

Report on the Progress of Recovery Strategy Implementation for the Eastern Sand Darter (*Ammocrypta pellucida*), Quebec populations, in Canada for the Period 2014 to 2019

Eastern Sand Darter



2022

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Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#) agreed to establish complementary legislation and programs that provide for protection of species at risk throughout Canada. Under section 46 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the competent ministers are responsible for reporting on the implementation of the recovery strategy for a species at risk, and on the progress towards meeting its objectives within five years of the date when the final recovery strategy was placed on the Species at Risk Public Registry and in every subsequent five-year period, until the recovery strategy is no longer required under SARA or the species' recovery is no longer feasible.

Reporting on the progress of recovery strategy implementation requires reporting on the collective efforts of the competent minister(s), provincial and territorial governments and all other parties involved in conducting activities that contribute to the species' recovery. Recovery strategies identify broad strategies and approaches that will provide the best chance of recovering species at risk. Some of the identified strategies and approaches are sequential to the progress or completion of others and not all may be undertaken or show significant progress during the timeframe of a report on the progress of recovery strategy implementation (progress report).

The Minister of Fisheries and Oceans is the competent minister(s) under SARA for the Eastern Sand Darter, Quebec populations, and has prepared this progress report.

As stated in the preamble to SARA, success in the recovery of species at risk depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in the recovery strategy and will not be achieved by Fisheries and Oceans Canada (DFO), or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the recovery strategy for the Eastern Sand Darter for the benefit of the species and Canadian society as a whole.

Acknowledgments

This progress report was prepared by Virginie Christopherson (DFO), Marie-Pierre Veilleux (DFO) and Arianne Savoie (DFO). To the extent possible, this progress report has been prepared with inputs from the [Équipe de rétablissement des cyprinidés et des petits percidés du Québec](#). DFO would also like to express its appreciation to all individuals and organizations who have contributed to the recovery of the Eastern Sand Darter, Quebec populations.

Executive summary

The Eastern Sand Darter (*Ammocrypta pellucida*), Quebec populations, was listed as threatened under the *Species at Risk Act* (SARA) in 2003. The [Recovery Strategy for the Eastern Sand Darter \(*Ammocrypta pellucida*\) in Canada, Quebec populations](#) was finalized and published on the [Species at Risk Public Registry](#) in 2014.

The main threats identified for the Eastern Sand Darter, Quebec populations, are increased sediment loading and siltation, altered flow regimes and water level fluctuations, presence of contaminants, barriers to fish passage, invasive aquatic species and diseases, excessive nutrient loading, reduced prey availability, and incidental harvest.

The population and distribution objectives for the Eastern Sand Darter, Quebec populations, established in the recovery strategy were to maintain the species' population throughout the species' distribution in Quebec over a five year period and to prevent their decline. The long term objective (that is, 20 years) is to promote the growth of existing populations to ensure their viability and, wherever possible, to restore historical populations that are extirpated. If possible, viable populations should eventually cover the entire current and historical range.

This "Report on the Progress of Recovery Strategy Implementation for the Eastern Sand Darter, Quebec populations, in Canada for the Period 2014 to 2019" (progress report) reports on the progress made by DFO and its partners towards implementing the recovery strategy and achieving its objectives. During this time period:

- sampling efforts have successfully observed the species in an additional nine rivers. The species presence has also been confirmed in several rivers where it is historically known to have occurred, namely the [L'Assomption](#), [Ouareau](#), [Bécancour](#), [aux Orignaux](#), [Champlain](#), and [Gentilly](#) rivers and the mouth of the [Saint-François](#) River at Lake [Saint-Pierre](#)
- various outreach efforts have been conducted with stakeholders (agricultural producers, riparian owners, municipal representatives) and riparian buffer restoration projects have been carried out under the Habitat Stewardship Program (HSP) and Aboriginal Fund for Species at Risk (AFSAR) program

The recovery of the Eastern Sand Darter, Quebec populations, is on track. However, it is important to bear in mind that the discovery of new populations can also be the result of increased survey effort, which is not to downplay the efforts invested in restoration or outreach by key stakeholders and the general public. The next steps are the identification of additional critical habitat and the continuation of outreach and habitat restoration. DFO remains committed to the recovery efforts for the Eastern Sand Darter and will continue with ongoing productive collaborations, and welcomes the participation of additional partners.

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1. Introduction

The “Report on the Progress of Recovery Strategy Implementation for the Eastern Sand Darter (*Ammocrypta pellucida*), Quebec populations, in Canada for the Period 2014 to 2019” (progress report) outlines the progress made towards meeting the objectives listed in the recovery strategy for the Eastern Sand Darter from 2014 to 2019 and should be considered as part of a series of documents for this species that are linked and should be taken into consideration together; including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report ([COSEWIC 2009](#)), a recovery potential assessment ([DFO 2011](#)), a recovery strategy ([DFO 2014](#)), and, if available, one or more action plan(s).

Section 2 of the progress report summarizes the key information on the threats to the species, population and distribution objectives for achieving its recovery, the approaches to meeting the objectives, and the performance indicators to measure the progress of recovery. For more details, readers should refer back to the [Recovery Strategy for Eastern Sand Darter \(*Ammocrypta pellucida*\) in Canada, Quebec populations](#) (recovery strategy). Section 3 reports the progress of activities identified in the recovery strategy, to support achieving the population and distribution objectives. Section 4 summarizes the progress toward achieving the objectives.

2. Background

2.1 COSEWIC assessment summary

The listing of the Eastern Sand Darter under the *Species at Risk Act* (S.C. 2002, c.29) (SARA) in 2003 led to the development and publication of the “Recovery Strategy for Eastern Sand Darter (*Ammocrypta pellucida*) in Canada, Quebec populations” in 2014. The recovery strategy is consistent with the information provided in the COSEWIC status report ([COSEWIC 2009](#)). The COSEWIC summary information is also included in section 1 of the recovery strategy.

Assessment summary: November 2009

Common name (population): Eastern Sand Darter, Quebec populations

Scientific name: *Ammocrypta pellucida*

COSEWIC status: Threatened

Reason for designation: This species prefers sand bottom areas of lakes and streams in which it burrows. There is continuing decline in the already small and fragmented populations; three (of 18) have probably been extirpated, and the fate of five others is unknown due to lack of recent sampling. The extent of occurrence of this species in Quebec is approximately two-thirds of what it was in the 1970s, despite records at five new sites in two locations. There is continuing habitat loss and degradation from historic and ongoing urban and agricultural development, stream channelization and competition with invasive alien species.

Canadian occurrence: Quebec

COSEWIC status history: The species was considered a single unit and designated “threatened” in April 1994 and November 2000. When the species was split into separate units in November 2009, the “Quebec populations” unit was designated “threatened.”

The “Recovery Strategy for the Eastern Sand Darter in Canada, Quebec populations” identifies the threats to the survival and recovery of the Eastern Sand Darter and threats to its critical habitat.

Section 4 of the recovery strategy provides information on the threats to the survival and recovery of the species, namely increased sediment loading and siltation, altered flow regimes and water level fluctuations, presence of contaminants, barriers to fish passage, invasive aquatic species and diseases, excessive nutrient loading, reduced prey availability, and incidental harvest.

Critical habitat for the Eastern Sand Darter is identified, to the extent possible, in section 7 of the recovery strategy ([DFO 2014](#)). The recovery strategy also provides examples of activities that are likely to result in destruction to critical habitat (that is, threats to critical habitat). The list of activities provided in table 12 of the recovery strategy is neither exhaustive nor exclusive, and their inclusion has been guided by the relevant threats to habitat described in the recovery strategy. For more information on the activities likely to result in destruction of critical habitat, refer to the recovery strategy.

Threats to the critical habitat of the Eastern Sand Darter include: degradation of riparian buffers by the removal of riparian vegetation; construction of structures on shorelines (for example, retaining walls, riprap); tilling and crop harvesting right up to the edge of streams; unfettered livestock access to streams; fertilizer use (manure or slurry) near streams; release of untreated wastewater, including overflow; straightening and channelization of streams; construction and management of dams; construction of other structures along shorelines or in streams (for example, wharves, bridges, culverts); infilling; maintenance dredging of watercourses; recreational boating activities; and introduction of invasive aquatic species.

2.2 Recovery

This section summarizes the information, found in the recovery strategy ([DFO 2014](#)), on the population and distribution objectives that are necessary for the recovery of the Eastern Sand Darter, and on the performance indicators that provide a way to define and measure progress toward achieving the population and distribution objectives.

Section 5 of the recovery strategy ([DFO 2014](#)) presents the population and distribution objectives necessary for the species’ recovery. The short-term objective (5 years) of this recovery strategy is to maintain Eastern Sand Darter populations throughout the species’ range in Quebec and to prevent their decline. In the long-term (20 years), the objective is to promote the growth of existing populations to ensure their viability and, wherever possible, to restore historical populations that are extirpated. If possible, viable populations should eventually cover the entire current and historical range.

Section 8 of the recovery strategy includes the following performance indicators to define and measure progress towards achieving the population and distribution objectives:

- identify three other viable populations (indicators: area and number of adult individuals) in the various watercourses by 2017, or nearly 50% of the target number of populations (13 viable populations) to achieve an extinction risk over 100 years of 1%, or a 99% probability of species persistence (Finch et al. 2011; DFO 2011)

- identify critical habitat for each of these populations

3. Progress towards recovery

The recovery strategy for the Eastern Sand Darter ([DFO 2014](#)) divides the recovery effort into 5 broad strategies: 1) survey and monitoring; 2) knowledge acquisition, 3) protection, restoration and stewardship; 4) communication and outreach; and 5) partnership and coordination.

Progress in carrying out these broad strategies is reported in section 3.1. Section 3.2 reports on the activities identified in the schedule of studies to identify critical habitat. Section 3.3 reports on the progress on meeting the performance indicators and other commitments (for example, action plan and critical habitat order) identified in the recovery strategy and information obtained through implementing the recovery strategy.

3.1 Activities supporting recovery

Table 1 provides information on the implementation of activities undertaken to address the recovery measures and broad strategies identified in the recovery planning table of the recovery strategy ([DFO 2014](#)).

Table 1. Details of activities supporting the recovery of the Eastern Sand Darter from 2014 to 2019.

Recovery measure	Broad strategy	Description and outcomes	Participants
Monitoring known Eastern Sand Darter populations, estimating their abundance, characterizing habitats in use and assessing suitable habitat area.	Survey and monitoring	<p>As part of the Habitat Stewardship Program (HSP) project for the years 2013 to 2015, the Corporation de l'Aménagement de la Rivière L'Assomption (CARA) conducted fish surveys and carried out habitat characterization in the L'Assomption and Ouareau rivers. A total of 11 Eastern Sand Darters were captured, including two at the Saint-Charles-Borromée municipal beach. Through inventories, Eastern Sand Darters were discovered, for the first time, upstream of the Scott Paper plant on the Ouareau River. This stretch of river has been isolated for close to 100 years. A total of 2.21 hectares of preferred habitat with presence of Eastern Sand Darters were discovered.</p> <p>In an experimental fishery project carried out for the Service de la gestion des habitats aquatiques et de la production piscicole - Direction de l'expertise sur la faune aquatique of the Quebec Department of Forests, Wildlife and Parks (MFFP), 56 Eastern Sand Darters were captured in the L'Assomption River. The fishing operations were carried out using a beach seine. A total of four beach seine passes were completed.</p>	CARA MFFP
Conducting surveys, first in historically occupied areas and then in potential habitat areas.	Survey and monitoring	In the summer of 2013, Fisheries and Oceans Canada (DFO) hired Genivar Inc. (WSP) to conduct surveys in 18 Quebec rivers and lakes: aux Saumons River (Richmond and Weedon), aux Bluets River, aux Ormeaux River, Batiscan River, Lac des Deux-Montagnes , des Mille-Îles River, du Chêne River, du Loup River, Gentilly River, Henri River, Jacques-Cartier River, Niger River, Noire River, Sainte-Anne River, Yamachiche River and Petite	CARA , Council of the Abenakis of Wôlinak, Éco-Nature , Council of the Abenakis of

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>Yamachiche River. Eastern Sand Darters were captured in three rivers, namely du Loup River (Mauricie, captured at one of the seven stations sampled), aux Orignaux River (Centre-du-Québec, at one of four stations) and Gentilly River (Centre-du-Québec, at two of five stations). In the case of the Gentilly and aux Orignaux rivers, these results once again confirm the presence of the species in streams where it was historically known to occur.</p> <p>In 2014 and 2015, DFO hired Synergis to characterize and survey suitable Eastern Sand Darter habitat in several rivers. In 2014, 91 individuals were captured in the Nicolet River (Centre-du-Québec), 141 in Nicolet Sud-Ouest River (Centre-du-Québec), 89 in du Loup River, 3 in Gentilly River, and 2 in aux Orignaux River. No fish were captured in the Yamachiche River (Mauricie). In 2015, surveys were conducted in the Champlain River (Mauricie) and the Noire River (Centre-du-Québec). Two Eastern Sand Darters were captured in the Noire River and 19 in the Champlain River.</p> <p>In 2015, DFO awarded a contract to a non-governmental organization (NGO) to conduct surveys in the Trout River (Montérégie). A total of 34 Eastern Sand Darters were captured.</p> <p>In 2016, DFO hired Englobe to survey six rivers in the Mauricie region in order to validate the presence of Eastern Sand Darters. The species was captured in three of the six rivers sampled, namely: the Maskinongé River (Mauricie), where 32 individuals were captured; Petite rivière du Chêne (Chaudière-Appalaches), where a single individual was captured; and du Chêne River, where eight individuals were captured. No Eastern Sand Darters were captured in the Saint-Maurice, Sainte-Anne or Batiscan rivers (Mauricie).</p> <p>In 2017, CARA conducted surveys in the Noire River and Lake Noir (Lanaudière); no Eastern Sand Darters were captured. Groupe</p>	<p>Odanak, DFO, Ambioterra, MERN, MFFP</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>Hémisphère sampled the following five rivers in the Basses-Laurentides: du Chêne, du Chicot, aux Chiens, Rouge and du Nord. No Eastern Sand Darters were captured in any of the rivers. In 2016, as part of an HSP project, Ambioterra conducted fish surveys and habitat characterization in the Châteauguay River, and four Eastern Sand Darters were captured. In 2017, as part of another HSP project, Ambioterra conducted fish surveys and habitat characterization in aux Saumons River. A single Eastern Sand Darter was captured.</p> <p>In 2016, the MFFP's Lanaudière wildlife management branch (DGFa) confirmed the presence of the species in a survey on the Mascouche River in the towns of Terrebonne and Mascouche. The area of potential habitat was determined for the three sampling stations at which the species was recorded. In 2017, the Laurentides DGFa conducted an Eastern Sand Darter survey on the Mascouche River in the towns of Sainte-Anne-des-Plaines and Mirabel, but no fish were captured.</p> <p>As part of HSP projects carried out between 2013 and 2016, Éco-Nature characterized 33 shorelines in Laval and identified potential Eastern Sand Darter habitat. Between 2016 and 2019, Éco-Nature, in partnership with MFFP, conducted seine surveys in the western portion of des Mille Îles River. No Eastern Sand Darters were detected at any of the 19 stations sampled</p> <p>In 2017, the Ministère de l'Énergie et des Ressources naturelles (MERN) conducted surveys in Missisquoi Bay (Montérégie) and Lake Massawippi (Estrie), but no Eastern Sand Darters were captured. In surveys conducted by Groupe BC2 Synergis in the summer and fall in the Nicolet River, 751 Eastern Sand Darters were captured.</p> <p>As part of projects carried out under the Aboriginal Fund for Species at Risk (AFSAR) program in 2013 to 2014, the Council of the</p>	

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>Abenakis of Odanak, in collaboration with the Comité Zone d'Intervention Prioritaire (ZIP) du lac Saint-Pierre, conducted surveys at the mouth of the Saint-François River at Lake Saint-Pierre, where the most recent records of the species date back to the period 1940 to 1959. Nine Eastern Sand Darters were detected at two of the five stations sampled.</p> <p>As part of an AFSAR project in 2015 to 2016, the Council of the Abenakis of Wôlinak conducted beach seine fisheries at 20 stations located over 100 km between the mouth of the Bécancour River and the town of Lyster. Eastern Sand Darters were discovered at three stations, all located downstream from Maddington Falls. A total of 2.21 hectares of preferred habitat where Eastern Sand Darters were present were detected, giving an estimate of 2,129 individuals, with a catch per unit effort of 0.25 fish/m². In another survey conducted in 2016-2017, the species was captured at 12 of 23 stations, distributed between kilometre 37 of the mouth of the Bécancour River and Maddington Falls. A total of 41.61 hectares of preferred habitat where the species was present were identified at a depth of 2 m.</p> <p>In 2018, fisheries of the Réseau de suivi ichtyologique (RSI) revealed the presence of the species at Oka beach.</p> <p>Through monitoring of Copper Redhorse recruitment by MFFP, it was possible to update Eastern Sand Darter records in the Richelieu River (2010 to 2018).</p>	
<p>Building biological and ecological knowledge (for example, life cycle, habitat used) of the Eastern Sand Darter in Quebec.</p>	<p>Knowledge acquisition</p>	<p>In a trawl fishery carried out in 2015 by the MFFP, the species was captured at depths of over 5 m, which suggests that the preferred habitat depth may have been underestimated by the use of fishing instruments (beach seines and electrofishing). Through an analysis of data collected between 2013 and 2018, the habitat needs of Eastern Sand Darter were identified and known habitats were mapped. The</p>	<p>MFFP</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		results are available in Couillard et al. 2013 and Ricard et al. 2018. Habitat use was not differentiated on the basis of life cycle stage.	
Building knowledge about threats to population survival and recovery.	Knowledge acquisition	<p>As part of HSP projects carried out between 2013 and 2015, the Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) characterized the impacts of the 2011 spring flood on the morphology of the islands, riparian buffers, and current of the Refuge faunique Pierre-Étienne-Fortin, critical habitat for the species. Following this phenomenon, COVABAR adopted an action plan and monitoring protocol targeting the physicochemical and biological components of the refuge in order to assess the quality of this habitat over time. Between 2014 and 2017, COVABAR carried out monitoring of water quality and aquatic ecosystem quality to determine the extent of fish habitat degradation. Bacteriological and physicochemical data were collected through sampling at the Carignan station of the Réseau-rivières network and at other stations on the L'Acadie River and its tributaries. Characterization of the status of riparian buffers (artificial shoreline alteration, vegetation) was undertaken in the stretch of this species' critical habitat located between Chambly Basin and Saint-Ours Canal. COVABAR also characterized 204 linear kilometres of streams over an area of 140 km², to assess the status of riparian buffers. This made it possible to target the most problematic sectors in terms of water quality.</p> <p>As part of HSP projects, water quality monitoring was initiated by Éco-Nature in the Milles-Îles and des Prairies rivers, with the support of the city of Laval and 3 regional county municipalities (RCMs; Thérèse-de-Blainville, Deux-Montagne, Les Moulins), as it is an important issue for fish species at risk.</p>	COVABAR , Éco-Nature
Assessing genetic variations among	Knowledge acquisition	This measure was not implemented.	N/A

Recovery measure	Broad strategy	Description and outcomes	Participants
populations in Canada.			
Protecting Eastern Sand Darter habitats.	Protection, restoration and stewardship	<p>As part of HSP projects carried out between 2012 and 2017, Ambioterra has concluded 18 voluntary conservation agreements with property owners in the Trout and Châteauguay river watersheds who have committed to take action to protect suitable Eastern Sand Darter habitat.</p> <p>As part of an HSP project in 2016 to 2017 by Corridor appalachien, the acquisition of the Scowen property in Estrie by Fiducie du lac Massawippi ensures the protection of that section of the Lake Massawippi shoreline.</p> <p>Efforts to expand the Refuge faunique de la Rivière-des-Mille-Îles are continuing with the objective of protecting 300 hectares of natural areas along Rivière des Milles Îles and giving these areas protected area status. The expansion of Refuge faunique Pierre-Étienne-Fortin in the Richelieu River will also contribute to protecting preferred habitat.</p> <p>As part of HSP projects carried out between 2016 and 2018, the Organisme de concertation pour l'eau des bassins versants de la rivière Nicolet (COPERNIC) concluded 14 voluntary conservation agreements with shoreline property owners to protect suitable Eastern Sand Darter habitat near their properties in accordance with the Quebec policy for the protection of lakeshores, riverbanks, littoral zones and floodplains (PPRLPI).</p> <p>Activities carried out in fish habitat are governed by federal, provincial and municipal legislation. Certain conditions for authorization or specific mitigation or compensation measures may be required.</p>	<p>Corridor appalachien, Nature Conservancy Canada (NCC), COPERNIC, DFO, MFFP, Ambioterra</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>Requests for authorization for activities affecting critical Eastern Sand Darter habitat are analyzed by DFO on a case-by-case basis, based on applicable legislation.</p> <p>Critical habitat for Eastern Sand Darter has been legally protected through a ministerial order under the <i>Species at Risk Act</i> since July 2018.</p>	
Restoring degraded habitats supporting known and historical populations where natural recolonization is possible, including in agricultural setting (primary threat).	Protection, restoration and stewardship	<p>Through response sites set up as part of HSP projects carried out between 2014 and 2020, improvements have been made to the quality of the riparian buffer and contaminant loads in the L'Acadie River (tributary of the Richelieu River) have been reduced by means of tree and shrub planting.</p> <p>As part of HSP projects in 2017 to 2018, Éco-Nature reduced artificial shoreline alteration and restored two riparian habitats on two municipal properties.</p> <p>As part of HSP projects carried out between 2014 and 2016, Ambioterra restored 342 linear metres of shoreline and an area of 3,160 m² of the Trout River through planting of native vegetation and shoreline stabilization using bioengineering techniques in order to improve Eastern Sand Darter habitat. Similar riparian management approaches have been implemented on the shoreline of the Châteauguay River.</p> <p>As part of HSP projects carried out between 2012 and 2018, the organization Groupe Pro-Conseil restored thousands of linear metres of shoreline along three creeks (Coderre, des Ormes and Belœil) through the planting of shrubs and other stabilizing vegetation. The Union des Producteurs Agricole from Montérégie (UPA-Montérégie) also received HSP funding between 2016 and 2018 to stabilize and enhance several linear metres of shoreline, specifically</p>	COVABAR, Éco-Nature, Ambioterra, Groupe Pro-Conseil, OBVLRY, UPA-Montérégie

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>through the establishment of riparian buffers and windbreaks and through mechanical bank reprofiling.</p> <p>HSP projects carried out between 2018 and 2021 by the Organisme de bassins versants des rivières du Loup et des Yamachiche (OBVRLY) include establishing riparian buffers, vegetating agricultural ditches and planting trees and shrubs in agricultural ravines and other areas that are unsuitable for farming. In addition, the design of agricultural water infrastructure in areas affected by erosion or hydraulic soil failures is planned.</p>	
<p>Ensuring that all involved stakeholders, including RCM land use planners and coordinators responsible for watercourses and fish habitat protection analysts, take the Eastern Sand Darter and its habitat requirements into account before authorizing work on shorelines or in watercourses inhabited by the species. Proposing mitigation measures where applicable.</p>	<p>Protection, restoration and stewardship</p>	<p>In 2013 to 2014, Ambioterra held meetings with key stakeholders in the water shed of the Trout River to discuss Eastern Sand Darter habitat protection issues: 1) at the municipal level, in urban development plans; 2) at the RCM, in site development plans; and 3) at the level of the Conférence régionale des élus de la Vallée-du-Haut-Saint-Laurent in the plan of the Commission régionale des ressources naturelles et du territoire (regional land and natural resources commission). Three environmental diagnostic assessments were submitted and four conservation agreements were signed in that watershed.</p> <p>CARA engaged in outreach with land use managers on Eastern Sand Darter habitat and threats to the species.</p> <p>COVABAR headed up meetings with stakeholders within its territory (municipalities, agricultural producers, etc.) to make them aware of the issues affecting the species and solutions for improving water quality and riparian buffers.</p> <p>Activities carried out in fish habitat are governed by federal, provincial and municipal legislation. Certain conditions of authorization or specific mitigation or compensation measures may be required.</p>	<p>Ambioterra, CARA, COVABAR, DFO, MFFP</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>Requests for authorization for activities affecting critical Eastern Sand Darter habitat are analyzed on a case-by-case basis by DFO based on applicable legislation.</p>	
<p>Undertaking habitat stewardship activities in riparian environments where the eastern sand darter is extant, including in agricultural settings (primary threat).</p>	<p>Protection, restoration and stewardship</p>	<p>As part of HSP projects carried out between 2012 and 2017, Ambioterra carried out 18 environmental characterizations and concluded 18 voluntary conservation agreements with landowners in the Trout and Châteauguay river watersheds who have committed to take action to protect suitable Eastern Sand Darter habitat.</p> <p>As part of HSP projects, for the year 2017 to 2018, CARA gave a talk on shoreline development for residents of Repentigny. The purpose of the talk was to promote best development practices on the municipality’s shorelines.</p> <p>As part of HSP projects carried out between 2016 and 2018, COPERNIC distributed plans for the development of properties to 20 shoreline property owners located near suitable Eastern Sand Darter habitat.</p> <p>Between 2014 and 2016, as part of HSP projects, COVABAR characterized 320 linear kilometres of shoreline to get a picture of the status of riparian buffers. It was then possible to target the most problematic sectors affecting water quality. As a result of the characterization, COVABAR and other sector stakeholders were able to set up sites for improving riparian buffer quality in agricultural areas. COVABAR has also developed the riparian buffers on 11 shoreline properties in the sector of Île de Jeannotte and Île aux Cerfs.</p> <p>As part of HSP projects carried out between 2013 and 2018, Éco-Nature prepared a conservation plan for natural shoreline areas in Boisbriand to protect wildlife habitat. In addition, shoreline property</p>	<p>Ambioterra, CARA, COPERNIC, COVABAR, Éco-Nature</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>owners were made aware of proper shoreline development and they undertook to conserve their natural shorelines.</p> <p>As part of HSP projects carried out between 2018 and 2021, OBVLR has committed to raising awareness among agricultural producers, riparian owners, and municipal stakeholders of issues relating to water quality and Eastern Sand Darter habitat quality. In addition, customized handbooks will be produced for agricultural producers and will include relevant information on aspects to be improved and preserved and a written conservation agreement.</p>	
<p>Taking the Eastern Sand Darter's requirements into account in water flow management at dams and in sea lanes, particularly during spawning.</p>	<p>Protection, restoration and stewardship</p>	<p>This measure was not implemented.</p>	<p>N/A</p>
<p>Protecting the Eastern Sand Darter from use as a bait fish and reducing incidental harvest as needed in at risk areas through concrete actions.</p>	<p>Protection, restoration and stewardship</p>	<p>Since April 1, 2017, the use or possession of live baitfish has been prohibited in Quebec, and the use of dead baitfish is authorized under certain conditions.</p> <p>As part of an HSP project between 2015 and 2017, COVABAR monitored catches and bait used by harvesters at Chambly Basin to reduce the use of this species as baitfish.</p>	<p>MFFP, COVABAR</p>
<p>Developing and distributing awareness tools specific to the Eastern Sand Darter to educate people</p>	<p>Communication and outreach</p>	<p>As part of HSP projects carried out between 2013 and 2020, Ambioterra distributed outreach materials, including landowner booklets and information sheets on ways to protect Eastern Sand Darter habitat and natural heritage. These documents were distributed to riparian owners, regional stakeholders and the general</p>	<p>Ambioterra, CARA, Centre de la nature Mont-Saint-Hilaire, Council of the</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
<p>about the Eastern Sand Darter's status as "threatened" under SARA and this recovery strategy, among other concerns.</p>		<p>public within the territory covered by Ambioterra, namely the western Montréal region.</p> <p>As part of HSP projects carried out between 2013 and 2019, CARA drafted and distributed 20 information booklets and 34 landowner booklets to riparian owners near suitable Eastern Sand Darter habitat. The new order identifying critical habitat for Eastern Sand Darter and its legal implications have also been presented to various municipalities located within the territory covered by CARA.</p> <p>As part of HSP projects carried out between 2014 and 2016, the Centre de la Nature Mont-St-Hilaire organized an outreach activity for the protection of at-risk species of the Richelieu River, including Eastern Sand Darter, for 16 classes at seven primary schools.</p> <p>As part of projects carried out under the AFSAR program between 2013 and 2016, the Council of the Abenakis of Odanak distributed relevant information regarding the species via its social networks and the community newspaper, <i>W8banaki Pilaskw</i>.</p> <p>As part of HSP projects carried out between 2016 and 2018, 50 riparian owners along the Nicolet, Nicolet Sud-Ouest and Bulstrode rivers were informed and made aware of the presence of Eastern Sand Darter near their property by COPERNIC. They were informed of the measures they could take to reduce the impact of threats to the species. Landowners booklets were also distributed.</p> <p>As part of HSP projects carried out between 2013 and 2017, COVABAR raised the awareness among harvesters, pleasure boaters and visitors to Refuge faunique Pierre-Étienne-Fortin. The main topics addressed were: legal status of the species, key threats, delineation and regulatory compliance of Refuge faunique Pierre-Étienne-Fortin, adverse effects of boating disturbance and baitfish.</p>	<p>Abenakis of Odanak, COPERNIC, COVABAR, Groupe Pro-Conseil, UPA Montréal</p>

Recovery measure	Broad strategy	Description and outcomes	Participants
		<p>More specifically, pleasure boaters from Île de Jeannotte and Île aux Cerfs have been made aware of the importance of the islands as critical habitat for Eastern Sand Darter and of the adoption of eco-friendly boating practices aimed at its protection. Bookmarks and information leaflets on the species presenting a number of its characteristics were distributed and several outreach booths engaged in public outreach. A total of 65 municipalities in the Richelieu River watershed were contacted and made aware of species at risk. Available documents (existing brochures and fact sheets on riparian buffers) were distributed to all municipalities. Eighteen agri-environmental clubs (1,102 members) and UPA Montérégie were made aware of the integration of agricultural practices promoting species at risk recovery, and the improvement and protection of the water quality in Richelieu River watershed. All marinas on the Richelieu River (20), the Vallée-du-Richelieu and Lake Saint-Pierre nautical stations, and representatives of various nautical organizations (Association maritime du Québec, watercraft rental centres, etc.) were made aware of the improvement in water quality and the adoption of eco-friendly behaviours by boaters and harvesters that visit the Richelieu River.</p> <p>As part of HSP projects carried out between 2012 and 2019, Groupe Pro-Conseil organized a number of outreach activities for agricultural producers relating to the impact of agricultural non-point source pollution on water quality and aquatic habitat quality in Coderre Creek and des Ormes Creek. Outreach meetings on the benefits and characteristics of riparian buffers were held with the affected RCMs. Over 50 km of riparian buffers were marked to encourage agricultural producers to respect their boundaries. Outreach on pesticide use was also undertaken.</p> <p>The Montérégie UPA conducted outreach to over 270 farm businesses and stakeholders (agri-environmental clubs/pesticide</p>	

Recovery measure	Broad strategy	Description and outcomes	Participants
		companies). A video clip was produced for agricultural producers to inform them of optimized pesticide application.	
Planning, both annually and over the longer term, recovery activities relating to the Eastern Sand Darter and involving the relevant stakeholders in the process.	Partnerships and coordination	Meetings of the Équipe de rétablissement des cyprinidés et petits percidés du Québec were held twice a year over the period 2014 to 2019 at which Eastern Sand Darter recovery implementation activities were prioritized.	MFFP, DFO, Ambioterra, COVABAR, Société de conservation et d'aménagement du bassin de la rivière Châteauguay, Hydro-Québec, Council of the Abenakis of Wôlinak and Council of the Abenakis of Odanak, Bureau d'écologie appliquée
Fostering effective cooperation from watershed organizations and other environmental groups active in areas where the Eastern Sand Darter is extant.	Partnership and coordination	Annual meetings of the Équipe de rétablissement des cyprinidés et petits percidés du Québec have allowed collaboration between various key stakeholders involved in Eastern Sand Darter recovery implementation.	MFFP, DFO, Ambioterra, COVABAR, Société de conservation et d'aménagement du bassin de la rivière

Recovery measure	Broad strategy	Description and outcomes	Participants
			Châteauguay, Hydro-Québec, Council of the Abenakis of Wôlinak, Council of the Abenakis of Odanak, Bureau d'écologie appliquée

*Lead participant(s) is/are listed on top; other participants are listed alphabetically. Not all activities have specific participants identified

3.2 Activities supporting the identification of critical habitat

Table 2 provides information on the implementation of the studies outlined in the schedule of studies to identify critical habitat of the recovery strategy ([DFO 2014](#)). Each study has been assigned one of four statuses:

- 1) completed: the study has been carried out and concluded
- 2) in progress: the study is underway and has not concluded
- 3) not started: the study has been planned but has yet to start
- 4) cancelled: the study will not be started or completed

Table 2. Status and details of the implementation of the schedule of studies outlined in the recovery strategy.

Study	Timeframe	Status	Description and results	Participants
Conduct studies on habitat requirements for each life stage of the Eastern Sand Darter and analyze data previously collected.	2013 to 2017	Cancelled	<p>Over the last five years, no studies of the habitat requirements for each life stage of the Eastern Sand Darter have been conducted in Quebec. However, in Ontario, an occupancy modelling study (Dextrase et al. 2014) has confirmed that substrate size is the most important determinant of the presence of Eastern Sand Darter, which shows a preference for sand and gravel. Moreover, water clarity and upstream distance of dams were also significant determinants of the species' occupancy of a given reach. For more details, see table 1 on p. 7 of this progress report (Building biological and ecological knowledge [for example, life cycle, habitat used] of the Eastern Sand Darter in Quebec).</p> <p>It should be noted, however, that the recovery teams is recommending that this measure be withdrawn from the next recovery strategy as it is no longer considered relevant and actionable.</p>	Fisheries and Oceans Canada (DFO)
Conduct surveys to fill in gaps in the knowledge about distribution and assist in	2013 to 2017	In progress	Since 2014, a number of rivers have been surveyed under contracts issued by the Species at Risk Management Division and through Habitat Stewardship Program (HSP) projects or as part of Quebec's Department of Forests, Wildlife, and Parks (MFFP) operations. The presence of Eastern Sand Darter was confirmed in the following rivers from which it is historically	MFFP, Corporation de l'Aménagement de la Rivière

<p>determining connectivity between populations. Focus first on historical and potential habitats, and where possible, estimate the density of Eastern Sand Darter populations found there.</p>			<p>known: Saint-François, L'Assomption, Ouareau, aux Orignaux, Gentilly and Bécancour. For the Bécancour River, refer to table 1 from section 3.1 of this document for more details on the surveys conducted. In addition, the presence of the species has also been confirmed in an additional nine rivers, namely: du Loup, Noire, Champlain, Nicolet, Nicolet Sud-Ouest, Maskinongé, Mascouche, Saint-Maurice and du Chêne. Apart from the projects of the Council of the Abenakis of Wôlinak on the Bécancour River, the other surveys did not include population density estimates. As for connectivity, a team of researchers observed low genetic diversity of populations between sandy habitats in a given river (Ginson et al. 2015). These results suggest that dispersal resulting from unstable degradation of sandy habitats may prevent genetic differentiation within rivers.</p>	<p>L'Assomption (CARA), Council of the Abenakis of Wôlinak, Éco-Nature, Council of the Abenakis of Odanak, DFO</p>
<p>Survey and map habitat quantity and quality in the current and historical distribution as well as in sites adjacent to currently occupied habitats.</p>	<p>2013 to 2017</p>	<p>In progress</p>	<p>A number of survey and characterization projects have been conducted in recent years. In 2012, DFO awarded a contract to CARA to assess the area of suitable Eastern Sand Darter habitat. The assessment estimated the total area of suitable habitat available to the species in the L'Assomption River to be approximately 4.47 hectares and in the Ouareau River to be 0.07 ha. However, none of the areas identified reached the minimum area for population viability (MAPV) of 3.7 ha. In 2013, DFO awarded a similar contract to assess the area of suitable Eastern Sand Darter habitat in the Richelieu River. The results of the characterization appear to be positive and encouraging for the survival of the Eastern Sand Darter as they exceed the MAPV in terms of discontinuous habitat. However, it is necessary to qualify the results and to specify that only nine stations of continuous habitat currently reach the MAPV.</p>	<p>DFO, CARA</p>
<p>Validate the population/habitat model and, if possible, make a population/habitat</p>	<p>2013 to 2017</p>	<p>Cancelled</p>	<p>The population/habitat model has not been validated and the construction of a model for each life stage is not considered essential to the protection and recovery of the species.</p>	<p>N/A</p>

model available for each life stage.				
Review population and distribution objectives based on the information collected. Determine the quality and quantity of critical habitat necessary to achieve these objectives where adequate information exists.	2013 to 2017	Not started	The population and distribution objectives have not been reviewed, and the quality and quantity of critical habitat necessary to achieve the objectives have not been determined.	

*Lead participant(s) is/are listed on top; other participants are listed alphabetically. Not all studies have specific participants identified

3.3 Summary of progress towards recovery

3.3.1 Status of performance indicators

Table 3 provides a summary of the progress made toward meeting the performance indicators outlined in the recovery strategy ([DFO 2014](#)). Each indicator has been assigned one of four statuses:

- 1) not met: the performance indicator has not been met, and little to no progress has been made
- 2) not met, underway: the performance indicator has not been met, and further work is ongoing or planned
- 3) met: the performance indicator has been met and no further action is required
- 4) met, ongoing: the performance indicator has been met, but efforts will continue until such time the population is considered to be recovered, meaning that the indicator will be reported against in the next five-year progress report

Table 3. Progress and details of the progress made toward meeting the performance indicators outlined in the recovery strategy.

Performance indicator	Status	Details
Identify three other viable populations (indicators: area and number of adult individuals) in the various watercourses by 2017, or nearly 50% of the target number of populations (13 viable populations) to achieve an extinction risk over 100 years of 1%, or a 99% probability of species persistence (Finch et al. 2011; DFO 2011).	Met, ongoing	In Eastern Sand Darter surveys conducted between 2014 and 2019, the species was identified in an additional nine rivers: Nicolet , Nicolet Sud-Ouest , du Loup , Champlain , Noire (Centre-du-Québec) , Maskinongé , Mascouche , Petite du Chêne (Chaudière-Appalaches) and Saint-Maurice (Mauricie) . Captures were relatively low for some of these rivers, such as the Noire River , where two Eastern Sand Darters were captured and Petite rivière du Chêne , where one Eastern Sand Darter was captured. However, captures were high in Nicolet River and the designation of a new population is considered. With respect to the other rivers (Nicolet Sud-Ouest , du Loup , Maskinongé and Champlain) the number of captures are lower than in the Nicolet River and other surveys will be required before designating new Eastern Sand Darter populations in these rivers.
Identification of critical habitat for each of these populations.	Not met, underway	No critical habitat has been identified for the additional rivers in which Eastern Sand Darters were found in the last five years. However, such measures will be taken in the next action plan.

3.3.2 Completion of action plan

The action plan for the [Richelieu](#) River is currently being developed and anticipated to be published in 2023. It is aimed at improving the water quality of the [Richelieu](#) River for the benefit of several species at risk. This river is very important for several aquatic species, including species at risk such as the Eastern Sand Darter, as a significant stretch of this river was identified as critical Eastern Sand Darter habitat in the recovery strategy ([DFO 2014](#)). One or more action plans will eventually be prepared to address other threats to the species.

3.3.3 Critical habitat identification and protection

Critical habitat was identified to the extent possible based on the best available information in three sectors: 1) [L'Assomption](#) and [Ouareau](#) rivers; 2) [Richelieu](#) River; and 3) [aux Saumons](#) River (near the town of Dundee). The critical habitat identified in the recovery strategy describes geospatial areas, for example stretches of streams, that contain habitat required for the survival or recovery of the species. The ministerial order to protect the critical habitat of the Eastern Sand Darter was formalized in July 2018.

3.3.4 Recovery feasibility

Currently available information supports the feasibility of recovery of the Eastern Sand Darter, Quebec populations.

4. Concluding statement

Significant progress has been made over the last five years in the implementation of the activities set out in the recovery strategy for the Eastern Sand Darter, Quebec populations ([DFO 2014](#)).

The species presence has been confirmed in the six rivers from which it is historically known ([L'Assomption](#), [Ouareau](#), [Saint-François](#), [Bécancour](#), [aux Orignaux](#) and [Gentilly](#)). The species has also been identified in an additional nine rivers: [du Loup](#), [Noire](#), [Champlain](#), [Nicolet](#), [Nicolet Sud-Ouest](#), [Maskinongé](#), [Mascouche](#), [Saint-Maurice](#) and [du Chêne](#). Although only a few specimens were recorded in some rivers, they are valuable new records that expand the range of the Eastern Sand Darter in Quebec. A number of habitat restoration and protection activities have been carried out within the framework of Habitat Stewardship Program (HSP) projects, as well as outreach activities targeting the general public and key stakeholders, including shoreline property owners, agricultural producers, and municipal representatives.

It is hard to say whether the general conditions required by the species have improved over the last five years or whether it is as a result of the recent search efforts that the species has been found in an additional nine rivers. In all cases, the outreach and restoration efforts have certainly benefited the Eastern Sand Darter and other species.

The next steps that will be taken towards the species' recovery are the identification of additional critical habitat, the preparation of an action plan addressing threats other than water quality in the [Richelieu](#) River watershed, awareness campaigns, and restoration of riparian habitat. DFO is determined to continue its efforts aimed at the recovery of the Eastern Sand Darter. The progress made to date would not have been possible without the contribution of our

partners. DFO is looking forward to continuing this productive collaboration and invites other partners to take part.

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