

Action Plan for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters

Northern Bottlenose Whale



2016

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¹ www.registrelep.gc.ca/default_e.cfm

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as Extirpated, Endangered, and Threatened for which recovery has been deemed feasible. They are also required to report on progress five years after the publication of the final document on the SAR Public Registry.

Under SARA, one or more action plan(s) provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines what needs to be done to achieve the population and distribution objectives (previously referred to as recovery goals and objectives) identified in the recovery strategy, including the measures to be taken to address the threats and monitor the recovery of the species, as well as the proposed measures to protect critical habitat that has been identified for the species. The action plan also includes an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. The action plan is considered one in a series of documents that are linked and should be taken into consideration together. Those being the COSEWIC status report, the recovery strategy, and one or more action plans.

The Minister of Fisheries and Oceans is the competent minister under SARA for the Northern Bottlenose Whale, Scotian Shelf population and has prepared this Action Plan to implement the Recovery Strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with other federal government departments, provincial government departments, Aboriginal organizations, and stakeholders (Appendix B).

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by Fisheries and Oceans Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the Northern Bottlenose Whale, Scotian Shelf population and Canadian society as a whole.

Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

² http://www.sararegistry.gc.ca/approach/strategy/Accord_Background_E.pdf

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Executive summary

The Scotian Shelf population of Northern Bottlenose Whales was listed as Endangered under the *Species at Risk Act* (S.C. 2002, c. 29) in 2006. A “Recovery Strategy for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters” was published in 2010, and was amended in 2016 (DFO 2010a; 2016). This Action Plan identifies activities (“recovery measures”) that will help achieve the recovery goals and strategies outlined in the Recovery Strategy.

The recovery goal for the Scotian Shelf Northern Bottlenose Whale population, as presented in the Recovery Strategy, is “*to achieve a stable or increasing population and to maintain, at a minimum, current distribution*”. This goal is supported by four recovery objectives. Broadly, these objectives seek to:

1. Improve understanding of Northern Bottlenose Whale ecology.
2. Improve understanding of population size, trend, and distribution
3. Improve understanding of, and appropriately mitigate, anthropogenic threats.
4. Engage stakeholders and the public in Northern Bottlenose Whale recovery.

These four recovery objectives informed the development of the 23 recovery measures proposed in this Action Plan. These recovery measures are considered required actions to achieve the recovery goal and objectives for the Northern Bottlenose Whale (Scotian Shelf population), and to address all currently identified threats. The recovery measures are described in Section 1.2 of this Action Plan. The Implementation Schedule summarizes and organizes these recovery measures according to which groups or organizations will lead the activity (Tables 1-3). For each recovery measure, a priority level, a list of participants and a status/timeline have been identified.

Critical habitat for the Scotian Shelf Northern Bottlenose Whale population is identified in Section 1.9 of the Recovery Strategy and includes deep-water areas within the Gully, Shortland and Haldimand canyons (DFO 2010a; 2016). This Action Plan proposes measures that will contribute to understanding and protecting that critical habitat.

Successful recovery of the Scotian Shelf Northern Bottlenose Whale population depends on the commitment and cooperation of many organizations that will implement the measures set out in this Action Plan. The Action Plan is designed to provide guidance to managers and partners seeking to implement specific recovery measures. The Action Plan builds upon the successful activities already underway by identifying new or complementary activities that have yet to be initiated or are in need of further improvement.

This Action Plan is expected to contribute to achieving the recovery goal for the Northern Bottlenose Whale. It is also expected to benefit other species that share similar habitat areas or threat sensitivities. The costs associated with implementing the recovery measures identified in this Action Plan range from negligible to >\$500,000,

depending on the measure. Distribution of the incremental costs and benefits of this Action Plan among stakeholders cannot be quantified at this time.

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1. Recovery actions

1.1 Context and scope of the Action Plan

The Northern Bottlenose Whale (*Hyperoodon ampullatus*) is a beaked whale, typically 6-9 m in length, found exclusively in the North Atlantic. The Scotian Shelf population is observed regularly within and between three offshore submarine canyons: the Gully, Shortland Canyon and Haldimand Canyon. In November 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Northern Bottlenose Whale (Scotian Shelf population) as Endangered. In 2006, this population was listed as Endangered under the federal *Species at Risk Act* (SARA) (S.C. 2002, c. 29). The most recent COSEWIC assessment of this population in May 2011 re-affirmed the Endangered status (COSEWIC 2011). Threats to the species include entanglement, oil and gas activities, acoustic disturbance, contaminants, changes in food supply, and vessel strikes (DFO 2010a; COSEWIC 2011).

The purpose of this Action Plan is to guide and support recovery of the population by identifying activities (“recovery measures”) to help achieve the recovery goal and objectives outlined in the “Recovery Strategy for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters” (DFO 2010a) (hereafter referred to as the “Recovery Strategy”). This Action Plan complements the Recovery Strategy, which provides more details on the strategic direction and approaches for recovery, critical habitat information, and background information on the species and its threats.

As stated in the Recovery Strategy, the recovery goal for this population is:

“...to achieve a stable or increasing population and to maintain, at a minimum, current distribution” (DFO 2010a).

Four recovery objectives that support this recovery goal were presented in the Recovery Strategy, and are reiterated in Section 1.2 of this Action Plan. In the Recovery Strategy, each of the four recovery objectives is accompanied by a series of strategies to help achieve the objectives. These strategies informed the development of the recovery measures described in this Action Plan. Action planning for species at risk recovery is an iterative process. The Implementation Schedule in this Action Plan may be modified in the future depending on the progression towards recovery.

This Action Plan pertains to the Scotian Shelf Northern Bottlenose Whale (Scotian Shelf population) throughout its range, and seeks to build on previous and ongoing recovery activities. Section 1.2 provides a detailed description of the recovery measures, which are then summarized in the Implementation Schedule in Section 1.3. The Implementation Schedule comprises three tables based on which groups or organizations are leading the activities listed therein. Section 1.4 describes where to find information on the critical habitat identified for the population, while Section 1.5 describes the mechanisms through which the identified critical habitat is or will be legally protected under SARA. Section 2 provides a socio-economic analysis of the

costs and benefits of implementing this Action Plan and Section 3 provides a brief description of how DFO will report on implementation.

1.2 Description of recovery measures

Below is a detailed description of, and rationale for, the recovery measures that provides the best chance of achieving the recovery goal for the Northern Bottlenose Whale, Scotian Shelf population. The recovery measures are organized according to the four recovery objectives in the Recovery Strategy. Each recovery measure described below has been assigned a number (1-23). The same numbering system is used to identify the recovery measures within the Implementation Schedule (Section 1.3; Tables 1-3).

1.2.1 Recovery 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. Undertake surveys to evaluate squid composition, distribution and abundance within high-use habitat areas (Table 3).

Priority: Medium

Northern Bottlenose Whales feed mainly on squid species in the genus *Gonatus* (DFO 2010a). Although little is known about the distribution and abundance of *Gonatus* squid on the Scotian Shelf or within identified Northern Bottlenose Whale critical habitat, Armhook Squid (*G. steenstrupi*) is thought to be their primary prey species (Hooker et al. 2001). Information on prey composition and availability within high-use areas (critical habitat and other areas frequently used by the whales that are not currently identified as critical habitat) will provide a better understanding of the functional characteristics of critical habitat, as well as how the whales are using different areas and their relative importance to the population. Knowledge of the distribution and abundance of *Gonatus* squid on the Scotian Shelf may also help predict or identify other critical habitat areas for the population.

During preliminary research to better understand food-web dynamics and to quantify prey distribution and abundance within the Gully Marine Protected Area (MPA), DFO conducted mesopelagic, or mid-water trawls (in depths between 200 and 1000 m) from 2007-2010 (MacIsaac et al. 2014; Kenchington et al. 2014). This work yielded little data on squid populations in the Gully. As outlined in the Schedule of Studies in the Recovery Strategy, further research is needed to assess squid composition, abundance and distribution in the Gully, Shortland and Haldimand canyons, and in other areas of the Scotian Shelf.

2. Conduct studies on social behaviour, reproduction and movement patterns of the Scotian Shelf population:

- a. Use photo-identification, and other novel methods, to examine the age-sex structure and reproductive characteristics of the population (Table 3).**
- b. Use photo-identification to better understand the social structure and movement patterns of the population (Table 3).**
- c. Conduct satellite-tagging studies to examine the movement patterns of individuals (Table 3).**

Priority: Medium

Knowing when and where the whales socialize, mate, give birth to and rear their young is necessary to evaluate the importance of particular areas to the population. Studies of pregnancy and birth rates and age-sex structure of the population can also be used to monitor population health. Little is currently known about pregnancy rates; however, novel approaches such as analyzing hormones in blow samples could provide valuable information on reproductive function (Hogg et al. 2009). Monitoring population health and understanding where important life functions occur are essential for ensuring that adequate protection measures and management actions are in place to support recovery goals.

The Schedule of Studies in the Recovery Strategy includes monitoring whale movements among and between the three canyons to better understand how the population is using the identified critical habitat and adjacent areas. Studies on the behaviour and movement patterns of Scotian Shelf Northern Bottlenose Whales have been led by the Whitehead Lab at Dalhousie University (Whitehead Lab) since the 1980s (e.g. Gowans et al. 2000; Gowans and Whitehead 2001; Gowans et al. 2001; Hooker et al. 2002; Wimmer and Whitehead 2004; Whitehead and Wimmer 2005; O'Brien 2013), and this research program is expected to continue. Currently, a focused effort is being made to identify and catalogue individual Northern Bottlenose Whales by photographing and analyzing unique markings on their backs and dorsal fins. Photo-identification has proven to be a highly effective method for assessing the abundance, life history traits, and social organization of other whale populations in Canada (e.g. Ellis et al. 2011; Towers et al. 2012). All of the Northern Bottlenose Whale photographs collected are stored in DFO's Beaked Whale Multimedia Database and the Beaked Whale Digital Photo-Identification Catalogue (Recovery Measure 7). Satellite-tagging studies could also provide information about the movements of individuals over long time scales. No studies of this nature are currently planned for the near future.

This recovery measure is closely related to Recovery Measure 5, which considers the spatial and temporal distribution patterns of the Scotian Shelf population.

3. Investigate Northern Bottlenose Whale foraging and diving behaviour (Table 3).**Priority: High**

Studies of foraging and diving behaviour will increase our understanding of Northern Bottlenose Whale foraging ecology which in turn can contribute to understanding the carrying capacity of their critical habitat areas (i.e. the maximum number of whales that their habitat can support). Knowing Northern Bottlenose Whales foraging locations and depths will help direct Recovery Measure 1, by identifying where to look for their prey.

Because Northern Bottlenose Whales are more vulnerable to disturbance from anthropogenic noise while undergoing long, deep foraging dives, understanding their foraging behaviour could point out areas and times when the whales will be more susceptible to human activities that produce underwater noise. This could help develop effective mitigation measures.

Hooker and Baird (1999) measured Northern Bottlenose Whale dive tracks in the Gully, including the depth, duration and speed of the dives. Correlating such dive tracks to simultaneous foraging vocalizations would provide a more complete understanding of the whales' foraging behaviour during deep dives. This can be accomplished using acoustic tags (e.g. archival digital acoustic recordings tags or "DTAGs"; Johnson and Tyack 2003) or acoustic localization techniques (e.g. large aperture multi-element hydrophone arrays). The Whitehead Lab and the Department of National Defense (DND) have collected some preliminary acoustic data using multiple-element hydrophone arrays, and other researchers have expressed interest in conducting acoustic tagging studies on Scotian Shelf Northern Bottlenose Whales. This measure is listed in Table 3 because no organization is known to be planning a full-scale study.

4. Research linkages between the Scotian Shelf population and the Davis Strait-Baffin Bay-Labrador Sea and other populations:

- a. Investigate the feasibility of conducting additional genetic studies and chemical signature studies to determine linkages between populations (Table 1).**
- b. Expand photographic identification studies to include shelf-edge areas off Newfoundland, Labrador and the Davis Strait (Table 3).**

Priority: Medium

Linkages between the Scotian Shelf Northern Bottlenose Whale population and other populations of Northern Bottlenose Whales are not completely understood, including connections with the Davis Strait-Baffin Bay-Labrador Sea population that was recently assessed by COSEWIC as Special Concern (COSEWIC 2011). Genetic analyses indicate that the Scotian Shelf population is distinct from the more northern Canadian population, with estimates of fewer than two individuals moving between the populations per generation (Dalebout et al. 2006). The separation between the two

populations is not well understood, especially given that sightings are almost continuous along the continental shelf edge from Labrador to the Scotian Shelf (COSEWIC 2011). In their 2011 assessment of the species, COSEWIC acknowledges that the geographic boundaries of the two populations (also known as “designatable units”) were chosen arbitrarily in the absence of sufficient data to make a science-based determination. Additional genetic and other biological studies will contribute to building the empirical evidence necessary to delineate the two populations. Understanding the amount of mixing between populations could influence the management and recovery of the Scotian Shelf population.

Further genetic research and expanding the photo-identification studies on the two Canadian Northern Bottlenose Whale populations can contribute to a better understanding of the linkages and separation between the populations. A feasibility study should be conducted to determine the sample size and techniques required to reliably assess the genetic separation between the populations. The use of chemical signatures such as fatty acid analyses or stable isotope chemical tracers to study population differentiation should also be investigated. The Whitehead Lab has started a photo-identification catalogue for the Davis Strait-Baffin Bay-Labrador Sea population, though to date few photos have been collected.

1.2.2 Recovery objective 2

Improve understanding of population size, trend and distribution.

5. Increase understanding of the spatial and temporal distribution of the Scotian Shelf Northern Bottlenose Whale population:

- a. Design, conduct and collaborate on visual and acoustic surveys appropriate for detecting beaked whales in the Scotian Slope and adjacent areas (including the Grand Banks) to verify population distribution (Table 2).**
- b. Continue to acoustically monitor high-use areas for Northern Bottlenose Whale presence to monitor distribution over time (Table 1).**

Priority: High

The complete spatial and temporal distribution of Scotian Shelf Northern Bottlenose Whales is not known. For example, the population consistently uses areas outside the identified critical habitat between the Gully, Shortland and Haldimand canyons, yet little is known about how much of the areas the whales use, what they do there, or how much time they spend there. The population is likely to use other areas that have yet to be identified, such as the canyons located west of the Gully. The distribution of the population off the Grand Banks is also poorly understood. Part of the recovery goal for the population is to maintain its current distribution, thus identifying the full distributional range of the population is important. This knowledge will also lead to a more complete

understanding of linkages between populations (see Recovery Measure 4).

Relatively little is known about seasonal variability in the distribution of the whales because most studies have been conducted during the summer months. Investigating seasonal variability will lead to a better understanding of habitat use in the identified critical habitat areas throughout the year, and may lead to the identification of additional critical habitat areas. This will also inform risk assessments of potential threats to the population such as overlap with fisheries, oil and gas activities, and noise-producing activities (see Recovery Measures 11, 13 and 14).

DFO identified passive acoustic monitoring of cetacean presence (including Northern Bottlenose Whales) throughout the year as a high priority indicator for the Gully MPA (DFO 2010b). The Whitehead Lab and DFO used acoustic recorders in and adjacent to Northern Bottlenose Whale critical habitat on the Scotian Shelf from 2005-2009 to monitor the presence of the species year-round. Recordings in the Gully, Shortland and Haldimand canyons, and to the southwest and east of the Gully showed seasonal variation in the distribution of the whales (Moors 2012). DFO is continuing to acoustically monitor the Gully and adjacent areas for the presence of Northern Bottlenose Whales by deploying autonomous acoustic recorders in the MPA and in areas between identified critical habitat. Acoustic monitoring efforts should be expanded to include other areas of the Scotian Slope. DFO will collaborate with partners to conduct concurrent visual and acoustic transect surveys along the edge of the Scotian Slope and in adjacent areas, such as along the edges of Georges Bank and the Grand Banks. Such collaborative opportunities may arise as part of research programs led by the Whitehead Lab, DND, or the United States' National Atmospheric and Oceanic Administration. There may also be opportunities to collaborate with the oil and gas industry during seismic surveys.

6. Continue to conduct Northern Bottlenose Whale photo-identification studies (Table 2).

Priority: High

Photo-identification studies are important for determining Northern Bottlenose Whales' population distribution, movements and health (see Recovery Measure 2) and population size (see Recovery Measure 8). The Whitehead Lab will continue to collect Northern Bottlenose Whale sightings data, photographs of dorsal fins and visual observations (including photos and video) of group composition and behaviour. This information is needed to monitor the recovery of the population. Data collected during such studies will be incorporated into the appropriate databases (see Recovery Measure 7). This work contributes to ongoing population studies conducted by the Whitehead Lab.

7. Maintain Northern Bottlenose Whale data (Table 1).

Priority: Medium

Northern Bottlenose Whale data are stored in a number of databases. These data have been collected by different groups using a variety of media. Work is ongoing to ensure that all databases are integrated with one another and kept up-to-date.

The DFO Cetacean Sightings Databases in Maritimes Region and Newfoundland Region is a repository for directed and opportunistic sightings collected from DFO researchers, fisheries observers, marine mammal observers (e.g. aboard seismic survey or military vessels), fishermen, academic researchers, and other sources.

DFO is currently collecting, centralizing, and digitizing existing Scotian Shelf Northern Bottlenose Whale data from a variety of sources including photo-identification images, videos, and acoustic recordings, as well as historical data from sources such as film negatives, VHS tapes, and magnetic tape recordings. These data are now being stored in the newly created DFO Beaked Whale Multimedia Database, which will be updated on an ongoing basis as more information becomes available. DFO is also investigating ways to incorporate biopsy data and the results of genetic and contaminant analyses into this multimedia database. Digital photographs are stored in the DFO Beaked Whale Multimedia Database, but are also catalogued within photo-editing software for analysis purposes. This catalogue is referred to as the Beaked Whale Digital Photo-Identification Catalogue.

Northern Bottlenose Whale incidents (e.g. entanglements, strandings, mortalities) are recorded in databases maintained by regional marine mammal response networks (see Recovery Measure 10).

8. Update the Scotian Shelf population estimate to a precision of +/- 10% approximately every five years using photographic-identification data and mark-recapture models (Table 3).

Priority: High

Estimates of population size are needed to monitor population status and trends over time. Part of the recovery goal for the Scotian Shelf Northern Bottlenose Whale population is to maintain a stable or increasing population size, and updating population estimates will contribute directly to monitoring the recovery of the population.

The most up-to-date population estimate, based on an analysis of data from 1988-2011, is 116 individuals, with 95% confidence that the real population number is 101-130 individuals (O'Brien 2013). The use of digital cameras in recent years has resulted in more accurate population estimates with a higher confidence interval, thus the goal of obtaining a population estimate with a precision of +/- 10% is feasible. (The Recovery Strategy identified a +/- 5% precision level; this has since been assessed as unrealistic and +/- 10% is an improvement over the previous estimate.) The Whitehead Lab will continue surveys over two consecutive field seasons every three to four years, with an expectation of updating the population estimate after five years. This updated estimate

will be used to assess the population trend (decreasing, stable or increasing) and monitor the recovery of the population.

9. Update the Scotian Shelf population viability analysis when new information becomes available (Table 1).

Priority: Medium

A population viability analysis (PVA) estimates the probability that a population will become extinct within a certain timeframe depending on the current population status, trend, and pressures. A PVA was conducted as part of a 2007 Recovery Potential Assessment for the Northern Bottlenose Whale (DFO 2007a; Harris et al. 2007). At the time there was insufficient information available to conduct a rigorous analysis, and many assumptions were made. As knowledge of the population increases, the PVA will be updated as warranted to ensure that recovery targets are being met.

1.2.3 Recovery objective 3

Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, oil and gas development, noise, and contaminants, and develop management measures to reduce threats where necessary.

10. Respond effectively to Northern Bottlenose Whale stranding, mortality and entanglement events:

- a. Ensure continued support for the work of regional marine mammal response networks through the Marine Mammal Response Program. (Table 1).*
- b. Maintain region-wide whale response networks including emergency response hotlines (Table 2).*
- c. Develop a protocol to respond to Northern Bottlenose Whale emergency events (Table 2).*
- d. Conduct necropsies on reported Northern Bottlenose Whale mortalities (Table 2).*

Priority: High

Eleven Northern Bottlenose Whale stranding and at-sea mortality events have been documented in eastern Canada since 2002, and include:

- Eight strandings in Newfoundland and Labrador.
- One stranding in Nova Scotia.
- One at-sea mortality on the Scotian Shelf.
- One at-sea mortality on the Newfoundland and Labrador Shelf.

The causes of these strandings and at-sea mortalities were not determined, nor was it determined whether they were the result of natural or human-induced pressures. Entanglement in fishing gear is identified as a threat to the Scotian Shelf Northern Bottlenose Whale population. Nine entangled individuals have been documented in Canadian waters since the early 1980s (Harris et al. 2013). The capacity to respond quickly and effectively to entanglement, stranding, and at-sea mortality events is important for the recovery of the population.

Information collected from live or recently deceased whales following entanglement, stranding, or mortality events can provide valuable biological information that can help clarify the impacts of threats on individuals and on the population. Such information can also support Recovery Objectives 1 and 2 by increasing knowledge about the population. Protocols and capacity for quick and effective response to Northern Bottlenose Whale stranding and at-sea mortality events should be developed and maintained to support the collection of such information. Handling and disentanglement techniques specific to beaked whales are also needed.

The first step in responding to a stranding or mortality event is communication and coordination among the partners that are best equipped and located to conduct a response. The Marine Animal Response Society (MARS), as a partner in the Maritime Marine Animal Response Network (MMARN), and Whale Release and Strandings Newfoundland and Labrador (WRS-NL) work in cooperation with DFO, including the Canadian Coast Guard, to coordinate responses to incidents involving dead, stranded, injured, or entangled cetaceans. These groups have experience responding to near-shore emergency events, but are limited in their ability to respond to offshore incidents due to logistical challenges. Response partners, with DFO, will develop a protocol to better respond to offshore emergency events, including remote islands such as Sable Island (now a National Park Reserve). As part of this effort, DFO will continue to work with Parks Canada Agency (PCA) to explore the possibility of training PCA staff working on Sable Island to respond to and document Northern Bottlenose Whale strandings and mortalities.

Northern Bottlenose Whale stranding, entanglement, and mortality events are recorded in the incident databases maintained by MARS and WRS-NL, and will also be included in the DFO Beaked Whale Multimedia Database (see Recovery Measure 7). These records are important for monitoring the occurrence of Northern Bottlenose Whale mortality events over time.

1.2.3.1 Recovery measures for fishing gear interactions

11. Document and analyze the factors contributing to the risk of entanglements:

a. Document and monitor interactions with fishing gear, including depredation (Table 2).

- b. Examine gear removed from entangled Northern Bottlenose Whales to identify gear types when possible (Table 1).***
- c. Map the spatial distribution of fishing activities and gear in high-use areas to determine fisheries likely to pose the highest risk of entanglement (Table 1).***
- d. Investigate the rate of scarring likely caused by encounters with fishing gear on Scotian Shelf Northern Bottlenose Whales (Table 3).***

Priority: Medium

To better understand the threat of entanglement, it is important to understand the types and frequency of interactions between Northern Bottlenose Whales and fishing gear. Interactions include both entanglements and depredation (whales taking fish from the gear). Although depredation is not harmful to Northern Bottlenose Whales in and of itself, it is an interaction that could lead to entanglement. Depredation is known to occur in the Davis Strait population of Northern Bottlenose Whales, but has not been documented for the Scotian Shelf population (COSEWIC 2011). Knowing whether and how rates of encounters with fishing gear are changing over time will help evaluate to what extent fishery interactions pose a threat to the population. Understanding depredation may help to understand and prevent entanglement. This will require exploration of methods to monitor and quantify depredation since little is known about it.

To better understand the gear types involved with entanglement, all gear should be removed and examined following entanglements. Accurate and precise identification of gear retrieved from whale entanglements requires the development of protocols and a chain of custody process.

Photographs collected for the photo-identification studies described in Recovery Measure 6 can also be used to quantify the percentage of the Scotian Shelf Northern Bottlenose Whale population that bears scars from entanglement, and to measure how that rate changes over time. While the Whitehead Lab has done some work on scarring rates (Mitchell 2008), a more thorough analysis of photographic data is required to fully assess the percentage of the population showing signs of encounters with fishing gear, and to understand post-encounter survival.

Spatial analysis of fishing activities in and around identified critical habitat and other high-use areas can be used to determine which fisheries Northern Bottlenose Whales are most likely to encounter, and when these encounters are most likely to occur. DFO can overlay fishery data with known occurrences of Northern Bottlenose Whales to get an idea of where and when the greatest entanglement risks exist. This analysis should be conducted approximately every five years.

12. Reduce the risk of entanglement:

- a. Evaluate the feasibility of, and implement as appropriate, mitigation measures for fishing activities that pose a high entanglement risk (Table 1).***

b. Assess the likelihood of interactions with Northern Bottlenose Whales when evaluating new or returning fisheries (Table 1).

Priority: Medium

DFO and others can use the results of Recovery Measure 11 to develop mitigation measures to reduce the risk of entanglement. This Action Plan does not prescribe specific mitigation measures (voluntary or regulatory) needed to reduce the risk of entanglements, as they should be developed once entanglement risk is better understood.

DFO's "Policy on Managing Bycatch" (DFO 2013) and "New Emerging Fisheries Policy" (DFO 2008a) should be referenced in the exploration and development of measures to prevent Northern Bottlenose Whale entanglement. In turn, Northern Bottlenose Whale recovery needs should be referenced in the development and revision of Integrated Fisheries Management Plans (IFMPs) and other fishery management tools. These plans combine the best available science on the species in question, outlining harvest objectives and management measures. IFMPs provide a direct means of incorporating Northern Bottlenose Whale recovery actions into fisheries management.

DFO will take entanglement risk for Northern Bottlenose Whales into account in its relevant management decisions including the licensing of new and emerging fisheries, and when monitoring increased effort in recovering fisheries.

1.2.3.2 Recovery measures for oil and gas exploration and development

13. Effectively mitigate the potential impacts of oil and gas activities on Northern Bottlenose Whales and their high-use habitat areas:

- a. Monitor and mitigate adverse effects that may be incurred as a result of oil and gas exploration and development activities in and near Northern Bottlenose Whale high-use areas (Table 1).***
- b. Conduct scientific studies on the effects of oil and gas activities on Northern Bottlenose Whales in the Scotian Shelf region (Table 3).***

Priority: High

Exploration and development activities for oil and gas have been identified as a threat to Scotian Shelf Northern Bottlenose Whales and their critical habitat (DFO 2010a). Noise produced by vessels, seismic exploration surveys, construction and drilling activities (Recovery Measure 15), and other potential outcomes of the industry's operations, such as increased ship traffic (Recovery Measure 19) and possible accidental discharges or spills (Recovery Measure 16), may affect Northern Bottlenose Whales and their critical habitat.

The impacts of these activities on Northern Bottlenose Whales are not well understood,

making it challenging to develop appropriate mitigation measures (DFO 2010a). DFO has a Memorandum of Understanding (MOU) with the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) and the Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB) to coordinate the review of oil and gas exploration and development projects in the region. Through this ongoing process DFO will track the occurrence of oil and gas activities on the Scotian Shelf to better understand how this threat to Northern Bottlenose Whales may be changing over time. In addition, project-specific effects monitoring will be considered for operations occurring near Northern Bottlenose Whale critical habitat. The resulting information would contribute to building a better understanding of the health and behavioural responses of individuals and the population to these activities. Directed scientific research on the effects of oil and gas activities will also be encouraged. A growing knowledgebase will inform the development of more effective mitigation measures, if necessary. DFO will continue to work with CNSOPB and CNLOPB to provide current information on Northern Bottlenose Whales for environmental assessment processes.

The *Statement of Canadian Practice (SOCP) with respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007b) guides seismic activity in the presence of cetaceans. Northern Bottlenose Whales, like other beaked whales, are thought to be particularly sensitive to noise. Therefore activities occurring in and near Northern Bottlenose whale high use areas will typically require measures beyond the minimum requirements of the SOCP. DFO will work with the CNSOPB and other regulators, with input from experts and stakeholders, to determine additional mitigation requirements to ensure compliance with SARA. Such requirements may include, for example, species-specific monitoring or expanded safety zones.

1.2.3.3 Recovery measures for anthropogenic noise

14. Conduct acoustic studies to identify and monitor sources of anthropogenic noise in and near high-use areas, and their potential impacts on Northern Bottlenose Whales and their critical habitat (Table 1).

Priority: High

Acoustic disturbance is identified as an important threat to the Scotian Shelf Northern Bottlenose Whale population, however, little is known about the effects of anthropogenic noise on individuals or on their critical habitat (DFO 2010a). The occurrence and levels of anthropogenic noise in high-use areas require investigation. A better understanding of noise sources and their potential impacts on Northern Bottlenose Whales and their habitat will help clarify the degree of threat to the population and its recovery. Like other beaked whales, this species is thought to be especially sensitive to intense underwater sounds produced by human activities such as sonar and seismic survey noise (Evans 2002).

DFO and partners such as the Whitehead Lab and DND have begun to collect acoustic data from Northern Bottlenose Whale critical habitat. Characterization of ambient and

anthropogenic noise levels within the Gully, using passive acoustic recording, has been identified as a high priority indicator for the MPA (DFO 2010b). DFO is currently collecting and analyzing acoustic data from the Gully and other Northern Bottlenose Whale high-use areas to identify anthropogenic noise sources and levels (Cochrane and Moors-Murphy 2013). This study should be complete within the next two years. The results of such work will contribute to identifying the types of high-risk activities occurring in the Gully and other high-use areas, and in turn will guide the level of effort for future studies.

Studies should be undertaken to determine the impacts of particular types of noise on Northern Bottlenose Whales. Impacts may occur at both the population level (e.g., changes in abundance, density or distribution) and the individual level (e.g., changes in swimming, diving, foraging or vocal behaviour in the presence of particular noise sources; masking potential of different sources of noise) (Gosselin and Lawson 2005). Studies should also be conducted to determine the impact of anthropogenic noise on the features and attributes of the identified Northern Bottlenose Whale critical habitat, and on the whales' ability to use this habitat to carry out their life functions. Collaborative research projects are likely the best approach to complete this recovery measure. This work has not yet started and is not likely to be completed in the near future given its complexity; however, given the importance of this threat to the population, this recovery measure is of high priority.

15. Minimize the potential impacts of anthropogenic noise on Northern Bottlenose Whales and their critical habitat:

- a. Establish acoustic exposure thresholds for harm or harassment to individuals and destruction of critical habitat (Table 1).**
- b. Continue and enhance noise mitigation and monitoring measures for beaked whales - also see Recovery Measure 14 (Table 1).**

Priority: High

As more is understood about the types and degrees of impacts noise can have on individual Northern Bottlenose Whales and their habitat (see Recovery Measure 14), it will become easier to determine how to minimize the potential impacts of noise.

Acoustic exposure thresholds (e.g. sound pressure levels, sound exposure levels) that ensure that SARA-prohibited impacts are avoided must be developed for various types of anthropogenic noise. Specifying levels appropriate for marine mammals including beaked whales is challenging, but the knowledge base and understanding of how to minimize impacts of noise on whales is increasing (e.g. Nowacek et al. 2013).

Although mitigation measures designed to reduce impacts on whale species have been developed for oil and gas exploration and production activities (e.g. DFO 2007b) and military activities (e.g. DND 2008), mitigation measures specifically addressing beaked whales are needed because of their apparent heightened sensitivity to anthropogenic

noise. DFO will work with the relevant regulators to develop and implement mitigation measures appropriate for beaked whales for noise-producing activities occurring in or near Northern Bottlenose Whale high-use areas. DFO and partners will monitor the implementation and outcomes of mitigation measures and will report on their effectiveness. Environmental assessments for activities taking place in and near high-use areas will continue to consider the potential impacts of anthropogenic noise on Northern Bottlenose Whales and their critical habitat.

1.2.3.4 Recovery measures for contaminants

16. Investigate potential sources and routes of contaminants in high-use areas, and monitor contaminant levels in the population and the ecosystem over time.

- a. Collect tissue samples from Northern Bottlenose Whales to conduct contaminant analyses (Table 3).***
- b. Develop a tissue bank for storage of biopsy samples (Table 3).***
- c. Continue and expand sampling of ecosystem components most likely to contain contaminants in high-use areas, and monitor over time (Table 3).***
- d. Explore appropriate regulatory mechanisms to mitigate the potential negative effects of contaminants on Northern Bottlenose Whales and their critical habitat (Table 2).***

Priority: Medium

Contaminants have been identified as a threat to Northern Bottlenose Whales (DFO 2010a), therefore the levels of toxins of concern should be monitored in the population over time. Pollutants in marine ecosystems may originate from land or from marine sources, and may be present in the ecosystem because of accidental discharge or because of ongoing operational discharge. Tracing their origins can be challenging. To understand the extent to which Northern Bottlenose Whales are exposed to contaminants when in their habitat, changes in the presence and composition of pollutants should be monitored. Increasing contaminant levels in important ecosystem components in Northern Bottlenose Whale high-use areas could signal potential health risks to the population and its critical habitat.

Although contaminant levels measured from Scotian Shelf Northern Bottlenose Whales were not thought to be high enough to cause health problems, a study of this population showed an increase in dichloro-diphenyl-trichloroethane (DDT) levels between 1996 and 2003 (Hooker et al. 2008). Contaminant monitoring in whales needs to be renewed through the collection and analysis of additional biopsy samples. At this time, however, there are no immediate plans to conduct such work. Biopsy sample collection will support future comparative analyses of contaminant levels. To help facilitate contaminant studies, DFO will provide storage space for tissue samples and will incorporate the results of any analyses into the DFO Beaked Whale Multimedia Database.

The levels of various contaminants within the ecosystem components (e.g. water, sediment, prey species) in Northern Bottlenose Whale high-use areas also can be monitored over time to provide an indicator of exposure levels. A scientific review of Gully MPA contaminant monitoring needs concluded that more extensive sampling of contaminants in finer-grained sediments within the MPA, as well as in nearby canyons for comparison purposes, should be conducted (DFO 2009). The review also recommended opportunistic sampling of potential indicator species, including Northern Bottlenose Whale.

Anthropogenic activity levels in critical habitat and other high-use areas should be assessed, and monitored if necessary to determine potential sources of contaminants so that routes of and exposure to these contaminants can be investigated. DFO (2009) identifies potential point and non-point sources of contaminants.

If contaminant levels have negative effects on the growth, reproduction or survival of individuals, the quality of their habitat, or the quality and quantity of their prey, management measures may be required to mitigate these impacts. Marine pollutants in Canada are controlled and prohibited by legislation such as the *Canadian Environmental Protection Act, 1999* (S.C. 1999, c. 33) and regulations under the *Canada Shipping Act, 2001* (S.C. 2001, c. 26). Options for reducing the impact of harmful contaminants in Northern Bottlenose Whale high-use habitat should be explored (e.g. discharge regulations) and implemented if deemed necessary and likely to be effective.

1.2.3.5 Recovery measures for other activities and threats

17. Ensure that tourism activities are conducted in a way that minimizes disturbance to Northern Bottlenose Whales:

- a. Develop whale-watching guidelines for tourism vessels traveling to Northern Bottlenose Whale high-use areas (Table 1).***
- b. Educate whale-watching tour operators about whale-watching guidelines and data collection needs for Northern Bottlenose Whales (Table 1).***
- c. Monitor aircraft-based tourism over high-use Northern Bottlenose Whale habitat areas and develop guidelines if warranted (Table 1).***

Priority: Low-Medium

Tourism interest in the Gully MPA has been increasing and is expected to grow with the establishment of Sable Island as a National Park Reserve. Whale-watching tours targeting Northern Bottlenose Whales occurred in 2011, 2012 and 2013. If not managed properly, tourism activities could cause disturbance to Northern Bottlenose Whales, for example, vessel noise could interfere with natural behaviours and boat operation could disturb individual whales (see Recovery Measures 14 and 15). Mitigation of potential impacts, monitoring and documentation of tourism impacts, and education and training of tour operators can all help reduce the potential impacts of tourism.

The future level of tourism likely to occur in the Gully MPA and other high-use areas is unknown, and it is important to develop thresholds limiting the type and number of vessels conducting whale-watching activities within an area during a given time period early on. With input from the Gully Advisory Committee and Northern Bottlenose Whale experts, DFO is considering the future of tourism activities in the Gully MPA. This work includes developing thresholds for vessel-based tourism in the Gully MPA and whale-watching guidelines specific to Northern Bottlenose Whales. DFO may issue an Activity Approval under the *Gully Marine Protected Area Regulations* (SOR/2004-112) for access to Zone 1 and 2 of the Gully MPA for low risk tourism proposals that include a robust research component. Tourism activities that do not include a research component are restricted to Zone 3 of the Gully MPA.

Tours to Northern Bottlenose Whale high-use areas offer an opportunity to collect data on the population. DFO will continue to work with tour operators to identify data collection needs and provide marine mammal identification training as needed (see Recovery Measure 21). The feasibility of placing trained observers on whale-watch vessels should be explored, as they could collect data while also ensuring that tour operators are complying with regulations to minimize their impact on Northern Bottlenose Whales.

DFO will monitor aircraft-based tourism over Northern Bottlenose Whale critical habitat. Specific guidance (e.g. guidelines for minimum height of over-flights) for such activities over these and other high-use habitat areas may be developed if deemed necessary to mitigate potential impacts on whales.

18. Ensure that research activities are conducted in a way that minimizes potential negative impacts to Northern Bottlenose Whales and their habitat:

- a. Encourage collection of opportunistic sighting data by researchers (Table 1).***
- b. Recommend that experienced marine mammal observers are onboard vessels conducting research in high-use areas (Table 1).***

Priority: Low-Medium

Research activities conducted within or near Northern Bottlenose Whale high-use areas, whether directed at the whales or not, may have an impact on the individuals or on the population. Research activities will be assessed to ensure that potential impacts on the whales and their critical habitat are compliant with SARA. DFO will continue to review and issue Gully MPA Activity Approvals for low-risk research that benefits the MPA.

To encourage the collection of opportunistic sightings data, DFO will offer marine mammal identification training to researchers conducting activities in or near high-use areas, in addition to outreach described in Recovery Measure 21 (Table 1).

When feasible, DFO will facilitate the placement of staff or contractors who are experienced marine mammal observers onboard research vessels conducting research in Northern Bottlenose Whale high-use areas.

19. Minimize the risk of vessel collisions with Northern Bottlenose Whales:

- a. Monitor and document the number of vessel transits in or near high-use areas (Table 1).**
- b. Document reported Northern Bottlenose Whale vessel strikes – also see Recovery Measures 7 and 10 (Table 2).**
- c. Increase awareness of Northern Bottlenose Whales among vessel operators transiting through high-use areas - also see Recovery Measures 23 and 24 (Table 1).**
- d. Explore and implement as required mitigation measures to reduce potential vessel strikes in high-use areas (Table 1).**

Priority: Low

Assessing and minimizing the risk of vessel collisions is important for addressing the recovery objectives of the population. If a ship strike mortally wounds a Northern Bottlenose Whale, the animal is not likely to be found because of the species' offshore distribution. No Northern Bottlenose Whale mortalities have been attributed to vessel strikes to date, yet scars likely caused by collisions with vessels have been observed on individuals (DFO 2010a).

DFO monitors the number of vessels and the amount of time that they spend in or near Northern Bottlenose Whale high-use areas by analyzing positional data using satellite-based monitoring systems such as Long Range Identification and Tracking (LRIT) and the Automatic Identification System (AIS). This will help to quantify the amount of vessel traffic that Northern Bottlenose Whales may encounter. DFO will analyze monitoring data to assess risk and will develop and implement mitigation measures if required.

DFO will continue to increase awareness of Northern Bottlenose Whales among vessel operators that transit through the population's high-use habitat areas. Information on Northern Bottlenose Whale critical habitat is included in the Notice to Mariners (see Recovery Measure 22). Fact sheets that can be posted onboard a variety of vessels will also be explored. Once the factors that may contribute to vessel collisions are better understood, DFO will evaluate the costs, feasibility and benefits of implementing additional mitigation measures to reduce the risk of collisions with Northern Bottlenose Whales.

1.2.4 Recovery objective 4

Engage stakeholders and the public in recovery actions through education and stewardship.

20. Develop a communications plan, programs and materials to support and promote the recovery of the Scotian Shelf Northern Bottlenose Whale (Table 1).

Priority: Low

Education and outreach are required to inform the general public about the status of Scotian Shelf Northern Bottlenose Whales, threats to the population, and activities underway to support its recovery. Examples of outreach efforts to date include public seminars, classroom presentations, event displays and multimedia products suited for general public events.

DFO will play a lead role in developing a communications plan to educate the general public about Scotian Shelf Northern Bottlenose Whales including information on ecology and behaviour, their critical habitat, how they can be identified and how to report sightings and incidents or emergencies such as strandings, entanglements, injuries or mortalities. This communications plan will include developing and distributing outreach materials with the assistance of non-government organization (NGO) groups. This may include the development and distribution of educational materials on Northern Bottlenose Whales to the general public, and opportunities to contribute to school curricula.

21. Develop and deliver awareness and training programs to targeted user groups about Scotian Shelf Northern Bottlenose Whale data collection and recovery needs (Table 1).

Priority: Medium

DFO currently collects whale sightings data from a variety of sources including At-Sea Fisheries Observers, fishery officers, Canadian Wildlife Service (CWS) bird observers, and marine mammal observers from DND, the oil and gas industry, and onboard DFO and NGO research cruises. Training observers will optimize the quality and consistency of data collected. DFO will continue to promote and improve the collection of Northern Bottlenose Whale sightings data and photographs from various sources by providing training on how to identify and photograph whales, as well as how to record sightings. DFO is developing a Cetacean Identification Training Program focused on at-risk species that should be completed within the next two years. This program will include input from partners such as the CNSOPB and will consider lessons learned from oil and gas marine mammal observer reporting procedures.

DFO is developing a SARA training module and SARA reporting forms for At-Sea Fisheries Observers, which will include training on identification of Northern Bottlenose Whales. Observer coverage is low in some fishing fleets that operate in and near high-use areas. DFO will examine whether an increase in Fisheries Observer coverage is required on these vessels, and will work with the At-Sea Fisheries Observer program to

increase observer coverage as needed and when feasible. At-Sea Fisheries Observers should document any interactions with fishing gear including depredation. This may require the development of methods to monitor Northern Bottlenose Whale depredation on gear (see Recovery Measure 11).

DFO will also investigate other opportunities to collect data off Nova Scotia and Newfoundland, such as providing berths, funding and equipment (cameras and video recorders) for marine mammal observers and at-sea fishery observers, when possible, aboard vessels traveling to Northern Bottlenose Whale critical habitat and other high-use areas. All sightings collected will be added to DFO Cetacean Sightings Databases. Providing information about the importance of data collection and reporting sightings and incidents and emergencies (strandings, entanglements, injuries or mortalities) to groups that travel regularly to areas where Northern Bottlenose Whales occur is an important and ongoing component of Northern Bottlenose Whale recovery. This may include oil and gas industry vessels, tourism operations, fishermen and researchers.

DFO will continue to develop and deliver marine mammal identification training programs that highlight the importance of reporting sightings and interactions with, or incidents and emergencies involving, Northern Bottlenose Whales to user groups such as fishers and oil and gas companies that operate in or near Northern Bottlenose Whale high-use areas. DFO will engage with fishers operating in areas where Northern Bottlenose Whales occur to increase their awareness of this species and can provide information about the whales and about emergency response that can be posted onboard.

22. Review and update the Canadian Coast Guard “Notices to Mariners” and relevant Canadian Hydrographic Service (CHS) charts with information about Northern Bottlenose Whale high-use areas and other relevant management measures (Table 1).

Priority: Medium

The CCG Notices to Mariners guides the activities of vessels in Canadian waters, and provides information related to environmental protection. DFO will annually review the Notices to Mariners and update information about Scotian Shelf Northern Bottlenose Whales as required. These Notices are an important means of raising the awareness of stakeholders travelling through or using areas where Northern Bottlenose Whales regularly occur. The document provides information about the emergency response hotline, critical habitat areas, and guidance for maneuvering vessels around whales.

23. Identify stewardship opportunities relevant to the recovery measures outlined in this document and disseminate information about these opportunities to appropriate target audiences (Table 1).

Priority: Low

Stewardship activities addressing recovery goals and objectives require funding support. The Habitat Stewardship Program and the Aboriginal Fund for Species At Risk, sponsored by the Government of Canada, support stewardship projects focused on the conservation and recovery of species at risk. Additionally, the Interdepartmental Recovery Fund provides a source of funding to federal departments, agencies and crown corporations for implementing species at risk recovery activities. DFO has supported and participated in these programs since their inception, and will continue to encourage, review, and support projects that promote the recovery of marine species through stewardship and recovery activities including the implementation of recovery measures outlined in this action plan.

1.3 Implementation schedule

Success in the recovery of this species is not solely dependent on the actions of any single jurisdiction; rather it requires the commitment and cooperation of many different constituencies that will be involved in implementing the measures set out in this Action Plan.

The purpose of this Action Plan is to outline what needs to be done to achieve the recovery goal and objectives for the Northern Bottlenose Whale to guide not only activities to be undertaken by DFO, but those for which other jurisdictions, organizations and individuals have a role to play. DFO strongly encourages all Canadians to participate in the conservation of the Northern Bottlenose Whale by undertaking priority recovery measures outlined in this Action Plan.

Tables 1-3 summarize the recovery measures described in Section 1.2. Each recovery measure has been assigned a priority level (low, medium or high) that is based on the degree to which the measure is expected to contribute to the recovery of the species, or is an essential precursor to another measure that will contribute to the recovery of the species. The current status and estimated timeline to completion for each recovery measure is also provided. Potential leads and partners have been identified for each recovery measure in Tables 1 and 2, recognizing that species recovery is dependent on a collaborative approach. The recovery measures are organized into three tables based on which groups or organizations are leading the activities listed therein. The numbering system used in Tables 1-3 corresponds to the numbering system used in Section 1.2; however, the measures may appear out of order due to their organization into three separate tables.

Table 1 identifies the recovery measures to be led by DFO, or for which DFO will provide an oversight or authoritative function. These measures may also involve participation or collaboration from other parties. Table 2 identifies the recovery measures to be led by other parties, although DFO may be involved as a participant or collaborator. Table 3 presents measures that would be advantageous to undertake in support of the species' recovery, but which currently have no identified leads or partners. These activities may offer good opportunities for interested groups to become involved in the recovery of Northern Bottlenose Whales. If your organization is

interested in participating in one of these measures, please contact the Species at Risk Maritimes Region office at xmarsara@mar.dfo-mpo.gc.ca or 1-866-891-0771.

Implementation of the recovery measures outlined in this Action Plan is subject to available funding and other resources.

Table Column Headings

The "Partners" (Table 1) and "Leads and Partners" (Table 2) columns list groups that are currently involved, or could potentially become involved in undertaking the recovery measures.

Each recovery measure is prioritized (low, medium or high) based on the degree to which it is expected to contribute directly to the recovery of the species or is an essential precursor to an action that will contribute to the recovery of the species:

- High priority measures are considered those most likely to have an immediate and/or direct influence on the recovery of Northern Bottlenose Whales.
- Medium priority measures may have a less immediate or less direct influence on Northern Bottlenose Whale recovery, but are still considered important.
- Low priority recovery measures will likely have an indirect or gradual influence on reaching the recovery objectives, but are considered important contributions to the knowledge base and/or public involvement in Northern Bottlenose Whale recovery efforts.

The "Status" column reflects whether an activity has been initiated, with two status categories:

- Not started
- Underway

The "Timeline" column refers to the estimated timeline to completion from the date of publication of this Action Plan:

- <2 years
- 2-5 years
- >5 years
- Continuous (i.e. the activity will need to be ongoing over time).

The following acronyms/abbreviations are used in the Tables that comprise the Implementation Schedule (i.e. Tables 1-3):

CHS	Canadian Hydrographic Service
CNLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
EC	Environment Canada
MARS	Marine Animal Response Society

MMARN	Maritime Marine Animal Response Network
NGO	Non-government organization
PCA	Parks Canada Agency
Whitehead Lab	Whitehead Lab, Dalhousie University
WRS-NL	Whale Release and Strandings Newfoundland and Labrador

Table 1. Recovery measures for the Northern Bottlenose Whale (Scotian Shelf population) to be led or overseen by Fisheries and Oceans Canada.

#	Recovery Measure	Partners	Priority	Status/ Timeline
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.				
4	Research linkages between the Scotian Shelf population and the Davis Strait-Baffin Bay-Labrador Sea and other populations: a. Investigate the feasibility of conducting additional genetic studies and chemical signature studies to determine linkages between populations.	Academia	Medium	a. Not started (2-5 years)
Objective 2: Improve understanding of population size, trend and distribution.				
5	Increase understanding of the temporal and spatial distribution of the Scotian Shelf Northern Bottlenose Whale population: b. Continue to acoustically monitor high-use areas for Northern Bottlenose Whale presence to monitor distribution over time.	Whitehead Lab	High	b. Underway (continuous)
7	Maintain Northern Bottlenose Whale data .	Whitehead Lab	Medium	Underway (continuous)
9	Update the Scotian Shelf population viability analysis when new information becomes available.	Whitehead Lab	Medium	Not started (>5 years)
Objective 3: Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, oil and gas development, noise, and contaminants, and develop management measures to reduce threats where necessary.				

#	Recovery Measure	Partners	Priority	Status/ Timeline
10	Respond effectively to Northern Bottlenose Whale stranding, mortality and entanglement events: a. Ensure continued support for the work of regional marine mammal response networks through the Marine Mammal Response Program.	Other government departments NGOs	High	a. Underway (continuous)
Recovery measures for fishing gear interactions				
11	Document and analyze the factors contributing to the risk of entanglements: b. Examine gear removed from entangled Northern Bottlenose Whales to identify gear types when possible. c. Map the spatial distribution of fishing activities and gear in high-use areas to determine fisheries likely to pose the highest risk of entanglement.	Fishing Industry	Medium	b. Underway (continuous) c. Not started (>5 years)
12	Reduce the risk of entanglement: a. Evaluate the feasibility of, and implement as appropriate, mitigation measures for fishing activities that pose a high entanglement risk. b. Assess the likelihood of interactions with Northern Bottlenose Whales when evaluating new or returning fisheries.	Fishing industry	Medium	a. Not started (continuous) b. Underway (continuous)
Recovery measures for oil and gas development				
13	Effectively mitigate the potential impacts of oil and gas activities on Northern Bottlenose Whales and their high-use habitat areas: a. Monitor and mitigate adverse effects that may be incurred as a result of oil and gas exploration and development activities in and near Northern Bottlenose Whale high-use areas.	CNSOPB CNLOPB Oil and gas industry	High	a. Underway (continuous)
Recovery measures for anthropogenic noise				

#	Recovery Measure	Partners	Priority	Status/ Timeline
14	Conduct acoustic studies to identify and monitor sources of anthropogenic noise in and near high-use areas, and their potential impacts on Northern Bottlenose Whales and their critical habitat.	Whitehead Lab DND	High	Underway (2-5 years)
15	Minimize the potential impacts of anthropogenic noise on Northern Bottlenose Whales and their critical habitat: <ul style="list-style-type: none"> a. Establish acoustic exposure thresholds for harm or harassment to individuals and destruction of critical habitat. b. Continue and enhance noise mitigation and monitoring measures for beaked whales. 	CNSOPB CNLOPB DND	High	a. Not started (> 5 years) b. Underway (continuous)
Recovery measures for other activities and threats				
17	Ensure that tourism activities are conducted in a way that minimizes disturbance to Northern Bottlenose Whales: <ul style="list-style-type: none"> a. Develop whale-watching guidelines for tourism vessels traveling to Northern Bottlenose Whale high-use areas. b. Educate whale-watching tour operators about whale-watching guidelines and data collection needs for Northern Bottlenose Whales. c. Monitor aircraft-based tourism over high-use Northern Bottlenose Whale habitat areas and develop guidelines if warranted. 	Tourism/ whale-watching industry	Low-Medium	a. Underway (2-5 years) b. Underway (continuous) c. Not started (continuous)
18	Ensure that research activities are conducted in a way that maximizes benefit to Northern Bottlenose Whales and their habitat: <ul style="list-style-type: none"> a. Encourage collection of opportunistic sighting data by researchers. b. Recommend that experienced marine mammal observers are onboard vessels conducting research in high-use areas. 	Academia	Low-Medium	a. Underway (continuous) b. Not started (2-5 years)

#	Recovery Measure	Partners	Priority	Status/ Timeline
19	<p>Minimize the risk of vessel collisions with Northern Bottlenose Whales:</p> <ul style="list-style-type: none"> a. Monitor and document the number of vessel transits in or near high-use areas. c. Increase awareness of Northern Bottlenose Whales among vessel operators transiting through high-use areas. d. Explore and implement as required mitigation measures to reduce potential vessel strikes in high-use areas. 	Mariners/industry	Low	<ul style="list-style-type: none"> a. Underway (continuous) c. Underway (continuous) d. Not started (>5 years)
Objective 4: Engage stakeholders and the public in recovery actions through education and stewardship.				
20	Develop a communications plan, programs and materials to support and promote the recovery of the Scotian Shelf Northern Bottlenose Whale.	N/A	Low	Not started (2-5 years)
21	Develop and deliver awareness and training programs to targeted user groups about Scotian Shelf Northern Bottlenose Whale data collection and recovery needs.	CNSOPB CNLOPB Industry	Medium	Underway (< 2 years)
22	Review and update the Canadian Coast Guard “Notices to Mariners” and relevant CHS charts with information about Northern Bottlenose Whale high-use areas and other relevant management measures.	N/A	Medium	Underway (continuous)
23	Identify stewardship opportunities relevant to the recovery measures outlined in this document and disseminate information about these opportunities to appropriate target audiences.	NGOs	Low	Underway (continuous)

Table 2. Recovery measures for the Northern Bottlenose Whale (Scotian Shelf population) to be led by other parties but where Fisheries and Oceans Canada may be a partner.

#	Recovery Measure	Leads and Partners	Priority	Status/ Timeline
Objective 2: Improve understanding of population size, trend and distribution.				
5	Increase understanding of the temporal and spatial distribution of the Scotian Shelf Northern Bottlenose Whale population: a. Design, conduct and collaborate on visual and acoustic surveys appropriate for detecting beaked whales in the Scotian Slope and adjacent areas (including the Grand Banks) to verify population distribution.	<u>Lead:</u> Whitehead Lab <u>Partners:</u> DND CNSOPB CNLOPB Oil and gas industry	High	a. Underway (2-5 years)
6	Continue to conduct Northern Bottlenose Whale photo-identification studies.	Whitehead Lab	High	Underway (continuous)
Objective 3: Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, oil and gas development, noise, and contaminants, and develop management measures to reduce threats where necessary.				
10	Respond effectively to Northern Bottlenose Whale stranding, mortality and entanglement events: b. Maintain region-wide whale response networks including emergency response hotlines. c. Develop a protocol to respond to Northern Bottlenose Whale emergency events. d. Conduct necropsies on reported Northern Bottlenose Whale mortalities.	<u>Leads:</u> MMARN MARS WRS-NL <u>Partners:</u> DFO PCA	High	b. Underway (continuous) c. Underway (<2 years) d. Underway (continuous)
Recovery measures for fishing gear interactions.				

#	Recovery Measure	Leads and Partners	Priority	Status/ Timeline
11	<p>Document and analyze the factors contributing to the risk of entanglements:</p> <p>a. Document and monitor interactions with fishing gear, including depredation.</p>	<p><u>Leads:</u> MMARN MARS WRS-NL</p> <p><u>Partners:</u> DFO Fishing Industry</p>	Medium	a. Underway (continuous)
Recovery measures for contaminants				
16	<p>Investigate potential sources and routes of contaminants in high-use areas, and monitor contaminant levels in the population and the ecosystem over time:</p> <p>d. Explore appropriate regulatory mechanisms to mitigate the potential negative effects of contaminants on Northern Bottlenose Whales and their critical habitat.</p>	<p><u>Lead:</u> EC</p> <p><u>Partner:</u> DFO</p>	Medium	d. Not started (>5 years)
Recovery measures for other activities and threats.				
19	<p>Minimize the risk of vessel collisions with Northern Bottlenose Whales:</p> <p>b. Document reported Northern Bottlenose Whale vessel strikes.</p>	<p><u>Leads:</u> MMARN MARS WRS-NL</p> <p><u>Partner:</u> DFO</p>	Low	b. Underway (continuous)

Table 3. Remaining opportunities for work to contribute toward Northern Bottlenose Whale (Scotian Shelf population) recovery objectives.

#	Recovery Measure	Priority	Status/ Timeline
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	Undertake surveys to evaluate squid composition, distribution and abundance within high-use habitat areas.	Medium	Not started (> 5 years)
2	Conduct studies on social behaviour, reproduction and movement patterns of the Scotian Shelf population: <ul style="list-style-type: none"> a. Use photo-identification, and other novel methods, to examine the age-sex structure and reproductive characteristics of the population. b. Use photo-identification to better understand the social structure and movement patterns of the population. c. Conduct satellite-tagging studies to examine the movement patterns of individuals. 	Medium	<ul style="list-style-type: none"> a. Underway (continuous) b. Underway (continuous) c. Not started (>5 years)
3	Investigate Northern Bottlenose Whale foraging and diving behaviour.	High	Not started (2-5 years)
4	Research linkages between the Scotian Shelf population and the Davis Strait-Baffin Bay-Labrador Sea and other populations: <ul style="list-style-type: none"> b. Expand photographic identification studies to include shelf-edge areas off Newfoundland, Labrador and the Davis Strait. 	Medium	b. Not started (2-5 years)
Objective 2: Improve understanding of population size, trend and distribution.			
8	Update the Scotian Shelf population estimate to a precision of +/- 10% approximately every five years using photographic-identification data and mark-recapture models.	High	Underway (continuous)

#	Recovery Measure	Priority	Status/ Timeline
Objective 3: Improve understanding of and monitor anthropogenic threats, including fishing gear interactions, oil and gas development, noise, and contaminants, and develop management measures to reduce threats where necessary.			
Recovery measures for fishing gear interactions.			
11	Document and analyze the factors contributing to the risk of entanglements: d. Investigate the rate of scarring likely caused by encounters with fishing gear on Scotian Shelf Northern Bottlenose Whales.	Medium	d. Not started (2-5 years)
Recovery measures for oil and gas development			
13	Effectively mitigate the potential impacts of oil and gas activities on Northern Bottlenose Whales and their high-use habitat areas: b. Conduct scientific studies on the effects of oil and gas activities on Northern Bottlenose Whales in the Scotian Shelf region.	High	b. Not started (2-5 years)
Recovery measures for contaminants			
16	Investigate potential sources and routes of contaminants in high-use areas, and monitor contaminant levels in the population and the ecosystem over time: a. Collect tissue samples from Northern Bottlenose Whales to conduct contaminant analyses. b. Develop a tissue bank for storage of biopsy samples. c. Expand sampling of ecosystem components most likely to contain contaminants in high-use areas, and monitor over time.	Medium	a. Not started (continuous) b. Not started (2-5 years) c. Not started (2-5 years)

1.4 Critical habitat

Critical habitat is defined in subsection 2(1) of SARA as the:

“...habitat necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species”.

The habitat of aquatic species is further defined under subsection 2(1) of SARA as:

“...spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced”.

Critical habitat for the Scotian Shelf Northern Bottlenose Whale population is identified to the extent possible in Section 1.9 of the Recovery Strategy (DFO 2010a; 2016). The recently amended Recovery Strategy provides a detailed description of the identified critical habitat, including geographic location and biophysical functions, features and attributes (Section 1.9.3), as well as background information on the identification of the critical habitat (Section 1.9.2), and a discussion of activities likely to destroy the critical habitat (Section 1.9.5). The Recovery Strategy also provides a Schedule of Studies that outlines the studies required to refine our understanding of identified critical habitat and to identify additional critical habitat that may exist (Section 1.9.4).

1.5 Proposed measures to protect critical habitat

Under SARA, critical habitat must be legally protected within 180 days of being identified in a recovery strategy or action plan. A description of the critical habitat located within Zone 1 of the Gully MPA was published in the Canada Gazette on August 14, 2010, pursuant to subsection 58(2). Ninety days following publication, the subsection 58(1) prohibition against destroying critical habitat applied to Zone 1 of the Gully MPA (Canada Gazette 2010). For the critical habitat located in Shortland and Haldimand canyons, it is anticipated that legal protection will be accomplished through a SARA Critical Habitat Order made under subsections 58(4) and (5), which will invoke the prohibition in subsection 58(1) against the destruction of the identified critical habitat.

Although the Northern Bottlenose Whale Recovery Strategy identifies activities that may cause destruction of critical habitat, thresholds to avoid the destruction of critical habitat for various activities have yet to be defined (DFO 2010a). Some of the recovery measures in this Action Plan will support the activities in the Schedule of Studies, which increases our understanding of the potential impacts of human activities on the critical habitat of Scotian Shelf Northern Bottlenose Whales, and at what levels they may constitute destruction of critical habitat.

2. Evaluation of socio-economic costs and of benefits

Subsection 49(1), paragraph (e), of SARA requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. This evaluation addresses only the incremental socio-economic costs of implementing this Action Plan from a national perspective as well as the social and environmental benefits that would occur if the Action Plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide partners' decision-making on implementation of the Action Plan.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that "*wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons*" (Preamble to the *Species at Risk Act*, S.C. 2002, c.29). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under the international *Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the [Accord for the Protection of Species at Risk](#).

The methods used to conduct this evaluation and the specific costs and benefits associated with this Action Plan are described below.

2.1 Methods used

This evaluation identifies the anticipated socio-economic impacts associated with the recovery measures listed in Tables 1-3. It addresses the costs and benefits that are anticipated to occur if the Action Plan is fully implemented. The analysis only considers costs and benefits that are incremental to the baseline (e.g., costs/benefits associated with new activities or enhancements to existing activities that are above-and-beyond what is part of current practice or formal commitments). Costs and benefits that are real or reasonably expected to occur are included while those of a highly speculative or uncertain nature are not. An order-of-magnitude estimate of potential costs and benefits is provided where sufficient information is available to provide an evaluation. Otherwise, a qualitative statement regarding potential impacts is provided.

Costs and benefits associated with the identification of critical habitat of Scotian Shelf Northern Bottlenose Whales are not considered in this evaluation. A detailed analysis of the incremental impacts of designating critical habitat will be completed as part of the regulatory process associated with the Critical Habitat Order (see Section 1.5).

2.2 Socioeconomic costs of implementing this Action Plan

Many of the recovery measures listed in this Action Plan represent a continuation of current activities or responsibilities and commitments of DFO and/or other groups into the foreseeable future. Unless there is an indication that these activities would cease in the absence of this Action Plan they are considered to be a continuation of the baseline. It is assumed that these activities would carry no incremental costs.

Implementation of certain recovery measures may require large-scale investments in excess of \$500,000 each. It is reasonable to assume that such significant additional costs would be incurred with the undertaking of survey work related to the evaluation of the whale's prey composition, distribution and abundance. In addition, work associated with visual and acoustic surveying and monitoring, satellite tagging and the collection of tissue samples could require sizeable investments in the range of hundreds of thousands of dollars each. However, it is not possible to quantify the exact cost of these activities until a survey design and/or monitoring plan is developed for each project. As noted in Tables 1-3, potential participants in this type of work include DFO, academics, NGOs, and other government departments.

Other measures may each require smaller-scale investments in the range of tens of thousands of dollars by DFO, the fishing industry, environmental groups, or other organizations to enhance current capabilities. Examples include potential costs associated with conducting additional field studies on the whale's behaviour, reproduction and movements, undertaking additional work related to research planning, and the expansion of a number of ongoing research activities.

For several of the listed measures insufficient information is available to provide an accurate assessment of potential costs. For example, costs related to at-sea observer coverage cannot be calculated until the actual desired levels of coverage are determined. As a result, costs associated with implementation of these recovery measures cannot be assessed at this time.

2.3 Benefits of implementing this Action Plan

The overall recovery goal for Scotian Shelf Northern Bottlenose Whales is to achieve a stable or increasing population and to maintain, at a minimum, current distribution. It is expected that the implementation of this Action Plan would result in an important contribution towards achieving this recovery goal. Recovery would be facilitated by improving the understanding of the species' ecology, population and distribution, by reducing significant threats to the species and by engaging stakeholders and the general public in recovery action through education and stewardship. A detailed description and explanation of each of the identified recovery measures is provided in Section 1.2.

This Action Plan may also result in benefits to other species. In particular, many of the stated measures would be beneficial to other marine mammals and marine reptiles as capacity is improved for entanglement prevention and response in general. Other

measures, such as aerial or vessel-based surveys, could result in important information on other marine mammals, reptiles and fishes that could be used to improve management and stewardship of these species.

Many of the benefits derived from biodiversity conservation, including the protection and recovery of species at risk, are non-market commodities that are difficult to quantify. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; DFO 2008b). Self-sustaining and healthy ecosystems, with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians.

2.4 Distributional impacts

Implementation of this Action Plan will require collaboration among many organizations and groups, and not only DFO but also other jurisdictions, organizations and individuals. This includes contributions from various levels of government, non-governmental organizations, the fishing industry, Aboriginal groups, universities and others. It is also possible that new groups could become involved in future recovery efforts. Probable partners for each measure are noted in Tables 1 and 2. However, at this time it is not possible to determine the extent to which each of these groups would contribute, financially or otherwise, to this Action Plan. Likewise, precise benefits to individual groups cannot be estimated at this time.

3. Measuring progress

The performance indicators presented in the Scotian Shelf Northern Bottlenose Whale Recovery Strategy (DFO 2010a) provide a way to define and measure progress toward achieving the recovery goal and objectives.

Reporting on implementation of the Action Plan (under section 55 of SARA) will be done by assessing progress towards implementing the recovery objectives.

Reporting on the ecological and socio-economic impacts of the Action Plan (under section 55 of SARA) will be done by assessing the results of monitoring the recovery of the species and its long-term viability, and by assessing the implementation of the Action Plan.

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Appendix A: Effects on the environment and other species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)³. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the [Federal Sustainable Development Strategy](#)'s⁴ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of action plans may inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats.

The potential for this Action Plan to inadvertently lead to adverse effects on other species or the environment was considered. No such adverse effects were identified. This Action Plan is expected to benefit other species that share similar threats and habitat, including the Sowerby's Beaked Whale, which is listed as Special Concern under the *Species at Risk Act*. This Action Plan will be implemented in coordination with the "Management Plan for the Sowerby's Beaked Whale (*Mesoplodon bidens*) in Canada" to enhance positive environmental effects where possible. The Action Plan may also benefit the marine environment through enhanced water quality monitoring. Implementation of the recovery measures in this Action Plan will contribute to achieving the following FSDS goal:

Goal 4: Conserving and Restoring Ecosystems, Wildlife and Habitat, and Protecting Canadians – Resilient ecosystems with healthy wildlife populations so Canadians can enjoy benefits from natural spaces, resources and ecological services for generations to come.

³ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

⁴ <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=A22718BA-1>

Appendix B: Record of cooperation and consultation

Bilateral meetings were held with the Canada-Nova Scotia Offshore Petroleum Board in June 2012 and the Department of National Defence in July of 2012. The purpose of these meetings was to review and discuss relevant recovery measures in this Action Plan and to provide general updates on recovery planning.

The Gully Advisory Committee (GAC), a multi-stakeholder group formed to provide input into the management of the Gully Marine Protected Area, was engaged during the drafting stages of this Action Plan. The following groups were represented on the GAC during this initial engagement:

Canada-Nova Scotia Offshore Petroleum Board
Canadian Coast Guard
Canadian Parks and Wilderness Society (Nova Scotia Chapter)
Canadian Wildlife Service, Environment Canada
Clearwater Seafood
Dalhousie University
Department of National Defence
Ecology Action Centre
EnCana
ExxonMobil
Geological Survey of Canada (Atlantic)
Kwilmu'kw Maw-klusuaqn Mi'kmaq Rights Initiative
Maritime Aboriginal Peoples Council
Natural Resources Canada
Nova Scotia Department of Fisheries and Aquaculture
Nova Scotia Department of Energy
Nova Scotia Swordfishermen's Association
Parks Canada Agency
Seafood Producers Association of Nova Scotia
Shell Canada
Unama'ki Institute of Natural Resources
World Wildlife Fund Canada