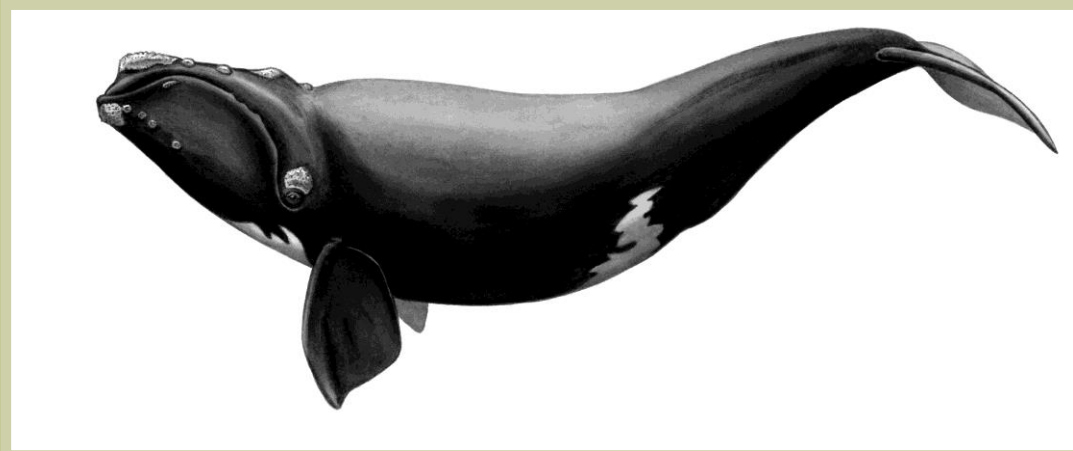


# Report on the Progress of Recovery Strategy Implementation for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canadian Waters for the Period 2009-2014

## North Atlantic Right Whale



2016

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For copies of the Recovery Strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, Action Plans, and other related recovery documents, please visit the SAR Public Registry at <http://www.registrelep-sararegistry.gc.ca/>.

**Cover illustration:** The cover illustration depicts a female North Atlantic Right Whale known as Arpeggio, catalogue number 2753. Born in 1997, Arpeggio is a poster child for what Right Whales do, what they are exposed to, and what tools researchers use to learn about their life history and the threats facing their recovery. She has ranged from the calving ground along the coast of eastern Florida to the Bay of Fundy and has been photographed in each year of her life in several different habitat areas. She was entangled briefly in 1999 at the age of 2½, and survived a hit by a small vessel at the age of eight. She has been exposed to almost every type of research: tagging to learn about dive profiles and response to sound playback, skin sampling to learn about her genetic profile, and ultrasound measurements to assess her health. Arpeggio gave birth to her first calf in the calving grounds off the southeast U.S. in 2007 at the age of 11. She had her second calf in 2013. She was most recently seen skim feeding with an aggregation of right whales in Cape Cod Bay during the spring of 2015. Illustration credit: Scott Landry, Provincetown Center for Coastal Studies.

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## Preface

Section 46 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA) requires the competent minister to report on the implementation of the Recovery Strategy for a species at risk, and on the progress toward meeting its objectives within five years of the date when the Recovery Strategy was placed on the Species at Risk Public Registry and in every subsequent five-year period, until its objectives have been achieved 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 organizations and all other parties involved in conducting activities that contribute toward 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 time frame of a Report on the Progress of Recovery Strategy Implementation (Progress Report).

The Minister of Fisheries and Oceans is the competent minister(s) under SARA for the North Atlantic Right Whale 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 North Atlantic Right Whale for the benefit of the species and Canadian society as a whole.

## Acknowledgments

This Progress Report was prepared by staff of the Species at Risk Management Division, DFO Maritimes Region. To the extent possible, this Progress Report has been prepared with input from other federal government departments, Provinces/Territories, Aboriginal organizations, and academic and NGO partners. The Department of Fisheries and Oceans would also like to express its appreciations to all individuals and organizations who have contributed to the recovery of the North Atlantic Right Whale.

## Executive Summary

The North Atlantic Right Whale (*Eubalaena glacialis*) was listed as endangered under the *Species at Risk Act* (SARA) in 2003. The *Recovery Strategy for the North Atlantic Right Whale (Eubalaena glacialis) in Canadian Waters* was finalized and published on the Species at Risk Public Registry in 2009, and it identified two critical habitat areas. In 2014, the Recovery Strategy was amended to provide a more detailed description of the features, functions and attributes of the critical habitat. The main threats identified for the North Atlantic Right Whale are vessel collisions and entanglement in fishing gear. Additional threats include acoustic disturbance, vessel-based disturbance, habitat degradation and contaminants. The recovery goal for the North Atlantic Right Whale is “to achieve an increasing trend in population abundance over three generations” (60 years). During the time period reported by this Progress Report, the North Atlantic Right Whale population increased from 438 to 522.

This progress report evaluates seven recovery objectives and 20 associated performance indicators, as well as the critical habitat schedule of studies that are described in the Recovery Strategy (DFO 2014a). Objectives to reduce threats to the population have been met to varying degrees, and work on them is ongoing. Eight of the 20 performance indicators have been met, and require ongoing work. Another nine of the performance indicators were partially met, and three were not met. Between 2009 and 2014, marine transport vessels have observed both mandatory and voluntary measures that were put in place to reduce the risk of vessel collisions with Right Whales. During that period, some fishing industry organizations have adopted voluntary measures to reduce the risk of interactions between fishing gear and Right Whales while others have continued measures that were in place before this reporting period.

DFO and recovery partners have undertaken many activities that supported objectives related to monitoring and studying the population and its threats. Such activities in turn have supported objectives and performance indicators related to collaboration and sharing of information. The threat presented to Right Whales by commercial fishing activities is better understood than it was before the reporting period, and that increased understanding contributes to ongoing work to reduce the threat.

Right Whales' pattern of habitat use has changed dramatically during the reporting period. They have largely been absent from their typical summer and fall feeding habitat, shifting to alternate known and unknown locations. This has presented challenges to researchers and to those developing recovery measures. Data on Right Whales' habitat use and an understanding of the environmental and climatic drivers of their distribution are needed to support recovery activities.

Because the body of knowledge about the Right Whale population, and about threats to it, has increased since the Recovery Strategy was prepared, reviewing and updating the performance indicators associated with the recovery objectives may be useful. Many of the performance indicators will become more meaningful if quantitative values can be established for them.

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# 1 Introduction

This Progress Report describes the progress made from 2009 to 2014 toward meeting the recovery objectives listed in the *Recovery Strategy for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canadian Waters* (hereafter “Recovery Strategy”). ([http://www.sararegistry.gc.ca/virtual\\_sara/files/plans/rs\\_bnan\\_narw\\_am\\_0414\\_e.pdf](http://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_bnan_narw_am_0414_e.pdf)). This report is one in a series of documents for this species that are linked and should be considered together, including a recovery potential assessment (DFO 2007), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report (COSEWIC 2013), a Recovery Strategy (DFO 2014a), and any future Action Plans.

Section 2 reproduces the COSEWIC assessment summary, recaps the threats to the population and its critical habitat, along with the recovery objectives, performance indicators, and the critical habitat schedule of studies from the Recovery Strategy. During the reporting period, many activities were undertaken to support the recovery objectives. These activities, along with an assessment of recovery progress according to the performance indicators, are presented in Section 3. Section 4 provides a concluding statement about the implementation of the Recovery Strategy during the reporting period, as well as suggestions to guide future recovery efforts.

## 2 Background

### 2.1 COSEWIC<sup>1</sup> assessment summary

**Date of Assessment:** November 2013

**Common Name (population):** North Atlantic Right Whale

**Scientific Name:** *Eubalaena glacialis*

**Status:** Endangered

**Reason for Designation:** This long-lived, slowly reproducing whale species was driven nearly to extinction by commercial whaling but has been protected from whaling since 1935. The whales found in Canada are part of a single global population of the species, which is endemic to the North Atlantic Ocean. Since 1990, the total population has been increasing at a rate of approximately 2.4% per year. The total population in 2010, including all age classes, was estimated at 468 individuals, of which between 122 and 136 were adult females. The estimated number of mature individuals, after accounting for a male-biased sex ratio among adults, and for a small number of females that are incapable of reproducing, is between 245 and 272. The rate of population growth is lower than would be predicted based on the biology of the species and is limited by ship strikes and entanglements in fishing gear. Although measures have been implemented in both Canada and the United States to lessen ship strikes, they continue to occur and ship traffic is expected to increase significantly within the range of the species in coming decades. Further, adult females appear to be more prone to being struck than males. Limited efforts have also been made to reduce the incidence and severity of entanglements, but these events remain a major cause of injury and mortality.

**Canadian Occurrence:** Atlantic Ocean

**COSEWIC Status History:** The Right Whale was designated Endangered in 1980, with its status re-examined and maintained Endangered in April 1985 and April 1990. In May 2003, the Right Whale was split into two species to allow for separate designations: North Atlantic Right Whale and North Pacific Right Whale. The North Atlantic Right Whale was designated Endangered in May 2003, with its status re-examined and maintained Endangered in November 2013.

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<sup>1</sup> COSEWIC – Committee on the Status of Endangered Wildlife in Canada

## 2.2 Threats

### 2.2.1 Threats to Right Whales

North Atlantic Right Whales (hereafter “Right Whales”) are subject to threats throughout their range in Canadian and U.S. waters. The threats below were identified in the Recovery Strategy (DFO 2014a) as presenting the greatest threat to Right Whales in Atlantic Canadian waters.

**Table 1. Summary of the current threats to the North Atlantic Right Whale (DFO 2014a).**

Threat	Description
<b>Vessel strikes</b>	<p>Right Whales are at risk of death or serious injury from collisions with vessels. As of 2007, 50% of known Right Whale mortalities were caused by vessel strikes, and at least 7% of the population had serious scars or injuries from vessel propellers. The total number of deaths resulting from vessel strikes is considered to be higher than the observed number because not all injured Right Whales are found and the poor condition of some carcasses prevents conclusive determination of the cause of death. In addition, the serious injuries that can be caused by interaction with vessels likely contribute to lower reproduction and shorter lifespan in injured animals, and thus the impacts to individuals also has a negative impact on the population. Commercial shipping activity is constant and intense throughout the Right Whale’s range in Atlantic Canadian and U.S. waters.</p>
<b>Entanglement in fishing gear</b>	<p>Entanglement in fishing gear is a primary source of injury and mortality that threatens Right Whale recovery. Fixed fishing gear used in Canadian and U.S. waters, such as gillnets, pots and traps is often implicated in Right Whale entanglement or entrapment. It is challenging to attribute entanglements to a particular geographic location or gear type. Vertical and horizontal lines used in fixed gear fisheries are identified as the most common causes of entanglements.</p> <p>The observed number of Right Whale mortalities caused by fishing gear entanglements and entrapments is considered a minimum estimate, because not all whale carcasses are observed. Some Right Whales have carried fishing gear for weeks or months, sustaining serious long-term injury leading to poor health, decreased reproduction, and shorter life span for the individual. This in turn is likely a limitation to the population’s recovery.</p>
<b>Disturbance and habitat reduction or degradation</b>	<p>The quality of Right Whales’ habitat may be subject to reduction or degradation caused by a variety of phenomena. Factors that could reduce habitat quality include exposure to contaminants from marine and land-based activities, exposure to excessive noise, disturbance from vessel presence, and changes in the food supply resulting from human activities.</p> <p>If the habitat becomes unsuitable, Right Whales are likely to leave. If they relocate because of disturbance, the cost to the whales is likely to be reduced fitness, reduced reproductive success, and/or increased mortality. Little is known about how cumulative or synergistic effects of disturbance may also affect Right Whales.</p> <p>While the effects of contaminants on large whales are not well understood, a species like the Right Whale which preys only on relatively small zooplankton that are low in the food web is likely less prone to accumulate</p>



Threat	Description
	<p>large body burdens of organic contaminants than most other baleen whales (which eat fish).</p> <p>Hearing is critical to Right Whales' ability to navigate, forage and communicate. Chronic and cumulative effects of acoustic disturbance are likely to have an impact on the Right Whale population's reproduction and recovery. Sources of acoustic disturbance include sonar, seismic activities and vessel noise. Chronic noise caused by vessels in Right Whale habitat may contribute to the whales' lack of avoidance response to large vessels. Vessel presence, aside from the noise produced, can disturb Right Whales' normal behaviours including important social interactions.</p> <p>Right Whales are specialist feeders that rely on an adequate supply of copepod prey to not only survive, but to be able to reproduce. Over the decades during which Right Whales have been studied, fluctuations in the apparent health of individuals and variations in annual birth rate are thought to be influenced by changes in food availability. It is possible that global climate change is affecting the distribution of copepods, which in turn influences the seasonal distribution of Right Whales as well as their calving rates.</p>

## 2.2.2 Threats to critical habitat

Section 58(1) of SARA prohibits the destruction of any part of the critical habitat of listed endangered, threatened, or extirpated aquatic species. Destruction results if part of the critical habitat is degraded, either permanently or temporarily, such that it does not serve its function when needed by the species.

Table 2 presents the activities that are considered likely to result in the destruction of Right Whale critical habitat. For more detail see Section 1.9.5 of the Recovery Strategy (DFO 2014a). The list of potentially destructive activities is neither exhaustive nor exclusive, nor does it mean that an activity is automatically prohibited, as the activity potentially could be conducted without resulting in destruction.

**Table 2 Examples of activities with the potential to result in the destruction of the critical habitat of the North Atlantic Right Whale (DFO 2014a).**

Threat	Known or possible activities	Possible Effect Pathway
Prey removal	Capture and removal of prey species (e.g., a plankton fishery)	Reduction in the abundance and availability of prey species.
Acoustic disturbance	Vessel noise (multiple sources). Types of vessel noise are described in Section 1.8.4.	Depending on the level of noise and mitigation employed, underwater noise production can cause: <ul style="list-style-type: none"> <li>• alterations from natural behaviour</li> <li>• interference with communication</li> <li>• interference with feeding activities</li> <li>• avoidance of the area (displacement)</li> </ul>
	Acute and chronic in-water and/or land-based industrial sounds (e.g. pile driving, production drilling etc.)	
	Seismic surveys using air gun arrays	
	Sonar	
Anthropogenic alteration of physical and biological oceanographic conditions	Large scale tidal energy turbine developments in the Bay of Fundy	Depending on the scale of development and mitigation employed, the potential to reduce the energy of the tidal cycle which in turn could persistently alter the oceanographic features within critical habitat that lead to prey aggregation.
Contaminants	Dumping and discharges of contaminants / pollution (multiple sources could include ocean dumping, industrial developments and persistent vessel discharges in and around critical habitat).	Contaminants could impact the quantity and quality of prey. Biological and ecosystem level effects may also occur.

## 2.3 Recovery

### 2.3.1 Recovery goal

Research and population monitoring indicate that recovery of Right Whales is technically feasible. For recovery to occur, human-induced mortality must be reduced to levels that will allow for net population growth. The interim recovery goal for Right Whale is: “**to achieve an increasing trend in population abundance over three generations**”. One generation for the Right Whale is approximately 20 years. Thus, the minimum time period necessary to achieve the recovery target is estimated to be 54 years, since this goal was established in 2009. Success in achieving the Recovery Goal can be assessed in 2069. Recovery objectives and

associated performance indicators have been developed to support the achievement of the recovery goal. For more detail about these recovery objectives and their associated Strategies, see the Recovery Strategy (DFO 2014a).

### 2.3.2 Performance Indicators

Table 3 outlines performance indicators originally listed in the Right Whale Recovery Strategy (DFO 2014a). Performance indicators are needed to gauge the extent to which recovery activities contribute to the stated recovery goal for the species.

**Table 3 Recovery objectives and corresponding performance indicators for the North Atlantic Right Whale, reproduced from the Recovery Strategy (DFO 2014a). The numbers of the performance indicators are for cross-referencing purposes within this report, and do not reflect prioritization.**

Recovery Objective	Performance Indicator
<b>Objective 1</b> Reduce mortality and injury as a result of vessel strikes	1. Rate of interactions in Canadian waters declines 2. Regular analysis of vessel/Right Whale risk and mitigation measures is conducted
<b>Objective 2</b> Reduce mortality and injury as a result of fishing gear interactions (e.g. entanglement and entrapment)	3. Rate of interactions in Canadian waters declines 4. Regular analysis of gear/Right Whale risk and mitigation measures is conducted 5. Increased involvement in mitigation efforts by fisheries associated with higher risk gear 6. Possible disentanglement efforts are conducted
<b>Objective 3</b> Reduce injury and disturbance as a result of vessel presence or exposure to contaminants and other forms of habitat degradation	7. Assessment of impacts of contaminants on Right Whales are completed 8. Harmful levels of noise in North Atlantic Right Whale habitat is taking place at acceptable levels and durations 9. Human-induced impacts on food supply are understood and reduced where possible
<b>Objective 4</b> Monitor population and threats	10. Information collected in monitoring programs is disseminated 11. Regular forums to discuss monitoring results are held 12. Necropsies are conducted when possible
<b>Objective 5</b> Increase understanding of life history characteristics, low reproductive rate, habitat and threats to recovery through research	13. Research is published 14. Regular forums to discuss research results and threat mitigation are held 15. Critical habitat in Canadian waters is identified and protected
<b>Objective 6</b> Support and promote collaboration for recovery between government agencies, academia, environmental non-government	16. Successful implementation of Right Whale conservation activities increases 17. Cooperative bilateral or multilateral arrangements to advance Right Whale research and conservation

Recovery Objective	Performance Indicator
groups, Aboriginal groups, coastal communities and international agencies and bodies	
<b>Objective 7</b> Develop and implement education and stewardship activities that promote recovery	18. Measured increase in awareness and support for recovery activities 19. Key user groups work to develop and implement best practices (stewardship) 20. Right whale emergencies are reported in a timely fashion

In addition to the recovery objectives and associated performance indicators, the Recovery Strategy includes a schedule of studies (SoS in Table 4) that outlines the research required to identify additional critical habitat, if necessary, and to acquire more detail about the identified critical habitat. The following activities are included in the Right Whale Recovery Strategy's schedule of studies:

- 1) Evaluate prey distribution in Roseway Basin, Grand Manan Basin and surrounding areas to refine critical habitat boundaries.
- 2) Evaluate Right Whale use of areas outside of the Scotia-Fundy region (e.g. Gaspé area in the Gulf of St. Lawrence).
- 3) Determine migratory routes of Right Whales into and out of Canadian waters during their annual migration and evaluate potential as critical habitat.

## 3 Progress

### 3.1 Progress toward recovery

Table 4 describes actions taken and information published from 2009 to 2014 supporting progress toward achieving the recovery goal and objectives (see Section 2.1) for Right Whales in Atlantic Canadian waters. In some cases no performance indicator is listed, reflecting that the activity supported the relevant Recovery Objective in ways beyond the original list of performance indicators included in the 2009 Recovery Strategy. Many of the activities listed in Table 4 were undertaken specifically to advance the recovery of Right Whales. Others were undertaken for other or broader purposes but still benefitted the population.

**Table 4 Recovery activities and performance indicators used to identify progress toward recovery undertaken from 2009 to 2014.**

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>Research and monitoring activities</b>				
<p><b>Long-term population survey and monitoring</b></p>	<p>The New England Aquarium (NEAq) has continued leading its long-term population study of North Atlantic Right Whales in their habitat including Atlantic Canadian waters. The NEAq and several partner organizations monitor the status of the population and conduct research on the whales' reproduction, mortality, behaviour and human-caused scarring. Organizations also collect data on Right Whale distribution and behaviour on an opportunistic basis, while conducting other activities such as research on other species and whale-watching excursions. Aerial and vessel-based surveys in known critical habitat areas and beyond are vital to monitoring the population. <a href="http://www.neaq.org/animal/north-atlantic-right-whale-2/">http://www.neaq.org/animal/north-atlantic-right-whale-2/</a></p> <p>NEAq has continued to manage a long-term photo-identification program through which they identify individual whales and increase understanding of Right Whale population dynamics. Samples of skin, blubber, feces and blow provide data valuable for understanding the health of individuals and the population. NEAq stores biological samples for additional analyses.</p> <p><a href="http://rwcatalog.neaq.org/Terms.aspx">http://rwcatalog.neaq.org/Terms.aspx</a></p> <p>NOAA's Northeast Fisheries Science Centre (NEFSC) conducted surveys and research by vessel and by aircraft in Canadian waters in each of the years 2009 to 2014. This work forms an important part of the larger body of work to understand the Right Whale population, and is used in collaborative studies with other organizations.</p> <p><a href="http://www.nefsc.noaa.gov/psb/whales/">http://www.nefsc.noaa.gov/psb/whales/</a></p> <p>The Canadian Whale Institute (CWI) conducted surveys in Roseway Basin in late summer in the years 2009, 2010 and 2013. Their surveys were designed in part to understand Right Whales' use of the habitat especially in relation to the potential threat of collision from large commercial vehicles.</p>	4, 5, 6	10, 11, 13, 14	<p>Canadian Whale Institute</p> <p>DFO</p> <p>Grand Manan Whale and Seabird Research Station</p> <p>NEAq</p> <p>NOAA NEFSC</p> <p>North Atlantic Right Whale Consortium</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p><a href="http://www.canadianwhaleinstitute.ca/">http://www.canadianwhaleinstitute.ca/</a></p> <p>The Grand Manan Whale and Seabird Research Station contributed to long-term Right Whale population monitoring by collecting sightings data obtained from whale watch vessels, using GPS and data loggers from 2009-2014. Distribution data were also collected through the Right Whale Mitigation strategy using aerial surveys of lobster fishing areas 36, 37 and 38, primarily in November and December. <a href="http://www.gmwsrs.info">www.gmwsrs.info</a></p> <p>DFO in Maritimes Region maintains a database of whale sightings, and contributes all sightings data and photos to NOAA for inclusion in the population assessment. These opportunistic data are obtained from a variety of sources including Coast Guard and DFO vessels, and the public.</p> <p>The North Atlantic Right Whale Consortium manages access to Right Whale databases containing many types of data including sightings, identification, and genetic information, The Consortium produces an annual Report Card summarizing the results of population monitoring. The Report Card includes known births and deaths, including deaths from vessel strikes and entanglements in fishing gear. It also presents an annual summary of management activities in Canada and the United States. <a href="http://www.narwc.org/index.php?mc=1&amp;p=1">http://www.narwc.org/index.php?mc=1&amp;p=1</a></p> <p>Between 2009 and 2014, the Right Whale population estimate increased from 438 to 522 (Pettis and Hamilton 2009; Pettis and Hamilton 2014).</p>			
<p><b>Development of molecular technique to identify individual Right Whales from free-floating feces</b></p>	<p>In 2010, researchers published a method they developed to genetically identify individual Right Whales from samples of feces collected at sea during a study of Right Whale health. The health investigation was enhanced when genetic profiles of known individual Right Whales could be matched to those derived from the fecal samples. The study provided a non-invasive methodology that could potentially contribute to population size estimates and studies</p>	<p>4, 5</p>	<p>10, 13</p>	<p>NEAq Trent University</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	of habitat use patterns (Gillett et al. 2010).			
<b>DFO 'shoulder season' survey of Right Whale critical habitat in the Bay of Fundy in October 2013.</b>	DFO conducted a vessel-based survey during what is considered the 'shoulder season' for Right Whale presence in the Bay of Fundy, in October 2013. Most Right Whales typically leave the Bay of Fundy area by late September but it is important to understand changes in the whales' distribution and the timing of their presence in and near their critical habitat areas. Two Right Whales were observed during this survey.	4,5, SoS	14, 15	DFO
<b>Discovery of evidence for a Right Whale mating ground</b>	For many years the location(s) of possible Right Whale mating grounds was unknown. In a study incorporating survey data, genetic data and modeling, researchers identified significantly higher proportions of known reproductive Right Whales (male and female) in the central Gulf of Maine during the time of year when conception is likely, based on gestation period. This strongly suggests that this region is a mating ground for the species. The work also showed that the Roseway Basin Right Whale critical habitat also may be the site of some conceptions if Right Whale gestation is as long as 14 months (Cole et al. 2013).	4, 5, 6	13	NEAq NOAA Trent University Saint Mary's University
<b>Oceanographic research to understand ocean warming trends in the Bay of Fundy</b>	Researchers collected water temperature data during a study of basking sharks in the Bay of Fundy and Gulf of Maine. Electronic monitors deployed on basking sharks in 2008-2010 and 2012-2013 recorded water temperature and depth. They monitored temperatures in deep waters that are vital to copepods, the primary prey for Right Whales. This work may contribute to an understanding of the yearly distribution of copepods and Right Whales. The study found that Bay of Fundy waters warmed more from 2010 to 2012 than did Gulf of Maine waters, and while Bay of Fundy temperatures declined slightly in 2013, those in the Gulf of Maine did not (Koopman et al. 2014).	5, 6	13, 17	GMWSRS
<b>Investigation of potential</b>	Researchers from DFO and World Wildlife Fund Canada (WWF) investigated the potential contributions of the inshore lobster fishery	2, 4	3	DFO



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>contribution of groundlines in the Bay of Fundy lobster fishery to Right Whale entanglement risk</b>	groundlines to entanglement risk for Right Whales. Lobster traps on a trawl are connected by groundlines made from rope that is typically buoyant. The study found that the existing trap-setting process maximized distance between interconnected traps, minimizing slack in the groundlines. This kept the lines close to the seabed, below the hypothesized entanglement threat threshold of 3 metres (Brillant and Trippel 2010).			WWF
<b>Acoustic research into Right Whale distribution and habitat use outside of the known critical habitat areas: Scotian Shelf</b>	<p>In 2012, 2103 and 2014, researchers developed passive acoustic monitoring datasets using bottom-mounted recorders in several areas of the Scotian Shelf. Similar work has been underway off the south and east coasts of Newfoundland, and off the coast of southern Labrador. This continuing work will help assess the presence of Right Whales outside the known critical habitat areas.</p> <p>Preliminary findings suggest that Right Whales are present outside of the currently identified critical habitat areas at times of year outside of their previously known summer and fall foraging season.</p> <p>Data analyses are expected to be completed in 2015-16.</p>	4, 5, 6, SoS		Akoostix Inc. DFO JASCO Applied Sciences NOAA Shell
<b>Right Whale passive acoustic and habitat survey in Roseway Basin</b>	<p>Researchers conducted visual and acoustic surveys for Right Whales in Roseway Basin in late August and September 2014. In the first week, they recorded high rates of Right Whale vocalizations. After that, sightings and acoustic recordings were extremely low or absent, indicating that the whales had abandoned the habitat. Measured copepod concentrations were high near the feeding whales, and moderate to low after the whales abandoned the area (Davies et al. 2015).</p>	5, 6, SoS	15, 17	Canadian Whale Institute Dalhousie University DFO-Atlantic Zone Monitoring Project (AZMP) JASCO Inc. Marine Environmental Observation, Prediction and Response Network (MEOPAR)



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
				NEAq NOAA
<b>Research on the behavior of Right Whale mother-calf pairs in the Bay of Fundy</b>	A research team from Syracuse University is conducting a long-term study of Right Whale mother-calf behaviour from birth through weaning. The aim of the work is to address the risk of vessel strike faced by mother-calf pairs. They made behavioural observations and acoustic recordings in the Bay of Fundy in 2011 and 2012. Starting in 2012, a significant shift in summer distribution of Right Whales was observed as they moved to unknown locations (Parks et al. 2014).	1, 5, 6	2, 13, 14, 17	NEAq NOAA NEFSC Penn State University Syracuse University
<b>Research to understand and reduce the risk of vessel collisions with Right Whales</b>	<p>To understand the effectiveness of efforts to reduce the risk of vessel strikes, researchers developed a method to estimate vessel compliance with the International Maritime Organization (IMO)'s voluntary Area to Be Avoided (ATBA) that had been established in Roseway Basin in 2008. They found that compliance stabilized at 71% within the first 5 months of ATBA implementation, contributing to an 82% reduction in the risk of lethal vessel strikes to Right Whales (Vanderlaan and Taggart 2009).</p> <p>Researchers developed a method to assess the probability of encounters between Right Whales and vessels, and a method to quantitatively determine vessel routing options that reduce the probability of collisions with Right Whales. These methods can be applied in different habitat areas to reduce vessel strike mortalities to Right Whales and other species at risk (Vanderlaan et al. 2009).</p> <p>Researchers used real-time data from vessels transiting through a Right Whale model population. They determined the space and time overlap of vessels and Right Whales, and from that developed probability estimates of lethal vessel strikes. The models developed can be used in other regions and with other species to inform management decisions and reduce the risk of vessel strikes on large whales (van der Hoop et al. 2012).</p>	1,5	1, 2, 10, 13,18	CWI DFO Dalhousie University University of Delaware University of Rhode Island

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>As part of the process of developing a national risk assessment framework, DFO developed an improved method to model the risk of ship strikes for marine mammals and sea turtles that incorporated vessel and animal characteristics contributing to risk. The Research Document is in review.</p>			
<p><b>Analysis of entanglement risk from fixed-gear fisheries</b></p>	<p>Researchers at Dalhousie University and DFO assessed the relative threat of entanglement in fishing gear in the Scotia–Fundy area, and the relative risk of lethal entanglement in the Grand Manan Basin and Roseway Basin critical habitats. The work focused on groundfish and pelagic hook-and-line, groundfish gillnet, and trap gear used in the crab, hagfish, and inshore and offshore lobster fisheries (Vanderlaan et al. 2011).</p> <p>The analysis showed that among the seven gear types examined, groundfish hook-and-line gear poses the greatest threat to Right Whales during the summer when they are resident in the two critical habitat areas. Gear from lobster fisheries poses the greatest threat during spring and autumn, when whales are migrating to and from the critical habitat areas.</p> <p>Subsequently, researchers at Dalhousie University, CWF and WWF are expanding the entanglement risk estimates for a broader set of fisheries, throughout Atlantic Canada (Brillant et al. in prep.). This analysis is being used to identify potential measures to reduce risk.</p> <p>Researchers analyzed 132 ropes retrieved from 70 whale entanglements in the U.S. and Atlantic Canadian waters. They concluded that increased rope strength over the years has contributed to increased severity of Right Whale entanglements. They recommended that ropes of reduced breaking strength be developed and tested in fixed gear fisheries, as they could contribute significantly to reducing entanglement risk while supporting viable fisheries (Knowlton et al. 2015).</p>	<p>2, 4, 5, 6, 7, SoS</p>	<p>4, 10, 13, 17, 18, 19</p>	<p>CWF Dalhousie University DFO WWF</p>
<p><b>Assessment of</b></p>	<p>Passive acoustic data was collected in August and September 2013</p>	<p>3, 4,</p>	<p>8, 15,</p>	<p>Akoostix Inc.</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>ambient and anthropogenic noise levels within identified critical habitat during seismic surveys in summer 2013</b>	in Roseway Basin during Shell's seismic survey conducted off the western Scotian Shelf. The files have been analyzed for the presence of Right Whale vocalizations, as well as calls produced by other species. The acoustic data collected may also contribute to a better understanding of the transmission of seismic airgun sounds across shelf waters and in Right Whale critical habitat.	5, 6	17	DFO Shell
<b>Demonstration that vessel traffic noise causes measurable stress in Right Whales</b>	In the immediate aftermath of the terrorist attack in New York City on 11 September 2001, vessel traffic worldwide ceased. At the time, separate research projects were underway in the Bay of Fundy to study acoustic noise in the marine environment, and stress-related fecal hormone metabolites of Right Whales. The researchers subsequently combined their data and were able to show that the decrease in background underwater noise from reduced vessel traffic after September 11th corresponded to a decrease in stress-related hormone levels in Right Whales. This work was completed and published within the reporting period (Rolland et al. 2012). It makes an important contribution to the body of knowledge about how noise may effect Right Whales and other marine mammals.	3, 5, 6	8,13, 17	NEAq NOAA NEFSC Woods Hole Oceanographic Institute (WHO)
<b>Evaluations of historical and present policy initiatives for Right Whale conservation in Canada, and trans-border between Canada and US.</b>	<p>Researchers published a document that summarizes the present threats to Right Whales, and initiatives to reduce those threats including trans-border initiatives to mitigate fishing gear entanglement and vessel strike risk. They collated information on international law, political frameworks and outreach initiatives into one document (Duff et al. 2013).</p> <p>Silber et al. (2012) reviewed initiatives under the jurisdiction of the International Maritime Organization (IMO), including two that were put in place in Canada for the protection of the Right Whale. The authors concluded that the IMO is a constructive and effective entity for reducing risk of vessels colliding with whales.</p>	All	13	Dalhousie University NOAA

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>Increasing understanding of Right Whale critical habitat in Roseway Basin</b>	<p>Research that contributed to the identification of Right Whale critical habitat in Roseway Basin and Grand Manan Basin was published during the reporting period. The boundaries of the critical habitat initially had been defined based on the probability distribution of Right Whale sightings. By analysing oceanographic processes that explain the variation in <i>Calanus</i> distribution and availability, researchers developed spatially explicit indicators to define Right Whale feeding habitat (Michaud and Taggart 2011; Davies <i>et al.</i> 2012; Davies <i>et al.</i> 2013; Davies <i>et al.</i> 2014).</p> <p>The researchers also identified an area outside the present boundaries of the Roseway Basin critical habitat that is likely to be an important feeding area for the whales. This area is now being explored as part of the annual Right Whale monitoring surveys (Davies <i>et al.</i> 2014).</p>	5, 6 SoS	10, 13,15, 17	Dalhousie University DFO
<b>Right Whale and plankton research in Roseway Basin</b>	<p>During a vessel-based survey in 2009, Dalhousie University researchers quantified the spatial distribution and abundance of Right Whale food, the zooplankton species <i>Calanus finmarchicus</i>, and water masses associated with the plankton aggregations that define the Right Whale critical habitat in Roseway Basin. This research explained the year-to-year patterns in variation of Right Whale distributions and migration within and between Roseway Basin and Grand Manan Basin between 1987 and 2009 (Davies <i>et al.</i> 2015; Davies <i>et al.</i> In press).</p>	5,6, SoS	10, 13,15, 17	CWI Dalhousie University DFO
<b>Research into Right Whale distribution and habitat use outside of the known critical habitat areas, including identification of unknown Right</b>	<p>Researchers began an analysis of historical data on zooplankton, especially <i>Calanus</i> copepods, to identify potential Right Whale foraging habitat in the Gulf of St. Lawrence and on the eastern Scotian Shelf. This work began in 2013 and is ongoing.</p> <p>Scientists conducted a preliminary analysis of the interannual variability in zooplankton biomass on the Scotian Shelf since 1982. With these analyses they can map the distribution and depth of the maximum energy density provided by Right Whale prey in late</p>	3, 4, 5, SoS	9, 13, 15	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>Whale foraging habitat</b>	<p>spring/early summer and late summer/fall. It will then be useful to identify areas where the <i>Calanus</i> energy density is above the optimal threshold to meet Right Whale foraging needs.</p> <p>Since 2011, DFO has studied the variability of zooplankton presence in the Gaspé region and the Baie des Chaleurs basin, and has monitored for the presence of Right Whales in those areas. Researchers conducted acoustic mapping of zooplankton masses, and passive acoustic monitoring (PAM) for Right Whale vocalizations. They use underwater microphones to record Right Whale ‘upcalls’, a type of vocalization that is unique to Right Whales. The scientists found a seasonal correlation between high concentrations of plankton in the summer and fall, and Right Whale presence. The whales regularly frequent the Gulf of St. Lawrence at the end of summer and in fall, passing through the Gaspé area and northeast of the Magdalen Islands. Historical observations also exist of Right Whales in the Gulf of St. Lawrence throughout the summer months. Analysis is ongoing and documents are in preparation for publication (Perrin et al (in prep), Plourde et al (in prep)).</p>			
<b>Increase knowledge about human impacts on Right Whales’ food supply</b>	<p>By analysing <i>Calanus</i> abundance and occurrence data collected through the Atlantic Zone Monitoring Program (AZMP) between 1999 and 2012, researchers developed habitat models that can be used to predict effects of future climate change in Atlantic Canadian waters. These models also can support the development of ecosystem-based advice about the potential effects of climate change (Albouy-Boyer et al. 2016). This work is contributing to increasing knowledge about changes to Right Whales’ food supply, including climate change, helping to identify potential links between shifts in Right Whales’ prey supply and to the whales’ habitat use.</p>	3, 4, 5 SoS	9, 10, 13	DFO-AZMP
<b>Investigations of Right Whale movement patterns within and among</b>	<p>During the reporting period, researchers used known start and end locations of individual Right Whales to model the most probable routes they used traveling into and out of critical habitat areas. They produced monthly estimates of the most likely locations of Right</p>	4,5,6 SoS	10, 13, 17	CWF CWI

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>Gulf of Maine and Canadian critical habitats in the Northwest Atlantic</b>	Whales in Atlantic Canada. This study includes recommendations of areas to focus the scarce resources available for survey effort, which may in turn contribute to the identification of previously unknown Right Whale habitat (Brillant et al. 2015).			Dalhousie University WWF Canada
<b>Management Activities</b>				
<b>Amendments to the Recovery Strategy for the North Atlantic Right Whale</b>	Amendments to the 2009 Recovery Strategy for the North Atlantic Right Whale were published in 2014 (DFO 2014a). The amended Recovery Strategy includes a more detailed description of the functions, features, and attributes of the critical habitat areas. These amendments were made to provide greater certainty about the legal protection of critical habitat, as well as increased awareness among ocean users about how their activities may affect the components of critical habitat.  <a href="http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=1750">http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=1750</a>		15	DFO
<b>Development of critical habitat orders for Grand Manan Basin and Roseway Basin</b>	For the Grand Manan Basin and Roseway Basin critical habitat areas, protection will be afforded using a critical habitat protection order made under subsections 58(4) and 58(5) of SARA. Development of a regulatory package is ongoing. Once the order is in place, the subsection 58(1) prohibition against the destruction of critical habitat will apply in these areas.		15	DFO
<b>Development of an Action Plan for the North Atlantic Right Whale</b>	DFO worked with others to develop an Action Plan for the North Atlantic Right Whale in Atlantic Canadian waters. This Action Plan places priority on addressing Objective 2 of the Recovery Strategy: <i>Reduce mortality and injury as a result of fishing gear interactions</i> , and presents two approaches to address this objective: prevention (reduce the probability of Right Whales interacting with fishing gear), and response (reduce the severity of entanglements by responding to reported incidents). Measures to be taken to address this threat are included in an implementation schedule. The development of this Action Plan is ongoing.	2, 3, 4, 5, 6, 7	3 - 18	DFO Right Whale Recovery Network

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<p><b>SARA permitting processes</b></p>	<p>Over the five-year reporting period from 2009 to 2014, DFO issued 30 SARA section 73 permits for scientific research activities in Maritimes and Gulf regions that focused directly on conservation of the Right Whale. In Québec and in Newfoundland and Labrador, DFO issued 55 SARA section 73 permits for work on other marine mammals that included reference to Right Whales in case the opportunity arose to study them as well.</p> <p>In each case, DFO evaluated the activities and determined that they did not jeopardize the survival and recovery of the species. The permit conditions included mitigation measures to ensure minimal impact to the species. For details, see the Species at Risk Public Registry. <a href="http://www.sararegistry.gc.ca/sar/permit/permits_e.cfm">http://www.sararegistry.gc.ca/sar/permit/permits_e.cfm</a></p>	6	16, 17	DFO
<p><b>Identification of Ecologically and Biologically Significant Areas within the Right Whale’s range in Atlantic Canada</b></p>	<p>Ecologically and Biologically Significant Areas (EBSAs) are areas that warrant a greater-than-usual degree of risk aversion in the management of activities. The identification of EBSAs will inform regional oceans planning and management, including the design of a marine protected area (MPA) network.</p> <p>Right Whale critical habitat in the Bay of Fundy and on the Scotian Shelf has been identified as EBSAs, and is being incorporated into region-wide spatial analysis for MPA network planning (Buzeta 2013; DFO 2014b).</p> <p>DFO has identified several Areas of Interest (AOIs) for future MPAs under the <i>Oceans Act</i> that are within the area of distribution of the Right Whale. These are American Bank and the Shediac Valley in the Gulf of St. Lawrence, and St. Anns Bank east of Cape Breton. The Laurentian Channel AOI may also be relevant if it is learned that this forms part of the Right Whales’ migration route into and out of the Gulf of St. Lawrence (Lesage et al. 2007, DFO 2009). As part of baseline studies for the Laurentian Channel MPA AOI evaluation, DFO flew aerial surveys in this area in 2014. DFO has also been assisting French colleagues in St. Pierre with deployment and analysis of data from autonomous acoustic recorders deployed in</p>	5	15	DFO



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>this area.</p> <p>As part of the MPA development process, consultations with stakeholder have begun. Various additional steps will be completed in the coming years to establish these areas as MPAs under the <i>Oceans Act</i>.</p> <p><a href="http://www.dfo-mpo.gc.ca/oceans/mpa-zpm-aoi-si-eng.html">http://www.dfo-mpo.gc.ca/oceans/mpa-zpm-aoi-si-eng.html</a></p>			
<p><b>DFO C&amp;P officer patrols and monitoring</b></p>	<p>DFO Conservation and Protection (C&amp;P) Officers conduct patrols for a variety of reasons, and in areas where Right Whales are observed, their patrols include verification or monitoring of Right Whale sightings.</p> <p>C&amp;P Officers discuss species at risk, including Right Whales, and distribute relevant materials during information sessions with licence holders that are held for all fisheries prior to the beginning of fishing seasons. During vessel patrols and shore-based monitoring, Officers monitor for the presence of lost, unattended or illegal fishing gear and remove it from the water, to reduce 'ghost gear' in the water and to minimise the risk of entanglements. In the past these patrols have removed crab traps, lobster traps and drifting mussel farm gear.</p> <p>C&amp;P Officers respond to reports of entangled or stranded marine mammals including Right Whales, as reported by the public or encountered during patrols. Officers monitor whale-watching activities to ensure that operators are not disturbing marine mammals. During these patrols, the officers take the opportunity to share information about Right Whales, including recovery activities, with fishing and whale-watching industry participants.</p> <p>A Marine Mammal Enforcement Advisory Committee was set up in southwest New Brunswick focusing on education of the Whale Watching Community to avoid harassment of Right Whales. C&amp;P Officers conduct patrols of whale watching activities undertaken by</p>	<p>1, 2, 4, 6, 7</p>	<p>3, 6, 16, 18, 19</p>	<p>DFO</p>



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	the industry and by private vessels.			
<p><b>Voluntary Standard Practices and Mitigation Strategies concerning interactions between Right Whales and fishing gear</b></p>	<p>In Lobster Fishing Areas (LFAs) 33 and 34 on the Scotian Shelf, the industry led an initiative to reduce the amount of rope in the water when Right Whales may be in the same area. The Voluntary Standard Practices (VSPs) were adopted by representatives of about 1,700 lobster fishermen. The VSPs include guidelines for deploying gear in ways that are intended to minimize the amount of slack rope in the water, and for communicating whale sightings to other fishing vessels to reduce the chance of interactions.</p> <p>The offshore lobster fishery operating in LFA 41 (Scotian Shelf) developed VSPs to reduce the risk of Right Whale entanglement as part of their Marine Stewardship Council (MSC) certification conditions.</p> <p>Late in 2014, the Groundfish Advisory Council was developing VSPs for member fishers to consider for adoption in 2015.</p> <p>The Grand Manan Fishermen’s Association (GMFA) operates a mitigation strategy for the inshore Lobster fishery (Bay of Fundy) in LFAs 36, 37 and 38, in partnership with DFO. The program began in 2007 and has continued annually. Aerial surveys for Right Whale presence are conducted in the three LFAs prior to the November lobster season opening. Fishers report Right Whale sightings to a telephone hotline and the resulting information is made available to other fishermen. Fishermen are instructed not to deploy or haul gear when Right Whales are present.</p> <p>The Fundy North Fishermen’s Association (FNFA) began a project in 2011 that is ongoing, to remove lost fishing gear, “ghost gear”, from the Bay of Fundy. This project includes major cleanup of old gear, and outreach to other marine users to prevent future loss of gear (Hood et al. 2011).</p>	2, 6, 7	5, 6, 16, 19	<p>DFO</p> <p>Fundy North Fishermen’s Association</p> <p>Grand Manan Fishermen’s Association</p> <p>Grand Manan Whale and Seabird Research Station</p> <p>Groundfish Advisory Council</p> <p>Lobster Fishery Associations 36, 37, 38 and 41</p> <p>WWF</p>
<p><b>Consideration of Right Whale-fishing</b></p>	<p>The Integrated Fisheries Management Plan (IFMP) for the snow crab fishery in the Maritimes Region addresses concerns about the potential risk of interactions with Right Whales. The fishery has 5%</p>	2, 7	3, 5, 6, 20	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<b>gear interactions in Integrated Fisheries Management Plans</b>	<p>observer coverage, and observers are required to monitor and report on interactions with SARA-listed species like the Right Whale.</p> <p>The Maritimes Region Inshore Lobster IFMP (2011) provides the MARS toll-free hotline for reporting whale emergencies. One of the conservation strategies identified in the IFMP is to protect biodiversity by controlling unintended incidental mortality of Right Whales using the voluntary standards of practice developed with WWF that are mentioned elsewhere in this progress report.</p> <p>The whelk fishery in Maritimes Region is an exploratory fishery that was initiated in 2004. Taking Right Whale recovery needs into consideration, the 2014 fishery licence condition excluded the fishery from Roseway Basin. This decision recognizes the need to reduce the risk of interaction between Right Whales and fishing gear by limiting new or expanding fisheries in areas where Right Whales concentrate.</p> <p><a href="http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/index-eng.htm">http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/index-eng.htm</a></p>			Fishing industry
<b>Updates to navigational documents and charts</b>	<p>Navigational charts used by mariners were updated to include the coordinates of Right Whale critical habitat published in the Recovery Strategy.</p> <p>The Canadian Coast Guard's Annual Notices to Mariners provides best practices for avoiding vessel contact with Right Whales and other marine mammals. This information is available to mariners by e-mail subscription and online.</p> <p>The most up-to-date version is available online at the Notice to Mariners website</p> <p><a href="https://www.notmar.gc.ca/go.php?doc=eng/index">https://www.notmar.gc.ca/go.php?doc=eng/index</a></p>	1, 3, 7	1, 18, 19, 20	DFO Canadian Coast Guard Canadian Hydrographic Service
<b>Production of the Mariner's Guide to Marine Mammals</b>	<p>The Réseau d'observation de mammifères marins (ROMM) worked with the Shipping Federation of Canada to publish the document "A Mariner's Guide to Whales in the Northwest Atlantic" (ROMM 2014). While focused on whale species, this guide also includes a profile of the Leatherback Sea Turtle that highlights the species'</p>	1, 7	1, 18, 19	Dalhousie University Réseau d'observation des mammifères marins (ROMM) Shipping Federation

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	physical attributes, behaviours, known threats, and vulnerability to ship strikes. <a href="http://www.shipfed.ca/home">http://www.shipfed.ca/home</a>			of Canada
<b>Amendment of Marine Mammal Regulations to include whale-watching guidance to reduce disturbance to marine mammals</b>	The <i>Marine Mammal Regulations</i> under the <i>Fisheries Act</i> are being considered for amendment to update them to provide the Department with regulatory tools to more effectively manage non-harvest resource uses and impacts. Specifically, the proposed amendments would include a broadened scope of application that includes conservation and protection, regulatory tools to limit and define disturbance, and the ability to track incidental harm.	1, 3	1, 8	DFO
<b>Completion and review of strategic environmental assessments for offshore oil and gas exploration and development activities on the Scotian Shelf</b>	Since 2009, seven strategic environmental assessments (SEAs) have been completed for large areas of the Scotian Shelf and Slope. Each SEA evaluated the potential impacts of oil and gas activities on the marine environment within a defined geographic area. Public comments on the SEAs were sought and recorded on the CNSOPB Public Registry (CNSOPB 2015a). DFO reviewed and provided extensive comments on each SEA, which included direction to improve information about the presence of Right Whales, and the importance of avoiding harmful effects to the whales and their critical habitat.	1, 3	1, 8, 19	CNSOPB DFO
<b>Completion and review of environmental assessments for seismic programs on the Scotian Shelf</b>	<p>Between 2012 and 2014, project-specific environmental assessments (EAs) were completed for two seismic exploration programs on the Scotian Shelf and Slope. Both EAs considered the Right Whale and its Roseway Basin critical habitat.</p> <p>The Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) incorporates the Right Whale, and the need to avoid vessel presence in the Roseway Basin critical habitat, into its assessment of offshore petroleum activities. EAs incorporate measures to reduce the possibility of ship strikes and effects of noise resulting from a 3D wide azimuth seismic program to be conducted near Roseway Basin, implementing appropriate mitigation measures as a result of rigorous environmental assessment.</p>	1, 3	1, 8, 19	BP Exploration (Canada) Limited CNSOPB DFO Shell Canada

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	Public comments on the EAs were sought and recorded on the CNSOPB Public Registry (CNSOPB 2015b). DFO reviews proposed industrial activities and ensures that marine mammals including the Right Whale are considered during the planning and execution of offshore exploration activities. DFO's extensive comments included requirements to improve mitigation measures for marine mammals such as the Right Whale.			
<b>Review of mitigation and monitoring measures for seismic survey activities in and near the habitat of cetacean species at risk</b>	On March 25-27, 2014, a DFO science advisory process was held on the topic of seismic noise and its impact on at-risk whale species (DFO 2015). The purpose of this process was to (a) identify sound exposure criteria, (b) identify whether the current "Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment" (SOCP) is adequate for avoiding harm to whales and their critical habitat, and (c) identify additional mitigation and monitoring measures if necessary. Two research papers will be published resulting from the advisory process. The Right Whale was used as a case study in this process. The advice generated through this process will be used by DFO in regulating and managing relevant activities.	3, 6	8, 16, 17	Academia DFO ENGOs Industry Other government departments and regulators
<b>Emergency Response</b>				
<b>Marine Mammal Response Program</b>	DFO's national Marine Mammal Response Program (MMRP) continued to support and coordinate responses to incidents of marine mammals in distress such as entanglement or stranding. In addition, the program has provided whale disentanglement training to DFO C&P officers, and provides resources and equipment in support of incident response in Atlantic Canada.  In Maritimes Region, the MMRP supported the necropsies of two Right Whales between 2009 and 2014 (see below).  Annual reports available at website: <a href="http://www.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/program-">http://www.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/program-</a>	2, 4	6, 12	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<a href="#">eng.html</a>			
<p><b>Regional marine mammal response networks respond to reports of dead or distressed marine animals including Right Whales</b></p>	<p>In Atlantic Canada and in Québec, regional response networks are in place to respond to marine mammals that are dead or in distress, including Right Whales. Between 2009 and 2014, these networks continued to provide widely-advertised 24-hour hotlines, coordinate multiple partners in response efforts, and conduct hands-on responses. Each network maintains data on incidents including entanglements, strandings and mortalities of marine mammals. The response networks conducted outreach to marine users, provided training to responders, and collected data that contributes to scientific studies. Trained experts are available through these networks to respond directly to reported incidents or provide advice on the most appropriate course of action.</p> <p>The Québec Marine Mammal Emergency Response Network (QMMERN) and Maritimes Marine Animal Response Network (MMARN) each bring together government, non-government, and private organizations that have the resources and expertise necessary to respond to a variety of incident types. These may include dead animals washed ashore (beached), live animals stranded ashore, and at-sea entanglements. QMMERN and MMARN ensure that necropsies are conducted whenever possible so that information can be gained from each whale carcass.  <a href="http://www.marineanimals.ca/">http://www.marineanimals.ca/</a> <a href="http://baleinesendirect.org/urgences-mammiferes-marins/">http://baleinesendirect.org/urgences-mammiferes-marins/</a></p> <p>In Québec the 24-hour emergency call centre and coordination centre for QMMERN is housed with the Group for Research and Education about Marine Mammals (GREMM). In the Maritime provinces, Nova Scotia, New Brunswick and Prince Edward Island, the Marine Animal Response Society (MARS) operates a 24-hour hotline and coordinates responses for the broader network, MMARN. MARS also provides training in response techniques for DFO personnel and others to safely return stranded animals to the</p>	<p>2, 4, 6, 7</p>	<p>6, 12, 17, 20</p>	<p>MMARN                      QMMERN                      Whale Release and Strandings Group</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>ocean.</p> <p>In the Bay of Fundy, the Campobello Whale Rescue Team (CWRT) continued to be on call to lead disentanglement efforts for Right Whales and other large whales. They responded to 7 incidents of Right Whales entangled in fishing gear or trapped in fishing weirs between 2009 and 2014.  <a href="http://www.bayoffundywhales.com/#!/rescue/c1a4e">http://www.bayoffundywhales.com/#!/rescue/c1a4e</a></p> <p>In Newfoundland and Labrador, the Whale Release and Strandings Group is authorized by DFO to disentangle cetaceans and sea turtles caught in fishing gear or stranded on the coastline. The group continues a program that has been in place since 1979.  <a href="http://newfoundlandlabradorwhales.net/">http://newfoundlandlabradorwhales.net/</a></p> <p>During the reporting period, these groups participated in or coordinated responses to a total of 11 incidents of entangled Right Whales, and conducted necropsies on two Right Whale carcasses (see below for more detail on the necropsies).</p>			
<p><b>Development of National Stranding Network Committee</b></p>	<p>In 2013, the regional marine mammal response networks and the Canadian Wildlife Federation (CWF) formed a National Stranding Network Committee to maintain and improve the operations of regional emergency response networks, foster consistency in response standards across regions, and encourage collaboration and knowledge-sharing in responses to marine mammal emergencies, including those involving Right Whales. The Committee will develop a National Stranding Network plan to guide future activities of regional networks.</p>	<p>2, 4, 5, 6, 7</p>	<p>6, 10, 11, 12, 16, 18, 20</p>	<p>CWF MARS QMMERN Whale Release and Strandings Group</p>
<p><b>Monitoring presence and condition of Right Whale carcasses</b></p>	<p>DFO is working to gather marine mammal entanglement and mortality information from imagery collected during regular pollution patrol flights by Transport Canada; this information has been used to detect and identify dead Right Whales in the Gulf of St. Lawrence and off southern Newfoundland in 2014.</p>	<p>4, 5, 6</p>	<p>10, 12, 16</p>	<p>DFO Transport Canada</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
<p><b>Right Whale Necropsies</b></p>	<p>Necropsies are conducted on Right Whale carcasses to determine the cause of mortality, and to evaluate and inform existing and potential mitigation measures. Two Right Whale necropsies were performed, both in Nova Scotia: in 2010 on a whale that came ashore on the Bay of Fundy coast, and in 2012 on a carcass that beached on Nova Scotia's eastern shore. A veterinary pathology report on each incident was prepared by the Canadian Cooperative Wildlife Health Centre (CCWHC). Information and samples collected were shared with the North Atlantic Right Whale Consortium and research partners. Necropsies were led by personnel from the Atlantic Veterinary College (AVC) and the Canadian Cooperative Wildlife Health Centre (CCWHC). For the 2010 case, Right Whale researchers from the NEAq participated in the necropsy.</p>	<p>4, 5, 6</p>	<p>12, 13, 17</p>	<p>AVC CCWHC DFO MARS NEAq</p>
<p><b>Education and Outreach Activities</b></p>				
<p><i>a) Targeted audiences</i></p>				
<p><b>Poster campaign to identify new Right Whales aggregation areas</b></p>	<p>In 2011 DFO initiated an outreach project to seek information from the public about sightings of Right Whales throughout Atlantic Canada, especially in areas outside of the critical habitat where Right Whales are known to aggregate. Over 300 posters were distributed on wharves, community bulletin boards, Coast Guard vessels, ferries, to whale watch companies and to DFO area offices in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, and Newfoundland and Labrador. DFO made presentations at fishery advisory committee meetings and the posters were distributed with fishery logbooks. Information about the campaign was distributed by DFO C&amp;P Officers.</p> <p>As a result, reports of sightings have increased as has our understanding of Right Whale distribution and habitat use in Atlantic Canadian waters.</p>	<p>4, 5, 6, 7, SoS</p>	<p>10, 15, 16, 18, 19, 20</p>	<p>DFO Maritime Aboriginal Peoples Council, IKAWNAWTIKET</p>



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>Sightings data were shared within DFO, with license holders who may be fishing in the area, and with the U.S. National Oceanographic and Atmospheric Administration (NOAA) for input into their interactive online map. With the permission of photographers, DFO shared video and photos with the New England Aquarium for inclusion in their photo-identification catalog, and sightings data were entered into the North Atlantic Right Whale Consortium database.</p> <p>As the designated logbook supplier for the Scotia-Fundy and Gulf Regions, the Maritime Aboriginal Peoples Council distributed the sighting posters with every logbook they shipped to licence holders.</p>			
<p><b>Outreach to fishing industry about identification and protection of Right Whales</b></p>	<p>DFO in Maritimes Region presents educational materials and information about Species at Risk at meetings of the Scotia-Fundy Groundfish Advisory Council, the Scotia-Fundy Herring Advisory Council, the Hagfish Advisory Council, the Shrimp Advisory Council, and sends it to inshore lobster licence holders. Since 2010, DFO provides the emergency contact number of the Marine Animal Response Society (MARS) to all lobster fishery licence holders in Maritimes and Gulf regions, requesting them to report sightings of entangled or injured whales.</p> <p>MARS has conducted targeted outreach to fixed gear fishery associations at association meetings and other professional fora (e.g. Fishermen and Scientists Research Society, Fisheries Expo).</p> <p>In 2012, the Quebec-Labrador Foundation (QLF) prepared and distributed identification charts for marine species including the Right Whale, making them available to dozens of organizations and companies in Newfoundland and Labrador. Most were distributed to fishermen and professional fishery organizations, with others going to tourism operators and educators. The objective was to help recipients improve their ability to identify marine mammal species they were observing or interacting with at sea, and ultimately to contribute to the management and recovery of species at risk.</p>	<p>7</p>	<p>18, 19, 20</p>	<p>DFO Fishing industry MARS Quebec-Labrador Foundation</p>



Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<a href="http://www.qlf.org/atlantic_program/biodiversity.htm">http://www.qlf.org/atlantic_program/biodiversity.htm</a>			
<b>Development of a herring weir release manual for large species including the North Atlantic Right Whale</b>	In 2012, two Right Whales were successfully released from two different herring weirs in the Bay of Fundy in New Brunswick. Weir construction varies, and the release methods vary for accidentally-caught large marine species. After these incidents, the Grand Manan Whale and Seabird Research Station (GMWSRS) prepared a guide that helps weir operators release species like Right Whales in ways that are safest for the whales and most effective for the weirs. That guide is distributed to fishing associations, NGOs and DFO (Murison 2013).	2, 6, 7	5, 6, 16, 18, 19, 20	GMWSRS
<b>Voluntary Codes of practice and record-keeping tools promoted for use by Bay of Fundy industries</b>	The GMWSRS works with industry to keep the profile of Right Whales high, and to promote best practices for whale-watching tour operators, for example by continuing to promote and distribute the Voluntary Code of Ethics for Water-based Tour Operators which has been in place since 1997. The GMWSRS promoted the use of a trip record for whale-watch companies to record species observed. The GMWSRS also promotes the Voluntary Fishing Code for people working around large whales, including Right Whales, which was developed in 2007.  <a href="http://www.gmwsrs.info">www.gmwsrs.info</a>	3, 4, 7	18, 19, 20	Fishing licence holders in the Bay of Fundy GMWSRS Whale-watching operators in the Bay of Fundy
<b>Cetacean Identification training for at-sea observers, Fishery Officers</b>	DFO in Maritimes Region has developed a Cetacean Identification Training program which it delivers annually to commercial fishery observers, DFO C&P Officers, Defense Research and Development Canada (DRDC) researchers, and twice annually to Canadian Wildlife Service (CWS) bird observers. This training increases the accuracy of sightings data collected by at-sea observers and patrols, and may contribute to a better understanding of the distribution of whale populations, including the Right Whale, in Atlantic Canadian waters. A similar program is in place in Newfoundland and Labrador, where DFO also trains marine mammal observers (MMOs) aboard seismic vessels if	4, 7	18, 19, 20	DFO MARS WWF

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>requested.</p> <p>Throughout the reporting period of 2009-2014, MARS has offered cetacean identification training, as well as live and dead cetacean response training, across the Maritime provinces (usually 5-10 sessions per year). Audiences typically include Fishery Officers, provincial Conservation Officers, and Park Wardens. In 2011, MARS developed a set of detailed response protocols for live and dead cetacean strandings. A handbook was produced and is now provided at training sessions (Reid and Wimmer 2011).</p> <p>Since 2012, WWF Canada has provided live and dead cetacean identification training to at-sea fisheries observers in Nova Scotia and Newfoundland.</p> <p>Cetacean Identification training materials provided, including Marine Species Identification Guide Common to the Bay of Fundy and Scotian Shelf Region (see above).</p>			
<p><b>Development of the “Marine Species Identification Guide Common to the Bay of Fundy and Scotian Shelf Region”</b></p>	<p>A marine animal identification key, including a description of Right Whales, was developed by DFO and distributed to the fishing industry, whale-watch companies, C&amp;P Officers, the Canadian Coast Guard, at-sea fishery observers, and marine mammal observers (DFO 2013). Data sheets for recording whale sightings are also made available. This guide is used in conjunction with the training described above.</p>	<p>4, 7</p>	<p>14, 15, 16, 18</p>	<p>DFO</p>
<p><b><i>b) Broad public audiences</i></b></p>				
<p><b>Websites with information about Right Whales</b></p>	<p>DFO provides websites about species at risk and Right Whales. <a href="http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=780">http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=780</a></p> <p>DFO in NL Region began a public outreach initiative based in social media (Twitter, Facebook, web site) to collect NGO and public sightings reports and disseminate information on species at risk,</p>	<p>7</p>	<p>20</p>	<p>CWI DFO GMWSRS NARWC</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>such as Right Whales.</p> <p>DFO presents information to the public about Species at Risk including the Right Whale during annual Oceans Day events.</p> <p>Research and conservation groups that contribute to Right Whale Recovery have developed websites that provide information and resources about the species and about efforts to understand its biology and threats to recovery. Some examples follow.</p> <p>The Canadian Whale Institute’s website describes Right Whale research and recovery efforts in Canada.  <a href="http://www.canadianwhaleinstitute.ca/">http://www.canadianwhaleinstitute.ca/</a></p> <p>The GMWSRS website has information about Right Whales in general and about the whales observed each year in the Bay of Fundy. <a href="http://www.gmwsrs.info">www.gmwsrs.info</a></p> <p>MARS’ website includes information to help identify species of marine mammals that may be dead or in distress needing help.  <a href="http://marineanimals.ca/site/maritime-species-profiles/cetaceans/#Baleen%20Whales">http://marineanimals.ca/site/maritime-species-profiles/cetaceans/#Baleen Whales</a></p> <p>The North Atlantic Right Whale Consortium hosts a Right Whale information web page. <a href="http://www.narwc.org/index.php?mc=2&amp;p=2">http://www.narwc.org/index.php?mc=2&amp;p=2</a></p> <p>The NEAq has a blog for communicating updates about their Right Whale research activities. <a href="http://rightwhales.neaq.org/">http://rightwhales.neaq.org/</a></p>			<p>NEAq</p> <p>MARS</p>
<p><b>Education and outreach activities for schools, local residents, and visitors to Grand Manan Island</b></p>	<p>From 2009 to 2014, the GMWSRS continued to present lectures for visitors to Grand Manan Island as they have done since 2006. They have museum and outdoor displays about Right Whales in place since 2003. Approximately 5000 people visit the GMWSRS museum annually. Since 2006 they have operated a symbolic adoption program that brings awareness about Right Whale conservation and recovery issues to approximately 600 supporters each year.</p> <p>The GMWSRS produced “Right whale Stewards”, a booklet for</p>	<p>7</p>	<p>18</p>	<p>GMWSRS</p>

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Organizations
	<p>middle schools to learn more about Right Whales and ways to protect them. It is made available to teachers through the GMWSRS website. They also made presentations to hundreds of university and high school students, Whale Camp groups, sea cadets, and at a student science fair. They also presented to approximately 4,000 students at the Kids Exploratorium in Saint John, NB and to approximately 500 high school students participating in the Eco-Expo in Charlotte County, NB.</p> <p><a href="http://www.gmwsrs.info">www.gmwsrs.info</a></p>			

## 3.2 Summary of progress

Table 5 provides a summary of the progress made toward meeting the performance indicators outlined in Table 3. Each indicator has been assigned one of four statuses:

- 1) *Not met*: The performance indicator has not been met, and little to no progress has been made.
- 2) *Partially met, underway*: Moderate to significant progress has been made toward meeting one or more elements of the performance indicator, and further work is ongoing or planned.
- 3) *Met, ongoing*: The performance indicator has been met, but efforts will continue until such time the population is considered to be recovered (i.e. the indicator will be reported against in the next five-year progress report).
- 4) *Met*: The performance indicator has been met and no further action is required.

**Table 5. Summary of progress made toward meeting the performance indicators and critical habitat schedule of studies.**

Performance indicator	Status	Comments	Next steps / recommendations
<i>Objective 1: Reduce mortality and injury from vessel strikes</i>			
(1) Rate of interactions in Canadian waters declines	Partially met, underway	Modeling, as an indirect measure of the rate of Right Whale-vessel interaction, suggests that the rate is declining. No Right Whale deaths from vessel strikes have been reported in Atlantic Canadian waters during 2009-2014, and the last confirmed Right Whale death from a vessel collision in Canadian waters occurred in 2006 (Glass et al. 2009). Sample sizes are too small to say conclusively whether the rate has declined. Changes were made to the Bay of Fundy Traffic Separation Scheme in 2003, and the International Maritime Organization (IMO) designated Roseway Basin as a voluntary Area To Be Avoided for large shipping vessels in 2009. Ongoing monitoring will help elucidate whether the rate of interaction is declining.	<p>Maintain current measures (Traffic Separation Scheme in the Bay of Fundy; Area to be Avoided in Roseway Basin).</p> <p>Continue and refine modeling and monitoring activities in current critical habitat areas and throughout Right Whales' range.</p> <p>Assess the risk of interaction in new areas of Right Whale habitat as they become known. Assess the need to establish new measures in these areas.</p>
(2) Regular analysis of vessel/Right Whale risk and mitigation measures is conducted	Partially met, underway	Analyses published in 2009 (Vanderlaan and Taggart 2009; Vanderlaan et al. 2009) conclude that the shipping industry is largely complying with the measures in place, and that this is making a significant contribution to reducing the risk of collisions. Analyses have not been conducted on a regular basis.	<p>An effective regular interval should be determined for monitoring and analysing vessel interactions, and further analyses undertaken.</p> <p>Explore additional methods for monitoring the vessel collision threat.</p>
<i>Objective 2: Reduce mortality and injury from fishing gear interactions (entanglement, entrapment)</i>			
(3) Rate of interactions in Canadian waters	Not met	The rate of interactions of Right Whales with fishing gear in Atlantic Canada has not been measured, and it would be impossible to observe all such interactions. Since the	Researchers and observers working throughout Right Whales' range will continue to obtain and share photographs

Performance indicator	Status	Comments	Next steps / recommendations
declines		<p>Recovery Strategy was first published, researchers have developed a proxy measure for Right Whales' interactions with fishing gear: analysis of the changing number of scars on individual right whales. By studying the photographic database and noting new scars from year to year, they could measure an indication of the rate at which the Right Whale population interacted with rope. This research showed that the rate of Right Whales' interactions with fisheries increased over 30 years from 1980 to 2009. (Knowlton et al. 2012). Because Right Whales are highly mobile between Canadian and U.S. waters, it is not possible to distinguish where scars were obtained; the clear evidence of an increase in the rate of interactions supports labeling this performance indicator as 'not met'.</p>	<p>that contribute to scarring rate monitoring.</p> <p>Mitigation programs that are in place during times of Right Whale presence in Canadian waters should be maintained. New mitigation measures should be developed in relevant fisheries.</p>
(4) Regular analysis of gear/Right Whale risk and mitigation measures is conducted	Partially met, underway	<p>Some analysis has been done of entanglement risk based on where Right Whales and fishing activity overlap, in Right Whale critical habitat (Vanderlaan et al. 2011). During the reporting period, additional analysis of the overlap between Right Whale presence and fishing activity throughout Atlantic Canada was undertaken, for subsequent publication (Brillant et al. in prep).</p> <p>Some fisheries in Maritimes Region have developed voluntary operating procedures intended to reduce the risk of entanglement of right whales in fishing gear. Compliance levels and effectiveness of those mitigation measures were not monitored.</p>	<p>In recent years the Right Whales appear to be shifting their areas of aggregation within Atlantic Canada to alternate locations, both known (e.g. Gulf of St. Lawrence) and unknown. This information should be taken into account in ongoing analyses of entanglement risk. Analyses conducted at regular intervals will provide the most useful means of understanding and monitoring changes in high-risk areas, and would help to monitor effectiveness of mitigation measures to be implemented.</p> <p>Exploration of methods to reduce the risk of fishing gear entangling Right Whales should continue. Methods to measure the</p>

Performance indicator	Status	Comments	Next steps / recommendations
		<p>In addition, research has shown significant increases in the severity of entanglement injuries and the entanglement risk based on gear configuration throughout the Right Whale's range (Knowlton et al. 2016). This ongoing research is another valuable tool for monitoring the impacts of entanglements on Right Whales.</p>	<p>effectiveness of existing and future fishery mitigation measures should be determined.</p>
<p>(5) Increased involvement in mitigation efforts by fisheries associated with higher risk gear</p>	<p>Partially met, underway</p>	<p>Inshore lobster fisheries in Nova Scotia and New Brunswick developed voluntary measures to decrease the risk of Right Whale entanglement during the reporting period. By the end of 2014, the groundfish fishery in Nova Scotia was considering developing and implementing measures relevant to their activities.</p>	<p>Additional fisheries that operate in areas of Atlantic Canada frequented by Right Whales are encouraged to develop mitigation measures to reduce entanglement risk.</p> <p>DFO in Maritimes Region has established a working group to assess and reduce the risks to Right Whales from interactions with fishing activities. DFO will work with industry to develop and implement mitigation measures in priority areas.</p>
<p>(6) Possible disentanglement efforts are conducted</p>	<p>Partially met, underway</p>	<p>Eleven Right Whales were successfully disentangled, all in Maritimes Region. In some cases, sea state or weather prevented successful disentanglement. Some whales were never located again after the initial sighting and their outcomes remain unknown.</p>	<p>Given the inherent difficulties in finding entangled Right Whales after they are first sighted or reported, new methods (e.g. tracking) and procedures to increase the likelihood of relocating and successfully disentangling Right Whales should be explored.</p> <p>Emergency response in Atlantic Canada would benefit from the development and sharing of clear, consistent protocols and guidance.</p>
<p><i>Objective 3: Reduce injury and disturbance as a result of vessel presence or exposure to contaminants and other forms of habitat</i></p>			



Performance indicator	Status	Comments	Next steps / recommendations
<i>degradation</i>			
(7) Assessment of impacts of contaminants on Right Whales are completed	Not met	No work on this was conducted in Canada during 2009-2014. Earlier work, predating the reporting period, demonstrated the presence of brominated flame retardants and organochlorine contaminants in Right Whales (Montie et al. 2010). The impact of contaminants on Right Whales remains unknown.	Right Whale biopsy samples are taken routinely during the New England Aquarium's and Canadian Whale Institute's surveys. These samples are available for future contaminant analysis, although this is not among the highest priority recovery activities because of Right Whales' role in the food web. They forage on organisms that are low in the food chain and are less likely to bioaccumulate contaminants than other whale species (see section 1.8.4 of the Recovery Strategy (DFO 2014a).
(8) Harmful levels of noise in North Atlantic Right Whale habitat is taking place at acceptable levels and durations	Partially met, underway	Efforts have been made to better understand and manage seismic noise and vessel noise in the marine environment and its effect on marine mammals including Right Whales, yet many challenges and uncertainties remain. While studies have not been conducted in Canadian waters specifically, several studies have begun to elucidate how anthropogenic noise in the marine environment is likely affecting Right Whales (e.g. Hatch et al. 2012). One study taking advantage of unusual circumstances demonstrated that ship noise causes stress in Right Whales (Rolland et al. 2012).	The following research and monitoring would help to inform the development of appropriate mitigation and management measures with respect to noise: <ul style="list-style-type: none"> <li>- determine baseline or ambient sound levels in known Right Whale habitat areas,</li> <li>- determine noise thresholds to define harmful sound levels, and</li> <li>- determine the behavioural and physiological effects of acute and chronic noise on Right Whales.</li> </ul>
(9) Human-induced impacts on food supply are understood and reduced where	Partially met, underway	Climate change may be contributing to oceanographic shifts that in turn are influencing the distribution of Right Whales' prey. Between 2009 and 2014, research was completed that contributed important new knowledge about the population dynamics and	As Right Whales adapt to shifts in prey availability, continued monitoring and research will be important and should continue.  Increased communication and

Performance indicator	Status	Comments	Next steps / recommendations
possible		<p>distribution of <i>Calanus</i> copepods in Right Whale critical habitat and other areas in Atlantic Canada (e.g. Michaud and Taggart 2011, Davies et al. 2012, Albouy-Boyer et al. 2016, Davies et al. in press).</p> <p>This performance indicator is partially met because, while the understanding of anthropogenic impacts on <i>Calanus</i> distribution has increased, reducing such impacts requires long-term and large-scale measures beyond the scope of single species recovery efforts.</p>	collaboration between those studying changes in plankton ecology and those engaged in Right Whale recovery efforts is encouraged.
<i>Objective 4: Monitor population and threats</i>			
(10) Information collected in monitoring programs is disseminated	Met, ongoing	The Right Whale research community is highly collaborative, and results of monitoring were shared annually through existing fora such as the North Atlantic Right Whale Consortium (NARWC) and at Right Whale Recovery Network meetings from 2009 to 2014. Other large-scale monitoring programs have published important contributions to the body of knowledge about ecosystem-scale influences on the Right Whale population, such as <i>Calanus</i> habitat shifts (Albouy-Boyer et al. 2016)	The sharing of information is expected to continue and as new Right Whale projects are undertaken by new partners in new areas, collaboration with the NARWC and the Right Whale Recovery Network should be encouraged.
(11) Regular forums to discuss monitoring results are held	Met, ongoing	Monitoring results were discussed at the annual meeting of the NARWC and at Right Whale Recovery Network meetings.	Research and monitoring information sharing should continue through Right Whale Recovery Network meetings and the NARWC annual meeting.
(12) Necropsies are conducted when	Met,	Between 2009 and 2014, two Right Whale carcasses were found in Nova Scotia, and full	Challenges remain in responding to whale carcasses observed offshore and in remote

Performance indicator	Status	Comments	Next steps / recommendations
possible	ongoing.	necropsies were conducted. Both of the carcasses were found on or near shore. While the cause of death was not identified for the 2010 carcass, the detailed necropsy allowed vessel collision to be ruled out as the cause of death. Drowning due to entanglement in rope was identified as the cause of death for the 2012 carcass.	coastal areas. Clear response protocols and procedures should be developed to facilitate a coordinated and timely response to species at risk such as the Right Whale.
<i>Objective 5: Increase understanding of life history characteristics, low reproductive rate, habitat and threats to recovery through research;</i>			
(13) Research is published	Met, ongoing	Many peer-reviewed and other publications have been produced during the reporting period 2009-2014, either published during those years, or published subsequently and reflecting relevant work being completed during those years. See the References section for a selection of publications relevant to Right Whales in Atlantic Canadian waters.	Publication of research results is expected to continue.
(14) Regular forums to discuss research results and threat mitigation are held	Met, ongoing	Results of research are shared annually through existing fora such as the North Atlantic Right Whale Consortium. Such information also has been shared at Right Whale Recovery Network meetings.	Research results and threat mitigation information should continue to be shared through the Right Whale Recovery Network meeting and the NARWC annual meeting. Industries that develop and implement mitigation measures are encouraged to participate.
(15) Critical habitat in Canadian waters is identified and protected	Partially met, underway	Critical habitat was identified and described in the 2009 Recovery Strategy, with a more detailed description included in the 2014 amendment. Right Whale critical habitat will be protected using a critical habitat protection order made under subsections 58(4) and	Work to complete the critical habitat order for existing critical habitat will continue.  Work to undertake the activities identified in the critical habitat schedule of studies will continue.

Performance indicator	Status	Comments	Next steps / recommendations
		58(5) of SARA. Once the order is in place, the subsection 58(1) prohibition against the destruction of critical habitat will apply.	
<i>Objective 6: Support and promote collaboration for recovery between government agencies, academia, environmental non-government groups, Aboriginal groups, coastal communities and international agencies and bodies</i>			
(16) Successful implementation of Right Whale conservation activities increases	Partially met, underway	The Recovery Strategy provided strategic direction for Right Whale recovery and has influenced activities being undertaken in Atlantic Canada, as described in this report. While Implementation of activities has increased, processes are not in place to measure how effective (successful) those measures have been.	With the publication of SARA Action Plans for the North Atlantic Right Whale, implementation of recovery and conservation activities is expected to continue, and to increase. Measuring the implementation and the success of measures will rely on the development of means and processes to monitor uptake and implementation, and to measure the recovery effectiveness of activities.
(17) Cooperative bilateral or multilateral arrangements to advance Right Whale research and conservation	Met, ongoing	Many cooperative projects have been undertaken with partnerships between research organizations, industry, NGOs, and government.	Cooperative arrangements are expected to continue.
<i>Objective 7: Develop and implement education and stewardship activities that promote recovery</i>			
(18) Measured increase in awareness and support for recovery activities	Not met	Numerous and diverse awareness activities have been undertaken during the reporting period, and it is likely that awareness of and support for Right Whale recovery has increased. However no actions have been undertaken to measure and confirm an increase in awareness or support for recovery	Groups specializing in public outreach and education are encouraged to explore ways to measure an increase in awareness and support for recovery activities.

Performance indicator	Status	Comments	Next steps / recommendations
		activities.	
(19) Key user groups work to develop and implement best practices (stewardship)	Met, ongoing	Many marine users including The Shipping Federation of Canada, individual marine transport companies, the Grand Manan Fishermen’s Association, the Fundy North Fishermen’s Association and several other fishing industry associations have undertaken activities as they strive to reduce the potential impact their activities have on individual Right Whales and on the population.	Such groups are encouraged to participate in the regular forums to discuss research results and threat mitigation.  Measures in place should be assessed and should continue, where effective.  DFO’s fisheries mitigation working group will work with industry to develop and implement mitigation measures in priority areas.
(20) Right Whale emergencies are reported in a timely fashion	Met, ongoing	It is likely that some Right Whale emergencies will always go undetected. However from 2009 to 2014, the presence and visibility of response networks has increased, as have specific outreach projects. These in turn have increased the likelihood that sightings of Right Whales – healthy or in distress – will be reported.  This indicator is related to the importance of timely response to incidents of distressed or dead whales. Such incidents were responded to in a timely fashion from 2009 to 2014, as information availability and weather conditions allowed. The Performance Indicator has been met, and it will always need to be ongoing.	Outreach to all citizens and stakeholders who are likely to come into contact with Right Whales should be maintained to support the continuous need for emergencies to be reported promptly and accurately. Right Whale emergencies (e.g. entangled whales, floating carcasses) are relatively infrequent activities, yet timely and thorough responses are of vital importance for understanding mortality in the species.  DFO Regions and other government departments would benefit from the development and sharing of clear protocols and guidance for timely reporting and information sharing regarding Right Whale emergencies.
<i>Critical Habitat Schedule of Studies</i>			
(1) Evaluate prey distribution in	Met,	Davies et al. (in press) completed research that identified prey conditions that confirmed	Continue monitoring the presence and population dynamics of <i>Calanus</i> in Right

Performance indicator	Status	Comments	Next steps / recommendations
Roseway Basin, Grand Manan Basin and surrounding areas to refine critical habitat boundaries	ongoing	the identification of Right Whale critical habitat in Grand Manan Basin and Roseway Basin. The information did not warrant a refinement of the critical habitat boundaries.	Whale critical habitat areas. If future work demonstrates that the prey populations are shifting such that the distribution and aggregation of <i>Calanus</i> as a food source for Right Whales is shifting, then critical habitat boundaries could be refined.
(2) Evaluate Right Whale use of areas outside of the Scotia-Fundy region (e.g. Gaspé area in the Gulf of St. Lawrence)	Partially met, underway	Partnerships and technology have advanced between 2009 and 2014, supporting research underway on the Scotian Shelf and in the Gulf of St. Lawrence to identify optimal Right Whale feeding habitat. Aerial and vessel-based surveys, as well as acoustic monitoring for Right Whales are linking to oceanographic studies that identify optimal conditions for Right Whales' copepod prey.	<p>These projects should continue and expand, and they have the potential to identify additional critical habitat that the Right Whale population is using and relying on.</p> <p>Such work should be coordinated among agencies and organizations throughout Atlantic Canada, including multiple DFO regions. This will optimize resources and expertise such that practical results are available in a timely manner.</p> <p>A peer review of research to identify and characterize important habitats areas for North Atlantic Right whales in the Gulf of St. Lawrence should be undertaken. The results of this review would inform the possible identification of additional critical habitat.</p>
(3) Determine migratory routes of Right Whales into and out of Canadian waters during their annual migration and evaluate potential as critical habitat	Partially met, underway	Migratory corridors have not been a direct focus of research to date. However as more observations are made of Right Whales moving throughout their Atlantic Canadian range, understanding of their movements in the region is improving. The publication of a quantitative model of Right Whale movements in Atlantic Canada indicates that individuals	Research should continue in areas outside the critical habitat, for example studies of Right Whales and their prey in the Gulf of St. Lawrence. Such work will support an increased understanding of the species' use of Atlantic Canadian waters.

Performance indicator	Status	Comments	Next steps / recommendations
		are highly mobile and move repeatedly in and out of important habitat areas. The study identifies several areas where new survey effort may be warranted (Brillant et al. 2015).	

## 4 Concluding Statement

The information in Tables 4 and 5 describes how, and to what extent, DFO and its partners have implemented the Right Whale Recovery Strategy from 2009 to 2014. Activities have been undertaken in support of all recovery objectives. Eight of the 20 performance indicators have been met, and all require ongoing work to maintain the progress made during the reporting period. Another nine of the performance indicators were partially met, and three were not met. Many of those that have been partially met relate to the reduction of threats to Right Whales. It is likely that progress will be ongoing to solve complex problems over an extended period of time. Objectives that have been met, and that will continue to be met, are those related to publication of research and collaboration among many recovery partners.

Indicators related to understanding the impacts of contaminants on Right Whales, and the effects of human activities on the whales' copepod prey, were not met. These have been relatively low priority among researchers. A third indicator that has not been met is that related to measuring levels of awareness of and support for recovery activities. It is particularly challenging to evaluate and measure the effectiveness of outreach and education activities.

The activities identified in the critical habitat schedule of studies have been met or partially met, and work will continue as it remains a high priority to locate and understand additional habitat areas that are important to Right Whales. Other elements of Recovery Strategy implementation that require more attention include understanding and reducing the major threats of entanglement and acoustic disturbance.

Recovery of the North Atlantic Right Whale population is feasible and the objectives continue to reflect the necessary directions for research and recovery. The performance indicators could be improved to reflect increases in the body of knowledge since the Recovery Strategy was prepared, and could become more meaningful if based on quantitative values.

### *Population and distribution objectives*

The recovery goal of *an increasing population trend for three Right Whale generations* represents a practical way to measure changes in the population, with some caution recommended. The North Atlantic Right Whale population has been increasing steadily since the late 1990s when recovery planning for the species began in Canada. Between 2009 and 2014, the Right Whale population increased from 438 to 522 (Pettis and Hamilton 2014). Extreme variations in annual birth rates have been observed. These may be natural fluctuations, or they may be influenced by anthropogenic activities in ways not yet fully understood. Right Whales are long-lived and reproduce slowly, which presents a challenge for understanding their population dynamics within human timeframes. Recent population increases cannot be assumed to translate into long-term population success. The increase in the number of Right Whales in turn increases the risk of whales encountering human activities that may injure them. Thus an increase in the population can be accompanied by an increased risk until the threats themselves are reduced.

Since 2012, Right Whales have abandoned their typical summer and fall feeding habitat in the Bay of Fundy, shifting to unknown locations (e.g. Davies et al 2015). This has made it challenging for researchers to conduct research on the species in this formerly reliable habitat area. Right Whales' shift away from of the Bay of Fundy is most likely driven by the availability of their food and there is no reason to expect that the whales and their prey will not return to this area, but the pattern is unpredictable at this time. Migration patterns and calving rates are



among the behaviours and population parameters that are likely to vary along with prey availability.

### *Threats*

Of the threats identified in the Recovery Strategy, the two most important are vessel strikes and entanglement in fishing gear. Their importance is reflected in the balance of activities that have been undertaken in Canada from 2009 to 2014. While progress has been made to address those threats, work to reduce them should continue, coupled with improved effectiveness of emergency response. The measured rate of injury and mortality in the Right Whale Population from human activities has not decreased despite measures undertaken in Canada and the U.S. van der Hoop et al. (2013) and Pace et al. (2014).

Research and analysis of the threat of entanglement provide direction for the ongoing development and implementation of recovery measures. Voluntary measures to reduce entanglement risk have been developed for some fisheries that have been identified as high risk because of the time and location they are undertaken. Additional approaches may be necessary to monitor and reduce entanglement risk.

Since the preparation of the Recovery Strategy, understanding of the threat presented to Right Whales by noise from industrial activities has increased. Anthropogenic noise can result in disturbance or displacement of Right Whales, which may impede their ability to carry out important life cycle functions such as feeding, communication and rearing of calves (Parks and Clark 2007; Parks et al. 2011; Hatch et al. 2012; Rolland et al. 2012; Parks et al. 2014). Noise in the marine environment is likely to increase as industrial activities such as shipping and oil and gas exploration and development continue and increase. The long-distance transmission of noise presents an inherent challenge in understanding and mitigating the impacts of acoustic noise on whales. Future research and recovery efforts may focus increasingly on this threat.

The Recovery Strategy identifies changes in food supply as a threat to Right Whales. More recent research has used long data series to understand large-scale shifts in the distribution and community structure of zooplankton populations in the North Atlantic (e.g. Villarino et al. 2014). Studies analyzing ecosystem-scale shifts in the availability and distribution of *Calanus* in the Gulf of Maine and on the Scotian Shelf between 1960 and 2005 predicted that the distribution of the species will continue to shift northward (Reygondeau and Beaugrand 2011), and conclude that anthropogenic climate change is an influence on past and future shifts in the distribution of *Calanus* (Meyer-Gutbrod et al. 2015). These research projects are helping to fill knowledge gaps and will continue to inform Right Whale recovery.

### *Emergency incident response*

Responding to Right Whale emergencies (e.g. disentanglement, necropsies) can be complicated by the large area of ocean that the species inhabits in Atlantic Canada, and the multiple jurisdictions that operate in this area. To date DFO has provided training for response personnel, and well-coordinated regional response networks exist. Necropsies are a primary source of information about Right Whale injury and mortality, and they support implementation of the Right Whale Recovery Strategy. Response protocols, incident analysis (including retrieved gear), record-keeping and information-sharing from incidents can all be improved. Information obtained from response and analysis feeds back into recovery planning and implementation to improve threat mitigation, limit future incidents, and thus promote Right Whale recovery.

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