fisheries and Oceans Canada and/or its partners to reduce the degradation in the quality of the aquatic environment in the Richelieu River watershed.

Nº	Recovery measures	Approach Objectives	Priority	Timeline	Potential partners[16]
#10	**Modernize municipal and residential wastewater management:**[17] • Assess wastewater volumes from municipal wastewater treatment works (MWTW) and determine if there is a hydraulic overload • Adapt capacity of wastewater treatment and disposal systems to the size of the population by requiring land development to align with environmental cross-compliance measures • Construct infrastructure allowing better management of stormwater and runoff • Prioritize MWTWs based on anticipated benefit for SAR and upgrade priority MWTWs	**Upgrading and improvement of infrastructure** Improvement of water quality by reducing nutrient loads from urban centers	High	Long term	**Government authorities, Municipal sector**
#11	**Reduce contaminants from residential wastewater in the Richelieu River** • Identify andans locate faulty reverse connections and isolated residential wastewater treatment systems (septic tanks) • Develop a working group of the municipalities of the Richelieu River to accelerate the compliance of septic tanks and reverse connections	**Upgrading and improvement of infrastructure** Improvement of water quality by reducing pollutants from urban centers	Medium	Long term	**Municipal sector**
#12	**Raise awareness and mobilize communities and industry to reduce pollution at the source and limit**	**Engagement / outreach**	Medium	Medium term	**Municipal sector,** Government authorities, ENGOs

[16] Potential partners in bold are identified as the lead partners for the implementation of the proposed recovery measure.

[17] Sources: MELCCFP 2018, *2018–2023 Action Plan for the 2018–2030 Québec Water Strategy* (appendix A) and COVABAR 2015-2020, *Plan d'action, Plan directeur de l'eau (appendix A).*

Nº	Recovery measures	Approach Objectives	Priority	Timeline	Potential partners[16]
	their withdrawals and water use from the Richelieu River watershed:[18] • Conserve drinking water • Adequately manage stormwater • Adequately dispose of hazardous waste	Reduction in volume of wastewater to increase MWTW efficiency Reduction in contaminant inputs Reduction in volume of wastewater to be treated			Industries

[18] COVABAR 2015-2020, *Plan d'action, Plan directeur de l'eau.*

Table 3.4. Measures linked to recreational uses to be implemented by Fisheries and Oceans Canada and/or its partners to reduce the degradation in the quality of the aquatic environment in the Richelieu River watershed.

Nº	Recovery measures	Approach Objectives	Priority	Timeline	Potential partners[19]
#13	**Reduce the impacts of boating** by enforcing laws and regulations: • Enact regulations limiting the speed of vessels and tow sports • Identify critical habitat by marking protected areas (for example: signage or interactive maps) • Increase the size of protected areas • Analyze the legal tools available and their applicability	**Regulatory enforcement** Conservation of sensitive environments	High	Medium term	**DFO,** **Transport Canada (TC),** Municipal sector, Environmental non-governmental organizations (ENGOs), Other government authorities
#14	**Promote sustainable boating:** • Patrol and monitor key habitats for species at risk (notably the spawning and nursery areas in the Pierre-Étienne-Fortin Wildlife Preserve and around Île de Jeannotte and Île aux Cerfs) • Enforce laws and regulations (see Measure #13) • Encourage recreational boaters to adopt good practices (for example: reduce speed, wash boats, avoid sensitive environments) • Develop communication, information and social marketing tools specifically targeting recreational boaters (see Measure #5) • Encourage implementation of Éco-marina certification	**Outreach** Conservation of sensitive environments Reduction of wave action Reduction of contaminant inputs	High	Short term	**DFO,** **TC,** **PC,** **Municipal sector,** **ENGOs,** **Other government authorities,** **Recreational sector and boating industry** (for example: Boating Industry Alliance (Nautisme Quebec) and marinas)

[19] Potential partners in bold are identified as the lead partners for the implementation of the proposed recovery measure.

Table 3.5. Knowledge acquisition measures to be implemented by Fisheries and Oceans Canada (DFO) and/or its partners.

Nº	Recovery Measures	Approach Objectives	Priority	Timeline	Potential Partners[20]
#15	**Conduct research to support the greening of the agriculture industry:** • Demonstrate the benefits of improved practices to the aquatic environment • Analyze the economic impacts generated by implementing best practices	**Applied research** Reduction of inputs	High	Long term	Government authorities, Universities, Agricultural sector partners
#16	**Monitor water quality annually** • Target areas where concentrations of inputs pose a high risk to the aquatic environment and species at risk • Identify and assess the water quality of the main sources of these inputs	**Monitoring** Measurement of progress	Medium	Continuous	**Environment and Climate Change Canada (ECCC), Government authorities,** Industries
#17	**Study the impacts of wave action** to better understand the effects of boat shape, type and speed on wave action in order to formulate recommendations for recreational boaters	**Basic research**	Low	Medium term	DFO, Universities
#18	**Study the effects of contaminants** on aquatic species at risk	**Basic research** Decision support	Low	Long term	Universities, Government authorities
#19	**Study the hydrogeomorphology** of watercourses in the watershed	**Basic research** Decision support	Medium	Medium term	Universities, Government authorities, Environmental non-governmental organizations (ENGOs)

[20] Potential partners in bold are identified as the lead partners for the implementation of the proposed recovery measure.

Nº	Recovery Measures	Approach Objectives	Priority	Timeline	Potential Partners[20]
#20	**Acquire knowledge** from citizen science and various collaborators (Parks Canada, ENGOs, etc.) following initiatives implemented in the Richelieu River watershed	**Mobilization and Monitoring** Implementation of the plan	Medium	Medium term	PC, DFO, ENGOs

5. Evaluation of socio-economic costs and of benefits

SARA requires the competent ministers to undertake an evaluation of the socio-economic impacts of the action plan. The evaluation includes the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA paragraph 49(1)(e)). This evaluation addresses only the incremental impacts of 'new' recovery measures outlined in this action plan (that is, measures that have not yet been implemented), recognizing that not all aspects of its implementation are solely or necessarily under the jurisdiction of the federal government. This evaluation does not address any 'underway' measures (that is, measures that were initiated or implemented prior to the development of the action plan but have not yet been completed) as they are not considered as incremental costs to the government and other stakeholders (for example, research studies to identify critical habitat). In addition, the analysis does not address the costs associated with social and cultural loss of access to the species by Indigenous peoples and Canadians.

The protection and recovery of species at risk can result in both benefits and costs. The preamble to SARA recognizes that "wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons". Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. Actions taken to preserve a species, such as habitat protection and restoration, are also valued.

The purpose of this action plan is to provide for the recovery of species at risk by improving the quality of the aquatic environment in the Richelieu River and its watershed. An evaluation of an action plan's socio-economic costs and benefits should describe, as far as possible, the potential advantages that it may generate, as well as the costs that governments, industry, municipalities, landowners, farmers, anglers, recreational boaters and Canadians as a whole might have to bear due to the implementation of the measures identified in this action plan.

This evaluation does not address the socio-economic impacts of protecting the critical habitats of the species at risk. Under SARA, DFO must ensure that the critical habitat identified in a recovery strategy or action plan is legally protected within 180 days of the publication of the final document. In the case of the critical habitat orders to protect the critical habitat of the Copper Redhorse and the Eastern Sand Darter, the regulatory process pursuant to the Cabinet Directive on Regulation was followed, including an analysis of any potential incremental impacts of the order in the Regulatory Impact Analysis Statement. Consequently, no additional analysis of the critical habitat has been undertaken for the evaluation of costs and benefits of the action plan. The critical habitat of Hickorynut has not yet been identified but is expected to be with the publication of a recovery strategy and action plan in the future. The critical habitat of Striped Bass, identified in the recovery strategy and action plan, excludes the Richelieu River. For other species of special concern, the identification and protection of their critical habitats is not required under SARA.

5.1 Profile of stakeholders

Agriculture accounts for 70% of the land use in the Richelieu River watershed (Largaespada et al. 2016). The Richelieu River is a key waterway linking Lake Champlain and the St. Lawrence River. The recovery measures outlined in tables 3.2 to 3.5 of the multi-species action plan are

grouped under 4 strategies relating to: (1) agricultural activities, (2) urban and industrial wastewater, (3) recreational uses, and (4) knowledge acquisition.

The partners that will likely take part in implementing the action plan are described in section 1.2 and identified in the tables in section 4. All levels of government could be involved (municipal, RCM, provincial and federal). Partners could also include those from the agricultural sector, environmental non-governmental organizations (ENGOs), industry, non-profit organizations (NPOs), recreational boaters, anglers, property owners, the boating industry (including marinas), the tourism industry and the academic community.

5.2 Costs of implementing this action plan

The implementation of the measures included in this action plan will be subject to the availability of funding and other required resources. Long-term recovery activities will be carried out using a collaborative approach following discussions among partners. This will allow costs and benefits to be taken into account throughout the process.

The action plan does not entail additional costs or constraints in terms of the requirements of other existing legal tools. There is no obligation to implement it under SARA. Some of the actions set out in the plan are ongoing initiatives by the federal government and its partners and would continue even in the absence of the action plan.

Although the measures in the action plan can affect certain stakeholders identified above, implementing them will not necessarily result in additional socio-economic costs. In some cases, measures may be funded under the existing programs of the federal and provincial governments. The total costs of implementing the recovery measures set out in this action plan are unknown.

Costs (including in-kind support) may be incurred by other government agencies, environmental organizations, farmers and landowners, among others. Other costs could be covered by organizations and partners choosing to voluntarily participate in these recovery measures, such as conserving habitats including the protection and restorationof riparian strips. In-kind costs, such as volunteer hours and the provision of expertise and equipment, could be incurred as a result of the implementation of activities listed in this action plan.

The implementation of the action plan could result in costs to farmers or organizations that support farmers to conserve habitats or modify agricultural practices. Modifying recreational boating practices could also result in costs to marinas, the boating industry and, indirectly, the tourism industry. The incremental costs of these measures cannot be estimated from the information available.

5.3 Benefits of implementing this action plan

SARA recognizes that “wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons.” Healthy and sustainable ecosystems that support a diverse range of species, including species at risk, contribute positively to the livelihoods and quality of life of all Canadians. A review of the literature confirms that Canadians care about species preservation and conservation in its own right. In addition, the more action contributes

to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996).

The implementation of the measures set out in this action plan will contribute in a positive way to the recovery of the Copper Redhorse, Eastern Sand Darter, Hickorynut, Striped Bass, and several other species at risk. It is difficult to quantify the benefits arising from the recovery of species at risk. Some benefits will result from the measures required to restore populations of the target species at risk. If implemented, measures to restore habitats or curb threats could improve habitats and lead to a healthier environment for both wildlife and humans due to the improved quality of the aquatic environment. Given the lack of information on the biological impacts of the measures identified in the multi-species action plan, it is difficult to assess the additional gains that could be directly and indirectly attributed to them. However, these benefits should be positive. The net benefits (incremental benefits minus incremental costs) will also likely be positive.

5.4 Distributional impacts

The federal and provincial governments will bear the majority of the direct costs of implementing the measures in this multi-species action plan. Some direct and indirect costs may be borne by other stakeholders (farmers, recreational boaters, landowners, etc.). The implementation of the action plan measures will have positive impacts on other species present in the Richelieu River and, beyond that, on some stakeholders. The implementation of some of the measures in the plan could result in funding opportunities and minimize regulatory impacts on recreational boaters, farmers, agricultural associations, industries, government departments and others.

The action plan includes measures that will involve modifications to agricultural practices. In the short term, these modifications could reduce input costs (pesticides, chemical fertilizers, liquid manure, etc.). Fertilizer costs could significantly decrease in the short and medium term, since the measures in the plan aim to alleviate the leaching of farmland. Therefore, the net cost of these measures could be neutral or even negative in the long term. The boating industry (tourism and recreational boating) will face a loss of earnings in the short and medium term due to restrictions on boating and other water-based recreational activities. In the long term, the value of recreational activities could be enhanced due to the improved quality of the aquatic environment, thus potentially increasing profits. It is also possible that shoreline naturalization and reduced wave action will have a positive impact on waterfront property owners and others by limiting the loss of land due to erosion. Lastly, the general public, particularly the population that frequents the region targeted by the action plan, will benefit from the implementation of measures, due to the non-commercial benefits expected from the recovery and conservation of species at risk and their critical habitats. The recovery measures will help create a healthier ecosystem which will provide additional benefits to Canadians, such as improved water quality and an improved aquatic environment.

6. Measuring progress

6.1 Monitoring species' recovery

The measures described in this action plan will further increase our understanding and contribute to monitoring the species of the Richelieu River Watershed. Once implemented, these measures should further the recovery of the Copper Redhorse, Eastern Sand Darter, Hickorynut and several other species at risk in Canada with the goal of achieving population and

distribution objectives outlined in the recovery strategies. The 20 measures in this action plan will improve species conservation and help to limit the reduction in the quality of aquatic habitat.

6.2 Reporting on the implementation of the action plan

Competent ministers will support and monitor the implementation of the action plan, and progress towards meeting its objectives, by assessing progress towards completing the recovery measures identified in this action plan (under section 55 of SARA),and will report on the plan's implementation 5 years after it comes into effect. This information will be published in a report on the progress towards action plan implementation in 5 years and will be included in the Species at Risk Public Registry.

6.3 Reporting on the ecological and socio-economic impacts

Ecological impacts may be defined as changes in the structure or function of ecosystems. The assessment of ecological impacts may be limited to species, their immediate habitats, or general natural resource categories. The broader ecological impacts of the implementation of this action plan have been considered in its development. In order to report on the ecological impacts of implementation (under section 55 of SARA), monitoring data for the following ecological components have been identified:

1. Quality of the aquatic environment (contaminant levels, turbidity, etc.)
2. Number of metres of riparian strips restored
3. Area of land legally or voluntarily protected
4. Abundance and distribution of populations of fish and mussel species at risk in the Richelieu River watershed
5. Change in behaviour observed among boaters
6. Production and dissemination of communication materials
7. Knowledge gained through research and relevant to the development of innovative mitigation and management measures
8. Improved agricultural practices
9. Improved wastewater management

Reporting on the socio-economic impacts of the action plan (under section 55 of SARA) will be done by providing information on the costs incurred to implement the action plan.

The Minister must assess and report on its ecological and socio-economic impacts 5 years after the plan comes into effect. This information will be published in a report on the progress towards action plan implementation in 5 years and included in the Species at Risk Public Registry.

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Appendix A: Strategic documents by DFO partners applicable to the Richelieu River watershed

The action plan takes into account several documents produced with respect to SARA, as well as other documents developed by the Government of Quebec, which is responsible for monitoring and maintaining the quality of water resources, in particular through the implementation of the MELCCFP [MELCCFP 2018] and the Water Master Plan of COVABAR published in 2015 (COVABAR 2015a in French only).

Here is the list of strategic documents developed to preserve the Richelieu River and its biodiversity through the conservation, restoration and improvement of watershed management:

COVABAR, Plan directeur de l'eau, 2015 to 2020 (in French only)

ECCC, Management Plan for the Snapping Turtle (*Chelydra serpentina*) in Canada, 2019

ECCC, Management Plan for the Spring Salamander (*Gyrinophilus porphyriticus*) in Canada, 2014

ECCC, Recovery Strategy for the False Hop Sedge (*Carex lupuliformis*) in Canada, 2014

ECCC, Recovery Strategy for the Least Bittern (*Ixobrychus exilis*) in Canada, 2014

ECCC, Recovery Strategy for the Spiny Softshell (*Apalone spinifera*) in Canada, 2018

ECCC, Recovery Strategy for the Western Chorus Frog (*Pseudacris triseriata*), Great Lakes / St. Lawrence – Canadian Shield Population, in Canada, 2015

ECCC, Recovery Strategy for the Wood Turtle (*Glyptemys insculpta*) in Canada, 2016a

MAPAQ, Plan pour l’agriculture durable, 2020 to 2030

MELCCFP, 2018–2023 Action Plan for the 2018–2030 Québec Water Strategy

MFFP, Plan de rétablissement du chevalier cuivré, 2012 to 2017

MFFP, Plan de rétablissement du dard de sable, 2007 to 2018

MFFP, Plan de rétablissement du fouille-roche gris, 2020 to 2030, 2019

MFFP, Plan de rétablissement du méné d'herbe, 2012 to 2017

MRC Maskoutains, Politique de la biodiversité, 2017

Municipalité de Saint-Amable, Politique environnementale, 2016

Saint-Bruno-de-Montarville, Plan de conservation des milieux humides et autres milieux naturels, 2016

Saint-Jean-sur-Richelieu, Stratégie et plan d'action en gestion des milieux naturels, 2017

St. Lawrence Action Plan, Atlas of Sites of Conservation Interest in the St. Lawrence Lowlands, 2020

Appendix B: Record of cooperation and consultation

Action plans are to be prepared in cooperation and consultation with other jurisdictions, organizations, affected parties and others, as outlined in SARA section 48. Fisheries and Oceans Canada has sought input from various stakeholders to develop this action plan. Information on participation is included below.

Table 4. List of partners and stakeholders who contributed to the development of the multi-species action plan for the Richelieu River watershed in Canada.

Partners and stakeholder groups	Member/attendee	Affiliation
Government of Canada	Science – Species at Risk Fish and Fish Habitat Protection Division (Regulatory Reviews and Partnerships and Integrated Planning) Strategic Services Fisheries Management Communications	Fisheries and Oceans Canada
Government of Canada	Office of Boating Safety	Transport Canada
Government of Canada	Conservation Programs Branch	Parks Canada
Government of Canada	Canadian Wildlife Service	Environment and Climate Change Canada
Government of Quebec	Direction générale de la gestion de la faune et des habitats Équipe de rétablissement du chevalier cuivré Équipe de rétablissement des cyprins et petits percidés	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
Government of Quebec	Direction de la qualité des milieux aquatiques Direction de l'agroenvironnement et du milieu hydrique	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
Government of Quebec	Direction de l'aménagement du territoire	Ministère des Affaires municipales et de l'Habitation
Government of Quebec	Direction générale de l'appui à l'agriculture durable	Ministère de l'Agriculture, Pêcheries et Alimentation du Québec
Regional County Municipality (RCMs) and Municipal sector	MRC Haut-Richelieu MRC Rouville MRC de La Vallée-du-Richelieu MRC Pierre-de-Saurel MRC Marguerite-D'Youville MRC Les Jardins-de-Napierville MRC des Maskoutains Ville-de-Longueuil Ville de Mont-Saint-Hilaire	Municipalité régionale de comté (MRC) [Regional County Municipality]

Partners and stakeholder groups	Member/attendee	Affiliation
Environmental non-government organizations (ENGOs)	Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) Nature Conservancy of Canada Fédération de l'Union des producteurs agricoles de la Montérégie (UPA Montérégie)	

Appendix C: Acronyms

AAC	Agri-environmental advisory club
AAFC	Agriculture and Agri-Food Canada
AMQ	Association maritime du Québec
ALUS	Alternative Land Use Services
CALC	Chronic aquatic life criteria
CNF	Canada Nature Fund
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COVABAR	Comité de concertation et de valorisation du bassin de la rivière Richelieu
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
ENGO	Environmental non-governmental organization
FA	*Fisheries Act*
FQM	Fédération québécoise des municipalités
ARTVS	*Act Respecting Threatened or Vulnerable Species*
MAMH	Ministère des Affaires municipales et de l'Habitation
MAPAQ	Ministère de l'Agriculture, Pêcheries et Alimentation du Québec
MELCCFP	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
MWTW	Municipal wastewater treatment works
NCC	Nature Conservancy of Canada
NPO	Non-profit organization
PC	Parks Canada
RCM	Regional county municipality
SARA	*Species at Risk Act*
TC	Transport Canada
UMQ	Union des municipalités du Québec
UPA	Fédération de l'Union des producteurs agricoles de la Montérégie