Species at Risk Act
Recovery Strategy Report Series

Report on the Progress of Recovery Strategy Implementation for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf Population, in Atlantic Canadian Waters for the Period 2010-2015

Northern Bottlenose Whale

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For copies of the recovery strategy report, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, recovery strategies, action plans, and other related recovery documents, please visit the SAR Public Registry[1].

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[1] http://www.sararegistry.gc.ca/

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Section 46 of SARA requires the competent minister to report on the implementation of the recovery strategy for a species at risk, and on the progress towards meeting its objectives within five years of the date when the 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, provincial and territorial governments, and all other parties involved in conducting activities that contribute towards the species' recovery. Recovery strategies identify broad strategies and approaches that will provide the best chance of recovering species at risk. Some of the identified strategies and approaches are sequential to the progress or completion of others and not all may be undertaken or show significant progress during the timeframe of a Report on the Progress of Recovery Strategy Implementation (Progress Report).

The Minister of Fisheries and Oceans is the competent minister under SARA for the Northern Bottlenose Whale, Scotian Shelf Population and has prepared this Progress Report.

As stated in the preamble to SARA, success in the recovery of species at risk depends on the commitment and cooperation of many different groups 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 these groups. All Canadians are invited to join in supporting and implementing the Recovery Strategy for the Northern Bottlenose Whale,Scotian Shelf population for the benefit of the species and Canadian society as a whole.

Acknowledgments

This Progress Report was prepared by Katherine Hastings (Species at Risk Management Division, Fisheries and Oceans Canada (DFO), Maritimes Region), with input from other DFO sectors, federal government departments, regulators, Aboriginal organizations, non-government organizations, and academic partners. DFO would like to express its appreciation to all individuals and organizations who have contributed to the recovery of the Northern Bottlenose Whale, Scotian Shelf Population.

Executive summary

The Northern Bottlenose Whale, Scotian Shelf population (NWB-SSP) was listed as Endangered under the federal *Species at Risk Act* in 2006. Threats to this species include acoustic disturbance, oil and gas activities, entanglement in fishing gear, contaminants, changes to food supply, and vessel strikes. A Recovery Strategy for this population was published as final on the Species at Risk Public Registry in May 2010.

Four recovery objectives were included in the Recovery Strategy for the NWB-SSP. This report outlines activities undertaken since May 2010 in support of these recovery objectives. Fisheries and Oceans Canada (DFO) is the authority responsible for the recovery of the NWB-SSP, and has been working to advance the implementation of the Recovery Strategy in several ways. These efforts continue to be strongly supported and complemented by those of the academic community, non-government organizations, Aboriginal organizations, and stakeholders.

Measureable progress has been made toward achieving each of the four recovery objectives, which broadly aim to improve understanding of (1) Northern Bottlenose Whale ecology, (2) population size, trend, and distribution, and (3) anthropogenic threats, while also (4) enhancing the awareness and engagement of stakeholders and the public. Significant progress was made toward addressing Recovery Objectives 2 and 4, in particular. For example, photos collected during dedicated visual surveys were used to build up the Northern Bottlenose Whale photo-identification database. This database facilitated the calculation of the most precise population estimate to date in 2013. Many activities were undertaken to address Recovery Objective 4, including efforts to engage ocean users directly, as well as raise awareness of the species and its threats among the public. Large-scale poster campaigns, public lectures, information booths, and social media are just a few examples of how audiences were reached.

The majority of the 16 performance indicators identified in the Recovery Strategy were either partially met or met. Areas where further work is required include: quantifying rates and sources of NWB-SSP mortality and injury; assessing and monitoring the threat of entanglement; measuring ecosystem contaminant levels; evaluating prey composition; delineating population range boundaries; and assessing habitat use outside of known critical habitat areas. The performance indicators that were met during the first five years of recovery strategy implementation will require continued attention over the next five years to maintain progress.

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1. Introduction

This Progress Report describes the progress made toward meeting the objectives listed in the “Recovery Strategy for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian Waters” for the five-year period since it was published in May 2010. This report is one in a series of documents for this species that are linked and should be taken into consideration together, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report (COSEWIC 2011), recovery potential assessments (DFO 2007; 2011), a recovery strategy (DFO 2010a; 2016a), and an action plan (DFO 2016b). The protection and management of the Gully Marine Protected Area (MPA), designated in 2004 under the *Oceans Act*, continues to play an important role in the recovery of the NWB-SSP. More information on the Gully MPA can be found in the management plan (DFO 2008; 2015c) and the 10-year progress report (DFO 2014e).

Section 2 of this report reproduces the COSEWIC assessment summary and recaps the threats to individual Northern Bottlenose Whales and their critical habitat. Also reproduced in Section 2 are the recovery goal, recovery objectives, and performance indicators from the Recovery Strategy. During the reporting period (May 2010-May 2015), many activities were undertaken in support of 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 on areas of focus to guide future recovery efforts.

2. Background

2.1. COSEWIC assessment summary[2]

Assessment summary – November 2002

Common name: Northern Bottlenose Whale (Scotian Shelf population)

Scientific name: *Hyperoodon ampullatus*

Status: Endangered

Reason for designation: This population totals about 130 individuals and appears to be currently stable. Oil and gas development in and around the prime habitat of this population poses the greatest threat and will likely reduce the quality of their habitat. However, there is little information as to how this species is, or is not, affected by oil and gas development activities.

Occurrence: Atlantic Ocean

Status history: The Northern Bottlenose Whale was given a single designation of Not at Risk in April 1993. Split into two populations in April 1996 to allow a separate designation of the Northern Bottlenose Whale (Scotian Shelf population). Scotian Shelf population designated Special Concern in April 1996. Status re-examined and uplisted to Endangered in November 2002. Last assessment was based on an existing status report with an addendum.

2.2. Threats

2.2.1. Threats to the species at risk

Threats to the Northern Bottlenose Whale, Scotian Shelf populationhave been identified in the relevant COSEWIC assessment reports (COSEWIC 2002; 2011) and Recovery Potential Assessments (DFO 2007; 2011). Threats of current concern are summarized in Table 1.

[2] The assessment summary included in this report is from the 2002 COSEWIC Assessment and Update Status Report (COSEWIC 2002), and is the same summary included in the original Recovery Strategy (DFO 2010a). COSEWIC reassessed the Northern Bottlenose Whale, Scotian Shelf population) in 2011 and confirmed its endangered status (COSEWIC 2011).

Table 1. Summary of the threats identified for the Northern Bottlenose Whale, Scotian Shelf population, based on the Recovery Strategy (DFO 2010a).

Threat	Description
Entanglement in fishing gear	There have been nine documented cases of Northern Bottlenose Whale (NBW) entanglement in trawl or longline fishing gear in Atlantic Canada over the past 35 years. Evidence of past entanglement has also been observed in scarring patterns on individual whales.
Oil and gas activities	Offshore oil and gas development has occurred on the Eastern Scotian Shelf since 1992, and is projected to increase in coming years. Exploration and production activities have the potential to affect the NBW-SSP through acoustic disturbance (e.g. seismic surveys, drilling), accidental oil spills, and increased vessel traffic.
Acoustic disturbance	The NBW relies on sound to communicate, forage, and navigate. The introduction of anthropogenic noise into the marine environment can interfere with their ability to carry out these functions, and may lead to temporary or permanent hearing loss, displacement, behavioural changes, physical injury, stranding, and mortality.
Contaminants	Marine pollutants, including floating debris and chemical contaminants, have been known to have adverse effects on marine mammal health through ingestion, bioaccumulation, or entanglement. Little is known about the impact of pollution on the NBW-SSP, specifically. Sources of pollution include fishing (e.g. discarded or lost gear, plastics), commercial shipping (e.g. loss of cargo, accidental discharges), oil and gas activities, munitions dumpsites, and terrestrial run-off.
Changes to food supply	The preferred prey species of the NBW-SSP is squid of the genus *Gonatus*. The abundance of *Gonatus* squid is thought to be especially high in the submarine canyons where the NBW-SSP is concentrated. Disruption or diminishment of this food supply could pose a threat to the NBW-SPP.
Vessel strikes	Whales can be seriously or mortally injured by a collision with a vessel. To date, there have been no confirmed instances of an NBW being struck by a vessel on the Scotian Shelf; however, scarring patterns on certain individuals have been attributed to possible interactions with vessels.

2.2.2. Threats to critical habitat

Critical habitat is identified for the NBW-SSP in the Recovery Strategy (DFO 2010a; 2016a), and includes the Gully, Shortland, and Haldimand submarine canyons, located at the edge of the eastern Scotian Shelf. Activities that could result in the destruction of critical habitat are also outlined in the Recovery Strategy, and are summarized in Table 2.

Table 2. Threats to Northern Bottlenose Whale, Scotian Shelf population critical habitat. Table adapted from the recently amended Recovery Strategy (DFO 2016a).

Threat	Activities	Effect-Pathway
Acoustic disturbance	Seismic surveys Sonar activities In-water or land-based industrial activities (such as pile driving, dredging and construction) Shipping	Underwater noise production causing: • alterations from natural behavior • interference with communication • interference with social and reproductive activities (such as socializing, mating and calving) • interference with feeding activities • avoidance of the area (displacement)
Changes to food supply	Capture and removal of prey species (e.g. a fishery, bycatch) Seismic surveys	Reduction in the abundance and availability of prey (such as *Gonatus* squid) causing: • a decrease in the ability to effectively and efficiently forage in the area • decreased use of the area (displacement)
Contaminants	Dumping and discharges of contaminants / pollution (e.g. ocean dumping, industrial developments and persistent vessel discharges, oil and gas production)	Release of pollutants (such as marine debris or chemical pollutants) into the marine environment causing: • reduced water quality • decreased prey quality and quantity
Alteration of biological and physical oceanographic conditions	Large-scale industrial development (e.g. offshore mining, dumping of aggregates, renewable energy development and generation)	Modifications to the seabed causing: • changes to the oceanography of the area in ways that reduce prey quality or quantity

2.3. Recovery

A final Recovery Strategy for the NBW-SSP was included in the Species at Risk Public Registry in May 2010 (DFO 2010a), and was recently amended to include a more detailed description of existing critical habitat (DFO 2016a). Recovery of this population was deemed to be both biologically and technically feasible. The overall recovery goal, as stated in the Recovery Strategy, is **"to achieve a stable or increasing population and to maintain, at a minimum, current distribution"**. Four recovery objectives, outlined in Table 3, were developed to support the achievement of the overall recovery goal. To facilitate the evaluation of progress toward the recovery of the NBW-SSP, measurable performance indicators were included in the Recovery Strategy (DFO 2010a). These performance indicators are reproduced in Table 3.

The overall recovery goal and objectives in the Recovery Strategy remain relevant. The technical feasibility of some of the recovery objectives is challenged by the remote offshore distribution of this species. However, this reality has not prevented progress. Funding has already been secured for continued NBW research on the Scotian Shelf over the next five years. This research is expected to address several of the recovery objectives and corresponding strategies.

Table 3. Recovery objectives and corresponding performance indicators for the Northern Bottlenose Whale,Scotian Shelf population, reproduced from the Recovery Strategy (DFO 2010a; 2016a). The performance indicators (also referred to as measures of progress in the Recovery Strategy) are numbered to allow for easy cross-referencing within this report, and do not reflect prioritization.

Recovery Objective	Performance Indicator
Objective 1 Improve understanding of NBW ecology, including critical habitat requirements, carrying capacity, breeding, trophic interactions, links with other populations (e.g. Davis Strait), and sources of mortality.	1. Sources of mortality have been identified and quantified 2. Carrying capacity of NBW habitat has been quantified 3. Studies outlined in the Schedule of Studies (refer to Recovery Strategy) have been completed. 4. Prey composition and prey availability have been evaluated 5. Qualified, trained persons have responded to all strandings in a timely manner
Objective 2 Improve understanding of the population size, trend and distribution.	6. Population size has been regularly assessed (c. $\leq$ 5 years) 7. Population trend estimates are considered accurate within +/– 5% 8. Abundance has been regularly monitored in the Gully, Haldimand and Shortland Canyons and adjacent areas 9. A population trend has been regularly calculated using the most recent available data
Objective 3 Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, petroleum development, noise, and contaminants, and develop management measures to reduce threats where necessary.	10. The contribution of anthropogenic threats to mortality has been quantified for each known threat 11. The extent and severity of threats has been routinely monitored 12. Anthropogenic mortality is within the recommended potential biological removal (PBR), and individual mortalities and mortality trends are tracked for this population 13. Additional management measures have been put in place to protect against PBR being exceeded
Objective 4 Engage stakeholders and the public in recovery action through education and stewardship.	14. Awareness and training programmes are underway to target key user groups, government, and the general public 15. Education materials have been developed and disseminated 16. Stakeholders and the public are engaged in stewardship activities

3. Progress towards recovery

3.1. Recovery activities

Table 4 outlines recovery activities that have been initiated or completed during the five years since the Recovery Strategy was published as Final in 2010. These activities are organized under three broad headings: (1) research and monitoring; (2) management; and (3) engagement, education, and outreach. The particular recovery objective(s) and performance indicator(s) related to each activity are also listed. The activities that occurred during the reporting period (May 2010-May 2015) contributed to meeting all four recovery objectives. The extent to which each of the performance indicators were met during the first five years of recovery strategy implementation is discussed in Section 3.3. Many of the activities listed in Table 4 were undertaken specifically to advance the recovery of the NBW-SSP. Others were undertaken for different or broader purposes but still resulted in benefits to the population (e.g. Gully MPA management activities, broader marine mammal conservation initiatives).

Table 4. Recovery activities started or completed since May 2010 for the Northern Bottlenose Whale, Scotian Shelf population, organized into three categories (research and monitoring; management; and engagement, education, and outreach). These categories were chosen for grouping purposes only, and do not correspond directly to specific strategies or approaches in the Recovery Strategy. Where there is more than one participant associated with a recovery activity, they are listed in alphabetical order. Frequently used acronyms: DFO = Fisheries and Oceans Canada; MARS = Marine Animal Response Society; WRS-NL = Whale Release and Strandings-Newfoundland and Labrador; GAC = Gully Advisory Committee; ENGO = Environmental Non-government Organization; CNSOPB = Canada-Nova Scotia Offshore Petroleum Board; C-NLOPB = Canada-Newfoundland and Labrador Offshore Petroleum Board; MPA = Marine Protected Area.

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Research and monitoring activities				
Population analysis, including size, trend, and sex ratio	Digital photographs of individuals from the NBW-SSP were collected during the summers of 2010 and 2011 for identification purposes. Analysis of the photographs using mark-recapture techniques rendered an updated estimate of population size (143 animals, with a 95% confidence interval of 129-156 animals). This is considered the most precise NBW population estimate obtained to date, with a margin of error less than +/-10%. The population trend (1988-2011) was also assessed, and the results suggest the population is currently stable. Changes in sex-ratio over time (1988-2011) were evaluated statistically and the demographics of the population were found to be unchanged. References: O'Brien (2013a); O'Brien and Whitehead (2013)	2	6, 7, 8, 9	Dalhousie University (Whitehead Lab)
Analysis of social structure and organization within the NBW-SSP	Using digital photographs and video collected since 1988, the social behaviours of NBW on the Scotian Shelf were examined. Areas of study included the strength and variability of associations among individuals over different time scales and breathing synchrony. Such studies contribute to establishing baseline knowledge of natural behaviours, which is needed to monitor the effects of human activities on the whales. References: O'Brien (2013a)	1	N/A	Dalhousie University (Whitehead Lab)

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Collection of biopsy samples	Six biopsy samples were collected from six different NBW during field work in the Gully in 2013. These biopsy samples have been stored for future analysis, which may include hormone analyses to determine nutritional stress or reproductive status in females. Lipid content may also be analyzed. The 2013 field work presented a valuable opportunity to test the effectiveness of biopsy sampling methodologies on NBW. References: Narazaki (2013)	1	N/A	University of St. Andrews (Sea Mammal Research Unit)
Deployment of accelerometer tags	Five different NBW were tagged with data loggers during Gully field studies in 2011 and 2013. These tags record information such as depth, heading, acceleration, and water temperature that is used to learn about diving behaviour. The tag data retrieved in 2011 was the second set of dive records ever to be collected for this species. In 2013, one Digital Acoustic Recording Tag (D-TAG) was deployed, which also recorded whale vocalizations. Both tagging studies resulted in important lessons learned regarding tagging technique and tag placement on NBW. References: Deecke (2011); Narazaki (2013)	1	N/A	University of St. Andrews (Sea Mammal Research Unit)
Collection of blow samples	The exhalations of three NBW were sampled during Gully field work in 2011; however, the samples were not sufficient to make strong inferences about body condition. Analysis methodologies were tested. References: Deecke (2011)	1	N/A	University of St. Andrews (Sea Mammal Research Unit)
Maintenance of NBW-SPP sightings and incidents records	DFO Maritimes and NL Regions maintain Cetacean Sightings Databases that include live sightings records obtained from multiple sources, such as research scientists, marine mammal observers, at-sea fisheries observers, and the Canadian Coast Guard. All stranding, entanglement, injury, and mortality events are recorded and maintained by regional marine mammal response networks. Data is collected and incorporated into these databases on an ongoing basis. References: DFO (2014a)	1, 2	N/A	DFO MARS WRS-NL

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Collection and maintenance of digital multimedia data (e.g. photos, videos, audio)	All of the NBW-SSP photographs, video, and acoustic recordings taken since 1988 have been collected, centralized, and digitized to facilitate future research, analyses, and monitoring. New data is being added on an ongoing basis. NBW-SSP sightings and incident data will be integrated into this collection in the future. References: COSEWIC (2011); O'Brien and Whitehead (2013)	1, 2	N/A	Dalhousie University (Whitehead Lab) DFO
Development of NBW digital photo-identification catalogue	All NBW film photographs have been digitized, and both the digitized and more recent digital photographs and associated metadata have been organized into a photo-ID catalogue to facilitate analysis. These photographs have been collected by research scientists and at-sea observers. DFO has supplied digital cameras and identification training to at-sea observers in NL Region.	2	6, 7, 8, 9, 11	DFO
Characterization of NBW vocalizations	Using acoustic recordings collected from the Gully, NBW echolocation pulses (clicks) were analyzed and their characteristics described. NBW pulse reflections were also described for the first time. These results are being used to refine the automated click detectors often applied to raw acoustic data. This will help increase the accuracy of detections. References: Martin and Moors-Murphy (2013a)	1	N/A	DFO JASCO Applied Sciences
Review of mitigation and monitoring measures for seismic survey activities in and near the habitat of cetacean species at risk	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. 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) to identify additional mitigation and monitoring measures if necessary. The NBW-SSP 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. References: DFO (2015a); DFO (2015b); Moors-Murphy and Theriault (in prep); Theriault and Moors-Murphy (in prep)	3	10, 11, 13	Academia DFO ENGOs Industry Other government departments and regulators

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Monitoring for presence of NBW-SSP outside of Eastern Scotian Shelf canyons	In 2013 and 2014, aerial cetacean surveys were conducted off Newfoundland and Labrador (NL), including areas off southern Newfoundland where the NBW-SSP may occur. In addition, several underwater acoustic recorders were deployed. The acoustic data collected will be examined to determine if it can be used to document the presence of this species in these areas throughout the year. Similarly, an underwater acoustic recorder was deployed in Logan Canyon (west of the Gully) in June through September 2014. The recordings are being analyzed for NBW clicks. Between May and September 2015, several acoustic recorders were deployed at deep-water locations along the shelf break and slope, from Nova Scotia to NL, where NBW may be observed. These recorders will be at these locations for 1-2 years. Sightings data from cetacean surveys, and collected opportunistically during other activities, have also helped to build an understanding of the NBW-SSP's presence outside of the Eastern Scotian Shelf canyons. These data are obtained from various sources, including aerial cetacean abundance surveys conducted over Canadian waters by the US National Oceanic and Atmospheric Administration (NOAA), as well as from Canadian Wildlife Service seabird observers, marine mammal observers, fisheries officers, and others.	1, 2	6	DFO
Scientific evaluation of Gully MPA monitoring needs and available data	Two regional DFO science advisory processes (2010 and 2012) have informed the development of a draft Gully MPA monitoring plan. Many indicators, monitoring protocols, and methodologies were considered during the advisory processes. The resulting science advice proposed 47 indicators to track and assess progress toward meeting the MPA's conservation objectives. Several of the indicators are related specifically to NBW-SSP, while others are related to their threats or habitat. References: Kenchington (2010); DFO (2010b); Allard et al. (2015)	2, 3	6, 8, 11	Aboriginal organizations Academia DFO ENGOs Industry Other government departments and regulators

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Processing and analysis of mesopelagic and bathypelagic survey samples and data	Four mid-water trawl surveys were carried out in the Gully between 2007 and 2010. The surveys primarily targeted organisms that feed on phytoplankton and zooplankton. The survey samples were expected to include the prey of *Gonatus* squid, which are in turn the prey of NBW. Laboratory work and data analyses are currently ongoing, and are expected to reveal new information about food web dynamics and energy flow in the Gully canyon ecosystems. Learning more about these lower prey layers is helping to build understanding of the ecology of NBW and threats to the Scotian Shelf population. In addition, a small number of *Gonatus* squid were caught during the same surveys, and samples were taken for stomach-content analyses. References: Kenchington et al. (2009); DeVaney et al. (2009); MacIsaac (2011); Kenchington et al. (2014a); Kenchington et al. (2014b); MacIsaac et al. (2014)	1	4	Delaware Museum of Natural History DFO Environment Canada Natural History of Museum of Los Angeles County Virginia Institute of Marine Science
Analysis of offshore vessel traffic patterns	Using Long Range Identification and Tracking (LRIT) data, a retrospective analysis of offshore vessel traffic in Atlantic Canada was completed for the period February 2010-February 2011. This study indicated that vessel traffic density is moderate to high in and around NBW-SSP habitat relative to other offshore areas in Atlantic Canadian waters. A pilot study was also initiated to determine whether satellite-based Automatic Identification System (AIS) data, which is higher resolution than LRIT data, can be used to effectively track and analyze marine traffic within and between the three Eastern Scotian Shelf canyons. Analyses of 2014 AIS data showed that vessel traffic was most dense from July to September, and that cargo vessels were the most common vessel type transiting through the area. Specifically within the Gully MPA boundaries, ~56% of transiting vessels, all carrying foreign flags, travelled at speeds higher than the recommended 10 knots. This analysis has helped to characterize vessel traffic as a possible threat to NBW within the Gully MPA. Similar analyses will be conducted on an ongoing basis to monitor the presence of this threat. A targeted letter campaign is being planned to increase awareness of recommended transit speeds.	3	11	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	References: Koropatnick et al. (2012)			
Habitat suitability modeling exercise applied to NBW-SSP	A recent study tested the use of a habitat suitability model as a potential means of predicting NBW-SSP distribution in the Maritimes Region. This model was based on a statistical analysis of the relationship between occurrence data and environmental variables, such as water depth, temperature, seafloor slope, and primary productivity. The results of the study suggested that with further refinement, this method could be effectively used to identify important habitat areas and improve our understanding of habitat use and distribution. An augmented version of this approach was also initiated in the NL Region to produce a comparative habitat use model. References: Gómez-Salazar and Moors-Murphy (2014)	1	N/A	DFO
NBW Recovery Potential Assessment	In 2010, a Recovery Potential Assessment for the NBW was undertaken by DFO in anticipation of the species' reassessment by COSEWIC in April 2011. The RPA includes scientific information and advice related to (1) the species' status, (2) the scope for management to facilitate recovery, and (3) scenarios for mitigation and alternatives to activities. References: DFO (2011); Harris et al. (2013)	1, 2, 3	10, 11, 12	DFO Other meeting participants
Species status reassessment by COSEWIC	In 2011, COSEWIC reassessed the status of NBW in Canadian waters based on the best available scientific information and found no change in the status of the Scotian Shelf population. For the first time, a geographic boundary was used to delineate the two known genetically distinct populations (also known as designatable units or DUs) in Canada. The status report acknowledged the uncertainty regarding the boundary between the DUs. Specifically, it is unclear to which DU animals sighted in the easternmost range of the Scotian Shelf DU, and the southernmost range of the Baffin Bay-Davis Strait-Labrador Sea DU, truly belong. Additional scientific study is needed to better understand the distribution of these two populations.	1	N/A	COSEWIC

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	References: COSEWIC (2011)			
DFO-Dalhousie University Academic Research Contribution Agreement related to studying the Gully, 2014-2019	In support of Gully MPA monitoring, the Whitehead Lab at Dalhousie University received funds through DFO's Academic Research Contribution Program to conduct several interrelated research studies involving NBW. This work, to occur over a five-year period, will include photo-identifications, scarring analysis, biopsy collection and analysis, and vocalization descriptions. It will help to increase knowledge of population dynamics, genetics, contaminant loads, diet, threats, and communication. Cruise planning and gear purchases were well underway by the spring of 2015 in preparation for summer field work.	1, 2	3, 6, 7, 8, 9, 11	Dalhousie University (Whitehead Lab) DFO
Management activities				
General				
Development of an Action Plan for the NBW-SSP	An Action Plan for the NBW-SSP was prepared. It puts forth a number of specific measures to be taken to address the threats posed to the species and its critical habitat, and to monitor its recovery. References: DFO (2015b)	All	All	Aboriginal organizations Academia DFO ENGOs Industry Other government departments and regulators
Activity plan approval process under the Gully MPA Regulations	Over the five-year reporting period, 21 activity approvals were issued for the Gully MPA. All proposed activities within the MPA follow the approval process as described in Sections 5 and 6 of the *Gully Marine Protected Area Regulations*. This includes an assessment of potential environmental or cumulative impacts, and the consideration of appropriate mitigation	3	11	DFO GAC

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	measures to minimize disturbance to NBW. Activities within Zones 1 and 2 must have a scientific research or monitoring component. References: DFO (2008; 2015c); DFO (2014e)			
SARA permitting processes	Over the five-year reporting period, 19 SARA Section 73 permits were issued for activities relating to the conservation of the NBW-SSP. These activities were evaluated by DFO and determined not to jeopardize the survival and recovery of the species. The permit conditions included mitigation measures to ensure minimal impact to the species. References: Species at Risk Public Registry (2015)	3	11	DFO
Identification of the "Eastern Scotian Shelf Canyons" as an Ecologically and Biologically Significant Area (EBSA)	The "Eastern Scotian Shelf Canyons", which encompasses the NBW-SSP critical habitat areas, is one of 18 offshore EBSAs identified through a regional peer review science advisory process (February 18-20 and March 24, 2014). EBSAs are areas that warrant a greater-than-usual degree of risk aversion in the management of activities. The identification of EBSAs on the Scotian Shelf will inform regional oceans planning and management, including the design of an MPA network. References: DFO (2014b)	3	N/A	DFO
Critical habitat				
Prohibition against the destruction of critical habitat applied to Zone 1 of the Gully Marine Protected Area	For the portion of critical habitat in Zone 1 of the Gully Marine Protected Area, a description was published in the *Canada Gazette* on August 14, 2010. Ninety days following this publication, the SARA subsection 58(1) prohibition against the destruction of critical habitat applied to this area. References: Government of Canada (2010)	3	13	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Amendments to the Recovery Strategy for the NBW-SSP	Amendments to the 2010 Recovery Strategy for the NBW-SSP, including a clearer description of the functions, features, and attributes of existing critical habitat areas, were made. These amendments were made to provide greater certainty with respect to the legal protection of critical habitat, as well as increased awareness among ocean users regarding how their activities may affect the components of critical habitat. References: DFO (2016a)	3	13	DFO
Development of a draft Critical Habitat Order for Shortland and Haldimand Canyons	For the Shortland Canyon and Haldimand Canyon critical habitat areas, protection will be afforded using a Critical Habitat 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.	3	13	DFO
Oil and gas activities				
Completion and review of strategic environmental assessments for offshore oil and gas exploration and development activities	During the reporting period, seven strategic environmental assessments (SEAs) were 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, including the NBW-SSP, within a certain geographic area. Public comments on the SEAs were sought and recorded on the CNSOPB Public Registry. DFO reviewed and provided extensive comments on each SEA, which included raising concerns regarding the completeness of the NBW information considered in the SEA and making recommendations regarding potential enhanced mitigation measures for beaked whales. SEAs conducted for areas in the NL Region were also reviewed, with consideration given to all species at risk, including the NBW-SSP. References: CNSOPB (2015a); C-NLOPB (2015a)	3	13	C-NLOPB CNSOPB DFO Industry Other government departments

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Completion and review of environmental assessments for seismic programs	During the reporting period, project-specific environmental assessments (EAs) were completed for two seismic exploration programs on the Scotian Shelf and Slope. Both EAs evaluated impacts to the NBW. Public comments on the EAs were sought and recorded on the CNSOPB Public Registry. DFO provided extensive comments, including comments relating to beaked whales. Background was provided on the particular challenges associated with detecting beaked whales and recommendations were made to maximize the probability of detection and enhance threat mitigation. For example, in the 2014 BP Tangier 3D seismic program, the standard observation time prior to airgun ramp-up was increased from the standard 30 minutes to 60 minutes if a beaked whale was detected. This enhanced mitigation measure was made a requirement through the environmental assessment process. A Marine Mammal Monitoring Plan must be approved by CNSOPB as part of the EA process for seismic programs. EAs conducted for areas in the NL Region were also reviewed, with consideration given to all species at risk, including the NBW-SSP. References: CNSOPB (2015b); C-NLOPB (2015b); LGL Limited (2014)	3	13	Aboriginal organizations BP Exploration (Canada) Limited C-NLOPB CNSOPB DFO ENGOs Industry Other government departments Shell Canada
Ongoing development of enhanced noise mitigation measures for seismic programs occurring within the vicinity of NBW-SSP critical habitat	The 2015 work plan under the Memorandum of Understanding between CNSOPB, DFO, and Environment Canada, included an objective to enhance the standard mitigation measures required to be taken by seismic operators when conducting work near areas of NBW-SSP critical habitat. Work toward meeting this objective is underway and will continue into the next reporting period. References: CNSOPB (2015c)	3	13	CNSOPB DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Emergency response				
Ongoing operation of the Marine Mammal Response Program (MMRP)	DFO supports regional marine mammal response networks through the umbrella MMRP. The mandate of the program is to work with partners to track and respond to incidents involving marine mammals, quantify threats, and provide information in support of SARA recovery planning. The funds, expertise, and other resources this program contributes represent an important contingency plan for mobilizing appropriate responses to incidents involving NBW. References: DFO (2014c)	1, 3	1, 5, 10	DFO
Ongoing operation of regional marine animal response networks	There are two primary whale response networks operating in Atlantic Canada: the Marine Animal Response Society (MARS), which covers all three Maritime provinces, and Whale Release and Strandings-NL (WRS-NL). Both organizations maintain a widely-advertised, toll-free phone line 24 hours a day, seven days a week. Trained experts are available through these networks to respond directly to reported incidents (e.g. live or dead stranding, entanglement) or provide advice on the most appropriate course of action. MARS and WRS-NL have been in operation since 1990 and 1979, respectively. In 2013, a National Stranding Network Steering Committee was formed to oversee the coordination of marine mammal response efforts across the country. The intent of the committee is to maintain and improve the operations of regional networks, foster consistency in response standards across regions, and encourage collaboration and knowledge-sharing.	1, 3	1, 5, 10, 11, 16	Canadian Wildlife Federation DFO MARS WRS-NL Other marine mammal response groups & experts from across Canada

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Fisheries				
Ongoing fisheries compliance monitoring and surveillance in the Gully MPA	Section 4 of the *Gully Marine Protected Area Regulations* (SOR/2004-112) prohibits all fishing in Zone 1 of the MPA, and restricts fishing in Zones 2 and 3 to certain fixed gear fisheries (i.e. longline directing for halibut, tuna, swordfish, and shark). DFO monitors compliance with this regulation through various means and in cooperation with other departments. Fishing activities in or near the Gully MPA are subject to close surveillance by DFO, and any suspicious activities are investigated. Such cases are rarely observed, and there have been no prosecutions under the *Oceans Act*. Fisheries compliance monitoring in the Gully MPA is important for minimizing the risk of NBW entanglement. References: DFO (2014g)	3	11	DFO Other government departments
Tourism and whale watching				
Proposed amendments to the *Marine Mammal Regulations* for the purpose of reducing disturbance to marine mammals	Marine mammals in Canadian waters are subject to the provisions of the *Marine Mammal Regulations* (MMRs) under the *Fisheries Act*. These regulations contain a prohibition against disturbing a marine mammal, except when fishing for marine mammals under the authority of the regulations. Proposed amendments to these regulations were put forward for public consultation in 2012. These amendments elaborate on the concept of disturbance and include enforceable guidelines for viewing marine mammals, such as minimum approach distances. The amendments are not yet in force, but would apply to NBW. The proposed amendments to the MMRs influenced the content of whale watching guidelines for the Gully MPA (see next entry). References: Government of Canada (2012)	3	13	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Development and distribution of whale watching guidelines for the Gully MPA	DFO whale watching guidelines for the Gully MPA were completed in 2013, and continue to be distributed to tour operators. Included are guidelines for approaching and observing whales; leaving whales; observing friendly whales that approach the vessel; and what to do in the event of contact or collision with a whale. These guidelines were developed primarily due to the concentration of NBW-SSP in the area and the interest shown in viewing this species. References: DFO (2013a)	3, 4	13, 14, 15, 16	DFO
Development of a tourism policy for the Gully MPA	DFO, with the multi-stakeholder Gully Advisory Committee, has developed a Gully MPA tourism policy that ensures maximum benefit to the whales, while minimizing any potential disturbances or cumulative impacts. The policy outlines various requirements for tourism activities, such as: inclusion of a research or monitoring component to meet regulatory requirements for activities in Zones 1 and 2; adherence to the Gully whale watching guidelines; submission of post-activity reports to DFO; and the completion of guest experience surveys. Activities such as water sports, recreational fishing, and deployment of smaller vessels from the main vessel will not be approved. References: DFO (2015c)	2, 3, 4	8, 11, 14	DFO GAC
Monitoring of an individual NBW in Spry Bay, NS	In October 2013, a single NBW was observed in Spry Bay, NS, following a similar sighting in Prospect Bay earlier that week. Such occurrences of live NBWs so near the coast are extremely rare. DFO's Conservation and Protection Branch was notified and Fishery Officers visited Spry Bay to monitor activities and ensure the whale was not harmed or harassed. MARS and staff from DFO's Ecosystem Management Branch also visited the site multiple times to monitor the situation. The whale did not appear to be in poor health and was observed feeding. After several days it left the bay and did not return. An attempt was made to photo-ID the individual, but no match was made.	3	13	DFO MARS

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Contaminants				
Ongoing oil pollution prevention and compliance monitoring	Transport Canada's National Aerial Surveillance Program (NASP) and Environment Canada's Integrated Satellite Tracking of Pollution (ISTOP) program are used to monitor Canada's oceans for illegal or accidental oil discharges from vessels. Both programs have contributed to decreasing oil discharges through deterrence and successful prosecutions. The Gully MPA coordinates were provided to the NASP flight planner in 2010, and since then the Gully has been included in aerial patrols whenever feasible. Gully coverage is variable, but averages 1-2 times a week. These patrols contribute to monitoring the threat of oil contamination in NBW-SSP critical habitat. References: TC (2013); EC (2014)	3	11	Environment Canada Transport Canada
Engagement, education, and outreach activities				
For targeted audiences (i.e. ocean users)				
Development of the "Marine Species Identification Guide Common to the Bay of Fundy and Scotian Shelf Region"	A marine animal identification key, including a full description of NBW, was developed by DFO and distributed to the fishing industry, whale watch companies, Fishery Officers, the Canadian Coast Guard, at-sea fishery observers, and marine mammal observers. Data sheets for recording whale sightings were also made available. DFO continues to receive reports of NBW and other marine animals through this outreach program. References: DFO (2013b)	4	14, 15, 16	DFO
Cetacean identification (and response) training programs	The following training sessions have included NBW: • Over the five-year reporting period, DFO Maritimes and NL Regions delivered cetacean identification training sessions upon request to at-sea fisheries observers, Fishery Officers, Canadian Wildlife Service (CWS) bird observers, and Defence Research and Development Canada (DRDC) researchers. • Throughout the reporting period, MARS has offered cetacean	1, 3, 4	1, 5, 10, 11, 14, 15, 16	DFO MARS WWF Canada

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	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. • Since 2012, WWF Canada has provided live and dead cetacean identification training to at-sea fisheries observers in Nova Scotia and NL. References: Reid and Wimmer (2011)			
Raising awareness of marine mammal incident response protocol	DFO has developed and is distributing a new handout entitled “Needed: information on entangled, injured or dead whales, dolphins or porpoises in the Maritimes”. This handout describes how to identify an entangled, injured, or dead whale, what information to record, and who to call to report an incident. Wider distribution within the Maritimes Region is planned for 2015/16. MARS and WRS-NL have developed and distributed outreach materials that raise awareness of their respective response networks and what to do if a stranded whale is encountered. For example, in 2011, MARS created an informational brochure, and in 2012, WRS-NL sent stickers with their toll-free number to ocean users in the region. Awareness campaigns increase the likelihood that trained personnel can respond to NBW incidents, and as a result more can be learned about the species and its threats. References: DFO (2014d)	4	14, 16	DFO MARS WRS-NL
Gully Advisory Committee (GAC) meetings	The GAC, a multi-stakeholder advisory body to DFO regarding the protection and management of the Gully Marine Protected Area, has a standing NBW-SSP agenda item where relevant research, monitoring,	4	16	Aboriginal organizations

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	and management activities are discussed. The GAC met five times over the five-year reporting period.			DFO (Chair) Other government departments and regulators Stakeholders
NBW-SSP critical habitat information included in the Canadian Coast Guard's Notices to Mariners	Notice 5 in the Annual Notices to Mariners is titled "General guidelines for aquatic species at risk and important marine mammal areas". This notice includes information on the NBW-SSP (status, physical description, threats) and critical habitat (map and coordinates). Avoidance of critical habitat areas is encouraged; however, if passage through these areas is necessary, the notice provides guidelines for minimizing risk to NBW. A link to the NBW-SSP Recovery Strategy is provided, as are incident and sightings reporting protocols. This notice is reviewed annually and updated as necessary. References: CCG (2015)	4	14, 16	DFO
Publication of "A Mariner's Guide to Whales in the Northwest Atlantic"	This guide includes information on factors that increase the risk of whale-ship collisions and discusses potential solutions. Species profiles for several cetaceans are provided, including the NBW. These profiles highlight the species' physical attributes, known threats, characteristic behaviours, and vulnerability to ship strikes. Each profile is accompanied by a map showing where the species is known to aggregate. References: ROMM (2014)	4	14, 15, 16	Dalhousie University Réseau d'observation de mammifères marins (ROMM) Shipping Federation of Canada

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
For broader audiences				
NBW videos posted on YouTube	Video 1: A 15-minute video, titled "The Gully Marine Protected Area: A Diversity of Life and a Sanctuary for Whales", was posted on YouTube on January 13, 2014. The NBW is featured prominently in the video. As of May 11, 2015, the video had been viewed 1040 times. http://www.youtube.com/watch?v=x7JLD8lu_fE Video 2: A two-minute video, titled "Hal Whitehead on the Gully and endangered northern bottlenose whales", was posted on YouTube on May 15, 2014. As of May 11, 2015 the video had been viewed 406 times. http://www.youtube.com/watch?v=tSIjnWR4lXo	4	15	Video 1: DFO Dalhousie University Video 2: WWF Canada
NBW webpage profiles	The NBW-SSP has been profiled on DFO's aquatic species at risk webpage since 2004. This web content was updated in August 2010. The NBW is also profiled on other webpages, such as MARS, where new content was also recently added. References: DFO (2010c); MARS (2015)	4	14, 15	DFO MARS
Short film titled "Studying Whales of the Gully" shown in the 2011 Halifax Oceans Film Festival	A 20-minute film featuring the work of cetacean scientists during a research cruise in the Gully MPA was shown at the 2nd Annual Halifax Oceans Film Festival. The primary focus of the film was NBW research. Approximately 80 people were estimated to have attended the screening.	4	14, 15	Hilary Moors (in affiliation with the Whitehead Lab, Dalhousie University)
Photo exhibit titled "Watching Whales: On the Surface of their World"	In November 2011, the ViewPoint Gallery in downtown Halifax featured the photography of Jennifer Modigliani, which included photos of NBW and NBW research activities during visits to the Gully MPA.	4	14	Jennifer Modigliani (in affiliation with Images by Modigliani and Sacajawea Tours)

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
News articles (including print, television, and radio)	The NBW-SSP has been featured in several stories in the news media, including The Chronicle Herald, CBC Information Morning Nova Scotia, Dal News, Breakfast Television, CTV Atlantic Morning, CBC News: Nova Scotia, and the Canadian Ocean Science Newsletter. These news items featured NBW research and/or promoted events (e.g. exhibits, film festivals) where the NBW-SSP was profiled. There were also other news items during the five-year reporting period that focused on the Gully MPA, with brief mentions of the NBW. References: Smulders (2010); Lee (2010); McNutt (2011); Moors-Murphy (2014)	4	14	Primarily featured work done at Dalhousie University (Whitehead Lab) and DFO Also includes interviews given by Jennifer Modigliani in relation to her 2011 photo exhibit (see previous entry)
Inclusion of Gully and NBW-SSP information in a 2012 EdGeo workshop	Information on the NBW-SSP and the Gully was presented by DFO at a Halifax workshop funded by EdGeo (also known as the Canadian Earth Science Teacher Workshop Program). Such local workshops provide knowledge, field experiences, and classroom resources to teachers.	4	14, 15	DFO EdGeo
Development and launch of "Tide to Technology" high school science program	In 2014, the "Tide to Technology" high school science program was launched in Halifax. This program includes a module dedicated to studying whales, including the NBW, and their vocalizations. The program was delivered over 20 times in schools across Nova Scotia in 2014. It is expected that it will continue to be available in the 2015/16 school year.	4	14, 15	Aerospace and Defence Industries Association of Nova Scotia DFO Discovery Centre Ocean Technology Council of Nova Scotia
Development and distribution of outreach materials	Outreach materials developed for the Gully MPA feature the NBW-SSP. These materials include a brochure/fold-out poster (available since 2008), a colouring book (available since 2010), and temporary tattoos (available since 2012). These materials are regularly distributed at events, and as	4	14, 15	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	part of educational outreach. References: DFO (2010d); DFO (2010e)			
Participation in World Oceans Day events	The NBW is featured prominently at DFO's booth at the annual World Oceans Day event in Halifax. This event, held at the beginning of June at the Maritime Museum of the Atlantic, draws hundreds of people each year. Photographs, video, and acoustic recordings of the NBW are on exhibit, and outreach materials are distributed. A cetacean scientist with expertise in NBW biology is available to answer questions. The NBW is also featured at the DFO booth at a similar event in St. John's, NL. In 2014, a "Whales and Sounds" booth was included in the Oceans Day event at the Discovery Centre in Halifax. Demonstrations were given on the use of hydrophones and spectrographic analysis software to capture and analyze whale vocalizations, including NBW.	4	14, 15, 16	DFO JASCO Applied Sciences
Classroom presentations	Classroom presentations on the NBW, often in conjunction with the Gully MPA, were given at daycares, summer camps, after-school programs, elementary schools, middle schools, high schools, and universities in Nova Scotia and NL. Dalhousie University's undergraduate Marine Mammalogy course, offered annually, discusses NBW in a focused beaked whale lecture, as well as in the context of whale acoustics and conservation and management. Dalhousie's first year biology course also includes a NBW photo-identification lab activity.	4	14, 15	Dalhousie University (Whitehead Lab) DFO
Public lectures	At least ten public lectures on the Gully MPA and/or NBW were given at the following locations: the Nova Scotia Museum of Natural History, the Halifax Oceans Film Festival, the Ottawa Public Library, the Huntsman Aquarium, the Bedford Institute of Oceanography, the Mersey Tobeatic Research Institute, and the Discovery Centre. Presentations were also given to tourists during excursions to Sable Island and the Gully MPA (annually from 2011-2014).	4	14, 15	Dalhousie University (Whitehead Lab) DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Conference presentations and other academic seminars	NBW-SSP research results were presented at nine local and international conferences, and at two regional academic seminar series (the Acadia University Biology Seminar Series and the DFO Ocean and Ecosystem Science Seminar Series). References: Dunn and Moors (2011); Moors (2012b); Moors (2012c); O'Brien and Whitehead (2012a); O'Brien and Whitehead (2012b); O'Brien (2013b); Martin and Moors-Murphy (2013b); Martin et al. (2014); Martin et al. (2015)	4	14, 15	Dalhousie University (Whitehead Lab) DFO JASCO Applied Sciences
Gully 10th anniversary celebrations	May 2014 marked the 10th anniversary of the Gully Marine Protected Area designation. Public events to celebrate this occasion included interactive displays at the Nova Scotia Museum of Natural History during spring break (March 2014), and during Open City Halifax (May 2014). A "Whales and Sounds" booth, which included NBW sounds, was set up at the latter event. A formal celebration event was co-hosted by DFO and WWF Canada at the Nova Scotia Museum of Natural History in June 2014. Representatives from government, First Nations and other Aboriginal organizations, industry, environmental non-government organizations, and academia were invited to attend. Hal Whitehead, a NBW expert, was a featured speaker at the event. In conjunction with the 10th anniversary of the Gully MPA, WWF Canada blogged about the MPA and NBW and created a NBW-SSP infographic. DFO also published a 10-year Gully MPA progress report, which included information on NBW-SSP research. References: WWF Canada (2014); Wimmer (2014a); Wimmer (2014b); DFO (2014g)	4	14, 15	DFO JASCO Applied Sciences WWF Canada
Outreach and education through the Bedford Institute of Oceanography	The "Gully Theatre" at the Bedford Institute of Oceanography (BIO) in Dartmouth, NS is an educational display about the Gully MPA that is open for guided or self-guided tours. This display features the NBW-SSP prominently, and is explored by thousands of visitors each year. Occasionally, presentations by DFO experts on the Gully and NBW are	4	14, 15	DFO

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
	included as part of the tour. In 2012, the Gully MPA and NBW-SSP were featured at BIO's special 50th anniversary open house. Up to 10,000 people visited this event geared toward informing the public about the scientific research and oceans management work being done at the institute. Outreach materials were distributed and experts were available to field questions from the public. Several high school co-op placements offered through BIO have focused on cetacean research and data entry. These students learned about the NBW through their co-op experiences.			
Educational outreach by Fishery Officers	Fishery Officers regularly engage with fishermen and the public for the purposes of education and stewardship. Species at risk awareness is raised during boat patrols and conversations at wharves. Fishery Officers also visit schools to talk about their role in ocean conservation.	4	14, 15, 16	DFO
DFO booths at public events	The Conservation and Protection Branch of DFO hosts a booth at the annual Atlantic Outdoor Sports and RV Show in Halifax, NS. For the past few years, the Ecosystem Management Branch has provided Gully and species at risk outreach materials for distribution, as well as posters and whale videos for display at the booth. DFO hosted a booth at the annual Hope for Wildlife Open House in August 2013 and 2014. Gully MPA outreach materials and species at risk activity books were distributed as part of this event. DFO staff gave brief presentations about the Gully ecosystem to interested visitors. Attendance at this open house has reached up to 2500 people, depending on weather.	4	15, 16	DFO
Planning underway for a new deep-sea exhibit at the Nova Scotia Museum of Natural History	In 2014, DFO and the Nova Scotia Museum of Natural History began discussing the creation of a new permanent, interactive museum exhibit focused on the Gully and deep-sea animals, including the NBW. The design phase of the project was initiated in early 2015.	4	14, 15	DFO NS Museum of Natural History

Recovery activity	Description and results	Rec. Obj.	Perf. Ind.	Participants
Regional DFO Twitter accounts opened	In 2011 and 2014, respectively, DFO's NL Region and Maritimes Region opened Twitter accounts. These accounts are used to notify followers of consultations, publications, and other news regarding aquatic species at risk, including NBW-SSP. Twitter handles: @DFO_MAR @DFO_NL	4	15, 16	DFO

3.2. Activities supporting the identification of critical habitat

Recognizing that other areas of critical habitat may exist, Section 1.9.2 of the Recovery Strategy (DFO 2010a) included a Schedule of Studies (SOS) to support the identification of additional critical habitat. The recently amended Recovery Strategy (DFO 2015a) expands upon the SOS, and progress toward its implementation will be reported following the next five-year reporting period. Table 5 outlines the implementation of the SOS to date. Each study has been assigned one of four statuses:

1) *Completed:* the study has been carried out and concluded
2) *In progress:* the study is underway and has not concluded
3) *Not started*: the study has been planned but has yet to start
4) *Cancelled*: the study will not be started or completed

Table 5. Summary of progress made toward implementing the Schedule of Studies from the Recovery Strategy (DFO 2010a).

Study	Timeline	Status	Details	Rec. Obj.	Perf. Ind.	Participants
Acoustic and visual monitoring of shelf break between the Gully, Shortland Canyon, and Haldimand Canyon	2010-2011* *As put forward in the 2010 Recovery Strategy. Due to the complexity and volume of work involved in this project, it could not be completed in one year.	In progress	An analysis of underwater acoustic recordings collected on the Scotian Slope between 2006 and 2009 was completed in 2012. The results of this analysis demonstrated that passive acoustic monitoring methods could be successfully used to study the occurrence of NBW over time. The data revealed that NBW are year-round residents of the Eastern Scotian Shelf canyons, and that the areas between the canyons are used for foraging as well as migrating between canyons. Days- to week-long deployments of acoustic recorders were conducted in the Gully in 2010 and 2011 to test newer units for recording NBW clicks. Between October 2012 and October 2014, these acoustic recorders were deployed at three sites for 5-7 month periods with 1-2 month breaks between deployments: 1) in the Gully, 2) between the Gully and Shortland Canyon, and 3) between Shortland and Haldimand Canyons. Beaked whale vocalization frequencies were recorded for two minutes at 15-20 minute intervals. The resulting passive acoustic data are more extensive than previous acoustic datasets and are being analyzed for NBW clicks to make more detailed inferences about the species' presence in, and use of, these areas throughout the year. The data are also being analyzed for ambient and anthropogenic noise sources and levels. An acoustic recorder was again deployed in May 2015 in the Gully. This unit is expected to be in place until 2017. References: Moors (2012a); Cochrane and Moors-Murphy (2013)	1, 2	3	Dalhousie University (Whitehead Lab) DFO JASCO Applied Sciences

3.3. Summary of progress

Table 6 provides a summary of the progress made toward meeting the performance indicators outlined in Table 2. 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 6. Summary of progress made toward meeting the performance indicators.

Performance indicator	Status	Comments	Next steps/recommendations
Objective 1: Improve understanding of Northern Bottlenose Whale ecology, including critical habitat requirements, carrying capacity, breeding, trophic interactions, links with other populations (e.g. Davis Strait), and sources of mortality			
(1) Sources of mortality have been identified and quantified	Not met	- Three dead NBWs were reported within the geographic range of the Scotian Shelf population. - Two were found near shore in an advanced state of decomposition (1 in SW NL and 1 in St. Pierre and Miquelon), and one was found far offshore. None were retrieved. - Since no necropsies were conducted, it could not be determined whether these NBW mortalities were related to natural or anthropogenic causes.	- Evaluate how to improve the success of carcass retrieval efforts and implement changes as appropriate. - Advancing offshore response to reports of dead NBW will be explored as part of Action Plan implementation. This may include the development and sharing of clear protocols and guidance. - Continue an ongoing awareness campaign to (a) improve the probability of NBW mortalities being reported, and (b) improve photographic and written documentation of mortalities. - It will not be possible to identify a source of mortality in every case, such as when a carcass cannot be retrieved, or when the results of a necropsy are inconclusive. Furthermore, NBW mortalities and strandings are rarely observed due to their offshore distribution. Recognizing these realities, this performance indicator will be considered to be “partially met, underway” when at least one animal has been necropsied. It will be considered “met, ongoing” once there is a sufficient sample size to draw some conclusions about threat-related mortality.

Performance indicator	Status	Comments	Next steps/recommendations
(2) Carrying capacity of NBW habitat has been quantified	Not met	- Carrying capacity has not been quantified due to data limitations.	- This performance indicator is not considered practical for this particular population given historic population numbers are unknown. - While carrying capacity could potentially be estimated indirectly, there are inherent challenges associated with taking such an approach. - This performance indicator should be removed or replaced with one that is more attainable.
(3) Studies outlined in the Schedule of Studies (refer to Recovery Strategy) have been completed	Partially met, underway	- There have been several deployments of acoustic recorders in the areas between the canyons since the Recovery Strategy was published (e.g. Moors 2012; Cochrane and Moors-Murphy 2013). - Visual survey effort has been limited in between canyons.	- Results to date strongly suggest that the areas between the canyons are used for foraging, in addition to serving as inter-canyon migration corridors. There is also evidence to suggest that the areas between the canyons are used more frequently by NBW than was previously understood. - Further analysis of the acoustic data collected is required to better understand the extent to which the NBW-SSP relies upon the between-canyon areas to carry out life processes. - More extensive visual survey effort is needed to confirm the presence and behaviours of NBW between the canyons. - Depending on the outcomes of the remaining analyses, it may be necessary to amend the Recovery Strategy to identify additional critical habitat for this population. Results of these analyses are expected in the 2015-16 fiscal year, and pending the outcomes, the need to identify additional critical habitat will be revisited.

Performance indicator	Status	Comments	Next steps/recommendations
(4) Prey composition and prey availability have been evaluated	Partially met, underway	- Prey composition was not studied during the reporting period. - The currently ongoing analyses of specimens taken from the lower trophic levels of the Gully ecosystem constitute a starting point for studying NBW prey availability.	- Work that builds on that of Hooker et al. (2001) is needed to better understand prey composition (e.g. using stomach content analysis, stable isotope and fatty acid analysis of skin and blubber samples, or other novel methods). - There are technical challenges associated with attempting to catch adult male *Gonatus* squid, which are large and active and may require different capture methods than traditional trawl sampling. The availability of prey outside of the Gully also needs to be evaluated.
(5) Qualified, trained persons have responded to all strandings in a timely manner	Met, ongoing	- Over the reporting period, there was one NBW (dead) stranding recorded within Canadian jurisdiction (the other two known NBW mortalities were either offshore or within the Exclusive Economic Zone of France). In this case, an appropriately qualified and trained individual was made aware of the stranding. An unsuccessful effort was launched to relocate the carcass so that measurements and tissue samples could be taken.	- Response to all reported incidents, including strandings, entanglements, and other injuries or mortalities should continue whenever feasible. - Specific protocols for responding to offshore incidents should be developed. - The effectiveness and timeliness of response efforts should be assessed regularly and improved upon as needed.
Objective 2: Improve understanding of the population size, trend and distribution			
(6) Population size has been regularly assessed (c. ≤ 5 years)	Met, ongoing	- A new population size estimate was calculated based on the work of O'Brien and Whitehead (2013).	- An updated population size estimate is expected within the next five years based on the proposed work of the Whitehead Lab (Dalhousie University) (refer to Section 3.1).
(7) Population trend estimates are considered accurate within +/- 5%	Partially met, underway	- Population trend estimates are not accurate to a precision of +/- 5% because the population size estimates (on which the trend is based) are not to that precision.	- A +/- 5% precision level for population size has been deemed unrealistic, and should be replaced with a +/- 10% precision level.

Performance indicator	Status	Comments	Next steps/recommendations
(8) Abundance has been regularly monitored in the Gully, Haldimand and Shortland Canyons and adjacent areas	Met, ongoing	- There have been several visual and acoustic surveys within and between the three canyons during the reporting period, the results of which have fed into abundance monitoring and the calculation of a new population estimate.	- Continued visual and acoustic monitoring of known important habitat areas for the NBW-SSP is required for ongoing assessments of population size, health, and behaviour. - Where possible, abundances in other known habitat areas should also be monitored.
(9) A population trend has been regularly calculated using the most recent available data	Met, ongoing	- A population trend was calculated for the period 1988-2011.	- Population trend will continue to be assessed as additional population data become available (approximately every five years).
Objective 3: Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, petroleum development, noise, and contaminants, and develop management measures to reduce threats where necessary			
(10) The contribution of anthropogenic threats to mortality has been quantified for each known threat	Not met	- See Performance Indicator 1.	- See Performance Indicator 1.
(11) The extent and severity of threats has been routinely monitored	Partially met, underway	- New technology has allowed for significant gains to be made in routinely monitoring the threat of oil contamination and vessel traffic in high-use NBW habitat areas. - Monitoring and quantifying the threat of noise to the NBW-SSP remains a challenge. - There were no new records of NBW-SSP entanglement during the reporting period. - No work was completed on the threat of food chain contamination or the effects of non-point source pollution.	- Regular monitoring of oil contamination and vessel traffic should continue. A risk analysis using LRIT and/or AIS data sets would help to better quantify the threat of vessel strikes. - Since noise is considered the threat of highest concern for this population, assessing its effects will continue to be a priority. - The extent and severity of the threat posed by entanglement remains poorly understood. Further study is needed to quantify this threat (e.g. the Whitehead Lab will be analyzing photographs to determine scarring rates from entanglement - refer to Section 3.1). - Contaminant profiles of the NBW and/or its prey are needed to help characterize the

Performance indicator	Status	Comments	Next steps/recommendations
			potential impact of contamination on the population (a study of this nature is already planned by the Whitehead Lab – refer to Section 3.1).
(12) Anthropogenic mortality is within the recommended potential biological removal (PBR), and individual mortalities and mortality trends are tracked for this population	Unknown	- In the 2007 NBW Recovery Potential Assessment, the Potential Biological Removal (PBR) due to anthropogenic causes was calculated as 0.3 animals per year. - Three mortalities were documented during the five-year reporting period, an average of 0.6 animals per year, which exceeds PBR only if two or more of those mortalities were caused by human activities. - Since the causes of death are unknown, this performance indicator cannot be evaluated.	- Further progress on Performance Indicator 1 is required before progress on this indicator can be measured. - The PBR should be updated using the most recent NBW population estimate, which is more precise than the estimate used previously.
(13) Additional management measures have been put in place to protect against PBR being exceeded	Met, ongoing	- Additional management measures were introduced as deemed necessary to protect the NBW-SSP. These measures included Gully-specific whale watching guidelines and enhanced mitigation during seismic surveys near beaked whale habitat. - Work is currently underway to identify best management practices to mitigate the effects of seismic surveys on whales (e.g. DFO 2015a; 2015b).	- The need for additional management measures will be continuously evaluated against best practices and new information. - Since fisheries interactions with the NBW-SSP are not well understood, additional mitigation measures may be explored once more is learned about this threat.
Objective 4: Engage stakeholders and the public in recovery action through education and stewardship			
(14) Awareness and training programmes are underway to target key user groups, government, and the general public	Met, ongoing	- Awareness of the NBW-SSP and its threats was raised among stakeholders, government, and the public through various mechanisms, including the Gully Advisory Committee, the distribution of outreach materials, targeted communications, poster	- Continue existing efforts over the next five years and explore new opportunities.

Performance indicator	Status	Comments	Next steps/recommendations
		awareness campaigns, public lectures/classroom visits, multimedia, news media coverage, and targeted cetacean identification and response training.	
(15) Education materials have been developed and disseminated	Met, ongoing	- Educational materials featuring the NBW have been developed and distributed at a variety of venues and events. - A new educational program that includes a focus on NBW sounds was developed. - Several classroom and public presentations featuring the NBW-SSP were delivered.	- Continue existing efforts over the next five years and explore new opportunities.
(16) Stakeholders and the public are engaged in stewardship activities	Met, ongoing	- Stewardship has been encouraged among stakeholder groups through the Annual Notices to Mariners, a poster awareness campaign, whale identification and response training, and whale watching guidelines.	- Continue existing efforts over the next five years and explore new opportunities.

4. Concluding statement

The information presented in Tables 4-6 provides many examples of how, and to what extent, the NBW-SSP Recovery Strategy has been implemented by DFO and its partners during the reporting period. Activities have been undertaken in support of all four recovery objectives. Half of the 16 performance indicators have been met; however, all of these will require ongoing action to maintain the progress made on recovery strategy implementation. One quarter of the performance indicators were partially met and three were not met during the reporting period. Two of the indicators that were not met related to the quantification of the rate and sources of NBW mortality.

The primarily offshore distribution of this species makes it challenging to observe and respond to incidents involving the NBW-SSP. A poster campaign is ongoing to raise awareness among ocean users about the need for information on encounters with dead, entangled, or injured whales. One of the anticipated outcomes of this campaign is an increased likelihood of dead or injured whales being reported and documented. There are also plans to evaluate how to effectively respond to offshore incidents, so that there may be a greater chance of saving an NBW in distress or retrieving a carcass for necropsy. Other elements of recovery strategy implementation that require more attention include quantifying the threat of entanglement, assessing prey composition, and measuring food chain contaminant levels. Acoustic disturbance continues to be a threat of particular concern for this population, as noise from several sources is becoming increasingly pervasive in the marine environment. Furthering our understanding of the effects of noise on this species will continue to be a high priority, as will the development of appropriate mitigation measures.

Work done by the Whitehead Lab (Dalhousie University), in partnership with DFO, has contributed significantly to addressing Recovery Objective 2. The high quality and number of digital photographs collected over the past decade, coupled with the availability of powerful photo editing software, has advanced the NBW photo-identification catalogue significantly. This has allowed for progressively more rigorous and precise estimates of population size and trend to be calculated. Regular visual and acoustic surveys have also contributed to a better understanding of abundance and distribution. While the Gully, Shortland, and Haldimand canyon habitats continue to be areas of concentration for the NBW-SSP, less is known about how the population uses other areas of the Scotian Shelf/Slope and the Grand Banks. The Action Plan for the NBW-SSP includes measures aimed at obtaining the scientific information needed to delineate the population’s range and to better understand distribution outside of the submarine canyons.

Considerable work has been done to address Recovery Objective 4, including efforts to engage ocean users directly, as well as raise awareness of the species and its threats among the public. Public exposure to this species is limited due to its predominantly offshore distribution. Through the activities profiled in this report, the NBW-SSP has been introduced to Canadians of all generations. Although it is difficult to measure the impact of outreach and education on species recovery directly, the existence value

placed on the NBW-SSP by the public is expected to have long-term benefits. Targeted engagement of resource users in NBW-SSP recovery likely has more immediate effects, but these are also challenging to quantify. Methods to better understand the influence of stakeholder and public engagement on NBW recovery could be explored in the future.

Overall, progress was made toward implementing the NBW-SSP Recovery Strategy during the first five-year reporting period; particularly in advancing the understanding of the population and promoting management measures that mitigate threats to its recovery. The recovery goal, which is to “achieve a stable or increasing population and to maintain, at a minimum, current distribution”, was reached at least in part. A recent study conducted by O’Brien and Whitehead (2013) revealed a stable population trend over the period 1988-2011. The extent to which distribution patterns were maintained cannot be fully assessed since habitat use outside of the Eastern Scotian Shelf canyons (including the inter-canyon areas) is not well-studied and has not been monitored. However, the use of critical habitat and surrounding areas has been consistent over time. The work started and completed to date has built a strong foundation for continued research and successful management of this species over the next five years.

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