Species at Risk Act
Recovery Strategy Report Series

Report on the Progress of Recovery Strategy Implementation for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population in Canada, for the Period 2012 to 2019

The Beluga Whale

2022

Canada

Recommended citation:

Fisheries and Oceans Canada. 2022. Report on the Progress of Recovery Strategy Implementation for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population in Canada, for the Period 2012 to 2019. *Species at Risk Act* Recovery Strategy Report Series. Fisheries and Oceans Canada, Ottawa. iv + 66 pp.

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Cover illustration: Paule de Margerie

Également disponible en français sous le titre
« Rapport sur les progrès de la mise en œuvre du programme de rétablissement du béluga (*Delphinapterus leucas*), population de l'estuaire du Saint-Laurent au Canada, pour la période 2012 à 2019 »

ISBN 978-0-660-41507-9
Catalogue no. Fs23-645/2022E-PDF

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 the 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 5 years of the date when the final recovery strategy was published on the Species at Risk Public Registry and in every subsequent 5-year period, until recovery 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, Oceans and the Canadian Coast Guard is the competent minister under SARA for the Beluga Whale, St. Lawrence Estuary population, 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, 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 Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population", for the benefit of the species and Canadian society as a whole.

Acknowledgments

This progress report was prepared by Species at Risk Program staff, with input from other sectors of Fisheries and Oceans Canada (DFO), federal and provincial government departments, non-governmental organizations and academic partners. DFO would also like to express its appreciation to all individuals and organizations who have contributed to, and continue to support, the recovery of the Beluga Whale, St. Lawrence Estuary population.

Executive summary

The Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary population (hereafter St. Lawrence Estuary Beluga), was listed as threatened under the *Species at Risk Act* (SARA) in 2005. In 2014, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reassessed the species as endangered, and in 2017 it was listed as such in schedule 1 of SARA. The "Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary population in Canada" was finalized and published on the Species at Risk Public Registry in 2012.

The main threats to the St. Lawrence Estuary Beluga identified in the recovery strategy are historical, specifically, hunting and harassment; as well as current threats including environmental contaminants; anthropogenic disturbance (including underwater noise); reduced prey abundance, quality and availability; other habitat degradation; vessel strikes; entanglement in fishing gear; scientific activities; toxic spills; toxic algal blooms; and epizootics.

The recovery strategy sets out the following population and distribution objectives for the St. Lawrence Estuary Beluga:

1) reduce contaminants in belugas, their prey, and their habitat
2) reduce anthropogenic disturbances
3) ensure adequate and accessible food supply
4) mitigate the effects of other threats to population recovery
5) protect the beluga habitat throughout the entire distribution range
6) ensure regular monitoring of the St. Lawrence Estuary Beluga population

During the time period reported by this progress report, progress has been made in the following areas:

- The manufacture, use, import, sale or offering for sale of many contaminants (some of which are described in appendix 2 of the recovery strategy) have been banned under the *Prohibition of Certain Toxic Substances Regulations (2012)*
- The prohibition against approaching Belugas within 400 m has been maintained in the *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations*, amended in January 2017. These regulations also include new measures to better protect the species, notably: (1) vessels are prohibited from remaining stationary or changing directions repetitively, and are required to operate at a constant speed of between 5 and 10 kt within a 0.5 nautical mile (926 m) radius of a Beluga; (2) personal watercraft, air cushion vehicles and towed watersports are prohibited within the boundaries of the Saguenay–St. Lawrence Marine Park; (3) vessels are required to reduce their speed at the mouth of the Saguenay River; (4) temporary exclusion areas (areas where navigation is prohibited) can be established within the Marine Park, such as the Sainte-Marguerite Bay exclusion area (June 21 to September 21) which was established by government order in June 2018 and the closure of nearly 44% of the territory of the Marine Park to whale watching cruises since 2019
- The *Marine Mammal Regulations in Canada* were also amended in 2018 to increase the approach distance between vessels and Belugas in the St. Lawrence Estuary to 400 m
- Increased funding contributed to recovery through initiatives included in the $1.5 billion Oceans Protection Plan to support cleaner, healthier and safer oceans, and the $167.4 million Whales Initiative directed towards the recovery of endangered whale populations including St. Lawrence Estuary Beluga

- Several of the measures that have been established have had a positive impact on noise levels in the Saguenay Fjord and St. Lawrence Estuary. For example, DFO issued a science advisory to limit commercial traffic in the south channel of Ile Rouge to prevent increased noise in this area heavily used by the female and juvenile Beluga whale herds (DFO, 2014b). Subsequently, the Working Group on Marine Transportation and the Protection of Marine Mammals in the Estuary (G2T3M) has recommended the use of the north channel and the application of speed reduction measures targeting commercial shipping vessels to minimize the impact of noise on Belugas and reduce the risk of collisions with whales. These voluntary measures, which are in effect from May to October and monitored by the G2T3M, were first put in place in 2013 and are announced through Canadian Coast Guard (CCG) notices to shipping
- The Quebec government has prohibited all activities related to oil and gas exploration and development in the northwestern Gulf of St. Lawrence, west of the western tip of Anticosti Island, and in the St. Lawrence Estuary

The progress made to date is due mainly to legislative changes limiting human activities and contaminants that pose a significant threat to the recovery of the St. Lawrence Estuary Beluga. In recent years, numerous studies have been conducted under initiatives implemented by the Government of Canada (Oceans Protection Plan 2016; Whales Initiative 2018) and the Government of Quebec ($2.1 million agreement over 5 years between the Ministère des Forêts, de la Faune et des Parcs du Québec [MFFP; Quebec Department of Forests, Wildlife and Parks] and the Université du Québec en Outaouais [UQO]). However, the results of these studies are not yet available and thus have not been included in this document.

Table of contents

1 Introduction

This report outlines the progress made from 2012 to 2019 towards meeting the objectives set out in the "Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population in Canada" and should be considered as part of a series of documents for this species that should be taken into consideration together, including the recovery potential assessment of Beluga populations (DFO 2005), the recovery strategy (DFO 2012), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Assessment and Status Report (COSEWIC 2014), the Review of the Effectiveness of Recovery Measures for St. Lawrence Estuary Beluga (Lesage 2017), the Action Plan to Reduce the Impact of Noise on the Beluga Whale (*Delphinapterus leucas)* and Other Marine Mammals at Risk in the St. Lawrence Estuary (DFO, 2020) and the Action Plan to Reduce the Impact of Other Threats to the St. Lawrence Estuary Beluga (*Delphinapterus leucas)*, which is currently being prepared by Fisheries and Oceans Canada (DFO).

Section 2 of this progress report summarizes key information on the threats to the species, population and distribution objectives for achieving its recovery, approaches for meeting the objectives, and performance indicators to measure the progress of recovery. For more details, readers should refer to the "Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population in Canada" (DFO 2012). Section 3 reports on the progress of activities identified in the recovery strategy to support achieving the population and distribution objectives and the identification of critical habitat. Section 4 provides a concluding summary of the progress made towards achieving the recovery objectives through 2019.

2 Background

2.1 COSEWIC assessment summary

The listing of the Beluga Whale, St. Lawrence Estuary population (hereafter St. Lawrence Estuary Beluga) as threatened under the *Species at Risk Act* (SARA) in 2005 led to the publication of a recovery strategy for the species in 2012. The recovery strategy is consistent with the information provided in the COSEWIC status report (COSEWIC 2004) and the COSEWIC summary. This information was included in section 1.1 of the recovery strategy. The listing and development of the recovery strategy were further informed by the Recovery Potential Assessment of Cumberland Sound, Ungava Bay, Eastern Hudson Bay and St. Lawrence Beluga Populations (*Delphinapterus leucas*) (DFO 2005).

In 2014, COSEWIC re-examined and changed the status of the St. Lawrence Estuary Beluga, from threatened to endangered in the COSEWIC Assessment and Status Report (COSEWIC 2014).

COSEWIC assessment summary, November 2014

Common name
Beluga Whale, St. Lawrence Estuary population

Scientific name
Delphinapterus leucas

Status
Endangered

Reason for designation
This population, endemic to Canada, is at the southernmost limit of the species' distribution, and is reproductively and geographically isolated from other populations. This population of a long-lived, slowly reproducing species was severely reduced by hunting, which continued until 1979. Since population monitoring surveys began in the 1980s, the total population size has remained at around 1,000 individuals, less than 20% of the population size in the late 1800s or early 1900s. The major threats currently affecting this population include pathogens, toxic algal blooms, pollution, noise disturbance, and other human intrusions and disturbance. The impacts of these threats are likely amplified by the low number of mature individuals remaining in the population. Since the mid-2000s, the population has shown evidence of major demographic changes including increased neonate mortality and a decline in the proportion of young individuals in the population. These trends, together with past and ongoing habitat degradation, and projected increases in threats, suggest that the status of this population has worsened and is at considerably greater risk than when it was previously assessed by COSEWIC in 2004.

Occurrence
Quebec, Atlantic Ocean

Status history
Designated endangered in April 1983. Status re-examined and confirmed in April 1997. Status re-examined and designated threatened in May 2004. Status re-examined and designated endangered in November 2014.

2.2 Threats

The "Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population in Canada" (DFO 2012) identifies the threats to the survival and recovery of the Beluga and identifies the activities that are likely to destroy its critical habitat. These threats include hunting and harassment; contaminants; anthropogenic disturbance (including underwater noise, vessel strikes, entanglement in fishing gear, and non-essential scientific activities); reduced prey abundance, quality and availability; other degradation of habitat; toxic spills; toxic algal blooms; and epizootics.

Critical habitat for the St. Lawrence Estuary Beluga has been identified, to the extent possible, in section 2.4 of the recovery strategy (DFO 2012) and corresponds to the summer distribution of groups of adults with newborns and juveniles, namely the upper estuary, from the battures aux Loups Marins to the Saguenay River, and the southern portion of the lower estuary. Table 6 of the recovery strategy provides examples of activities that are likely to result in the destruction of critical habitat; the list is neither exhaustive nor exclusive, and the inclusion of activities has

been guided by the relevant threats to habitat described in the recovery strategy. For more details on the activities likely to result in the destruction of critical habitat, consult the recovery strategy (DFO 2012).

2.3 Recovery

This section summarizes the information, found in the recovery strategy (DFO 2012), on the population and distribution objectives that are necessary for the recovery of the St. Lawrence Estuary Beluga, and on performance indicators that provide a way to define and measure progress toward achieving the population and distribution objectives.

Section 2 of the recovery strategy (DFO 2012) identifies the following population and distribution objectives necessary for the recovery of the species:

- achieve a long-term population size of 7,070 individuals, or 70% of its historical size
- achieve a population growth rate of at least 2% per year
- reach an intermediate objective of a population size of 1,000 mature individuals
- increase the beluga's range to a minimum level corresponding to 70% of the historical distribution area

Section 2.6 of the recovery strategy (DFO 2012) includes the following performance indicators to define and measure progress toward achieving the population and distribution objectives:

- increase in population size
- increase in the number of mature individuals to 1,000 adult Belugas
- increase in the distribution area
- increase in the yearly recruitment rate
- steady-state calving percentage
- decrease in the mortality rate of juveniles

3 Progress towards recovery

The recovery strategy for St. Lawrence Estuary Beluga (DFO 2012) divides the recovery effort into 6 recovery objectives: 1) reduce contaminants in Belugas, their prey, and their habitat, 2) reduce anthropogenic disturbances, 3) ensure adequate and accessible food supply, 4) mitigate the effects of other threats to population recovery, 5) protect the Beluga habitat throughout the entire distribution range, and 6) ensure regular monitoring of the St. Lawrence Estuary Beluga.

Section 3.1 provides information on the activities undertaken to implement the broad strategies and approaches identified in the recovery strategy. Section 3.2 describes the progress made in carrying out the work outlined in the recovery strategy's 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 broad strategies and approaches identified in the recovery planning table of the recovery strategy.

Table 1. Details of activities supporting the recovery of the St. Lawrence Estuary Beluga, from 2012 to 2019.

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Study the effects of contaminants on survival, health, reproduction, and growth.	Study the effects of contaminants on Belugas, their key prey species, and sentinel species.	Several studies allude to the potential effects of major contaminant groups on the immune system and physiology, and thus the health, of Belugas. It should be noted that the only studies feasible in these whales, aside from the regular monitoring of contaminant levels (established and emerging substances) in tissues, are biomarker-based studies (molecular and cellular, etc.). These studies are used to predict toxic effects on immune functions, metabolism and hormone regulation. Although the results of these studies can serve as indicators of health, they cannot be used to assess direct effects of contaminants on reproduction, growth or survival of individuals. Certain studies conducted on Canadian Arctic Belugas showed sufficiently high methylmercury (MeHg) concentrations in brain tissue to cause neurochemical (Ostertag et al. 2014) and neurobehavioural (Krey et al. 2015) modifications. In addition, the reduced incidence of cancers in	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO) (National Contaminants Advisory Group [NCAG]) and Group for Research and Education on Marine Mammals (GREMM)

[1] Participants are listed alphabetically. Not all activities have specific participants identified.

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		St. Lawrence Estuary Beluga since regulations pertaining to polyaromatic hydrocarbons (PAH) were enacted could be the strongest indication of a link between exposure to a class of contaminants and effects on health and survival (Lair et al. 2016). Simond et al. (2019) suggested that elevated concentrations of persistent organic pollutants and certain halogenated flame retardants in the tissues of Belugas and Minke Whales in the St. Lawrence Estuary could disrupt the transcription of genes involved in regulating the thyroid gland, sex steroids and glucocorticoid hormones. The analysis of genomic markers, combined with the use of other biomarkers such as titration of the hormones and protein and metabolite measurements, would considerably improve our understanding of the mechanisms of action of contaminants (Simond et al. 2019). Simond et al. (2020)[2] quantified organohalogens in St. Lawrence Estuary Beluga and found a correlation between the presence of short-chain chlorinated alkanes (SCCA) (also known as short-chain chlorinated kerosenes) and concentrations of certain unsaturated			

[2] The research carried out was within the 2012 to 2019 reporting period represented in this progress report, albeit the publication date occurred afterwards.

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		fatty acids in tissues. The presence of these chlorinated compounds could cause faulty lipid metabolism in the Beluga. Examination of the relationship between the levels of certain contaminants and the physical condition of Belugas found dead indicates that certain emerging compounds used as flame retardants are found in greater abundance in belugas with poorer flesh condition (Bernier-Graveline et al. 2020)[2]. The emergence of new, non-targeted chemical analysis methods will aid in the identification of pollutants of interest in the near future.			
Evaluate the risks of the potential impacts of different contaminant groups on Belugas and the factors that influence these risks.	Study the effects of contaminants on Belugas, their key prey species, and sentinel species.	No activity identified for this measure.	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	N/A
Improve Canadian and Quebec regulations to reduce toxic chemical discharges into	Develop new regulations or fully apply existing regulations to control the discharge of toxic	The *Prohibition of Certain Toxic Substances Regulations* (PCTSR 2012) prohibits the manufacture, use, sale, offering for sale and importing of many toxic substances and products containing them (with a limited number of	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	ECCC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
the Great Lakes–St. Lawrence basin, particularly by reviewing or setting toxicity thresholds for pollutants.	pollutants into the environment, especially new contaminants.	exceptions), including polybrominated diphenyl ethers (PBDEs) (added in 2016), perfluorooctane sulphonate (PFOS), its salts and precursors (added in 2016), SCCA (added in 2013), tributyltins (added in 2013), dichlorodiphenyltrichloroethane (DDT) (added in 2005) and Mirex (added in 1996). The PCTSR also prohibit other types of organobromine compounds and perfluorinated compounds not listed in appendix 2 of the recovery strategy for the species such as hexabromocyclododecane (HBCD), perfluorooctanoic acid (PFOA), and long-chain perfluorocarboxylic acids (LC PFCAs) and their salts and precursors. Dioxins, furans, PAHs, mercury, lead and cadmium are also on the List of Toxic Substances in schedule 1 of the *Canadian Environmental Protection Act* (1999). The Government of Canada has put in place a number of measures and strategies aimed at reducing the emissions and releases of these contaminants before and after the reporting period of this progress report, such as the Risk Management Strategy for Mercury (2010) and the Risk Management Strategy for Lead (2013). Since the publication of these strategies, additional measures have been taken targeting mercury, including the Notice Regarding			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Pollution Prevention Planning in Respect of Mercury Releases from Dental Amalgam Waste (2010); the *Products Containing Mercury Regulations* (2014); the addition of mercury to the *Export of Substances on the Export Control List Regulations* (2017); the Code of Practice for the Environmentally Sound Management of End-of-Life Lamps Containing Mercury (2017); and the National Strategy for Safe and Environmentally Sound Disposal of Lamps Containing Mercury (2019). Since 2013, ECCC has commissioned 4 studies on lead in order to: (1) gather information on the use of lead sinkers and jigs, as well as on lead-free alternatives; (2) collect data on the use of lead ammunition and lead-free alternatives in non-military applications in Canada; (3) gather information on the bioavailability of lead from spent ammunition at recreational shooting ranges in Canada; and (4) collect information on lead coatings used in the Canadian construction industry. The use of lead sinkers and jigs is prohibited in National Parks and National Wildlife Areas pursuant to recent amendments to the *Canada Wildlife Act* and lead ammunition has been banned for waterfowl hunting			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		since 1999 under the *Migratory Birds Convention Act, 1994.* The Government of Canada continuously evaluates chemical substances of concern to determine their level of toxicity to human health and the environment. In 2018, a consultation document on proposed amendments to the PCTSR was released. The proposed amendments would further restrict the manufacture, use, sale, offering for sale or import of PFOS, PFOA, LC PFCA, HBCD and PBDE. These modifications would also ban Dechlorane Plus (DP) and decabromodiphenyl ethane (DBDPE). Internationally, the Government of Canada has been working with other countries to reduce exposure to contaminants from foreign sources over time. This includes efforts under the Stockholm Convention on Persistent Organic Pollutants (POP) aimed at eliminating or severely restricting many of the contaminants listed in appendix 2 of the recovery strategy, as well as work under the Minamata Convention on Mercury, which aims to protect human health and the environment from the adverse effects of mercury through obligations to control anthropogenic			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		emissions of mercury throughout the mercury life cycle.			
Develop mechanisms to monitor the impacts of regulation.	Develop new regulations or fully apply existing regulations to control the discharge of toxic pollutants into the environment, especially new contaminants.	A time series (since 1983) is available that documents changes in the concentrations of certain regulated, unregulated (for example, certain flame retardants and perfluoroalkylated substances) and emerging chemical substances in the St. Lawrence Estuary Beluga (Lebeuf et al., 2014 ; Simond et al., 2017; Barrett et al., 2021)[2]. A Beluga carcass monitoring program has documented a decrease in cancers in these whales since 1983, a trend that could be attributed to the control of certain contaminants like PAHs and polychlorinated biphenyls (PCBs) (Lair et al. 2016). Canada administers a number of environmental surveillance programs to monitor and evaluate the presence of chemical substances in the air, water, sediments and biota owing to certain releases to the environment that could be directly or indirectly harmful to the health of Belugas, their prey species or their habitats. Since 2009, the Environmental Monitoring and Surveillance Program of the Chemicals Management Plan (CMP) has included wastewater (influents, effluents and biosolids from wastewater treatment plants across	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	DFO, ECCC, MELCC and Université de Montréal

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Canada). Since 2019, the program has included certain wastewater treatment plants near areas frequented by Beluga. Between 2008 and 2013, leachates were sampled at 13 municipal solid waste landfill sites in Canada to analyze releases of chemical substances into the environment, several of which have been identified as being of concern for the Beluga. In addition, ECCC currently samples leachates from 10 municipal solid waste landfill sites in Canada that are located near the critical habitat of the St. Lawrence Estuary Beluga. The project, which began in the spring of 2019, is part of the Whales Initiative. The purpose of this 5-year project is to determine whether specific contaminants of concern are being released in landfills at concentrations and loads that pose a risk to these whale species.			
Reduce the number and scope of accidental and illegal discharges of pollutants.	Develop new regulations or fully apply existing regulations to control the discharge of toxic pollutants into the environment, especially new contaminants.	The *Fisheries Act* prohibits the deposit of deleterious substances into waters frequented by fish unless authorized by regulations made under the *Fisheries Ac*t or other federal laws. In the event of an unauthorized deposit, the Act requires that any occurrence be reported without delay, that measures be taken to prevent or minimize the adverse effects and that	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	ECCC, Government of Quebec, private enterprises, and municipalities

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		a written report be submitted afterward. Fishery officers responsible for enforcing the Act are responsible for carrying out inspections to determine compliance, to gather evidence on alleged offences through investigations and to take appropriate enforcement actions if they discover a possible offence. In 2012, the federal government implemented the Wastewater Systems Effluent Regulations (WSER) under the *Fisheries Act*. The regulations, which went into effect in 2015, impose minimum effluent quality standards that can be achieved through secondary level treatment. This level of treatment removes more than 95% of the total mass of conventional pollutants in the wastewater (i.e. biochemical oxygen demand material, suspended solids and nutrients). Significant amounts of non-conventional pollutants and potentially present bacteria are also removed with this type of treatment. Since 2018, the federal and provincial governments have reached an equivalency agreement, and an order-in-council has been issued by the Governor in Council to waive the application of the WSER given that			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		the provincial regulation is of equivalent effect. As a result, the Quebec regulatory regime has governed wastewater discharges from municipal and provincial wastewater systems since 2018.			
Reduce discharges of pollutants from waste storage sites, landfills, sewage treatment plants, industries, etc.	Reduce emissions and discharges of all types of pollutants at the source.	Given that atmospheric emissions constitute a significant source of pollution in aquatic environments, federal regulations and other measures that aim to reduce emissions from various industrial sectors helped to reduce heavy metals such as lead, mercury and cadmium in the St. Lawrence River. These measures include environmental performance agreements for the base metal smelter and refinery sector, regulations to gradually phase out coal-fired electric power plants, and notices requiring pollution prevention plans for mercury switches in end-of-life vehicles processed at steel mills. Additional regulations restricting the use of mercury and lead in consumer and commercial products (for example, Health Canada regulations under the *Canada Consumer Product Safety Act*) also help to prevent contaminants from ending up in landfills and then in the aquatic environment. To better address this	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	ECCC, Government of Quebec and municipalities

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		problem, the federal government has taken measures to ensure the safe and environmentally sound disposal of products containing contaminants through measures such as the National Strategy for Lamps Containing Mercury and dental amalgam residues (Mercury). According to the 2019 Air Pollutant Emission Inventory, during the last decade, lead emissions in Canada declined by 28% and those of mercury by 61%. During the same period, according to the National Pollutant Release Inventory, quantities of lead and mercury released into the water declined by 44% and 66%, respectively. Reports examining these results in greater detail and evaluating the effectiveness of risk management measures for lead and mercury have been published in 2020 as part of the Government of Canada's commitment to performance measurement evaluation. Another report for cadmium is in preparation.			
Identify the main sources of contamination, and determine how contaminants spread through the Beluga population and	Monitor contaminant sources and concentrations in the tissues of Belugas and their key prey species.	A recent study measured 11 PBDE congeners present in the tissues of Belugas (n=22) and certain potential prey species between 1999 and 2003. According to the results of the study, Atlantic Cod, Sand Lance and Capelin are important prey species for the Beluga. The evaluation of these prey species' role	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	DFO and Université du Québec à Rimouski (UQAR)

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
its environment, and how Belugas and their prey are exposed to different contaminant groups.		in the transfer of contaminants suggests that Atlantic Cod and Redfish are the main dietary exposure pathways for contaminants in the Beluga (Ferchiou 2019).			
Study the movement and spread of contaminants in the tissues of Belugas, key prey species, and sentinel species, particularly emerging contaminants, and publish results.	Monitor contaminant sources and concentrations in the tissues of Belugas and their key prey species	Between 1987 and 2007, persistent organic pollutants (POP) were measured in the blubber of St. Lawrence Estuary Beluga (Lebeuf et al. 2014). A small but significant decline was found in POP concentrations in Belugas during this period, including PCBs, DDT and hexachlorobenzene (≤11% per year). This decline is correlated with the tightening of regulations and restrictions on the use of these compounds in developed countries. Simond et al. (2017) examined concentrations of emerging halogenated flame retardants (HFR) in St. Lawrence Estuary Beluga between 1997 and 2013. The blubber in these animals were found to have higher PBDE concentrations than Minke Whales or Nunavik Belugas. A study by Barrett et al. (2021)[2] detected the presence of per- and polyfluoroalkyl substances (PFAS) in St. Lawrence Estuary Beluga livers collected between the years 2000 and 2017. In addition to establishing	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	DFO, ECCC and Université du Québec à Montréal (UQAM)

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		temporal trends of these substances in beluga tissues, the results showed that newborns and juveniles had higher concentrations of PFAS than adults, suggesting transfer of these substances through the placenta and lactation. In addition, this study also demonstrated continuous emissions of unregulated PFAS into the environment Barrett et al. (2021).			
Identify priority contaminated sites and use environmentally sensitive decontamination techniques to clean up identified sites.	Continue cleanup of contaminated terrestrial and aquatic sites in the Great Lakes-St. Lawrence basin.	As mentioned in the recovery strategy (DFO, 2012), the St. Lawrence Estuary Beluga is exposed to a number of contaminants present in both the water column and in the sediments. The latter, even located upstream of beluga habitat, can be transported downstream and pose a threat to the species. Strategies for managing contaminated sediments have been initiated in several areas identified as priority areas of concern in the Great Lakes, the Niagara River, Bay of Quinte and the Ontario part of the St. Lawrence River around Cornwall. Contaminated sediment remediation projects in Port Hope and Randle Reef areas (Hamilton Harbour area of concern) are under way. Randle Reef is the largest and most severely contaminated site in terms of contaminated sediments on the Canadian side of the Great Lakes. In Quebec, a network of highly contaminated aquatic sites in the St. Lawrence River system have been	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	DFO and ECCC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		cleaned up. They include the Pier 103 basin in the Port of Montreal, the lower Saint-Louis River (Beauharnois), Ile aux Chats, and the Baie de Gaspé area (Sandy Beach). Chemical characterization of the sediments at the Contrecœur site is currently under way to determine the environmental issues at this site.			
Initiate actions with Quebec, Ontario, and the United States to coordinate efforts to reduce pollution in the Great Lakes and the entire St. Lawrence Riverbasin.	Continue coordinating pollution reduction efforts, in collaboration with the International Joint Commission.	Under the 2012 Great Lakes Water Quality Agreement between Canada and the United States and the 2014 Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, ECCC is working with the United States, the Province of Ontario and local communities to clean up contaminated sites in the Great Lakes basin known as areas of concern. Some 8 chemicals (mercury, PCBs, PBDE, HBCD, LC PFCA, PFOA, PFOS and SCCA) were identified under the Canada-United States agreement, and binational strategies are currently being developed to reduce, and even eliminate, their use. Additionally, 2 other chemicals of concern, lead and PAHs, were identified under the Canada-Ontario agreement. Other chemicals will be evaluated in the near future and could be added to this list. Under the Canada–Quebec Agreement on the St. Lawrence (St.	Reduce contaminants in Belugas, their prey, and their habitat	Contaminants	ECCC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Lawrence Action Plan), various technical guides and best practice guides have been jointly produced to manage and reduce the environmental risks associated with dredging and sediment management activities in the St. Lawrence. The Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks, Prevention, Dredging and Remediation (EC and MDDEP, 2007) allows assessment of levels of sediment contamination. When used with other contamination evaluation tools, these criteria can be used to identify appropriate methods for managing dredged sediments. They can also be used as indicators for remedial measures required at contaminated sites, as well as to define restoration objectives. In 2016, a study on the effects of dredging activities on the St. Lawrence Estuary Beluga and its habitat was published (DFO 2016b). All the reference documents developed for the St. Lawrence can be consulted for additional information.			
Carry out impact studies of disturbances created by marine traffic, marine observation activities and development	Determine the short- and long-term effects of chronic and acute forms of disturbance.	The volume of vessel traffic at specific sites or within the boundaries of the Saguenay-St. Lawrence Marine Park (SSLMP) was characterized in 2007 (Chion et al. 2009) and 2017 (Turgeon 2019). Interactions between ships and Belugas were also characterized (Ménard et al. 2014; Martins 2016). However, the link	Reduce anthropogenic disturbances	Disturbance	DFO, Marine Mammal Observation Network (MMON), PC and Université du Québec en Outaouais (UQO)

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
projects in, and off-shore in areas used by Belugas.		between navigation and use of the areas by Belugas was not specifically examined in these studies. The use of 2 popular areas for Belugas in the Saguenay Fjord (that is, the mouth of the Saguenay River and Sainte-Marguerite Bay) by ships was documented by the Parks Canada Agency (PC) over a 15-year period (Conversano 2013; Conversano et al. 2017; Ménard et al. 2018). Although these studies were not designed to study the impact of navigation on Belugas, the results suggest that the behaviour and presence of Belugas at these 2 sites are affected. A significant decline in the number of calves as a function of the number of vessels was observed. In addition, a negative correlation was established between the number of boats and the proportion of Belugas showing feeding- or suckling-related behaviour (Conversano et al. 2017). Furthermore, since 2014, MMON, in collaboration with PC, has documented the Beluga's use of 2 areas near Rivière-du-Loup and Cacouna in the southern part of the species' critical habitat, using the protocol developed by PC. These long-term monitoring efforts will allow examination of a possible link between the intensity of vessel traffic and the frequentation of these sectors by Belugas.			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		The potential effects of seismic surveys on habitat use by Belugas were evaluated as part of a project in the Cacouna/Rivière-du-Loup area (DFO 2014a). Aerial surveys were conducted to monitor Belugas while the seismic work was in progress. However, owing to the small sample size, no clear conclusions could be drawn on the effects of these activities on the frequentation of the area by Belugas. Under a mandate from DFO, MMON collected data to document the occurrence of Belugas and changes in their behaviour and frequentation in and around dredging (Rivière-du-Loup) and sediment disposal sites in the fall of 2019. According to the results, MMON technicians observed Belugas on 26 of the 60 observation days, which corresponds to a rate of 43.3%. In addition, this rate came close to 50% in the months of September and October. The results also showed that the most common Beluga behaviours observed at the Rivière-du-Loup site were movement (63%), followed by feeding (32%).			
Based on disturbance impact studies, determine management measures to reduce	Determine the short- and long-term effects of chronic and acute forms of disturbance.	The *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations* provide a series of management measures to reduce disturbance to Belugas, including the implementation of reduced speeds and certain navigation rules when the	Reduce anthropogenic disturbances	Disturbance	DFO, PC and Transport Canada (TC)

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
anthropogenic disturbance.		animals are present (these regulations were reviewed to ensure that they remain an effective conservation tool, with the amendments in effect since January 2017). In 2018, PC introduced a new measure to protect Belugas in Sainte-Marguerite Bay, banning boat in the area between Cap Nord-Ouest and Cap Sainte-Marguerite from June 21 to September 21. In 2019, PC established a new conservation area in the upper estuary where marine mammal observation activities are prohibited. This conservation area makes up 44% of the Marine Park and includes several areas with high concentrations of Belugas, particularly females and calves. In the case of development projects in the marine environment, measures such as restriction periods, noise reduction technologies, and suspension of activities when Belugas are present are used to limit disturbance.			
Identify main noise sources of various frequencies, monitor Beluga exposure, and	Study the impacts of noise pollution on Belugas.	Noise levels from 255 commercial ships transiting through the St. Lawrence Estuary were characterized (Simard et al. 2016).	Reduce anthropogenic disturbances	Disturbance	Academia (UQAR, UQO), DFO, Government of Quebec, GREMM, OceanWise, PC and TC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
study the impacts of noise on the Beluga's health and behavior.		In 2018 and 2019, DFO conducted a program in collaboration with PC to measure noise levels from 30 vessels operating daily in Beluga habitat in the Marine Park, including whale watching, research, search and rescue, and patrol vessels and ferries and pilot boats. The density of vessel traffic (daily, monthly and yearly) was mapped in the St. Lawrence Estuary and other areas in eastern Canada. Overall traffic density was calculated, and it was also calculated selectively for 7 vessel types, 5 length classes and 5 sailing speed classes (Simard et al. 2014). Belugas' exposure to noise varies depending on the location and is greater near the shipping lane and at the mouth of the Saguenay River, and lower in south-shore habitats (Simard et al. 2010; McQuinn et al. 2011; Gervaise et al. 2012; Roy and Simard 2015). A considerable proportion (15% to 53%) of the St. Lawrence Estuary Beluga (72% to 81% of which are females with calves or juveniles) is exposed many times daily to harmful noise levels from commercial shipping traffic, resulting in behavioural modifications and adverse effects on individual and			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		population-level survival. The use of the south channel by commercial ships, a solution envisioned to bypass the shipping lane and thus reduce noise in this area which is heavily used by Belugas, would expose greater numbers of Belugas and a larger portion of their habitat to noise, and contribute to the acoustic degradation of the habitat which, at present, is lightly exposed to vessel noise (Lesage et al. 2014a). Former ferry operations at the mouth of the Saguenay Fjord (that is, before 2019) affected St. Lawrence Estuary Beluga echolocation and call frequency. Half of the time, the Beluga's acoustic space was reduced to 30% of its expected value under natural noise conditions (Gervaise et al. 2012). Since 2019, new ferry boats have been in operation and should be less noisy, although data on this aspect are not yet available. A study conducted in 2017 and 2018 in Sainte-Marguerite Bay looked at whether ship noise can mask the vocalizations of females and calves and reduce their ability to maintain contact with each other. The study also aimed to characterize the Beluga's vocalization patterns in the presence and absence of boats (Vergara et al. 2021)[2].			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Anthropogenic noise reduces the window of time, and the area available, to Belugas for foraging (Gervaise et al. 2012). Management measures that lead to a reduction in noise levels could help to slow the decline of the species by increasing the animal's foraging efficiency (Williams et al. 2017). The recent study by Giard et al. (2020)[2] demonstrates that passive acoustic monitoring methods can be used to monitor movements of loquacious marine species, such as the Beluga, in a sound environment dominated by shipping noise, and thus lead to a better understanding of their habitat use over multi-year periods.			
Based on noise impact studies, determine management measures to reduce noise pollution.	Study the impacts of noise pollution on Belugas.	On the basis of the results obtained by Lesage et al. (2014a), it was recommended that commercial ships preferably transit along the north shore of the St. Lawrence Estuary to minimize the exposure of Belugas and their habitat to disturbances and noise. This measure was implemented in 2014 by the G2T3M and the proportion of vessels transiting along the south shore has remained low (roughly 5% a year) but stable since 2014. Simulations involving a reduction in speed for commercial vessels were conducted to determine if this	Reduce anthropogenic disturbances	Disturbance	Academia, DFO, Government of Quebec, marine industry, Non-Governmental Organization (NGO), PC and Transport Canada (TC)

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		measure would be effective in reducing the Beluga's instantaneous and cumulative noise exposure (Chion et al. 2017). The simulations revealed a 1.6% decrease in the total amount of noise experienced by Belugas in their critical habitat following the implementation of protection measures when the entire area of the critical habitat is taken into account. Although slowing vessels reduces instantaneous radiated noise, it also increases the total amount of acoustic energy released into the environment by extending the time ships spend in the speed reduction zone, resulting in a 2.4% increase in cumulative noise. In the upper estuary specifically, which is frequented mainly by females and calves, a 5.4% reduction in cumulative noise level was observed.			
Reduce anthropogenic noise in the St. Lawrence Estuary (construction, navigation, gas exploration, etc.).	Reduce anthropogenic disturbances in high-use areas.	The Government of Quebec has banned all oil and gas exploration and development activities, along with mining, in the northwestern Gulf of St. Lawrence (west of the western tip of Anticosti Island), and in the St. Lawrence Estuary, including the Magdalen Islands (Quebec 2011, reaffirmed in 2014). In 2017, the minister of l'Énergie et des Ressources naturelles (MERN; Quebec Department of Energy and Natural Resources) issued a ministerial order that protects all of Anticosti Island from oil and gas	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Quebec, PC and TC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		exploration and development (*Gazette officielle du Québec*, Partie 2, July 28, 2017). In 2018, the Quebec government amended the *Petroleum Resources Act*. In addition to prohibiting shale gas development, the Act identifies 13 navigable watercourses where all drilling activities are prohibited, including the entire length of the St. Lawrence and Saguenay rivers (*Gazette officielle du Québec*, Partie 2, June 20, 2018). When a development project affects the critical habitat of the Beluga, DFO, through the regulatory review process, evaluates whether the project is likely to destroy this habitat. DFO also evaluates whether the noise levels generated during the various project phases are likely to injure, harm or cause the death of an individual. Noise avoidance (for example, relocation, establishment of restricted areas or periods) or mitigation measures (for example, suspension of operations when Belugas are present, bubble curtains), and monitoring and follow-up programs during the work are required in order to meet SARA requirements. Use of the Baie-Sainte-Catherine dock, which is managed by the PC,			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		has been decreased by reducing boating traffic between the 2 shores of the Saguenay Fjord at the mouth of the fjord. Voluntary speed reduction measures for commercial ships have been implemented in a section of the shipping lane near the mouth of the Saguenay Fjord. Although the purpose of these measures is to mitigate the risk of collision with baleen whales, they have helped to reduce the noise footprint of vessels in Beluga habitat to some extent. In 2017, with the review of the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations,* PC imposed a speed limit of 15 kt for vessels at the mouth of the Saguenay River between May 1 and October 31. The purpose of this current regulation is not only to reduce the risk of collisions between vessels and belugas, but also to reduce ship noise. It was implemented based on the findings of Gervaise et al. (2012) indicating that a reduction of speed from 25 to 15 kt could lower the average ship-generated noise level by 4.6 dB at the river mouth. In addition, in 2018, PC established a voluntary speed reduction zone in the area off Sainte-Marguerite Bay.			
Implement protection measures in	Reduce anthropogenic	The Working Group on Marine Traffic and Protection of Marine Mammals (G2T3M) proposed a voluntary	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Quebec (Ministère des

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
problematic marine traffic lanes.	disturbances in high-use areas.	measure to encourage ships to avoid the south channel and the Rivière-du-Loup/Cacouna area when transiting through the St. Lawrence Estuary, in order to minimize noise levels in important habitats for females and calves. This measure has increased St. Lawrence pilots' awareness and understanding of noise issues in relation to the Beluga and helped to maintain the usual level of traffic in this area (around 5% annually, Chion et al. 2018). The *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations* limit the number of whale watching permits issued in the Marine Park. Although the whale watching industry is not allowed to target Belugas in its activities, this measure helps to reduce vessel traffic in the species' critical habitat.			Forêts, de la Faune et des Parcs du Québec [MFFP; Quebec Department of Forests, Wildlife and Parks] and the Maritime Strategy Secretariat), PC, shipping industry and TC
Reduce the number of incidents (for example, direct approaches, harassment).	Reduce anthropogenic disturbances in high-use areas.	Pursuant to the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations,* amended in January 2017, personal watercraft, air cushion vehicles, and towed water sports are prohibited within the boundaries of the Marine Park; actively approaching within 400 m of a Beluga, flying at an altitude less than 2,000 ft and exceeding 25 kt within park boundaries are also prohibited. In 2018, PC implemented a new Beluga protection measure in Sainte-Marguerite Bay: between June	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Quebec, NGO and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		21 and September 21, all vessels, including research vessels, are prohibited in the area between Cap Nord-Ouest and Cap Sainte-Marguerite. The members of the Eco-Whale Alliance have established a code of practice for an environmentally friendly observation of marine mammals.			
Develop best practice guidelines for chance meetings with Belugas.	Reduce anthropogenic disturbances in high-use areas.	The *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations* stipulate how users must behave in unexpected encounters with Belugas (January 2017). Since 2015, guidelines developed for recreational boaters have been publicized through awareness campaigns at marinas and in communities along the south shore of the St. Lawrence Estuary. In addition, 8 video clips with 2D animation have been produced and distributed to make recreational boaters (using motorboats, sailboats or kayaks) aware of how they must behave in the presence of Belugas or Blue Whales, in order to comply with the provisions of the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*.	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Québec, MMON and PC
Review, adopt, and enforce the *Marine Mammals*	Protect Belugas against anthropogenic	In 2018, the Government of Canada amended the *Marine Mammal Regulations*. The new regulations	Reduce anthropogenic disturbances	Disturbance	DFO, PC and TC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Regulations as well as the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations* to better protect Belugas from disturbance, particularly by enforcing a 400 m “no-boat” zone around Belugas throughout the area.	disturbance throughout their entire distribution area.	include provisions for the St. Lawrence Estuary requiring that a minimum approach distance of 400 m be maintained from whales, dolphins and porpoises that are assessed as threatened or endangered under SARA. The amendments to the *Marine Mammal Regulations* also define disturbance and require mandatory reporting of any accidental contact between a marine mammal and a vessel or fishing gear. The *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations* were updated in January 2017, with the amendments specifying how users should behave when they encounter a Beluga, implementing a lower speed limit for pleasure craft and tour boats in the mouth of the Saguenay and prohibiting certain activities (personal watercraft, air cushion vehicles, and towed water sports) within the park boundaries. The new regulations also include the definition of the disturbance of marine mammals and establish a certification system for tour boat operators and kayak guides. PC is responsible for the application and enforcement of the new regulations.			
Improve marine observation activities monitoring	Protect Belugas against anthropogenic	In addition to the enforcement patrols that take place in the Marine Park, awareness campaigns have been carried out since 2010 with the	Reduce anthropogenic disturbances	Disturbance	DFO, MMON, PC and Société des établissements de

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
patrols during the tourist season in the Marine Park and elsewhere in the Estuary.	disturbance throughout their entire distribution area.	participation of MMON. In addition, joint patrols with DFO fishery officers and PC wardens have been conducted since 2016. These patrols take place over several days in July and August, the high season for tourists.			plein air au Québec (SEPAQ)
Identify target groups for awareness campaigns, and develop and implement a communications strategy.	Implement the education strategy for species at risk developed by the Saguenay-St. Lawrence Marine Park and extend it to cover the entire Beluga distribution range.	Since 2015, user profiles (sailboat and motorboat users, recreational fishers, personal watercraft users, and kayakers) developed by Marine Park authorities have been used to tailor communication strategies and tools to specific clienteles. In addition, a campaign to build awareness among pleasure boaters on the issues surrounding the disturbance of Belugas has been conducted jointly by DFO and PC. The campaign includes the distribution of awareness and communication tools to pleasure boaters frequenting the St. Lawrence Estuary during the tourist season (awareness materials are distributed at marinas and during boating events, joint patrols, etc.). A survey of pleasure boaters, conducted by MMON and published in 2019, provides an up-to-date portrait for academic institutions and PC of boaters' use of the area and their knowledge of, and interest in, species at risk in the St. Lawrence and regulations pertaining to Canada's marine mammals, including those in the Marine Park. This	Reduce anthropogenic disturbances	Disturbance	DFO, MMON, PC and SEPAQ

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		information will be helpful for developing targeted awareness tools and for guiding future conservation measures involving best whale watching practices for pleasure boaters in the St. Lawrence, notably in protected marine areas.			
Improve training for captains, kayaking guides, and nature guides in order to reduce disturbances, and make training mandatory.	Implement the education strategy for species at risk developed by the Saguenay-St. Lawrence Marine Park and extend it to cover the entire Beluga distribution range.	Since January 2017, the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations* have formally prescribed the implementation of a certification system for tour boat operators and sea kayak guides. Certification requires attendance at a mandatory training session on the Marine Park and the new regulations as well as the successful completion of an annual knowledge exam.	Reduce anthropogenic disturbances	Disturbance	DFO, NGO and PC
Publicize conservation actions and provide educational activities to local residents.	Implement the education strategy for species at risk developed by the Saguenay-St. Lawrence Marine Park and extend it to cover the entire Beluga distribution range.	Interpretation and observation centres, exhibitions and interpretation activities have been established for Saguenay-St. Lawrence Marine Park visitors. The presence of specially trained interpretive guides has been added at sites in the marine park where Belugas can be observed. A partnership has been developed between PC and École en réseau to offer online educational activities on the Beluga and other whales in the St. Lawrence for Quebec elementary schools.	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Quebec, GREMM, MMON and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Since the summer of 2015, a joint PC and DFO awareness campaign on disturbance of Belugas is conducted among recreational boaters and kayakers in the Saguenay and St. Lawrence Estuary. Conservation messages related to species at risk have been also broadcasted on Marine Park communications platforms (Web, social media, outreach events, scientific symposia, etc.). In 2019, an online training was specially designed for boaters and kayakers in the Saguenay and St. Lawrence to inform them of the regulations to be followed to protect whales. The design of the platform is carried out in partnership by MMON, GREMM, PC and DFO. The *Whales Online* magazine is produced and published during the summer by the GREMM, a non-profit organization dedicated to scientific research on marine mammals and public education on issues related to marine ecosystems and their conservation. Since 2018, MMON has provided short educational videos about the Beluga at the Rivière-du-Loup wharf and on the Rivière-du-Loup-Saint-Siméon ferry during high season.			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Set up a recognition program for sea excursion companies that adopt best practices.	Implement the education strategy for species at risk developed by the Saguenay-St. Lawrence Marine Park and extend it to cover the entire Beluga distribution range.	The Eco-Whale Alliance, a voluntary initiative that aims to set the highest standards in environmentally responsible practices for whale watching tours, was created in 2010. It continues to carry out a range of activities to help tour companies limit their impacts and ensure the sustainable development of whale watching activities in the Saguenay-St. Lawrence Marine Park.	Reduce anthropogenic disturbances	Disturbance	DFO, Government of Quebec, NGO and PC
Define specific best practice guidelines for each type of user navigating the St. Lawrence Estuary.	Implement the education strategy for species at risk developed by the Saguenay–St. Lawrence Marine Park and extend it to cover the entire Beluga distribution range.	Guidelines on best practices for tour boats and pleasure craft users operating within the Saguenay-St. Lawrence Marine Park boundaries are implemented under the *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations.* Since 2015, guidelines for pleasure boaters have been disseminated in awareness campaigns at marinas and in communities along the south shore of the St. Lawrence Estuary.	Reduce anthropogenic disturbances	Disturbance	DFO, MMON and PC
Establish the rules and a decision-making committee, and set-up a single-window system, in collaboration with all the responsible authorities, to evaluate the	Improve the decision-making process for granting research permits and permits for other activities requiring approaches within 400 m.	The Saguenay–St. Lawrence Marine Park ensures that activities within its boundaries have been reviewed by DFO. Permit issuance by DFO is coordinated by its Resource Management; Fish and Fish Habitat Protection Program (FFHPP); and Species at Risk programs, in consultation with DFO Science when needed. However, there is currently no formal system to assess the	Reduce anthropogenic disturbances	Disturbance	DFO and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
relevance, methods, and issuance of permits for projects involving Belugas or their critical habitat.		potential cumulative effects of these activities on the Beluga.			
Strengthen measures to protect important sites for key prey species.	Protect spawning and rearing sites and migration corridors of key prey species.	A systematic assessment is carried out to analyze the potential impacts of, and associated mitigation strategies for, proposed marine development projects in the critical habitat or any project that is likely to harm the main prey species of Beluga or that could lead to the destruction of the critical habitat. There are currently 7 sectors of the Estuary and the Saguenay Fjord located outside the current boundaries of the Saguenay–St. Lawrence Marine Park that are being studied with a view to establishing a marine protected area in the St. Lawrence Estuary. Four of these sectors will help to protect the prey fish of the Beluga; in particular, they contain important spawning grounds for Capelin and Rainbow Smelt. This is a joint project by the governments of Quebec and Canada under the Canada-Quebec Collaborative Agreement to Establish a Network of Marine Protected Areas in Quebec.	Ensure adequate and accessible food supply	Food supply	DFO and Government of Quebec

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		The modernized *Fisheries Act*, enacted in the summer of 2019, provides comprehensive protection for all fish species and restores the prohibition against the harmful alteration, disruption or destruction of fish habitat. These prohibitions cover the prey of the St. Lawrence Estuary Beluga.			
Prohibit trawl nets from the Upper St. Lawrence Estuary and the Saguenay River.	Protect spawning and rearing sites and migration corridors of key prey species.	Commercial fishing is prohibited in the Saguenay River within the Saguenay–St. Lawrence Marine Park boundaries. Bottom trawling is prohibited in the Saguenay River pursuant to the *Atlantic Fishery Regulations*, schedule XXXI, item 7. In the upper estuary, an informal agreement has been reached between DFO and shrimpers instituting a voluntary halt to trawl fishing.	Ensure adequate and accessible food supply	Food supply	DFO, Government of Quebec and PC
Maintain the moratorium on forage species.	Protect spawning and rearing sites and migration corridors of key prey species.	In the Gulf of St. Lawrence, the absence of fishing for some forage species has helped to mitigate the threat of inadequate food supplies for the Beluga to some extent, (for example, Sand Lance) or that the Beluga's prey depend on (for example, Krill and Copepods). In addition, the *Policy on New Fisheries for Forage Species* requires that the Beluga's dietary needs must be taken	Ensure adequate and accessible food supply	Food supply	DFO

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		into account when evaluating new fisheries.			
Study diet habits and feeding strategies.	Continue research on the diet and feeding habits of Belugas.	There have been 3 studies using different approaches to examine the Beluga diet were conducted (Lesage 2014; Ferchiou 2019; Lesage et al. 2020)[2] during the period covered by this progress report. There is a consensus among these studies on important prey species for the Beluga, and on dietary differences between the sexes, which is consistent with the spatial segregation observed. Consequently, Capelin, Atlantic Cod, Redfish, and Sand Lance as well as squid and marine worms are likely among the Beluga's key prey species. In addition, a study using isotope ratios for certain chemical elements found that a change occurred in the early 2000s either in the Beluga's diet or in the ecosystem structure (Lesage 2014).	Ensure adequate and accessible food supply	Food supply	DFO and UQAR
Study prey availability and factors that influence their quantity and quality.	Continue research on the diet and feeding habits of Belugas.	Studies on climate factors, the abundance and quality of Beluga prey, and their relationship with Beluga calf mortality were undertaken (Plourde et al. 2014; Williams et al. 2017). Plourde et al. (2014) demonstrated that a decline in the percentage of young individuals in the population and higher calf mortalities were observed during a period characterized by very low biomass of large Groundfish species and Spring	Ensure adequate and accessible food supply	Food supply	Academia and DFO

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Herring, as well as below-normal ice cover. In addition, very high calf mortality was observed during a period of very low ice cover. William et al. (2017) have developed a predictive demographic model for the St. Lawrence Estuary Beluga, which indicates that the population can increase only if the impacts of 3 main threats (prey availability, noise and PCBs) can be mitigated. According to a study on Capelin spawning and larval abundance, a unit of the Gulf of St. Lawrence Capelin population uses the St. Lawrence Estuary and is composed of individuals that remain in this area after hatching (Ouellet et al. 2013).			
Based on studies of prey availability, determine management measures to protect the Beluga's food resources.	Continue research on the diet and feeding habits of Belugas.	Given the apparent importance to the Beluga of Groundfish and Spring Herring stocks in the southern Gulf of St. Lawrence (NAFO Division 4T) and their potential role in the current decline of the Beluga, it was recommended that these forage species be protected in the St. Lawrence Estuary and Gulf of St. Lawrence (DFO 2014b). Consequently, since 2017, DFO has funded, in the form of a contribution agreement under the Coastal Restoration Fund, several projects totalling over $4 million to protect and restore habitats of forage fish in the St. Lawrence Estuary, including	Ensure adequate and accessible food supply	Food supply	DFO and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Capelin, Rainbow Smelt, Herring and Sand Lance, all important prey species of the Beluga. The total allowable catch for Capelin in the Gulf of St. Lawrence (4RST) area was lowered by 30% in 2018 and 2019. The Herring fishery has been managed under the 2016 to 2017 conservation and harvesting plan. A rebuilding plan for the spring spawning Herring components, which, under the precautionary approach, is in the critical zone, is under development. The purpose of the plan is to identify management measures to assist in the rebuilding of the stock. The southern Gulf of St. Lawrence Cod stock, which provides prey for the Beluga in the St. Lawrence Estuary, was the target of a directed fishery ; this fishery has been under a moratorium since 2009 to allow the population of Atlantic Cod to recover. However a 300-ton bycatch is authorized (DFO 2016a). The Sustainable Fisheries Framework was established to ensure that Canadian fisheries are managed so as to support conservation and the sustainable use of resources.			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		In addition, the passage of Bill C-68 by the government in 2018 amended the *Fisheries Act* by introducing new provisions and requirements related to fish stocks, in order to: (1) maintain major fish stocks at levels necessary to promote sustainability; (2) develop and implement rebuilding plans for stocks that have declined to the critical zone (work on the Spring Herring rebuilding plan began in 2018); and (3) prescribe the list of major stocks to which these provisions apply. The amendments also include new authorities to develop regulations related to rebuilding. A draft regulation specifies the major stocks that will be subject to the new provisions and for which DFO must draft a rebuilding plan. The Gulf of St. Lawrence Herring stock (4T) is one of these major stocks.			
Consider the Beluga's food requirements when assessing new fisheries.	Prevent new fisheries with the potential to significantly impact Belugas and their prey.	Under the *Policy on New Fisheries for Forage Species,* the assessment of new fisheries must take account of the ecological relationships (for example, predator-prey and competition) among species affected directly or indirectly by the fishery within the bounds of the natural fluctuations in these relationships.	Ensure adequate and accessible food supply	Food supply	DFO
Include protective measures in	Develop and implement adequate protective	DFO conducts a detailed examination of potential project impacts on Beluga critical habitat (including the physical and acoustic environment and prey)	Mitigate the effects of other threats to population recovery	Other habitat degradations	DFO and MMON

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
inshore and offshore projects.	measures for all inshore and offshore projects that could have an impact within the Beluga distribution area.	in order to limit all other habitat degradation that could result from inshore and offshore development (for example, dredging, construction, seismic surveys and hydroelectric dams). When necessary, DFO requires that available mitigation measures be implemented, provided they are effective (for example, DFO 2007, 2011a, 2011b, 2014a, 2016b). MMON has developed a training program for marine mammal observers to improve the identification of marine mammals and turtles frequenting marine work zones (for example, dredging areas), thus supporting the application of SARA and the *Fisheries Act*.			
Conduct an environmental impact assessment for all oil and gas exploration and development projects in the Gulf of St. Lawrence.	Develop and implement adequate protective measures for all inshore and offshore projects that could have an impact within the Beluga distribution area.	Under DFO's FFHPP, regulatory reviews are carried out of inshore and offshore development projects such as dredging, bridge construction, wharf repairs and natural resource transport. This process allows the impacts of these projects on the Beluga, as well as any element of their critical habitat or residences, to be assessed, in order to ensure that projects are carried out in accordance with sections 32, 33, 35 and 58 (1) of SARA. DFO Science and ECCC's Environmental Protection Branch are regularly invited to participate in assessing the impacts of marine development projects in the St.	Mitigate the effects of other threats to population recovery	Other habitat degradations	Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB), DFO, ECCC, Government of Quebec and National Energy Board

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		Lawrence Estuary and the Gulf of St. Lawrence. For instance, they have contributed to impact assessments of oil and gas projects in different areas (for example, Old Harry, Cabot Strait, Sidney Bight, western Newfoundland and Labrador, western Gulf) and several other smaller-scale projects (for example, DFO 2007, 2011a, 2011b, 2014a, 2016b). In the Gulf of St. Lawrence, oil and gas projects are subject to an environmental impact assessment process under both the Quebec Environment Quality Act and the federal Impact Assessment Act.			
Improve the reliability and accessibility of the carcass monitoring program database (since 1983) and improve data processing and integration methods.	Maintain and improve the carcass monitoring program, with a focus on determining causes of death.	The Beluga carcass monitoring program has been in place since 1982, and has been fully implemented since 1983. It is currently maintained through financial support from DFO, and collaboration from various institutions (for example, universities, aquariums and federal departments and agencies). Following the increase in calf mortality events in 2012, calves now routinely undergo a full necropsy (Faculty of Veterinary Medicine at the Université de Montréal) regardless of the state of carcass preservation (unless they are mummified). DFO remains the curator of the central database, which was rebuilt and standardized in 2012.	Mitigate the effects of other threats to population recovery	All	DFO, GREMM, PC and Université de Montréal

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Regularly publish results.	Maintain and improve the carcass monitoring program, with a focus on determining causes of death.	A summary of the causes of mortality in Belugas necropsied between 1983 and 2012, and mortality patterns based on the results of the program, was published (COSEWIC 2014; Lesage et al. 2014b; Lair et al. 2016; Mosnier et al. 2015).	Mitigate the effects of other threats to population recovery	All	DFO and Université de Montréal
Based on studies of causes of death, determine management measures to reduce sources of mortality.	Maintain and improve the carcass monitoring program, with a focus on determining causes of death.	Taking into account the causes of Beluga mortality, recommendations were made in the context of the DFO status review for the species (DFO 2014b; Williams et al. 2017). In the short term, efforts can be directed to reducing anthropogenic stressors such as disturbance in sensitive areas and during critical periods for females and calves, chemical contamination, high nutrient inputs, habitat loss, and competition for food resources with the fisheries.	Mitigate the effects of other threats to population recovery	All	DFO, ECCC and PC
Develop tools to detect and prevent collisions and entanglements.	Reduce the impact of ship strikes and entanglement in fishing gear.	Since 2017, under the *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations,* vessel speed has been limited to 25 kt in the Marine Park, and seasonally (May 1 to October 31) to 20 kt (tour boats) and 15 kt (pleasure boats) in the Saguenay River mouth. Since 2017, personal watercraft, air cushion vehicles, and towed water sports have been prohibited within the boundaries of the Marine Park.	Mitigate the effects of other threats to population recovery	Collisions and entanglement	DFO and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		In 2018, the Government of Canada amended the *Marine Mammal Regulations*. The new regulations include provisions for the St. Lawrence Estuary requiring that a minimum approach distance of 400 m be maintained from whales, dolphins and porpoises that are assessed as threatened or endangered under SARA. The amendments to the *Marine Mammal Regulations* also define disturbance and require mandatory reporting of any accidental contact between a marine mammal and a vessel or fishing gear. Since 2018, commercial fish harvesters are required by the conditions of their licence to report lost fishing gear, which could pose an entanglement threat. The code of practice to be followed when Belugas are present has been incorporated in the *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations* and in the communications tools used by the Marine Park and DFO, mainly to reduce collision risks.			
Ensure the continued operation of the Quebec Marine Mammal	Reduce the impact of ship strikes and entanglement in fishing gear.	The Marine Mammal Emergency Response Network has been in place since 2004, and receives continued financial support from DFO and other partners, and logistical support from various institutions (for example,	Mitigate the effects of other threats to population recovery	Collisions and entanglement	DFO and QMMERN

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Emergency Response Network (QMMERN).		universities, aquariums, and federal departments and agencies). Financial support from DFO was renewed in 2019, allowing permanent teams to be established on the north and south shores of the Estuary. DFO is responsible for assisting marine mammals in distress, including the St. Lawrence Estuary Belugas. Under the umbrella of the National Marine Mammal Response Program (MMRP), DFO collaborates with non-governmental organizations across the country to respond to marine mammal incidents, including dead, entangled, or otherwise injured whales (for example, from vessel strike). In addition to providing expert care and assistance to distressed animals, these response networks provide valuable data that can be used to help quantify threats to species at risk, support SARA recovery planning, threat mitigation activities, and policy development, and collaborate with the appropriate authorities on enforcement cases. Annual reports are available for this program. In 2018, Canada's federal budget announcement set aside $167.4 million for Canada's Whales Initiative, including $1 million annually to support marine mammal response organizations across Canada. This			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		includes a contract with the GREMM, as well as funding for a standing offer with necropsy providers at the Université de Montréal. Now identified as part of the Whales Initiative funding, the Marine Mammal Response Program Capacity Building Fund (originally part of Coastal Restoration Fund) allocated $4.5 million over 4 years across Canada with the goal of increasing capacity to conduct safe and effective incident response, which includes funding towards GREMM which is responsible for coordinating the QMMERN.			
Ensure monitoring of incidents involving Belugas (ship strikes, wounds, incidental catches, harassment).	Reduce the impact of ship strikes and entanglement in fishing gear.	In accordance with the accidental contact provisions of the amended *Marine Mammal Regulations*, any operator of a watercraft or fishing gear, including tour boat operators in the Saguenay–St. Lawrence Marine Park, are required to report all collisions with marine mammals, including Beluga. Under the conditions for commercial fishing licences, fishers must report all interactions with marine mammals. Specifically, interactions with species at risk must be reported in the SARA section of the logbook. In addition, in commercial fisheries that are monitored under the At-Sea Observer Program, at-sea observers must	Mitigate the effects of other threats to population recovery	Collisions and entanglement	DFO, PC and QMMERN

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		report interactions with marine mammals. DFO carries out aerial and at-sea surveillance, which increases the likelihood of detection of such incidents. The Beluga carcass monitoring program also allows detection of some of these interactions An awareness campaign that has been conducted annually since 2015 in communities on the south shore of the St. Lawrence Estuary has increased the likelihood of detection of incidents. The DFO Marine Mammal Response Program, in collaboration with response networks, provides expert care and assistance to distressed animals including the St. Lawrence Estuary Beluga, and provides valuable data that can be used to help quantify threats to species at risk.			
Prepare or update emergency plans for the St. Lawrence Estuary.	Prepare emergency plans for Belugas in case of spills, harmful algal blooms, and epizootic diseases.	An emergency response plan in the event of an accidental spill of toxic chemicals in the St. Lawrence Estuary is in place, specifying how the Canadian Coast Guard Environmental Response (CCG-ER) team will proceed in case of a spill. In addition, under the Planning for Integrated Environmental Response	Mitigate the effects of other threats to population recovery	Algal blooms, spills and disease	CCG Environmental Response Program, DFO, ECCC and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		(PIER) initiative, DFO Science is currently developing a protocol for environmental incidents (for example, oil spills) that is adapted specifically to marine mammals. Under the federal Environmental Emergencies Program, ECCC has established a robust notification system for environmental emergencies based at the National Environmental Emergencies Centre (NEEC), which provides all the relevant information needed for spills of harmful substances in the St. Lawrence River for the federal stakeholders concerned. The NEEC serves as a hub for coordinating the federal government's scientific expertise and ECCC's technical and scientific services to support the response to an environmental emergency and maintains an up-to-date geospatial database on resources at risk in Canada, including the habitat of the St. Lawrence Estuary Beluga. The NEEC's specialized cartographic applications are used to enhance geospatial data, facilitating the definition of objectives and decision-making during environmental emergency operations.			
Carry out an awareness and education campaign on the	Inform and raise awareness of navigators (all boat types) on	No activity identified for this measure.	Mitigate the effects of other threats to population recovery	Toxic spills	N/A

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
regulations on pollutant discharges.	the regulations and the impacts of pollutants discharges.				
Monitor the number of incidents.	Inform and raise awareness of navigators (all boat types) on the regulations and the impacts of pollutants discharges.	Under the *Canada Shipping Act*, the CCG-ER program is mandated to manage pollution incidents from ships, hydrocarbon handling facilities or unknown marine sources. This mandate covers the release of any type of pollutant. Between 2012 and 2019, 104 cases were identified in the St. Lawrence sector.	Mitigate the effects of other threats to population recovery	Toxic spills	CCG-ER
Develop tools to detect and prevent spills, algal blooms, and epizootic diseases.	Detect and prevent spills, harmful algal blooms, and epizootic diseases.	The program to monitor toxic algal blooms was reduced in 2009, but was maintained at the Tadoussac dock and other stations in the St. Lawrence. Sample analysis is now done on an as-needed basis, based on budgets, and thus may not allow the detection of harmful blooms in a timely manner. The protozoan parasite *Toxoplasma gondii* has been detected in many species of marine mammals, including the St. Lawrence Estuary Beluga. The study by Iqbal et al. (2018) indicates that a large percentage of stranded Belugas in the St. Lawrence test positive for *T. gondii*, although very few Beluga deaths have been attributed to toxoplasmosis based on the published necropsy reports. The parasite can cause a number of	Mitigate the effects of other threats to population recovery	Algal blooms, spills and disease	DFO, ECCC and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		different health problems, including neurological deficits, and additional research is needed to determine the impact of parasites on the recovery of the population.			
Carry out awareness campaigns targeting captains of tourist vessels and pleasure craft.	Reduce ship strikes, in particular with tourist vessels and pleasure craft.	Since January 2017, the *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations* have formally prescribed the implementation of a certification system for tour boat operators and sea kayak guides. Certification requires attendance at a mandatory training session about the Marine Park and the new regulations, and requires the successful completion of an annual knowledge exam. Since 2015, a summer awareness campaign aimed at reducing disturbance to Belugas has been carried out with pleasure boaters on the south shore of the St. Lawrence Estuary. It involves explaining how boaters should behave in the presence of Belugas. Outreach and training for pleasure boaters and tour operators on how to comply with the new regulations enacted in 2018 continues with the development of an online training tool.	Mitigate the effects of other threats to population recovery	Collisions	DFO, MMON and PC
If new threats are identified, initiate additional research and management	Examine other potential obstacles to recovery.	No new threats have been identified.	Mitigate the effects of other threats to population recovery	New threats	N/A

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
strategies to reduce the impact.					
Identify Beluga high-use areas according to season, including the characteristics that make them favourable to Belugas and the vital functions they support, and identify potential new habitats should the distribution area expand as well as threats to these habitats.	Increase our understanding of the seasonal distribution and potential habitats of Belugas.	Fine-scale habitat use (for example, relative to tides, time of day and season) in some important areas within the species' critical habitat (for example, Cacouna/Île Verte, mouth of the Saguenay Fjord, Sainte-Marguerite Bay) has been characterized (Conversano 2013; Conversano et al. 2017; Roy and Simard 2015; Ménard et al. 2018). In addition, land-based observation sites have been used to describe habitat use patterns, including Pointe-Noire (since 1998), Sainte-Marguerite Bay (since 2003) and Rivière-du-Loup and Cacouna (since 2014). Summer high-use areas have been identified using long-term data from both photographic aerial surveys and Beluga herd monitoring efforts (Mosnier et al. 2016; Lemieux-Lefebvre et al. 2012). Over 30 aerial surveys have been conducted in spring, fall and winter since 2013. However, due to these surveys' partial results, high-use habitats have not been identified at a fine scale. The results do indicate that Belugas are present year-round in the St. Lawrence Estuary and that the areas used vary seasonally (Harvey et al., in review). For example, a	Protect the Beluga habitat throughout the entire distribution range	All	Academia, DFO, NGO, and PC

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		downstream movement of Belugas has been observed in fall, with a substantial reduction in the use of the upper estuary at this time. In winter, the lower estuary is heavily used, although Belugas are found downstream of the areas currently considered to be the species' critical habitat, with an incursion of part of the population into the northwestern Gulf of St. Lawrence. In spring (April to May), Belugas begin to move back into their summer habitat, and the upper estuary is used to a moderate extent at this time. A passive acoustic technique was used between 2007 and 2017 to determine the presence and occurrence of Belugas from a site downstream from their summer habitat, located on the north shore in the lower estuary (Giard et al., 2020). The results of this study showed that Belugas are present year-round in this region and that they have a seasonal behaviour with significant interannual variations. In fact, there appears to be a stronger presence of Belugas in this region in early spring, midsummer and late fall. In addition, this study showed that it is possible to use passive acoustic monitoring methods to track the movements of loquacious marine species, such as the Beluga, in a			

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		noise environment dominated by shipping noise, and thus better understand their habitat use over a time scale of several years.			
Set up Marine Protected Areas (MPAs) in Beluga territory, such as the St. Lawrence Estuary Marine Protected Area Project and the Manicouagan Aquatic Reserve.	Protect Beluga habitat using various legal tools.	The proposed Manicouagan Aquatic Reserve was designated as such in 2013 by the MELCC under the Quebec *Natural Heritage Conservation Act*. The planned aquatic reserve is occasionally used by some species of marine mammals, including the Beluga and the Blue Whale. Planning of the proposed St. Lawrence Estuary MPA is currently under way. The conservation objectives and boundaries of the MPA proposed in 2018 have been reviewed. Information sessions were held in 2019 to present the St. Lawrence Estuary MPA project to the main stakeholders and Indigenous groups concerned. Potential conservation measures, which will govern each sector of activities (commercial shipping and pleasure boating, marine observation activities, fisheries, development projects, and scientific activities) that poses a threat to marine mammals at risk and fish species in a precarious situation and their prey species and habitats, will be examined.	Protect the Beluga habitat throughout the entire distribution range	Collisions, entanglement, and disturbance	DFO and Government of Quebec

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
Enact zoning regulations in the Saguenay–St. Lawrence Marine Park to protect high-use areas.	Protect Beluga habitat using various legal tools.	The new *Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations* (2017) contain provisions for creating temporary exclusion areas in some sectors and for limiting tour boats' access to sensitive areas. The permitting conditions for tour boats and notices to boaters limit access to certain key areas of the Beluga's habitat in the Marine Park having been identified as an integral preservation area in the 2010 marine park zoning proposal. In 2018, PC instituted a no-boating zone in Sainte-Marguerite Bay in the Saguenay Fjord. All navigation, regardless of the user and type of vessel, is prohibited there from June 21 to September 21. In addition, in the summer of 2019, an area covering 44% of the territory of the Marine Park closed to commercial marine mammal watching tours was established (from Pointe au Bouleau to Baie-Sainte-Catherine, as far as Gros Cap-à-l'Aigle, in the Charlevoix region, and the area around the Île aux Lièvres). These 2 areas are mainly visited during the summer by pods of Belugas consisting of females and young.	Protect the Beluga habitat throughout the entire distribution range	Collisions, entanglement, and disturbance	PC
Study the feasibility of extending the	Protect Beluga habitat using various legal	Through the mandate of the Canada-Quebec Bilateral Group on Marine Protected Areas, MELCC and DFO	Protect the Beluga habitat throughout	Collisions, entanglement, and disturbance	DFO, ECCC, Government of Quebec (Ministère

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
boundaries of the Saguenay–St. Lawrence Marine Park, in accordance with the management plan of the Marine Park (PC and MDDEP 2010), to include a more significant portion of the summering area for Beluga.	tools.	are working on the development of a MPA in the St. Lawrence Estuary. Currently, the preferred option is the establishment of a new, much larger, MPA rather than the expansion of the current Saguenay–St. Lawrence Marine Park.	the entire distribution range		de l'Agriculture, des Pêcheries et de l'Alimentation [MAPAQ; Quebec Department of Agriculture, Fisheries and Food], MERN, MFFP, MELCC) and PC
Continue to conduct population surveys, at least every 3 years.	Monitor the St. Lawrence Beluga population.	A study by Gosselin et al. (2014) involves a time series of visual aerial surveys conducted at regular intervals. A total of 36 surveys were flown as part of the study in 2001, 2003, 2005, 2007, 2008, 2009 and 2014. Additional surveys were conducted in 2018 and 2019, with the results to be available soon.	Ensure regular monitoring of the St. Lawrence Estuary Beluga population	Collisions, entanglement, and disturbance	DFO
Monitor juvenile recruitment rates and causes of juvenile mortality.	Monitor the St. Lawrence Beluga population.	Recruitment indices were calculated using photographic aerial surveys (1988 to 2009: Gosselin et al. 2014), and long-term photo-identification surveys (1989 to 2012: Michaud 2014). According to these surveys, the proportion of calves and juveniles in the population has declined over time. Necropsies have been conducted on Beluga carcasses to determine the	Ensure regular monitoring of the St. Lawrence Estuary Beluga population	Collisions, entanglement, and disturbance	DFO, GREMM, QMMERN and Université de Montréal

Activity	Broad strategy and approach	Descriptions and results	Recovery objectives	Threat or concern addressed	Participants[1]
		cause of mortality, but juveniles only represent a small proportion of this sample (Lair et al. 2016). Verminous pneumonia was the primary cause of death in 70% of juveniles other than calves.			
Continue the population monitoring program (distribution, size, structure, dynamics, social organization, and genetics).	Monitor the St. Lawrence beluga population.	Aerial surveys to monitor population size and distribution are conducted regularly (summarized in Gosselin et al. 2014, 2017; Mosnier et al. 2016). Population parameters and dynamics continue to be tracked through the carcass monitoring program and aerial surveys, and have been recently summarized (Lesage et al. 2014b; Mosnier et al. 2016; Gosselin et al. 2017). A sampling program has been in place for over 25 years in collaboration with GREMM to document the social organization and genetic structure of the population. The data obtained from this program are currently being analyzed in collaboration with the UQO. In addition, the L'Isle-aux-Coudres-Saint-Joseph-de-la-Rive ferry has become an observer member of MMON and has been collecting observational data on Belugas since the spring of 2019.	Ensure regular monitoring of the St. Lawrence Estuary Beluga population	Collisions, entanglement, and disturbance	DFO, GREMM, MMON and UQO

3.2 Activities supporting the identification of critical habitat

Table 2 provides information on the implementation of the studies undertaken to identify critical habitat in accordance with the schedule of studies provided in the recovery strategy. Each study has been assigned a status according to the following list:

1) completed: the study has been carried out and completed
2) in progress: the planned study is underway and has not concluded
3) not started: the study has been planned but has yet to start
4) cancelled: the planned 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	Timeline	Status	Description and results	Participants[3]
Better define the Beluga's summering grounds and their characteristics upstream of Kamouraska and La Malbaie, and downstream of Rimouski and Forestville.	2016	In progress	Work is under way and includes a passive acoustics project which involves characterizing the species' presence and absence in these areas. The research component of the new Sentier Béluga [Beluga Trail] project, funded by Fisheries and Oceans Canada's (DFO) Canada Nature Fund for Aquatic Species at Risk, aims to improve our knowledge of the frequentation of high-use areas in the species' critical habitat (drone coupling, hydrophones and photo-identification in 3 female communities) and our understanding of the effects of noise and anthropogenic disturbances on their vocalizations and behaviour.	Fisheries and Oceans Canada (DFO), Group for Research and Education on Marine Mammals (GREMM) and Marine Mammal Observation Network (MMON)
Identify the areas used by the Beluga outside the summer season.	2016	In progress	Studies are in progress, including a passive acoustics project that will make it possible to qualify the presence and absence of the species in these areas. In 2018 and 2019, 2 spring surveys, 5 summer surveys and 2 winter surveys were completed, but no fall surveys could be carried out due to bad weather. The results, evaluated in February 2018, indicate that Belugas are present year-round in the St. Lawrence Estuary, but that the areas used	DFO

[3] Participants are listed alphabetically. Not all activities have specific participants identified.

Study	Timeline	Status	Description and results	Participants[3]
			vary depending on the season. For example, a downstream movement of Belugas is observed in fall, along with a substantial reduction in the use of the upper estuary. In winter, the lower estuary is heavily used, but Belugas are found downstream of the areas currently considered to be the species' critical habitat, with an incursion of a portion of the population into the northwestern Gulf. In spring (April to May), Belugas begin to move back into their summer habitat, and the upper estuary is used to a moderate extent at this time.	
Define the attributes of the critical habitat.	2016	In progress	Analyses are under way to define precisely the attributes of the critical habitat.	DFO, PC and Université du Québec en Outaouais (UQO)

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 2012). Each indicator has been assigned 1 of 4 statuses:

1) not met: the performance indicator has not been met, and little to no progress has been made
2) partially met, underway: moderate to significant progress has been made toward meeting 1 or more elements of the performance indicator, 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 (that is, the indicator will be reported in the next 5-year progress report)

Table 3. Progress and details of the progress made toward meeting the performance indicators outlined in the recovery strategy for the St. Lawrence Estuary Beluga.

Performance indicator	Status	Details
Increase in population size	Not met	An age-structured Bayesian population model was used to describe population dynamics. The results suggest that the population has declined since the 2000s, to 889 individuals (95% CI 672-1167) in 2012 (Mosnier et al. 2015).
Increase in the number of mature individuals to 1,000 adult Belugas	Not met	Mosnier et al. (2015) estimated the Beluga population to 889 individuals in 2012 and therefore, the current data shows that the minimum figure of 1,000 adult Belugas has not been reached.
Increase in the yearly recruitment rate	Not met	Mosnier et al. (2015), who examined population trends until 2012, reported a yearly decline of 1% beginning in the early 2000s. The abnormally high annual mortality of calves since 2008, as well as the increase in perinatal mortality since roughly the same time, suggests that the status of the population has not improved substantially since the last assessment in 2012.
Increase in the distribution area	Not met	Based on the data available when this document was written, an increase in the distribution area of the Beluga cannot be confirmed.
Steady state calving percentage	Not met	The most recent data is from 2012 when the percentage of newborns was 6% and the percentage of juveniles was 33% (Mosnier et al. 2015). Photo-identification surveys conducted between 1989 and 2012 have shown that the proportion of juveniles increased until the mid-to late 2000s, at which point a downward trend began (Michaud 2014).
Decrease in the mortality rate of juveniles	Not met	The number of newborns found dead has increased since 2008 and has remained abnormally high since then (Gosselin et al. 2017).

3.3.2 Completion of action plan

The Action Plan to Reduce the Impact of Noise on the Beluga Whale (*Delphinapterus leucas*) and Other Marine Mammals at Risk in the St. Lawrence Estuary was published in March 2020. This action plan is based on the threat of anthropogenic disturbances, more specifically underwater noise. The document proposes a series of measures to improve our knowledge of noise sources in the St. Lawrence Estuary. These measures, which arose from multiple consultations and discussions with Indigenous groups and stakeholders from various sectors connected with the St. Lawrence Estuary, as well as with the Government of Quebec, are grouped into 4 main strategies:

- research and data acquisition
- threat management
- communication and outreach
- coordination and monitoring

Another section of the action plan focuses on the socio-economic costs and benefits of implementing the action plan, as well as progress indicators for measuring the effectiveness of the measures implemented.

A second action plan, which will address the other identified threats to the St. Lawrence Estuary Beluga, is currently being developed.

3.3.3 Critical habitat identification and protection

The 2012 recovery strategy includes the identification of critical habitat using the area of occupancy approach. It corresponds to the summer distribution of groups made up of adults and newborn calves and juveniles, that is the upper estuary, from the battures aux Loups Marins to the Saguenay River, and the southern portion of the lower estuary. Studies are underway to increase our knowledge of this habitat and to define the areas used by Belugas outside the summer season.

In 2017, the critical habitat of the Beluga was legally protected by a Ministerial Order under section 58 of SARA.

3.3.4 Recovery feasibility

The recovery of the St. Lawrence Estuary Beluga is feasible, based on the best available information. However, according to Williams et al. (2017), the recovery objective of reaching 7,070 individuals by 2100 (which corresponds to 70% of the historical population) is unattainable. A new recovery objective will be contemplated when the recovery strategy is updated. Nevertheless, the recovery of the St. Lawrence Estuary Beluga is still considered feasible based on having met the 4 criteria identified for the technical and biological feasibility of recovery (previously identified in the 2012 recovery strategy). These 4 criteria are:

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance
2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration
3. The main threats to the species or its habitat may be avoided or mitigated

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable time frame

4 Concluding statement

From 2012 to 2019 , progress in implementing the activities identified in the “Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), St. Lawrence Estuary Population” has been made in some areas, namely the tightening of regulations targeting the use, manufacture and import of contaminants and toxic products; industrial atmospheric emissions; environmental contaminants; and recreational and commercial navigation within the boundaries of the Saguenay–St. Lawrence Marine Park. Awareness and education efforts targeting users of the St. Lawrence Estuary have also been productive in terms of the observance of navigation rules and approach distances for marine mammals. However, the situation of the St. Lawrence Estuary Beluga remains critical, as demonstrated by its change in status under SARA from threatened to endangered in the spring of 2017.

Based on the information available and knowledge that has been acquired since the recovery strategy was published, there does not appear to be an improvement in the Beluga’s status. Indices do not suggest an increase in the size of the population, an increase in the population of mature individuals to 1,000 adult Belugas, or a growth rate in the population. Furthermore, the distribution area seems to be the same, the percentage of newborns in the population does not appear to have increased, and the rate of juvenile mortality does not appear to have declined. Implementation of the first action plan, the goal of which is to reduce the impact of underwater noise, should support this population’s recovery. A second action plan is currently in preparation, and will deal with other threats of priority to the St. Lawrence Estuary Beluga (prey availability, environmental contamination, and anthropogenic disturbance).

Additional next steps to further the Beluga’s recovery should be the establishment of a marine protected area in the St. Lawrence Estuary, as well as the continuation of other specific activities to its conservation, including awareness campaigns.

DFO remains committed to continuing efforts to recover the St. Lawrence Estuary Beluga. The progress made to date would not have been possible without the contributions of our partners. DFO is looking forward to continuing this successful collaboration and invites other potential partners interested in supporting the recovery of the St. Lawrence Estuary Beluga to join in this undertaking.

5 References

Barrett, H., X. Du, M. Houde, S. Lair, J. Verreault and H. Peng. 2021. Suspect and Nontarget Screening Revealed Class-Specific Temporal Trends (2000–2017) of Poly-and Perfluoroalkyl Substances in St. Lawrence Beluga Whales. Environmental Science & Technology, 55(3), 1659-1671.

Bernier-Graveline, A., V. Lesage, J. Cabrol, S. Lair, R. Michaud, M. Rosabal and J. Verreault. 2020. Lipid metabolites as predictors of energy reserves in highly contaminant-exposed belugas from the endangered St. Lawrence Estuary population. Environment Research 192:110272.

Chion, C., S. Turgeon, R. Michaud, J.-A. Landry and L. Parrott. 2009. Portrait de la navigation dans le parc marin du Saguenay–Saint-Laurent. Caractérisation des activités sans prélèvement de ressources entre le 1er mai et le 31octobre 2007. Présenté à Parcs Canada. 86 p.

Chion, C., D. Lagrois, J. Dupras, S. Turgeon, I.H. McQuinn, R. Michaud, N. Menard, and L. Parrott. 2017. Underwater acoustic impacts of shipping management measures: Results from a social-ecological model of boat and whale movements in the St. Lawrence River Estuary (Canada). Ecological Modelling 354: 72–87.

Chion, C., S. Turgeon, G. Cantin, R. Michaud, N. Ménard, V. Lesage, L. Parrott, P. Beaufils, Y. Clermont, and C. Gravel. 2018. A voluntary conservation agreement reduces the risks of lethal collisions between ships and whales in the St. Lawrence Estuary (Québec, Canada): From co-construction to monitoring compliance and assessing effectiveness. PloS one, 13(9).

Conversano, M. 2013. Utilisation d'un habitat particulier par le béluga (*Delphinapterus leucas*) du Saint-Laurent : Fréquentation interannuelle, saisonnière, circadienne et tidale de l'embouchure du Saguenay. Mémoire de maîtrise, Université du Québec à Rimouski, Rimouski (Québec), Canada. 191 p.

Conversano, M., S. Turgeon and N. Ménard, 2017. Caractérisation de l'utilisation de l'embouchure du Saguenay et de la baie Sainte-Marguerite par le béluga du Saint-Laurent et par le trafic maritime entre 2003 et 2016. Analyse des données d'observation terrestre et recommandations sur les mesures de gestion visant à réduire le dérangement dans les aires de haute résidence du béluga dans le parc marin du Saguenay–Saint-Laurent. Parcs Canada, Tadoussac, 122 p.

COSEWIC. 2004. COSEWIC assessment and update status report on the Beluga Whale *Delphinapterus leucas* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 70 p.

COSEWIC. 2014. COSEWIC assessment and status report on the Beluga Whale *Delphinapterus leucas*, St. Lawrence Estuary population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 64 p.

DFO. 2005. Recovery Potential Assessment of Cumberland Sound, Ungava Bay, Eastern Hudson Bay and St. Lawrence Beluga Populations (*Delphinapterus leucas*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/036.

DFO. 2007. Impacts of constructing a methane port at Gros-Cacouna on marine mammals. DFO Can. Sci. Advis. Sec. Sci. Resp. 2007/010.

DFO. 2011a. Adding a breakwater to the pilot wharf at Les Escoumins, Quebec: Potential impacts on marine mammals. DFO Can. Sci. Advis. Sec. Sci. Resp. 2011/007.

DFO. 2011b. Reconstruction of the Tadoussac and Baie-Ste-Catherine, Quebec, landing docks – Impacts on marine mammals. DFO Can. Sci. Advis. Sec. Sci. Resp. 2011/009.

DFO. 2012. Recovery strategy for the Beluga whale (*Delphinapterus leucas*) St. Lawrence Estuary population in Canada. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. x + 88 p.

DFO. 2014a. Impacts of Geophysical Surveys in the port of Cacouna on the St. Lawrence Beluga. DFO Can. Sci. Advis. Sec. Sci. Resp. 2014/020.

DFO. 2014b. Impacts of rerouting marine traffic in the St. Lawrence estuary on Beluga (*Delphinapterus leucas*): Science in support of risk management. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/004.

DFO. 2016a. Assessment of Atlantic Cod (*Gadus morhua*) in the southern Gulf of St. Lawrence (NAFO Div. 4T-4Vn (Nov. — April)) to 2014. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/061.

DFO. 2016b. Effects of dredging activities on St. Lawrence beluga and their habitat. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/033.

Environment Canada and Ministère du Développement durable, de l'Environnement et des Parcs du Québec. 2007. Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation. 39 p.

Ferchiou, S. 2019. Nouvelle approche chimique basée sur la bioaccumulation des retardateurs de flamme pour identifier et évaluer la diète récente du béluga du Saint-Laurent (*Delphinapterus leucas*). Mémoire de maîtrise, Université du Québec à Rimouski, Rimouski (Québec), Canada. 98 p.

Gervaise, C., Y. Simard, N. Roy, B. Kinda, and N. Menard. 2012. Shipping noise in whale habitat: characteristics, sources, budget, and impact on belugas in Saguenay–St. Lawrence Marine Park hub. Journal of the Acoustical Society of America 132: 76-89.

Giard, S., Y. Simard, and N. Roy. 2020. Decadal passive acoustics time series of St. Lawrence Estuary Beluga. The Journal of the Acoustical Society of America 147, 1874.

Gosselin, J.-F., M.O. Hammill, and A. Mosnier. 2014. Summer abundance indices of St. Lawrence Estuary Beluga (*Delphinapterus leucas*) from a photographic survey in 2009 and 28 line transect surveys from 2001 to 2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/021. iv + 51 p.

Gosselin, J.-F., M.O. Hammill, A. Mosnier, and V. Lesage. 2017. Abundance index of St. Lawrence Beluga, *Delphinapterus leucas*, from visual line transect surveys flown in August 2014 and an update on reported deaths. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/019. v + 28 p.

Government of Canada. 2017. Prohibition of Certain Toxic Substances Regulations. 2012. (SOR/2012-285).

Government of Canada. 2018. Consultation Document on Proposed Amendments to the *Prohibition of Certain Toxic Substances Regulations, 2012* for PFOS, PFOA, LC-PFCAs, HBCD, PBDEs, DP and DBDPE (December 2018). https://www.canada.ca/en/environment-climate-change/services/canadian-

environmental-protection-act-registry/proposed-amendments-certain-toxic-substances-2018-consultation.html [consulted in June 2021]

Iqbal A., L. Measures, S. Lair, and B. Dixon. 2018. *Toxoplasma gondii* infection in stranded St. Lawrence Estuary Beluga *Delphinapterus leucas* in Quebec, Canada. Dis Aquat Org 130: 165-175.

Krey, A., S.K. Ostertag, and H.M. Chan. 2015. Assessment of neurotoxic effects of mercury in beluga whales (*Delphinapterus leucas*), ringed seals (*Pusa hispida*), and polar bears (*Ursus maritimus*) from the Canadian Arctic. Science of the Total Environment 509-510: 237-247.

Lair, S., L.N. Measures, and D. Martineau. 2016. Pathologic findings and trends in mortality in the Beluga (*Delphinapterus leucas*) population of the St Lawrence Estuary, Quebec, Canada, from 1983 to 2012. Veterinary Pathology 53: 22-36.

Lebeuf, M., L. Measures, M. Noel, M. Raach, and S. Trottier. 2014. A twenty-one year temporal trend of persistent organic pollutants in St. Lawrence Estuary Beluga, Canada. Science of the Total Environment 485: 377-386.

Lemieux-Lefebvre, S., R. Michaud, V. Lesage, and D. Berteaux. 2012. Identifying high residency areas of the threatened St. Lawrence Beluga Whale from fine-scale movements of individuals and coarse-scale movements of herds. Marine Ecology Progress Series 450: 243-257.

Lesage, V. 2014. Trends in the trophic ecology of St. Lawrence beluga (*Delphinapterus leucas*) over the period 1988-2012, based on stable isotope analysis. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/126. iv + 25 p.

Lesage, V., I.H. McQuinn, D. Carrier, J.-F. Gosselin, and A. Mosnier. 2014a. Exposure of the beluga (*Delphinapterus leucas*) to marine traffic under various scenarios of transit route diversion in the St. Lawrence Estuary. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/125. iv + 28 p.

Lesage, V., A. Mosnier, L. Measures, S. Lair, and P. Béland. 2014b. Mortality patterns in St. Lawrence Estuary Beluga (*Delphinapterus leucas*), inferred from the carcass recovery data, 1983-2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/118. ii + 24 p.

Lesage, V. 2017. Examen de l'efficacité des mesures de rétablissement concernant le béluga de l'estuaire du Saint-Laurent. Rapport préparé pour Pêches et Océans Canada, Ottawa, 74 p.

Lesage, V., S. Lair, S. Turgeon, and P. Béland. 2020. Diet of St. Lawrence Estuary Beluga, Delphinapterus leucas, in a changing ecosystem. Canadian Field-Naturalist 134(1): 21-35.

Marine Mammal Observation Network (MMON). 2019. Sondage concernant les habitudes de plaisance et les connaissances des règlements concernant l'observation des mammifères marins dans l'estuaire et le golfe du Saint-Laurent. Rapport de résultats. vii + 26 p.

Martins, C.C.A. 2016. Les activités d'observation en mer dans le parc marin du Saguenay–Saint-Laurent et en périphérie : Portrait 2011-2015 ; Évolution de l'activité 1994-2015 ; Espèces en péril. Rapport final. Tryphon Océans, Tadoussac, Québec, présenté à Parcs Canada et au Groupe de Recherche et Éducation sur les Mammifères Marins (GREMM). 67 p. + iii annexes.

McQuinn, I., V. Lesage, D. Carrier, G. Larrivée, Y. Samson, S. Chartrand, R. Michaud, and J. Theriault. 2011. A threatened Beluga (*Delphinapterus leucas*) population in the traffic lane: vessel-generated noise characteristics of the Saguenay–St. Lawrence Marine Park, Canada. Journal of the Acoustical Society of America 130: 3661-3573.

Ménard, N., R. Michaud, C. Chion and S. Turgeon. 2014. Documentation of maritime traffic and navigational interactions with St. Lawrence Estuary Beluga (Delphinaterus leucas) in calving areas between 2003 and 2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/003. v + 24 p.

Ménard, N., M. Conversano et S. Turgeon. 2018. La protection des habitats de la population de bélugas (Delphinapterus leucas) du Saint-Laurent : bilan et considérations sur les besoins de conservation actuels. Le Naturaliste canadien 142(2): 80-105.

Michaud, R. 2014. St. Lawrence Estuary beluga (*Delphinapterus leucas*) population parameters based photo-identification surveys, 1989-2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/130: iv + 27 p.

Mosnier, A., T. Doniol-Valcroze, J.F.Gosselin, V. Lesage, L.N. Measures and M.O. Hammill 2015. Insights into processes of population decline using an integrated population model: The case of the St. Lawrence Estuary Beluga (*Delphinapterus leucas*). Ecological Modelling 314:15-31.

Mosnier, A., R. Larocque, M. Lebeuf, J.-F. Gosselin, S. Dubé, V., Lapointe, V. Lesage, D. Lefaivre, S. Senneville and C. Chion. 2016. Définition et caractérisation de l'habitat du béluga du Saint-Laurent selon une approche écosystémique. Secr. can. de consult. sci. du MPO, Doc. de rech. 2016/052. vi + 93 p.

Ostertag, S.K., A.C. Shaw, N. Basu and H.M. Chan. 2014. Molecular and neurochemical biomarkers in Arctic Beluga Whales (*Delphinapterus leucas*) were correlated to brain mercury and selenium concentrations. Environmental Science & Technology 48:11551-11559.

Ouellet, P., A.O.V. Bui, D. Lavoie, J. Chassé, N. Lambert, N. Ménard and P. Sirois. 2013. Seasonal distribution, abundance, and growth of larval capelin (*Mallotus villosus*) and the role of the Lower Estuary (Gulf of St. Lawrence, Canada) as a nursery area. Canadian Journal of Fisheries and Aquatic Sciences 70(10): 1429-1437.

PC and MDDEP. 2010. Saguenay–St.Lawrence Marine Park Management Plan. Parks Canada and Ministère du Développement Durable, de l'Environnement et des Parcs du Québec. 84 p.

Plourde, S., P. Galbraith, V. Lesage, F. Grégoire, H. Bourdage, J.-F. Gosselin, I. McQuinn and M. Scarratt. 2014. Ecosystem perspective on changes and anomalies in the Gulf of St. Lawrence: a context in support to the management of the St. Lawrence Beluga Whale population. DFO Can. Sci. Advis. Sec., Res. Doc. 2013/129. vi + 27 p.

Roy, N. and Y. Simard. 2015. Bruit ambiant et fréquentation de la région de Cacouna par le béluga du Saint-Laurent à l'été 2014 par monitorage acoustique continu. Rapp. tech. can. sci. halieut. aquat. 3141. vi + 22 p.

Simard, Y., R. Lepage and C. Gervaise. 2010. Anthropogenic sound exposure of marine mammals from seaways: Estimates for Lower St. Lawrence Seaway, eastern Canada. Applied Acoustics 71: 1093-1098.

Simard, Y., N. Roy, S. Giard and M. Yayla. 2014. Canadian year-round shipping atlas for 2013: Volume 1, East Coast marine waters. Can. Tech. Rep. Fish. Aquat. Sci. 3091(1). xviii + 327 p.

Simard, Y., N. Roy, C. Gervaise and S. Giard. 2016. Analysis and modeling of 255 ship source levels from an acoustic observatory along St. Lawrence Seaway. Journal of the Acoustical Society of America 140(3): 2002-2018.

Simond, A.E., M. Houde, V. Lesage and J. Verreault. 2017. Temporal trends of PBDEs and emerging flame retardants in Belugas from the St. Lawrence Estuary (Canada) and comparisons with Minke Whales and Canadian Arctic Belugas. Environmental Research 156: 494-504.

Simond A.E, M. Houde, V. Lesage, R. Michaud, D. Zbinden and J. Verreault. 2019. Associations between organohalogen exposure and thyroid- and steroid-related gene responses in St. Lawrence Estuary Belugas and Minke Whales. Mar Pollut Bull 145:174-184.

Simond A.E, M. Houde, V. Lesage, R. Michaud and J. Verreault. 2020. Metabolomic profiles of the endangered St. Lawrence Estuary Beluga population and associations with organohalogen contaminants. Sci Total Environ 717: 137204.

Turgeon, S., 2019. Portrait de la navigation dans le parc marin du Saguenay–Saint-Laurent - 2017. Parcs Canada, 59 p. + annexes.

Vergara, V., J. Wood, V. Lesage, A. Ames, M.A. Mikus, et R. Michaud. 2021. Can you hear me? Impacts of underwater noise on communication space of adult, sub-adult and calf contact calls of endangered St. Lawrence belugas (*Delphinapterus leucas*). Polar Research, 40.

Williams, R., R.C. Lacy, E. Ashe, A. Hall, C., Lehoux, V. Lesage, I. McQuinn and S. Plourde. 2017. Predicting responses of St. Lawrence beluga to environmental changes and anthropogenic threats to orient effective management actions. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/027. v + 43 p.