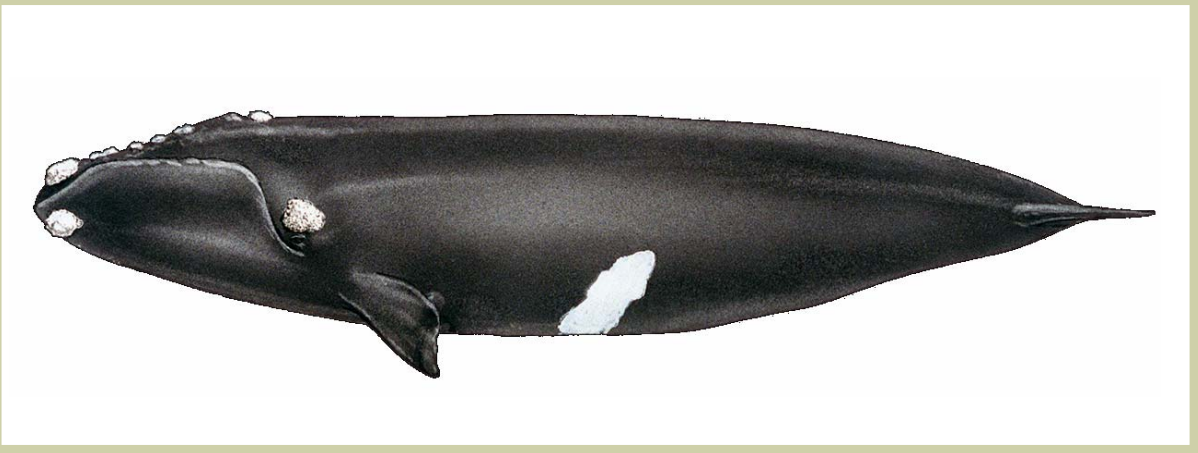
PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters

North Pacific Right Whale



2011

Fisheries and Oceans Canada
Pêches et Océans Canada
Canada

About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/approach/act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. A period of three to four years is allowed for those species that were automatically listed when SARA came into force.

What's next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters [Proposed]

2011

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Additional copies:

Additional copies can be downloaded from the SARA Public Registry (www.sararegistry.gc.ca).

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PREFACE

The North Pacific Right Whale is a marine mammal and is under the responsibility of the federal government. The Minister of Fisheries and Oceans is a "competent minister" for aquatic species under the *Species at Risk Act* (SARA). Since the North Pacific Right Whale may occur in the Gwaii Haanas National Marine Conservation Area Reserve, administered by the Parks Canada Agency, the Minister of the Environment is also a "competent minister" under SARA for this species. The *Species at Risk Act* (SARA, Section 37) requires the competent ministers to prepare recovery strategies for species listed as extirpated, endangered or threatened, in cooperation and consultation with affected and interested parties. The North Pacific Right Whale was listed as Endangered under Schedule 1 of SARA in 2006. Fisheries and Oceans Canada – Pacific Region, led the development of this recovery strategy, in cooperation and in consultation with the Parks Canada Agency and many individuals, organizations and government agencies (Appendix III).

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Fisheries and Oceans Canada, the Parks Canada Agency or any other party alone. This strategy provides advice to jurisdictions and organizations that may be involved or wish to become involved in the recovery of this species. In the spirit of the National Accord for the Protection of Species at Risk, the Minister of Fisheries and Oceans and the Minister of Environment invite all responsible jurisdictions and Canadians to join Fisheries and Oceans Canada and the Parks Canada Agency in supporting and implementing this strategy for the benefit of the North Pacific Right Whale and Canadian society as a whole. Fisheries and Oceans Canada and the Parks Canada Agency will support implementation of this strategy to the extent possible, given available resources and overall responsibility for species at risk conservation.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new information. The competent ministers will report on progress within five years.

This strategy will be complemented by one or more action plans that will provide details on specific recovery measures to be taken to support conservation of the species. The competent ministers will take steps to ensure that, to the extent possible; Canadians interested in or affected by these measures will be consulted.

RESPONSIBLE JURISDICTIONS

Fisheries and Oceans Canada
Parks Canada Agency

AUTHORS

This document was drafted by Barbara Koot and the 2009/2010 North Pacific Right Whale Recovery Team (see Section 4.2). The foundation for this document (the 2004 "Draft National Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters") was written by John Ford, Miriam O, and the 2004 North Pacific Right Whale Recovery Team (see Section 4.1).

ACKNOWLEDGMENTS

Fisheries and Oceans Canada (DFO) acknowledges the efforts of the members of the 2004 North Pacific Right Whale Recovery Team (see Section 4.1) who prepared the pre-SARA "Draft National Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters", the foundation for the development of this document. DFO also acknowledges the members of the 2009/2010 North Pacific Right Whale Recovery Team (see Section 4.2) who revised the draft that was prepared in 2003/2004 as per SARA Recovery Strategy content requirements, updated with new information, and provided valuable information, expertise, and perspective.

Input from the public, scientific experts, non-governmental environmental organizations, government agencies, and First Nations during the consultation process is also acknowledged and greatly appreciated (see Section 4.2).

STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

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*. 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.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also 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 results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the North Pacific Right Whale. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA Public Registry:
www.sararegistry.gc.ca/sar/recovery/residence_e.cfm.

EXECUTIVE SUMMARY

A draft "National Recovery Strategy for the North Pacific Right Whale in Pacific Canadian Waters" was prepared in 2003-04 by Fisheries and Oceans Canada, with input from other stakeholders and interested parties. This current recovery strategy fulfills requirements under SARA and provides updated information regarding North Pacific Right Whales in Pacific Canadian waters and adjacent waters, as well as re-focused recovery measures for the species.

The North Pacific Right Whale, *Eubalaena japonica* (Lacépède 1818; Rosenbaum *et al.* 2000b), is a large, robust, baleen whale, characterized by a stocky body, black colouration (sometimes with white patches on the ventral surface), lack of a dorsal fin, strongly bowed lower lip, and callosities on the head region (Kenney 2002). The North Pacific Right Whale filter feeds almost exclusively on copepods, which can be gathered at the surface by skim feeding or at depth during feeding dives.

What is known about North Pacific Right Whale distribution is determined from historical whaling data (1785-1913) and rare sightings in the post-whaling era. Analysis of whaling data suggests that in the summer, right whale density was high in the Gulf of Alaska and along the eastern coast of Kamchatka, around the Kuril Islands and northward into the Sea of Okhotsk, and in the Sea of Japan, and that densities were lower in offshore regions (Josephson *et al*. 2008). The North Pacific Right Whale is considered to have eastern and western sub-populations, at least with regard to concentrations on feeding grounds (Brownell *et al*. 2001). Whaling data show that historically, right whales were present in Pacific Canadian waters from April to October (Townsend 1935, Scarff 1986, Brownell *et al.* 2001, Clapham *et al.* 2004). The current presence of this species in Pacific Canadian waters has not been confirmed due to insufficient data. Only seven right whales were taken by B.C. whalers (1900-1951), who worked mainly in coastal waters. The last right whale sighting that may have been in Pacific Canadian waters (due to the range of coordinates given for this sighting, there is a possibility that it occurred outside of Pacific Canadian waters) was in 1970 from a Japanese scoutboat west of the Haida Gwaii (Queen Charlotte Islands) (Wada 1975).

North Pacific Right Whales were hunted intensively from 1835 to 1900, when the species was depleted throughout its range, and was no longer a principal target for commercial whaling (Scarff 1986, Scarff 2001). Although there is little information on pre-exploitation abundance of North Pacific Right Whales, it is estimated that the population size was at least 11,000 animals (NMFS 1991) and possibly 26,500 to 37,000 animals (Scarff 2001). Although right whales were first protected from commercial whaling by the International Convention for the Regulation of Whaling in 1935, and then by the International Whaling Commission (IWC) in 1949 (Scarff 1986, Donovan 1992), North Pacific Right Whales were subject to illegal Soviet whaling between 1961 and 1979 (Brownell *et al.* 2001). This species has shown very few signs of recovery, likely because of the relatively recent end of illegal Soviet whaling (Brownell *et al.* 2001, Clapham and Ivashchenk 2009).

At this time, very little information is available on current abundance, population trends, seasonal distribution or movements of the North Pacific Right Whale. Estimates of recent population abundance and trends are speculative, being based upon general patterns of sightings

(e.g. Berzin and Yabokov 1978, Braham and Rice 1984, Berzin and Vladimirov 1989, Vladimirov 1994, Vladimirov 2000 cited in Brownell *et al.* 2001). However, it has been postulated that the current population in the eastern North Pacific may number in the tens of animals (LeDuc *et al.* 2001, Clapham *et al.* 2005, NMFS 2006). First abundance estimates for the Bering Sea and Aleutian Islands combined, of 31 and 28 individuals (photographic and genotypic data respectively, using mark-recapture analysis), are not thought to be much below the total population abundance of the eastern North Pacific (Wade *et al.* 2010).

Historically, commercial whaling was the principal threat to the North Pacific Right Whale, but is no longer a threat today. Due to the general lack of information on right whale occurrence in Pacific Canadian waters, threats to the species cannot be clearly identified. Based on information from other right whale populations around the world, and other baleen whale species, current potential threats that could affect the North Pacific Right Whale are identified as marine traffic and ship strikes, entanglement in fishing gear, noise, and pollution. In addition to these threats, biologically limiting factors could complicate the recovery of the North Pacific Right Whale. The primary limiting factor affecting the survival of the North Pacific Right Whale is likely small population size, potentially resulting in inbreeding depression and depensation. Other limiting factors are the life history characteristics of the species (late age of sexual maturity, long reproductive interval, and long life-span), climate change, and the effect of climate change on food supply. Identified knowledge gaps are population structure and genetics; life history parameters and population dynamics; current occurrence, abundance, distribution, migratory behaviour and habitat use in Pacific Canadian waters; threats and human influences; and critical habitat.

Research is needed to confirm the presence of the species in Pacific Canadian waters before recovery and population and distribution objectives can be fully defined and addressed. Once the species' presence is confirmed, the remaining objectives will focus primarily on research to gather basic information on abundance, distribution, habitat, and threats. The long-term goal of this recovery strategy is to increase the probability of survival, and attain long-term viability, of the North Pacific Right Whale in Pacific Canadian waters. The objectives and associated knowledge gaps are to be addressed through multi-species research activities expected to benefit baleen whales and other species at risk. It is important to note that for long-lived species such as the right whale, it may take many decades before increases in this population can be observed, and even longer before recovery is achieved. It is therefore critical that the long-term nature of this strategy is recognized in the evaluation of the objectives and supporting strategies.

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1. BACKGROUND[1]

1.1 Species Assessment Information from COSEWIC

Date of Assessment: November 2004

Common Name (population): North Pacific Right Whale

Scientific Name: *Eubalaena japonica*

COSEWIC Status: Endangered

Reason for Designation: Although there have not been sightings of this species in the last 50 years in Canadian waters, there have been sightings both south and north of British Columbia waters. Therefore, it is not appropriate to classify the species as extirpated. The total population in the eastern North Pacific likely numbers a few tens of animals.

Canadian Occurrence: Pacific Ocean

COSEWIC Status History: The Right Whale was considered a single species and designated Endangered in 1980. Status re-examined and confirmed in April 1985 and April 1990. Split into two species in May 2003. North Pacific Right Whale was not re-evaluated in May 2003; it retained the Endangered status of the original Right Whale. Status re-examined and confirmed Endangered in November 2004. Last assessment based on an update status report.

1.2 Description of the Species

The North Pacific Right Whale, *Eubalaena japonica* (Lacépède 1818, Rosenbaum *et al.* 2000b), is a large, robust, baleen whale. All of the right whale species have similar physical descriptions. Adults can reach up to 18 meters in length, and may weigh over 100 tonnes (Kenney 2002). Females are larger than males, and newborns are 4.5 to 6 meters long at birth. Right whales are distinguished by a stocky body, black colouration (sometimes with white patches on the ventral surface), lack of a dorsal fin, a large rostrum (about ¼ of the body length), strongly bowed lower lip, and callosities on the head region. Callosities are irregular patches of thickened, keratinized tissue, which can be inhabited by dense populations of specialized amphipod crustaceans, known as cyamids (Kenney 2002). Two rows of long (up to 2.5 m in length), dark baleen plates hang from the upper jaw, with about 225 plates on each side. The tail is very broad, deeply notched, and all black with a smooth trailing edge. They have a distinct V shaped blow, upwards of 5 meters in height. Right whales lack elastic throats, unlike other baleen whales that have pleated, expandable throats used to gulp food consisting of large krill or fish. The right whale feeds

[1] SARA requires that the recovery strategy identify "a description of the species and its needs that is consistent with the information provided by COSEWIC [SARA s.41(1)(*a*)].

almost exclusively on copepods (*Calanus* spp.), which are gathered by moving through dense patches of these organisms with their huge mouths open at the surface. Filter feeding can also take place at depth. Feeding dives in the bottom boundary layers have been observed in North Atlantic Right Whales (Baumgartner and Mate 2003, Gregr and Coyle 2009).

1.3 Populations and Distribution

1.3.1 Nationally Significant Populations

Recent studies indicate that North Pacific, North Atlantic and Southern Right Whales are three distinct species with complete and long-established isolation (Rosenbaum *et al.* 2000a, Brownell *et al*. 2001). The Southern Right Whale has long been recognized as a separate species, *E. australis*. Although the North Pacific Right Whale was formerly considered to be the same species as the North Atlantic Right Whale (*E. glacialis*), genetic data show that the North Pacific Right Whale is more closely related to the Southern Right Whale (Rosenbaum *et al.* 2000a). Rosenbaum *et al.* (2000a) reviewed genetic data on right whales worldwide and concluded that three species should be recognized. The International Whaling Commission Scientific Committee accepted Rosenbaum *et al*.'s analysis and proposed nomenclature, and three species – *E. japonica* in the North Pacific, *E. glacialis* in the North Atlantic, and *E. australis* in the southern hemisphere – were formally recognized (IWC 2001b). More recently, Gaines *et al*. (2005) confirmed this species delineation by examining both mitochondrial and nuclear DNA.

The historical population structure for right whales in the North Pacific is not clear. What is known about historical distribution is inferred from charts prepared by Matthew Fontaine Maury in the early 1850's and Charles Haskins Townsend in the 1930s based on data from American whalers' logbooks (Josephson *et al.* 2008). Townsend's charts (1935; see Figure 1 for eastern North Pacific chart) show a discontinuous distribution across high latitudes, with few catches in the mid-Pacific region. These data have been used by numerous authors as evidence to support the hypothesis of discrete eastern and western populations in the North Pacific (Brownell *et al*. 2001). However, Scarff (1991) noted that Maury's charts (Maury 1852, Maury 1853) suggest a more continuous distribution of right whales (relative to effort), across the North Pacific (Figure 2; Scarff 1991), and that the apparent discrete populations of right whales in the eastern and western North Pacific reflected in the Townsend charts is largely an artifact of the non-random distribution of whalers in the North Pacific and their concentration on the eastern (Gulf of Alaska "Northwest Ground') and western (Kamchatka/Sea of Okhostk) areas. However, the depiction of data in the Maury charts has recently been proven to be erroneous. Reeves *et al*. (2004) provide direct evidence that the distribution of North Atlantic Right Whales in an offshore area called 'Maury's Smear' shown in the 1852-53 charts is at least partially and possibly entirely erroneous, due to errors in extraction and transcription of data in the making of the charts. This finding casts doubt on the reliability of inferences about the historical distribution of right whales from the Maury charts in other areas. Josephson *et al*. (2008) subsequently analyzed the Maury data for the North Pacific Right Whale, and determined that plotting errors were also made in this region. This analysis showed that right whales were likely not distributed continuously across the North Pacific as the Maury charts depict, but instead had a pronounced longitudinally bimodal distribution, and were not frequently encountered in the central-northern North Pacific (Figure 3). This bimodal distribution is similar to the distribution shown in the Townsend (1935)

charts (Josephson *et al.* 2008), and supports the two stock (eastern and western populations) hypothesis.

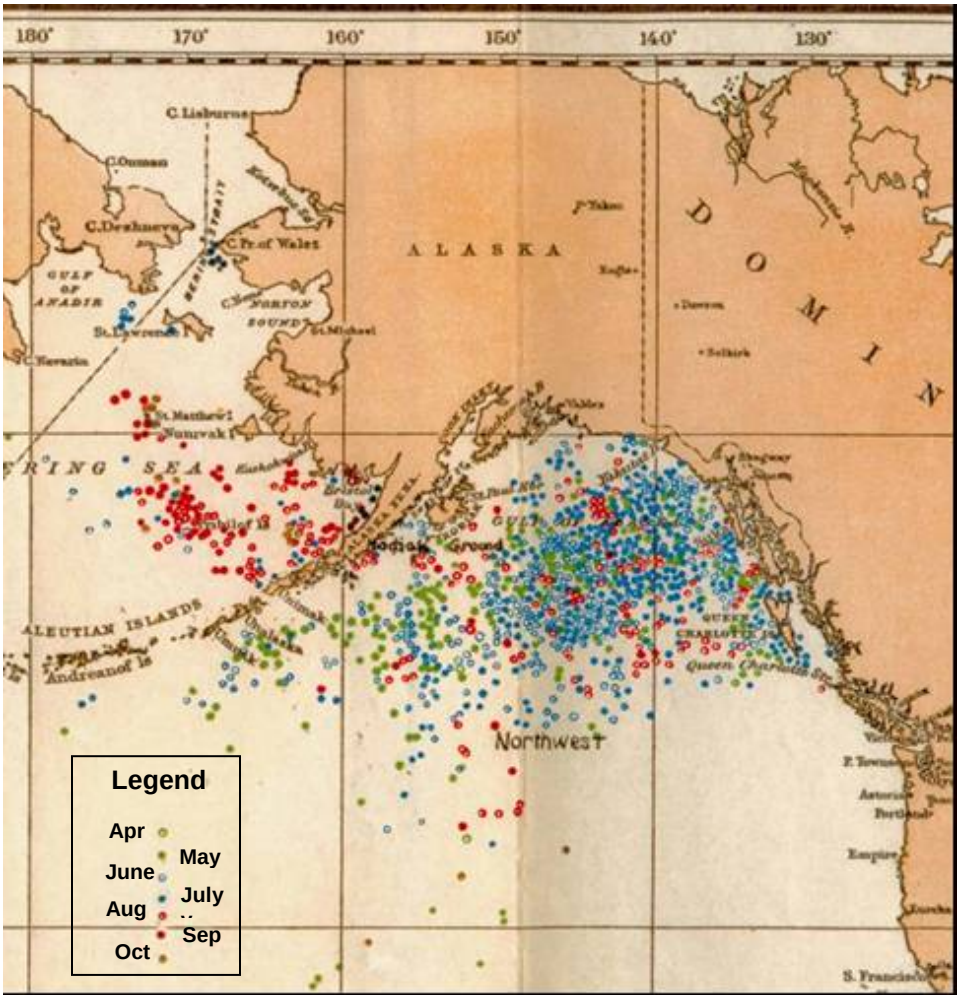

Figure 1. Map of historical right whale catches from 1785 – 1913 in the eastern North Pacific from logbook records of American whaleships (replicated from Townsend 1935). The dot colour represents month of catch. The discontinuous distribution across high latitudes has been used to support the hypothesis of discrete eastern and western populations in the North Pacific (Brownell *et al.* 2001).

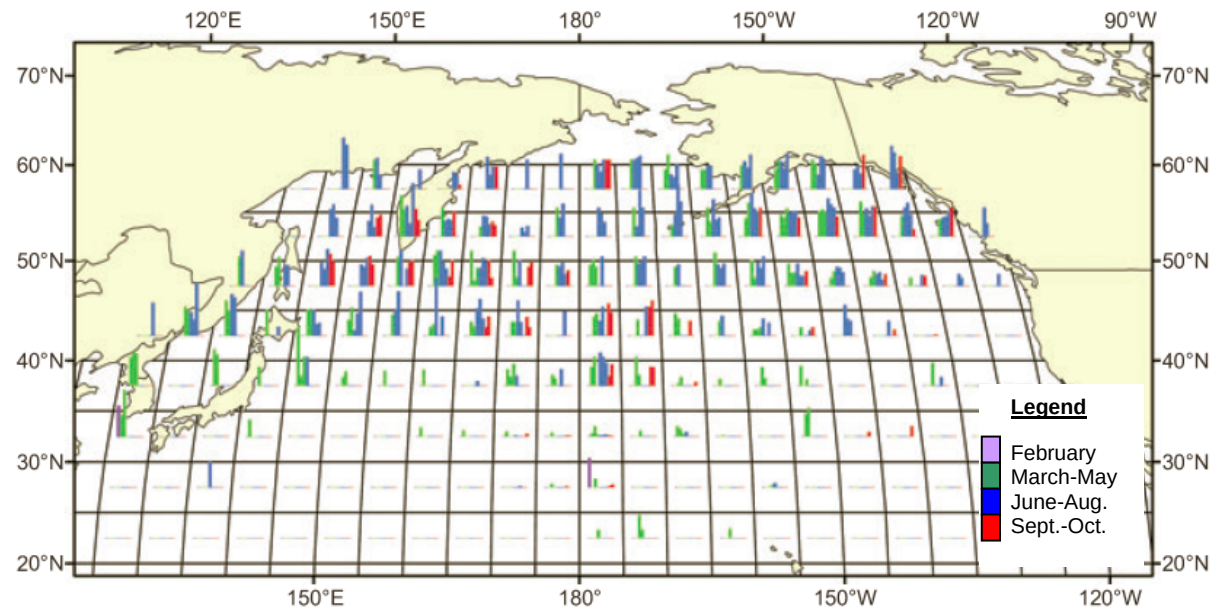

Figure 2. Encounter rates (number of right whale days divided by the number of whaling days) by 5° square and month as portrayed on Maury's charts (as tabulated by Scarff 1991) (Adapted from Josephson *et al*. 2008). This depiction of the data showing continuous distribution across the Pacific has recently been proven to be erroneous (Reeves *et al.* 2004, Josephson *et al*. 2008).

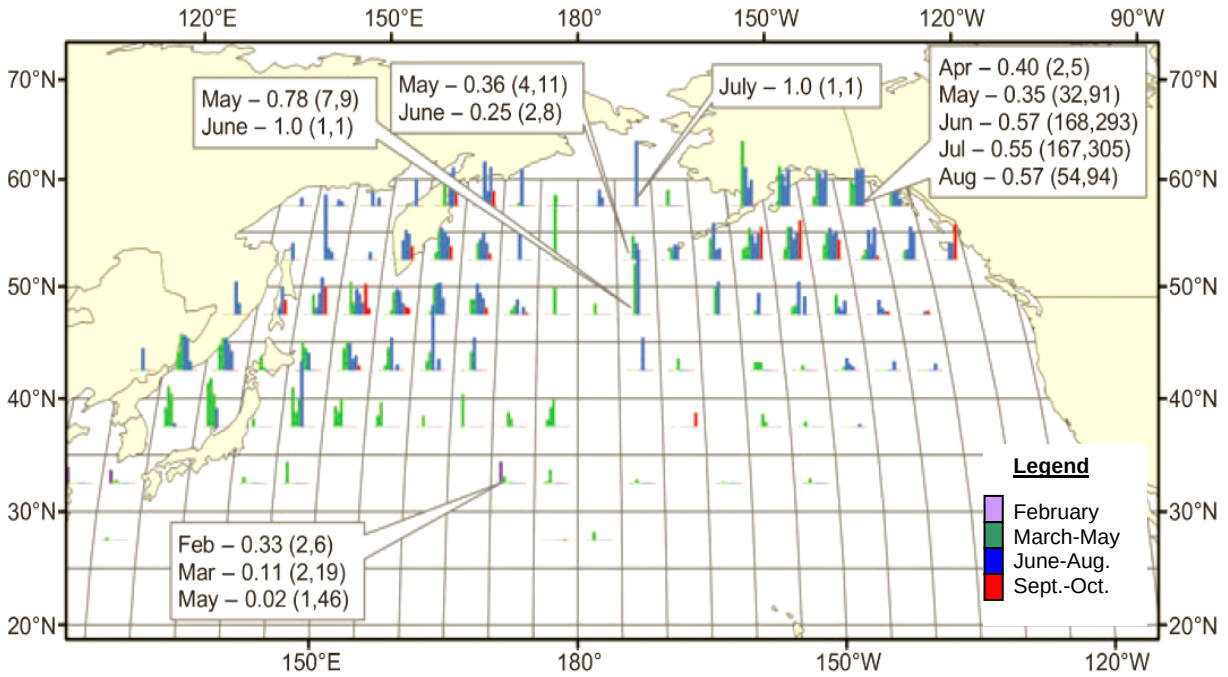

Figure 3. Encounter rates (number of right whale days divided by number of whaling days) by 5° square and month from selected Maury Abstracts. The encounter rates in five 5° squares are listed by month to illustrate the vertical scale, followed by the numbers of right whale days and whaling days in parentheses (Adapted from Josephson *et al.* 2008). Re-analysis of the Maury data by Josephson *et al*. (2008) show that right whales were not distributed continuously across the North Pacific (as the Maury charts depict) but instead exhibit pronounced longitudinally bimodal distribution.

Patterns of sightings in the 20th century, and apparently distinct catch and recovery histories of right whales in the eastern and western North Pacific, provide further support for the two stock hypothesis, at least with regard to concentrations on feeding grounds (Brownell *et al*. 2001). Although some authors (e.g., Kenney 2002) have argued that there are insufficient genetic or re-sighting data to support this separation, most support the distinction between western and eastern North Pacific Right Whale populations, and a review by the IWC (2001b) concluded that the east-west population distinction should remain in place until new data are available. As a result, this report will also recognize the east-west population distinction. The degree of genetic exchange between the eastern and western populations in high latitudes or on a possible offshore breeding ground is unknown (Brownell *et al.* 2001).

1.3.2 Global Range

The recent re-analysis of the Maury whaling data (see Section 1.3.1 Nationally Significant Populations) by Josephson *et al*. (2008) represents the best available information on the distribution of North Pacific Right Whales in the 1840s. In summer, the density was high in the Gulf of Alaska and along the eastern coast of Kamchatka, around the Kuril Islands and northward into the Sea of Okhotsk, and in the Sea of Japan (Figure 3; Josephson *et al*. 2008). At all latitudes between longitudes 170° E and 160° W, the density of right whales was much lower than suggested in the Maury charts (Josephson *et al.* 2008). Right whales were encountered by American whalers farther south in the spring than in other seasons. This is consistent with the hypothesis that right whales moved seasonally northward from regions south of where American whalers usually searched, but does not necessarily suggest the locations of wintering or calving grounds (Josephson *et al*. 2008). The historical distribution shown in Figure 3 is similar to the right whale catch distribution shown in charts by Townsend (1935), which do not account for search effort.

Post-exploitation distribution of the North Pacific Right Whale is poorly known, but it is clearly much more restricted than the historical distribution (Brownell *et al.* 2001). There are very few data on current summering and wintering grounds. Gaskin (1987) indicated that whaling data assembled by Nemoto (1957, 1959, and 1962) and Gaskin (1976) suggest that most remaining eastern North Pacific Right Whales gather together in summer on the southeastern shelf of the Bering Sea, around the eastern Aleutian Islands, and Kodiak Island. Further studies of historical concentrations and some recent summer sightings indicate that the Bering Sea and Gulf of Alaska may contain important feeding grounds (Scarff 1986, Scarff 1991, Moore *et al*. 2000, Brownell *et al*. 2001, Clapham *et al.* 2004, Josephson *et al.* 2008, Munger *et al*. 2008). Post-whaling sightings have been reported as far south as central Baja California in the eastern North Pacific, and Hawaii in the central North Pacific and as far north as the sub-Arctic waters of the Bering Sea and Sea of Okhotsk in the summer (Herman *et al*. 1980, Berzin and Doroshenko 1982, NMFS 1991, LeDuc 2004, Wade *et al*. 2006).

The calving or wintering grounds of the eastern North Pacific Right Whale are unknown. Scattered reports exist of right whales seen off Washington, northern Oregon, California and Hawaii during winter months (Scarff 1986, Gaskin 1987, Scarff 1991), but other than these

sightings Brownell *et al*. (2001) found little evidence that these areas were ever important habitats for North Pacific Right Whales.

Migratory patterns of the North Pacific Right Whale are unknown, although other right whale species generally spend the summer on high-latitude feeding grounds (Braham and Rice 1984). Among North Atlantic Right Whales, part of the population moves south in the winter (pregnant females, some juveniles and few adult males) while the rest is thought to remain at higher latitudes (Brown *et al.* 2009; L. Murison, Grand Manan Whale and Seabird Research Station, personal communication, 2010). Historically, North Pacific Right Whales were found across a wide range of latitudes during both summer and winter, which is evidence of a staggered or diffuse migration (Scarff 1991). Seasonal movement is also evident in monthly plots of twentieth century and historical records (Clapham *et al.* 2004, Josephson *et al*. 2008).

1.3.3 Canadian Range

Historical whaling data (Figures 1 and 3) indicate that right whales were present in Pacific Canadian waters from April to October (Townsend 1935, Clapham *et al.* 2004, Josephson *et al*. 2008), possibly feeding or migrating to or from calving grounds.

Due to insufficient data, it is not possible to confirm the presence or describe the distribution of this species in Canada. Only seven right whales were taken by B.C. whalers, who worked mainly in coastal waters (Table 1, Figure 4). The last confirmed right whale sighting that may have been in Pacific Canadian waters was in 1970 from a Japanese scoutboat west of the Haida Gwaii (Queen Charlotte Islands) (Table 1; Wada 1975). However, due to the range of coordinates given for this sighting, there is a possibility that it did not occur in Pacific Canadian waters. An unconfirmed right whale sighting in Pacific Canadian waters was made in 1983 at the mouth of Juan de Fuca Strait (Table 1; Reeves and Leatherwood 1985). No sightings of right whales have been made during 28,725.33 km of shipboard cetacean surveys undertaken during 2002-2008 in coastal Pacific Canadian waters by the Cetacean Research Program, Pacific Biological Station, Fisheries and Oceans Canada (Ford *et al*. 2010a). Although survey effort over this time period was extensive (see App. A), it was focused primarily on nearshore species and was minimal in offshore areas (> 10 nautical miles from shore) that were historically occupied by right whales as indicated by whaling catches (Figure 1). No right whale vocalizations have been detected during the initial phase (2006 and 2007)[2] of passive acoustic monitoring conducted by Fisheries and Oceans Canada in coastal Pacific Canadian waters (Ford *et al.* 2010b).

[2] Passive acoustic monitoring was conducted at Union Seamount and La Perouse Bank (see App. A). 1915 hours over 160 days were recorded in 2006 at Union Seamount and 1437 hours over 120 days were recorded in 2007 at La Perouse Bank (Ford *et al.* 2010b).

Table 1. Right whale catches and sightings in British Columbian waters, 1900-2008.

DATE	LOCATION	TYPE	NUMBER OF WHALES	WHALING STATION	REFERENCE
June, 1914	Haida Gwaii (no coordinates)	Catch	1	Naden Harbour	Nichol *et al.* 2002
June, 1918	Haida Gwaii (no coordinates)	Catch	1	Rose Harbour	Nichol *et al.* 2002
June 15, 1924	W of Dixon Entrance (54°35 N, 133°55 W)	Catch	1	Naden Harbour	Nichol *et al.* 2002
June 24, 1924	W of Graham Island (54°05 N, 133°40 W)	Catch	1	Naden Harbour	Nichol *et al.* 2002
June 10, 1926	W of Graham Island (53°40 N, 133°45 W)	Catch	1	Naden Harbour	Pike and MacAskie 1969
June 10, 1929	Haida Gwaii (no coordinates)	Catch	1	Rose Harbour	Nichol *et al.* 2002
July 18, 1951	Off NW Vancouver Island (50° N, 128° W)	Catch	1	Coal Habour	Pike and MacAskie 1969
1970	W of Haida Gwaii (50-55° N, 130-140° W)	Sighting	2	-	Wada 1975 †
1983	Juan de Fuca Strait (48° 33 N, 124° 39 W)	Sighting	2	-	Reeves and Leatherwood 1985 in Braham 1986††

† Due to the range of coordinates given for this sighting, there is a possibility that this sighting occurred just outside of Canadian waters.
†† This is an unconfirmed sighting.

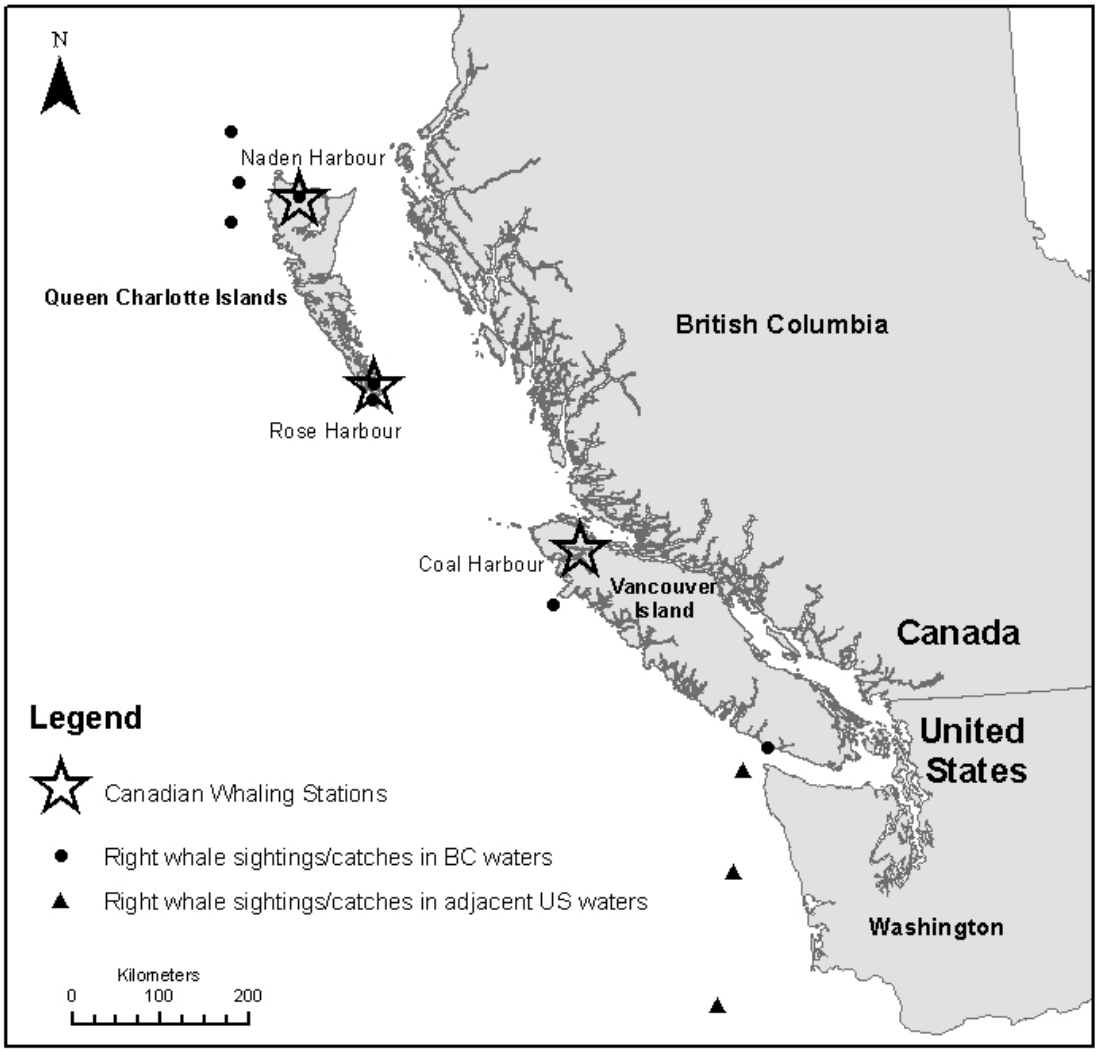

Figure 4. Right whale sightings and catches in British Columbia waters and in U.S. waters adjacent to the Canadian border, 1900-2008. Note that coordinates were not found for several catches positioned at whaling stations (see Table 1), and that the range of coordinates for the 1970 sighting (Wada 1975) is too broad to plot on this map.

Sightings Adjacent to Canadian Waters

Three nearshore sightings of seven animals have been documented in U.S. waters near the B.C./Washington border (Table 2, Figure 4). The proximity of these sightings to Canadian waters suggests that these animals could potentially be using similar habitats in Canadian waters, or be passing through Canadian waters on their way to the Bering Sea and Gulf of Alaska where right whales have been observed in the summer. Between 1958 and 1977, eight sightings in offshore (i.e., outside the 200 mile limit to 145° W) waters are recorded (Table 2).

Table 2. North Pacific Right Whale sightings in nearshore and offshore areas adjacent to Pacific Canadian waters, 1900-2008.

DATE	LOCATION	NUMBER OF WHALES	REFERENCE
Nearshore			
April 8, 1959	SW of Grays Harbour, Washington (45°55 N, 125°25 W)	3	Fiscus and Niggol 1965
January 17, 1967	W of Cape Flaherty, Washington (48°20 N, 125°06 W)	3	Rice and Fiscus 1968
May 24, 1992	NW of Grays Harbour, Washington (47°17 N, 125°11 W)	1	Rowlett *et al*. 1994
Offshore			
1958-1967	50° N, 145° W	2	Pike and MacAskie 1969
1958-1967	54° N, 155° W	1	Pike and MacAskie 1969
1973	45-50° N, 140-150° W	1	Wada 1975
1974	40-50° N, 140-160° W	1	Anonymous 1976
1975	40-45° N, 140-150° W	2	Wada 1977
1977	40-50° N, 140-145° W	1	Wada 1979
1977	45-50° N, 135-140° W	2	Wada 1979

1.3.4 Population Sizes and Trends

North Pacific Right Whales were hunted intensively from 1835 to 1900 until the species was too severely depleted to support commercial whaling (Scarff 1986, Scarff 2001). Pre-exploitation abundance has been estimated to be at least 11,000 animals (NMFS 1991). However, Scarff (2001) analyzed total whaling-related mortality from 1839 to 1909, including mortality of struck-but-lost whales and mortality by non-American whalers, and estimated pre-exploitation abundance to be in the range of 26,500-37,000 animals. Among the large whales, North Pacific and North Atlantic Right Whales have shown the fewest signs of recovery following depletion due to whaling. Because so little is currently known about the North Pacific population, it is impossible to determine population trends at this time and only recently have the first population abundance estimates been presented (Wade *et al*. 2010).

Most estimates of recent population abundance and trends are speculative, being based upon general patterns of sightings (e.g. Berzin and Yabokov 1978, Braham and Rice 1984, Berzin and Vladimirov 1989, Vladimirov 1994, Vladimirov 2000 cited in Brownell *et al.* 2001). Even the most quantitative studies (e.g., Ohsumi and Wada 1974, Miyashita and Kato 1998) have high variance in abundance estimates due to extrapolations from small sample sizes over large

geographic areas (Brownell *et al.* 2001). North Pacific Right Whales almost certainly do not number more than those found in the western North Atlantic (~300; IWC 1999, Brown *et al.* 2009), and most occur in the western North Pacific. The western North Pacific population is little studied but may be growing (Miyashita and Kato 1998). A population estimate of 922 (CV=0.433; 95% CI 404-2108) was calculated for the Okhotsk Sea for 1989-1992 (Miyashita and Kato 1998). However, the reliability of this estimate is low (95% CI 404-2108). Many still believe it is unlikely that there are more than a few hundred animals in the western population (Knowlton *et al.* 1994, IWC 1999, IWC 2001a, Kraus *et al.* 2001).

Ohsumi and Wada (1974) and Wada (1976) estimated a population size of 120 for the eastern North Pacific. More recently, a lack of sightings despite considerable survey effort by Japan and the U.S. suggest that the population may number in the tens (Miyashita and Kato 1998, Scarff 1986, LeDuc *et al.* 2001, NMFS 2006). Clapham *et al.* (2005) believe that the total eastern North Pacific population is considerably less than 100 individuals. First abundance estimates of 31 individuals (95% CL 23-54) based on photo-identification data and 28 individuals (95% CL 24-42) based on genetic data for the Bering Sea and Aleutian Islands have been developed by Wade *et al.* (2010) using mark-recapture methods. While these estimates may represent a sub-population with a strong site fidelity to the southeastern Bering Sea, the total eastern North Pacific population is not thought to be much larger (Wade *et al.* 2010).

Recent sightings of right whales in the eastern North Pacific have been rare. Following a 1996 sighting of a group of right whales in the southeastern Bering Sea (Goddard and Rugh 1998), dedicated photo-identification studies, acoustically-aided ship based studies, and long-term passive acoustic monitoring studies have been conducted in this area, with most effort focused on shelf and slope waters of the southeastern Bering Sea and Gulf of Alaska (Shelden *et al.* 2005). Since the beginning of these studies, a few animals- from 4 to 23 individuals– have consistently been sighted and acoustically detected in the southeastern Bering Sea and the Gulf of Alaska in the summer (Tynan 1999, Brownell *et al*. 2001, LeDuc *et al.* 2001, McDonald and Moore 2002, LeDuc 2004, Mellinger *et al.* 2004, Wade *et al.* 2006, Munger *et al.* 2008). Acoustic detection suggests that right whales occur in the southeastern Bering Sea from May until December, and based on higher calling rates, that right whale habitat use in the southeastern Bering Sea may increase in mid-summer through early fall (Munger *et al*. 2008). In the summer of 2004 one satellite-tagged right whale[3] moved throughout the southeast Bering Sea shelf over 40 days, including outer shelf areas where right whales have not been seen for decades. Photo-identification and genetic analyses of 23 right whales in 2004, confirmed 16 individuals– six females and ten males, of which two were calves (Wade *et al.* 2006, Wade *et al*. 2010). Of these 16 whales, at least one male had been previously photographed, and four animals previously biopsied (Wade *et al*. 2006, Wade *et al*. 2010). This was a significant sighting, as the only other female and calf identified during recent studies in the eastern North Pacific were sighted in the Bering Sea in 2002 (Ferrero *et al.* 2000, Wade *et al*. 2006).

[3] One of two animals fitted with satellite-tags in summer 2004 (Wade *et al.* 2006)

1.4 Needs of the North Pacific Right Whale

1.4.1 Habitat and Biological Needs

The current abundance, reproductive rates, distribution patterns, migration routes, feeding and calving grounds of North Pacific Right Whales are not known. Based on information from other right whale populations around the world, the International Whaling Commission (IWC) has identified four categories of right whale habitats (NMFS 2009):

1. Feeding areas having high copepod and krill densities, where right whales routinely feed and visit seasonally. Feeding takes place in spring, summer and fall at higher latitudes, where ocean temperatures are cool, and biological production is high (Kenney 2002).
2. Calving areas that are routinely used for calving and neonatal nursing. Calving occurs at low latitudes in the winter, and where calving grounds are known, they are in shallow coastal regions or bays (Kenney 2002; NMFS 2006).
3. Nursery aggregation area(s) where nursing females feed and suckle.
4. Breeding locations where mating behaviour occurs. Breeding occurs in the winter and can take place away from calving grounds[4] (Kenney 2002).

It is the right whale's dependence on large, dense, aggregations of prey that determines much of its distribution (NMFS 2006). Right whales are low trophic-level filter feeders. They feed entirely on zooplankton, primarily copepods. Limited stomach contents and field observations suggest that North Pacific Right Whales are less monophagous than North Atlantic Right Whales (Gregr and Coyle 2009) which depend heavily on the copepod *Calanus finmarchius* (now recognized as *C. marshallae)* (Brown *et al.* 2009). Western North Pacific Right Whale stomach contents included *Neocalanus plumchrus, C. finmarchicus, N. cristatus, Metridia spp*., and a small amount of euphausiids (Omura 1958 cited in NMFS 2006). Eastern North Pacific Right Whale stomach contents included *N. plumchrus, N. cristatus,* and *E. pacifica* (krill) (Omura *et al*. 1969, Omura 1986), and zooplankton sampling near feeding whales has suggested feeding on *C. marshallae* (Tynan 1999, Tynan *et al.* 2001, Coyle 2000 cited in NMFS 2006). A single whale can eat several tonnes of copepods a day. Bio-energetic modeling suggests that right whales require between 407,000 and 1,140,000 calories per day– the equivalent of 0.25-2.6 billion late-stage *C. finmarchicus* copepods (Kenney *et al*. 1986).

Important North Pacific Right Whale habitat has not been identified in Pacific Canadian waters due to the lack of long-term survey effort and right whale sightings. Oceanographic modeling may allow the prediction of potentially important habitat, and help to focus future survey efforts. Using knowledge of right whale prey and North Pacific oceanography, Gregr and Coyle (2009) have presented hypotheses about how patches of prey suitable for North Pacific Right Whale foraging might be formed in the eastern North Pacific. These hypotheses, combined with distribution data and descriptions of the ocean environment, may allow for prediction of potential right whale foraging habitat in the future (Gregr and Coyle 2009). However, moving from

[4] This is the case for the North Atlantic Right Whale where most of the population is thought to remain at higher latitudes in the winter, while the pregnant females along with some juveniles and few adult males move south to the calving grounds (Brown *et al.* 2009; L. Murison, Grand Manan Whale and Seabird Research Station, personal communication, 2010).

predictions of potential foraging habitat to predictions of how right whales use the habitat is another step, and it is not yet known how North Pacific Right Whales use their environment and locate prey patches. It is suggested that if experience is accumulated over generations of right whales, long-term suitability of foraging habitat could be determined by long-term oceanographic conditions (Gregr and Coyle 2009).

1.4.2 Ecological Role

It is thought that patterns of food consumption by large cetaceans (such as the right whale) have had strong effects on community structure in the Bering Sea (NRC 1996). Laws (1985) estimated that the enormous reduction in the biomass of large whales in the Antarctic (caused by commercial whaling) may have released 150 million tonnes of krill annually to remaining predators, resulting in an increase in smaller whales, seals, seabirds, and fish. Similarly, a reduction in major consumers of plankton, such as the right whale, and the resulting increase in plankton, may have greatly contributed to the shift in dominant fisheries seen in the Bering Sea during the 1970s and 1980s (Bowen 1997).

The reduction of baleen whales and this shift in dominant fisheries took place concurrently with physical changes throughout the Pacific. Primary and secondary production increased in the North Pacific, due to changes in the depth of mixed layers of different regions (Venrick *et al.* 1987, Venrick 1994, Polovina *et al.* 1995). The combined changes in species abundance, community composition, trophic organization and physical factors indicate that a regime shift occurred (Benson and Trites 2002). Such a regime shift could likely be accelerated by an abrupt change in biomass of large whales, thus increasing the amount of plankton available to remaining predators. It has been recently postulated however, that marine mammals may exhibit a top-down effect on plankton production and that the impacts of whaling may have directly altered marine pelagic ecosystem structures (Smetacek 2009).

1.4.3 Limiting Factors

The following biological limiting factors could prevent or slow the recovery of the North Pacific Right Whale, regardless of the impacts of potential threats to the species' population viability and habitat discussed below (see Section 1.5 'Threats').

Population Numbers and Genetic Diversity (Inbreeding Depression)

North Pacific Right Whales have a critically small population, which could result in low genetic diversity leading to inbreeding depression, thus restricting their recovery. Inbreeding depression is of major concern in the management and conservation of endangered species (Hedrick and Kalinowski 2000). Rosenbaum *et al.* (2000a) determined that mtDNA haplotype diversity (in extant individuals) is low in the North Atlantic Right Whale, and is even lower in the North Pacific species (5 and 2 haplotypes, respectively). This low genetic variation is a potential limiting factor for population health because of the possibility of inbreeding depression (Schaeff *et al.* 1997). A population exhibiting inbreeding depression could have reduced reproduction and recruitment resulting from reduced fecundity, decreased neonate and juvenile survival, or lowered resistance to disease (Charlesworth and Charlesworth 1987, Haebler and Moeller 1993,

Frankham 1995a, Frankham 1995b, Hedrick and Kalinowski 2000). Evidence from mtDNA suggests that the North Atlantic Right Whale went through a very small genetic "bottleneck" (Schaeff *et al.* 1993), which may have resulted in a reduced reproductive rate and increased calving interval (Knowlton *et al.* 1994). Because of the rarity of this species, inbreeding depression should be considered a major factor limiting the recovery of the North Pacific Right Whale.

Depensation (Allee effect)

The Allee effect, or depensation, is defined as the negative impact on reproductive rates due to reduced social interactions necessary for breeding (i.e., as seen in North Atlantic Right Whale "surface-active groups" which require several males; Kraus and Hatch 2001) and loss of mating opportunities (probability of finding a viable mate is low) in a small population (Anonymous 2000, NMFS 2006). However, it will always be difficult to verify that depensation is the cause of reduced reproductive success when alternative explanations exist.

Life History Characteristics

Although there are no data for right whales in the North Pacific, studies on other right whale populations suggest that they are long-lived, with a lifespan of at least 30 years (Brown *et al.* 2009) and as long as 70 years (Hamilton *et al.* 1988; Kenney 2002). Females have a late age of sexual maturity, estimated at nine or ten years (Hamilton *et al.* 1988); and have a long calving interval of approximately three to four years (Knowlton *et al.* 1994). These biological characteristics make right whales particularly susceptible to exploitation, environmental variation, and demographic stochasticity, which may impact recovery (Clapham *et al.* 1999). Until sightings of a female and calf in the Bering Sea on August 24, 2002 and of two calves in September 2004 (Wade *et al.* 2006), there had been no sightings of calves in the eastern North Pacific since 1900 (Ferrero *et al*. 2000).

Climate Change and Food Supply

Climate-driven regime shifts cause major changes in ecological relationships over large-scale oceanographic areas (Francis and Hare 1994), and are manifested faster at lower trophic levels in marine ecosystems (Benson and Trites 2002). An increase in surface water temperature could result in a declining zooplankton population (Roemmich and McGowan 1995), thus changing the carrying capacity of the Pacific (Venrick *et al*. 1987). Because right whales require high densities of copepod prey (Omura *et al*. 1969), which are dependent upon physical factors, the species may be more sensitive than other cetaceans to impacts from global climate change (Kenney 2002).

The potential effects of inadequate food supply on right whales could be either a reduction in individual growth rates, thus delaying sexual maturity, or insufficient blubber reserves needed for females to sustain pregnancy or lactation (Kenney *et al.* 1986). Reduction in the abundance of copepods, caused by either climate change or competition, is a possible explanation for the low population growth rate observed in North Atlantic Right Whales (Kenney 2002). However, it is important to note that although food supply may be a contributing factor, demographic

constraints are much more likely to be the main cause of low population growth rates for the North Pacific Right Whale. Furthermore, any impacts may be amplified by matrilineal fidelity to feeding grounds (Kenney 2002, Schaeff *et al*. 1993), and possibly a reduced ability to locate new feeding grounds when changing conditions lead to a shift in prey distribution.

1.5 Threats[5]

1.5.1 Description of Threats

Historic Threats

Commercial whaling

Right whales were once hunted extensively by commercial whalers because they are large, slow swimming, tend to congregate, and their thick layer of blubber usually prevents them from sinking when killed, making them an easy and profitable target. Commercial whaling for right whales began in the North Pacific in 1835 (Scarff 1991, 2001). Whaling was most intense during the decade 1839-1848 which accounts for approximately 80 percent of the total historic catch of right whales (Scarff 2001). The species was depleted throughout its range by 1900, at which point it ceased to be a principal target of commercial whaling (Scarff 2001). The recorded right whale catches by American whalers amounted to at least 14,500 animals (Best 1987, IWC 1986), and Scarff (2001) estimates that the total whaling-related mortality during the period 1839-1909, including mortality of struck-but-lost whales and non-American whalers, was in the range of 26,500-37,000 animals. Although right whales received international protection from commercial whaling by the 1931 Convention for the Regulation of Whaling, which took effect in 1935, important North Pacific whaling countries– Japan and the Soviet Union– did not sign the convention and continued whaling the North Pacific Right Whale through World War II (Scarff 1986). The first comprehensive prohibition on commercial whaling that was agreed to by all major North Pacific whaling nations was implemented by the IWC in 1949. However, "research whaling" was still permitted under this convention and Japan harvested 13 right whales and the Soviet Union harvested 10 right whales legally during the 1950s and 1960s (Brownell *et al*. 2001).

After the era of commercial whaling, illegal whaling in the North Pacific occurred on a much larger scale than once thought. Brownell *et al*. (2001) indicate that illegal hunting from 1961 to 1979 by the Soviet Union explains the current depleted status of North Pacific Right Whales. Hundreds of right whales were illegally hunted in the Kuril Islands and the Okhotsk Sea, and 372 were killed in the eastern North Pacific, notably the Gulf of Alaska and southeastern Bering Sea (Yablokov 1994, Zemsky *et al*. 1995, Tormosov *et al*. 1998, Doroshenko 2000, Ivashchenko *et al*. 2008). Remnant populations may have been gradually recovering from past commercial whaling until the 1960s, when illegal Soviet catches further compromised recovery (Brownell *et al.* 2001, Clapham and Ivashchenko 2009).

[5] SARA requires that the recovery strategy identify "…threats to the survival of the species and threats to its habitat that is consistent with information provided by COSEWIC." [SARA s.41(1)(*b*)].

Subsistence/Aboriginal Harvest

North Pacific Right Whales were hunted historically by central and northern Nuu-chah-nulth (Nootkan) tribes off the west coast of Vancouver Island (Monks *et al*. 2001). Subsistence whaling may also have been conducted by the Haida off Haida Gwaii (Queen Charlotte Islands), but it is unknown whether right whales were taken (Acheson and Wigen 2002). Various aboriginal peoples from Washington State were also known to take this species (Mitchell 1979), although it was not usually the main target of their hunts, nor were they taken in great numbers (Brownell *et al*. 2001). Currently, subsistence hunters in Alaska and Russia do not report taking animals from the eastern North Pacific Right Whale population (Ferrero *et al.* 2000). In Canadian waters, a renewed interest in aboriginal whaling of the North Pacific Right Whale is unlikely given the extreme rarity of the species.

Current Potential Threats

Due to the lack of data on occurrence, distribution, habitat use, reproduction and genetics of the right whale in Pacific Canadian waters, current threats cannot be directly determined. However, it is important to consider all possible threats that may affect the survival of right whales occurring in Pacific Canadian waters and their habitat. Listed below are threats that are identified as having the potential to affect the North Pacific Right Whale based on information from other right whale populations around the world, as well as from other large whale species. At this time, the significance of these potential threats to the North Pacific Right Whale in Canadian waters cannot be assessed or prioritized.

Ship Strikes and Marine Traffic

In the North Atlantic, ship strikes are the most significant human-related source of injury and mortality for right whales (Kraus *et al.* 2005, Jensen and Silber 2004, Moore *et al.* 2007), with both small and large vessels causing injury and death (Knowlton and Brown 2007). Recent investigations suggest that vessel speeds of less than 13 knots (26 km/h) may increase the likelihood of right whales being able to avoid collisions (Knowlton and Brown 2007). At vessel speeds above 15 knots (28 km/h), mortality due to vessel strikes approaches 100%, and at vessel speeds below 11.8 knots (22 km/h), mortality dropped below 50% (Vanderlaan and Taggart 2007).

It is not known whether ship strikes are a significant source of injury or mortality of the North Pacific Right Whale. The Large Whale Ship Strike Database (Jensen and Silber 2004), which contains records of known large whale ship strikes worldwide from 1975 to 2002, does not include any record of North Pacific Right Whale strikes. However, ship strikes may be under-reported for right whales off the Pacific Canadian coast, due to the remoteness of most of the coast and because ship strikes can go undetected or unreported.

In the last 20 years, container and cruise ship traffic through B.C. ports has increased by 200% and is expected to continue to increase (Transport Canada 2005). This increase in marine traffic

may disrupt right whales by displacing animals from important habitat, and increasing the risk of ship strikes. As information is gathered on the distribution and habitat-use of North Pacific Right Whales, their proximity to major shipping channels will determine whether ship strikes may pose a significant threat.

Entanglement in Fishing Gear

Entanglement in fishing gear is a major source of injury and mortality for the North Atlantic Right Whale (Kraus 1990, Clapham *et al.* 1999, IWC 2001a, Kraus *et al.* 2005), and it is possible that right whales in the North Pacific are also exposed to this threat. Entanglements that are not initially lethal may result in a gradual weakening of the entangled whale, making it more susceptible to other indirect causes of mortality, such as disease (Kenny and Kraus 1993). A recent analysis showed that more than 75% of North Atlantic Right Whales have scars that indicate past entanglement events (Knowlton *et al.* 2005 cited in Brown *et al.* 2009). Scar accumulation increased in the 1990s, and juvenile right whales were found to be more susceptible to entanglement than adults (Knowlton *et al.* 2005 cited in Brown *et al.* 2009). It has been shown that vertical and horizontal lines used in fixed gear fisheries (i.e., gillnets and pot gear) are the type of fishing gear most often implicated in right whale entanglements in Atlantic Canadian and U.S. waters (Johnson *et al*. 2005).

Due to the operation of Japanese salmon driftnet fisheries within the Russian Exclusive Economic Zone (EEZ) (inside the Okhotsk Sea and around Kamchatka) since 1991, entanglements in fishing gear may represent a threat to the western population of North Pacific Right Whales (Brownell *et al*. 2001). An entangled whale in the Okhotsk Sea was reported by T. Miyashita in 1992 (Brownell *et al.* 2001). The Russian gillnet fishery was implicated in the death of two right whales: one in 1983, and the other off the Kamchatka Peninsula (Russia) in 1989 (NMFS 1991, Kornev 1994). Although entangled whales have not been reported in the Bering Sea or Pacific Canadian waters, there are extensive fisheries in the eastern Bering Sea and entanglements should be considered a threat to right whales in this area, which may include individuals that also use Pacific Canadian waters.

Noise

Right whales, like all baleen whales, rely on sound for communication, navigation, and detection of predators and possibly prey (Clark 1994, Parks *et al.* 2006). Sound sources that interfere with these functions could thus result in disruption of migration, feeding, breeding, and other vital activities (Richardson *et al.*1995). The effects of noise on right whales might range from subtle changes in behaviour to physiological damage, such as permanent hearing loss and mortality due to inner ear blast injuries (Richardson *et al.* 1995).

Although the extent to which various noise sources affect the North Pacific Right Whale is unknown, anthropogenic activities in the marine environment do produce sound in the audible range of North Atlantic Right Whales (estimated to be 10 Hz to 22 kHz; Parks 2003), and therefore have the potential to affect these whales. These sources include seismic testing for oil and gas exploration, active and passive sonar and explosives testing by the military, fish-finding and bottom mapping sonar, acoustic deterrent devices, and increasing levels of noise from

routine marine industrial activities (e.g., aquaculture, marine construction), commercial ships and small boats (Brown *et al*. 2009). Commercial shipping is the major contributor to chronic underwater noise (5 to 500 Hz). From 1950 to 2000, low frequency noise in the oceans increased 16 dB, corresponding to a doubling of noise power (3 dB) every decade, or a 7% annual increase in noise power (NRC 2003, IWC 2004).

Evidence of disturbance and displacement due to underwater noise has been observed in several baleen whale species (Richardson *et al.* 1995). Reactions have included avoidance of the noise area, interruption of feeding, movement away from the sound source, and changes in respiration and dive patterns (Anonymous 2005; Frankel and Clark 2000; McCauley *et al.* 2000; Richardson *et al.* 1995; Stone and Tasker 2006; Weir 2008).

The North Atlantic Right Whale produces vocalizations at frequencies primarily between 50 Hz and 2 kHz (Parks 2003), and similar vocalizations have been documented from the eastern North Pacific Right Whale (McDonald and Moore 2002, Mellinger *et al*. 2004, Munger *et al.* 2008). Right whale calls occur within the same frequency as anthropogenic noise, most notably noise from commercial shipping, so there is the potential for vocalizations to be masked by noise (Parks *et al.* 2007). Masking of right whale vocalizations could interfere with communication (Richardson *et al*. 1995), leading to a reduction in social communication (e.g., contact calls, mother-calf interaction), which could result in reduced mating opportunities (Richardson *et al.* 1995). It has been shown that changes in North Atlantic and Southern Right Whale calling behaviour varies with background noise levels, indicating that the whales may shift call frequency (Hz) in order to compensate for masking effects during periods of higher noise (Parks *et al.* 2007).

Underwater explosions from construction, military sonar exercises, and seismic surveys are known to directly affect the physiology of whales, and may result in mortality (Richardson *et al*. 1995, Ketten *et al.* 1993). In 1992, Humpback Whales off Newfoundland were found with damaged ear structures after underwater blasting was used in constructing oil installations (Ketten *et al*. 1993, Lien *et al.* 1995), and Todd *et al*. (1996) reported that acute noise was correlated with increased rates of entanglement in Humpbacks. The United States Navy released a report in which it took responsibility for the death of six beaked whales found beached with hemorrhaging after a sonar test in the Bahamas on March 15 and 16, 2000 (Anonymous 2001). In Pacific Canadian waters, noise from proposed activities such as oil and gas exploration, pipeline construction, military exercises, research studies, and wind-farm construction, may be of concern in the future. The *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007) has been developed to provide guidance and marine mammal mitigation for seismic use in marine environments.

Pollution

Pollution may affect marine mammals in various ways. Contaminants can enter the tissues either directly (e.g., ingestion) from the environment or through bioaccumulation from prey. Non-food items or contaminants could be ingested directly during feeding (Katona and Kraus 1999). Right whales feed in convergent zones and slicks where surface currents concentrate flotsam, including contaminants, oil, and floating garbage (Carr 1985).

Organochlorine compounds (e.g., ∑DDT and PCBs) and metals are the contaminants of most concern for marine mammals. Despite high concentrations of PCBs in fish- and mammal-eating cetaceans (Béland *et al.* 1993, Ross *et al.* 2000, Addison and Ross 2001, Grant and Ross 2002, Ross 2002a, Ross 2002b, Ross 2006), right whales are low trophic level grazers, thus minimizing the concentrations of contaminants accumulating via their prey (Woodley *et al.* 1991). O'Shea and Brownell (1994) reported that concentrations of contaminants in baleen whales were generally much lower than in odontocetes; however, they emphasize that additional data would assist in addressing uncertainties. Baleen whales may also be affected through negative impacts of pollution on marine productivity (O'Shea and Brownell 1994), especially right whales due to their specialized copepod diet.

1.6 Actions Already Completed or Underway

1.6.1 Research in Canada

Until recently, no research was being conducted on the North Pacific Right Whale in Canadian waters. From 2002 to 2008, Fisheries and Oceans Canada conducted twenty-one multi-species, shipboard surveys (total of 28,725.33 km surveyed and 1,749.4 hours of effort, see App. A) to investigate the seasonal distribution and abundance of SARA-listed cetacean species (Ford *et al*. 2010a). These surveys were focused primarily in waters over the continental shelf and no right whales were sighted. Remote acoustical recording packages (ARPs) to monitor for the presence of right whales and other cetaceans off the Pacific Canadian coast have been deployed. One ARP was deployed for approximately six months in 2006 at Union Seamount and one ARP was deployed for approximately four months in 2007 at La Perouse Bank off the west coast of Vancouver Island[6]. No right whale vocalizations were detected in acoustic data collected during these deployments (Ford *et al*. 2010b). Future acoustic deployments are to focus on offshore locations with an emphasis on areas of historic whaling catches.

A conceptual framework has been developed to provide a near real-time prediction model for the distribution of large whale prey patches (i.e., zooplankton concentrations) (Gregr *et al.* 2005). The framework was then developed for North Pacific Right Whales as part of a multi-year North Pacific Research Board (NPRB)-funded project (Gregr *et al.* 2006). The project developed hypotheses about how patches of prey suitable for North Pacific Right Whale foraging might be formed in the eastern North Pacific, based on available knowledge of right whale prey and North Pacific oceanography (Gregr and Coyle 2009). Such hypotheses, combined with available distributional data and descriptions of the ocean environment, would be suitable for predicting potential North Pacific Right Whale foraging habitat in the future (Gregr and Coyle 2009).

[6] Passive acoustic monitoring began in 2003 however reliable data was not collected until 2006 and 2007. 1915 hours over 160 days were recorded in 2006 at Union Seamount and 1437 hours over 120 days were recorded in 2007 at La Perouse Bank (Ford *et al.* 2010b).

1.6.2 Listing Status

Status in Canada

The North Atlantic Right Whale and North Pacific Right Whale were formerly considered a single species (*Eubalaena glacialis*) by COSEWIC and were designated Endangered in 1980. The status of this species was re-examined and confirmed in April 1985 and in April 1990. Based on new scientific information, COSEWIC followed the lead of other international agencies and the species was split into two separate species in May 2003 (for further details, see Section 1.3 'Populations and Distribution – Nationally Significant Populations'). Status of the North Pacific Right Whale was re-examined and confirmed as Endangered in November 2004 based on an updated status report. This species was subsequently listed as Endangered under Schedule 1 of SARA in August 2006.

Status in the U.S.

In U.S. waters, the "northern right whale" (which included the North Pacific and North Atlantic Right Whale) was listed as Endangered under the *Endangered Species Conservation Act* in June 1970, and was subsequently listed as Endangered under the *Endangered Species Act* (ESA) in 1973. In 1973, the "northern right whale" was also designated as Depleted under the *Marine Mammal Protection Act* (MMPA) (NMFS 2009). In 2008, National Marine Fisheries Service (NMFS) officially listed the "northern right whale" as two separate, endangered species under the ESA: the North Pacific Right Whale (*E. japonica*) and North Atlantic Right Whale (*E. glacialis*) (Federal Register 2008b).

International Status

An international assessment of the conservation status of right whales was completed in 1996 by the International Union for Conservation of Nature (IUCN). This assessment delineated three "populations"- North Pacific, North Atlantic and Southern. However, it did not distinguish these populations as separate species. The North Pacific and North Atlantic populations were listed as Endangered, and the Southern population was listed as Lower Risk.

In most of the scientific literature prior to 2000, including previous Red Lists, all northern hemisphere right whales were treated as the single species *E. glacialis*. Currently, the taxonomy used by the IUCN follows that of the IWC Scientific Committee (IWC 2001b) and the Convention on Migratory Species, which now recognize right whales in the North Atlantic, North Pacific and southern hemisphere as three distinct species. A 2008 assessment by the IUCN listed the North Pacific Right Whale as Endangered (Reilly *et al*. 2008a), the North Atlantic Right Whale as Endangered (Reilly *et al*. 2008b), and the Southern Right Whale as Least Concern (Reilly *et al*. 2008c).

1.6.3 Legal Protection

Protection in Canada

North Pacific Right Whales in Canada are protected under the *Species at Risk Act* (SARA) as well as under the Marine Mammal Regulations (MMR). The MMR, made pursuant to the *Fisheries Act*, apply in respect of the management and control of fishing for marine mammals and related activities and, therefore, provide a legislative framework for the conservation and protection of marine mammals in Canada. SARA prohibits killing, harming and harassing a threatened, endangered, or extirpated species[7] and protects their critical habitat from destruction[8].

Protection in the U.S.

In U.S. waters, right whales were first protected by the *Endangered Species Conservation Act* (precursor to ESA) in 1970. Since 1973 right whales have been protected under the *Marine Mammal Protection Act* (MMPA), which prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The *Endangered Species Act* (ESA) protects endangered and threatened species and their habitats by prohibiting the "take" of listed animals and the interstate or international trade in listed plants and animals, including their parts and products, except under Federal permit.

International Protection

Right whales were first protected internationally from commercial whaling by the 1931 Convention for the Regulation of Whaling, which took effect in 1935. However, protection was not complete since neither Japan nor the Soviet Union signed the Convention (Scarff 1986, Donovan 1992). All right whales worldwide were protected under the International Convention for the Regulation of Whaling, implemented by the IWC when Japan and the Soviet Union joined in 1949.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its goal is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Right whales were listed by CITES in 1975 in Appendix 1, which lists species that are the most endangered among CITES-listed animals and plants. Trade in specimens of these species is tightly monitored, and permitted only in exceptional circumstances.

1.7 Knowledge Gaps[9]

[7] SARA s. 32(1): No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, endangered species or a threatened species.
[8] SARA s. 58(1): Subject to this section, no person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species.
[9] SARA requires that the recovery strategy include "a statement about whether additional information is required about the species [SARA, s.41(1)(*f*)].

There is an urgent need for information on the distribution, biology, ecology and threats to the North Pacific Right Whale. Knowledge of the species is not yet adequate to clearly define recovery objectives or approaches.

Current Presence, Abundance, Distribution, Habitat Use, and Critical Habitat in Pacific Canadian Waters

Information on the occurrence, distribution and migration patterns of right whales in the North Pacific is critical to identifying the key factors affecting the recovery of this species. Feeding grounds remain unknown in Pacific Canadian waters, yet right whales may exist in Pacific Canadian waters, though in very low numbers. Without current data on distribution, it is not possible to identify if a conflict exists between shipping channels and important habitats, or whether a decrease in reproductive success is a result of shifts in prey availability. Determining habitat use is necessary in order to determine the abundance and distribution of right whales in Pacific Canadian waters. Critical habitat has not been identified for the right whale in Pacific Canadian waters (see Section 1.4.1 'Habitat and Biological Needs' and Section 2.7 'Critical Habitat').

Population Structure and Genetics

There are uncertainties about population structure and number of populations for the North Pacific Right Whale. Genetic investigations would delineate populations, perhaps providing further support for the two-population hypothesis (see Section 1.3 'Populations and Distribution-Nationally Significant Populations'). Analyses using both mitochondrial and microsatellite DNA would address the question of genetic exchange between populations in high latitudes or on offshore breeding grounds (Brownell *et al.* 2001). These analyses would provide information on genetic diversity and determine whether a bottleneck has occurred in these populations, as found in the North Atlantic Right Whale. A genetic "bottleneck" could limit the recovery of the North Pacific Right Whale through reduced reproduction and recruitment resulting from reduced fecundity, decreased neonate and juvenile survival, or lowered resistance to disease (Ralls *et al*. 1988, Haebler and Moeller 1993) (see Section 1.4.3 'Limiting Factors'). However, as Brownell *et al*. (2001) noted, the major obstacle to these genetic studies is finding a sufficient sample size of right whales.

Life History Parameters and Population Dynamics

The life history parameters and population dynamics of the North Pacific Right Whale need further investigation. Data on the abundance and population dynamics (e.g., birth rate, growth rate, and mortality) of right whales in the North Pacific need to be collected and analysed. For example, if evidence exists for delayed onset of sexual maturity, then potential causes such as insufficient food supply, low genetic diversity or depensation could be investigated.

Clarification of Threats and Human Influences

Due to the general lack of knowledge of the North Pacific Right Whale, particularly for Pacific Canadian waters, current threats to the species, or the significance of potential threats, cannot be

directly determined. However, it is important to consider potential threats, so that they can be assessed and addressed when the presence of right whales has been confirmed in Pacific Canadian waters. Clarification on the extent to which marine projects or developments (e.g., shipping lanes, underwater explosives) pose direct and/or indirect threats to the North Pacific Right Whale is required. A thorough investigation of the potential for conflict between shipping lanes and right whale distribution may be critical to the survival of right whales, as illustrated in the North Atlantic (Brown *et al.* 2009). Preferred habitat and genetic delineation of populations must also be clarified. Information regarding the population structure of North Pacific Right Whales and their habitats is needed to determine the potential effects of human actions and whether future management actions are effective.

2. RECOVERY

It is important to note that it is not possible to develop detailed recovery criteria, including quantitative population and distribution objectives, at this time due to the lack of data on the biology, distribution, abundance and threats affecting the North Pacific Right Whale. Nor will it be possible to acquire enough data in the short-term (i.e., within a few decades) to develop and measure recovery criteria for such an extremely depleted and long-lived species. Due to the significant species knowledge gaps, the recovery goals, objectives and approaches outlined in this document are primarily qualitative and research based. The information gathered from the identified research activities will help to provide the information that is necessary to determine specific, quantitative recovery criteria.

2.1 Recovery Feasibility[10]

Although it is difficult to accurately assess the feasibility of recovery for the North Pacific Right Whale due to the lack of understanding of factors affecting the survival and productivity of the species, based on the best current available information, recovery of the North Pacific Right Whale in Canadian waters is determined to be feasible[11]. The current small population size of the North Pacific Right Whale is thought to be the main factor limiting its recovery and presence in Pacific Canadian waters. However, the population has the potential to increase in size and re-occupy Pacific Canadian waters, because evidence of reproduction exists, suitable habitat is available in Pacific Canadian waters, no direct threats have been identified, and effective measures are available to mitigate threats if they are identified.

1. **Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?**

Answer: Unknown.

[10] SARA requires that "the competent minister must determine whether the recovery of the listed species is technically and biologically feasible. The determination must be based on the best available information, including information provided by COSEWIC" [SARA, s.40].

[11] Determination of recovery feasibility shall be based on "the four criteria" (listed above). Species recovery shall be determined not feasible if the answer to any one of the questions is *no*. If the answer to all of these questions is *yes* or *unknown*, recovery should be determined feasible.

It is unknown whether individuals capable of reproduction are currently available to improve the population growth rate or population abundance in Canadian waters. However, it is known that individuals capable of reproduction exist outside of Canadian waters. Recently, a few females and calves have been sighted in the southeastern Bering Sea, U.S. Genetic analysis identified seven females and two calves in a group sighted in September 2004, and one female and one calf was sighted on August 24, 2002. Although the last confirmed sighting of a North Pacific Right Whale in, or just outside Canadian waters was in 1970 (Wada 1975), the fact that there has been a lack of long-term survey effort, and that there have been three sightings of seven right whales in close proximity to Canadian waters between 1959 and 1992 (in U.S. waters near the B.C./Washington border), suggest that the species could potentially be using Canadian waters.

2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?

Answer: Yes.
The current distribution, migration routes, and feeding and calving grounds of the North Pacific Right Whale are unknown (COSEWIC 2004). However, whaling records indicate that right whales historically occurred in Pacific Canadian waters from April to October (Townsend 1935, Clapham *et al.* 2004, Josephson *et al*. 2008). Despite the presence of threats, other species of baleen whales (particularly Humpback and Fin Whales) currently occupy some of the areas formerly occupied by right whales in Pacific Canadian waters. Right whales in the U.S. North Pacific continue to occupy habitat susceptible to potential threats that also exist in Pacific Canadian waters. Habitat occupied by right whales in the past is thought to be functionally similar to habitat currently available as that habitat is known to be suitable for other baleen whale species. For these reasons, it seems reasonable to conclude that suitable habitat is available for right whales in Pacific Canadian waters.

3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?

Answer: Yes
There are insufficient data on occurrence, distribution, reproduction or genetics of North Pacific Right Whales to directly determine threats to the species specifically in Pacific Canadian waters. However, based on information from other right whale populations around the world, as well as from other large whale species, threats that could potentially affect right whales in Pacific Canadian waters have been identified (see Section 1.5 'Threats'). Actions to mitigate threats to right whales in other areas have been demonstrated to be effective. For example, in the western North Atlantic, shipping lanes in the Bay of Fundy have been moved, reducing the relative potential for accidental ship strikes by approximately 80% (Brown *et al.* 2009); an acoustic monitoring network to reduce the likelihood of ship strikes has been implemented to provide early warning to ships travelling through the Stellwagen Bank National Marine Sanctuary to the Northeast Gateway Deepwater Port, Massachusetts (Bruce 2008); and protocol and a rescue team have been developed for releasing whales entangled in fishing gear (Brown *et al.* 2009). Actions that have been successful in mitigating threats to other baleen whale species could also be effective for mitigating those same threats for the North Pacific Right Whale. For example, gear modifications that have the potential to reduce the severity and frequency of Humpback and

other whale entanglements have been implemented on both Atlantic and Pacific coasts (Johnson *et al.* 2005, Kozuck 2003). Mitigation strategies have also been developed in a number of jurisdictions to reduce the impact of seismic surveys and military-related sonar use (e.g., Australian Government 2007, DFO 2007, JNCC 2004).

4. Do the necessary recovery techniques exist and are they demonstrated to be effective?

Answer: Unknown.
The best available population trajectory model of the North Atlantic Right Whale shows a population increase in the 1980s followed by a population decline in the 1990s, possibly due to an increase in anthropogenic threats (Fujiwara and Caswell 2001). This initial population increase illustrates the ability of this species of critically low abundance, to recover (Brown *et al.* 2009) and this likely applies for the North Pacific Right Whale as well. The North Atlantic Right Whale species experts consider the reduction of human-induced mortality to be feasible (Brown *et al.* 2009). Additionally, the anthropogenic threats considered to be the most significant (fixed-gear entanglements and vessel strikes) are less likely to affect the North Pacific Right Whale in Pacific Canadian waters to the same extent because they do not occur near densely populated areas like the North Atlantic Right Whale. Measures to mitigate threats that have been demonstrated to be effective exist and are available to be implemented if such threats are determined to be affecting North Pacific Right Whales. Given the relatively recent cessation of illegal Soviet whaling (1979; Brownell *et al.* 2001), the North Pacific Right Whale may not yet have had an opportunity to recover from this threat, or for the signs of recovery to be detected. Any recovery would be extremely slow even in the absence of anthropogenic mortality as right whales are long-lived, have delayed onset of breeding, and a long reproductive cycle.

In conclusion, recovery of the North Pacific Right Whale is determined to be feasible because there is recent evidence of reproductively successful individuals in adjacent waters, historic habitat is not physically degraded and is currently available for use, and mitigation of threats that can potentially affect right whales in Pacific Canadian waters has been proven successful for other right whale populations and other baleen whale species. Also, given the longevity of the species, it will take many decades for the benefits of recovery actions to be observed, so it would be inconsistent with the precautionary approach to rule out recovery feasibility.

2.2 Recovery Goal

Long-term goal:

> Increase the probability of survival, and attain long-term viability, of the North Pacific Right Whale in Canadian waters.

The first step in addressing this long-term goal is to confirm species presence (objective #1 below). As basic information on presence, abundance, distribution, habitat, and threats is collected, recovery and population and distribution objectives and their associated strategies are expected to be further developed.

2.3 Population and Distribution Objectives [12]

Short-term objective:

1. Confirm the presence of North Pacific Right Whales in Pacific Canadian waters.

Long-term objectives (contingent on first achieving #1 above)**:**

2. Determine population structure, abundance, and seasonal distribution.
3. Work toward an increasing population trajectory.
4. Promote re-occupation of historical habitat in Pacific Canadian waters.

Quantitative long-term population and distribution objectives may be established once the presence of right whales has been confirmed in Pacific Canadian waters.

2.4 Recovery Objectives[13]

At this time, recovery objectives, as well as population and distribution objectives, are predominantly research based, as basic information about presence, abundance, distribution, habitat, and threats is required before recovery objectives can be clearly defined. To achieve progress towards reaching the recovery goal, the following objectives should be met.

Short-term objective:

5. Characterize and determine the extent of potential habitat in Pacific Canadian waters.

Long-term objective:

6. Maintain or increase the relative proportion of right whales in Pacific Canadian waters compared to the whole population, by ensuring that as threats are identified, they do not significantly reduce potential habitat or distribution of the North Pacific Right Whale.

2.5 Approaches Recommended to Meet Recovery Objectives

2.5.1 Recovery Planning

Fisheries and Oceans Canada encourages other agencies and organizations to participate in the recovery of North Pacific Right Whale where possible, through the implementation of this recovery strategy. Table 3 summarizes the activities that are recommended to support the goal and objectives. The activities implemented by Fisheries and Oceans Canada will be subject to the availability of funding and other required resources.

[12] SARA requires that the recovery strategy identify "a statement of the population and distribution objectives that will assist the survival and recovery of the species" [SARA s. 41(1)(*d*)].
[13] SARA requires that the recovery strategy identify "a description of the broad strategy to address those threats" [SARA s.41(1)(*b*)] and "a general description of the research and management activities needed to meet those objectives" [SARA s.41(1)(*d*)].

Table 3. Recovery Planning Table

Priority	Threats addressed	Broad strategy to address threat	Recommended approaches to meet recovery objectives
Objective 1: Confirm the presence of right whales in Pacific Canadian waters. Objective 2: Determine population structure, abundance, and seasonal distribution.			
High	N/A	Scientific Research	• Conduct multi-species surveys focusing on areas formerly occupied by right whales in Pacific Canadian waters. • Expand network of acoustic monitoring instruments to monitor for the presence of N. Pacific Right Whales and other cetaceans in Pacific Canadian waters. • Continue to support the B.C. Cetacean Sightings and B.C. Marine Mammal Response Network to take advantage of opportunistic sightings. • Coordinate with international research efforts on right whales to ensure that photographic identification and skin samples are collected and shared in order to contribute to our understanding of migratory behaviour and animal affiliation. • Undertake genetic studies of available samples (including skeletal remains) of the N. Pacific Right Whale.
Objective 5: Characterize and determine the extent of potential habitat in Pacific Canadian waters.			
High	N/A	Scientific Research	• Characterize preferred habitats of right whales worldwide to identify potential important habitats in Pacific Canadian waters.
Objective 3: Work toward an increasing population trajectory. Objective 4: Promote re-occupation of historical habitat in Pacific Canadian waters. Objective 6: Maintain or increase the relative proportion of right whales in Pacific Canadian waters compared to the whole population, by ensuring that as threats are identified, they do not significantly reduce potential habitat or distribution of the North Pacific Right Whale.			
High	All	Threats Research; and Mitigation and Protection	• Continue to evaluate information on human impacts on right whales and other cetaceans worldwide to determine whether similar activities in Pacific Canadian waters could affect the right whale. • Review mitigation measures that have been effective for right whales and other cetaceans, and where appropriate, incorporate such measures into mitigation planning and protocols for the N. Pacific Right Whale. • Where possible, maintain prohibitions against human-induced mortality of N. Pacific Right Whales in Canadian waters. • When threats are identified through research or circumstance, take immediate steps to minimize impacts of threats. • Support the B.C. Marine Mammal Response Network to track and respond to threats that involve injury or mortality to individual whales.

2.5.2 Narrative to Support Recovery Planning Table

It is important to note that for a long-lived species such as the right whale, it may take many decades before increases in this population can be documented, and even longer before recovery is achieved. It is therefore imperative that the long-term nature of this strategy is recognized in the evaluation of the objectives and supporting strategies.

The approaches listed above (Table 3) include efforts that will not only be essential to the survival of the North Pacific Right Whale, but may also be important for other baleen whale species that occur in the same habitats in the region (e.g., Blue, Fin, Sei, and Humpback Whales). This set of approaches should be coordinated with other baleen whale strategies in a multi-species approach. Recovery documents for other baleen whales and other cetacean species at risk (e.g., Grey Whale, Humpback Whale, 'large whales' (Blue, Fin and Sei Whales), Harbour Porpoise, Resident Killer Whale, Transient Killer Whale, Offshore Killer Whale) have or are anticipated to have similar objectives and strategies, and will directly benefit from the foresight of developing an efficient multi-species research program. Some of the approaches in Table 3 address potential threats in Pacific Canadian waters that can be acted upon immediately, while others call for action following the identification and assessment of new threats.

2.6 Performance Measures[14]

Table 4. Performance Measures

Recovery Objective	Performance Measures
Objective 1: Confirm the presence of right whales in Pacific Canadian waters.	• Was the network of acoustic monitoring instruments to monitor for the presence of right whales in Pacific Canadian waters expanded? • Were multi-species surveys conducted off the Pacific Canadian coast? • Was support of the B.C. Cetacean Sightings and B.C. Marine Mammal Response Network continued? • Was the presence of right whales confirmed in Pacific Canadian waters?
Objective 2: Determine population structure, abundance, and seasonal distribution.	• Were multi-species surveys conducted off the Pacific Canadian coast? • Was coordination undertaken with international research efforts on right whales to ensure that photographic identification and collection of skin samples were collected in order to contribute to our understanding of migratory behaviour and animal affiliation? • Were genetic studies of available samples (including skeletal remains) of the N. Pacific Right Whale undertaken?

[14] SARA requires that "the competent minister must report on the implementation of the recovery strategy, and the progress towards meeting its objectives, within five years after it is included in the public registry… [SARA, s.46].

Table 4. Performance Measures (continued)

Recovery Objective	Performance Measures
Objective 3: Work toward an increasing population trajectory.	• Was the N. Pacific Right Whale population number observed to increase? • Was the B.C. Marine Mammal Response Network supported to track and respond to threats that involve injury or mortality to individual whales? • Was it ensured that no human-induced mortality of right whales occurred in Pacific Canadian waters? • When threats were identified through research or circumstance, were immediate steps were taken to minimize impacts of the threats?
Objective 4: Promote re-occupation of historical habitat in Pacific Canadian waters.	• Were N. Pacific Right Whales observed in historical habitat? • When threats were identified through research or circumstance, were immediate steps taken to minimize impacts of the threats?
Objective 5: Characterize and determine the extent of potential habitat in Pacific Canadian waters.	• Were preferred habitats of right whales worldwide characterized in order to identify potential important habitats in Pacific Canadian waters?
Objective 6: Maintain or increase the relative proportion of right whales in Pacific Canadian waters compared to the whole population, by ensuring that as threats are identified, they do not significantly reduce potential habitat or distribution of the North Pacific Right Whale.	• Was information on human impacts on right whales and other cetaceans worldwide continued to be evaluated in order to determine whether similar activities in Pacific Canadian waters could affect the right whale? • Were mitigation measures that have been effective for right whales in other areas and other cetaceans reviewed, and where appropriate, incorporated into mitigation planning and protocols for the N. Pacific right whale? • Was it ensured that no human-induced mortality of right whales occurred in Pacific Canadian waters? • When threats were identified through research or circumstance, were immediate steps taken to minimize impacts of the threats?

2.7 Critical Habitat

2.7.1 Identification of the Species' Critical Habitat[15]

Under Section 2(1) of SARA, critical habitat is defined as "*the habitat that is 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*."

[15] SARA requires recovery strategies to include "an identification of the species' critical habitat, to the extent possible, based on the best available information, including information provided by COSEWIC" [SARA, s.41(*c*)].

At this time, establishing 'critical habitat' for baleen whales that can have ranges on ocean-basin scales is difficult, although the knowledge base to help determine critical habitat is increasing. Critical habitat for the North Pacific Right Whale in U.S. waters has been designated in the southeastern Bering Sea and south of Kodiak Island in the Gulf of Alaska (Figure 5; Federal Register 2008a). The identification of this critical habitat was based on sightings of right whales as a proxy for the existence of suitably dense copepod and euphausiid patches. For the North Atlantic Right Whale, the Grand Manan and Roseway Basins have been identified as critical habitat in Canadian waters. Although studies to refine this critical habitat and its boundaries are ongoing, these areas were identified for the foraging opportunities they provide as determined in part by the distribution of North Atlantic Right Whale sightings (Brown *et al.* 2009).

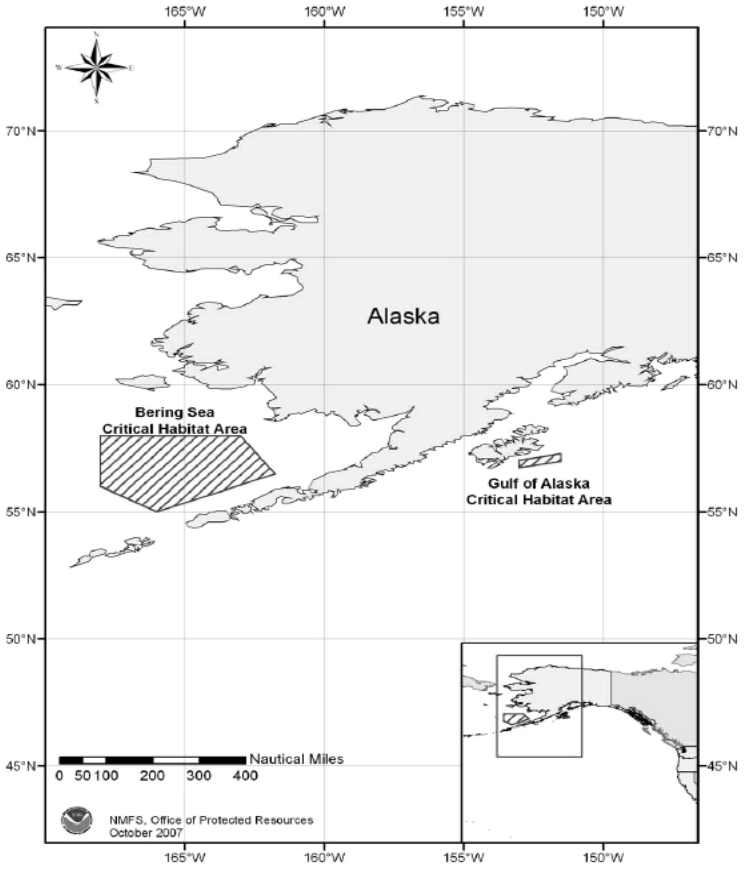

Figure 5. Designated critical habitat for the North Pacific Right Whale in U.S. waters (from NMFS 2009).

At this time it is not possible to identify critical habitat for the North Pacific Right Whale in Canadian waters because the presence, current abundance, distribution patterns, migration routes, and feeding and calving grounds are not known. Studies have not yet been conducted to identify the Canadian habitat required by North Pacific Right Whales to achieve and sustain a viable population. It is therefore impossible to identify either the habitat currently occupied by the species, or the extent needed to maintain the current population size or support population recovery. As set out in SARA, if information is inadequate to identify critical habitat within the recovery strategy, a schedule of studies must be prepared. This schedule, once implemented,

will ideally yield new information that should contribute to the identification of the species' critical habitat in the future.

The schedule of studies identified for the North Pacific Right Whale is included below (Table 5). Upon completion of these projects, it is hoped that the results will provide information to allow Fisheries and Oceans Canada to make progress towards identifying critical habitat for this species. It is important to note that the long lived nature of the species, lack of documented sightings in Canada, and the associated long-term scope of the recovery strategy, indicate that it may take decades to address the issue of critical habitat.

2.7.2 Schedule of Studies to Identify Critical Habitat[16]

In order to identify critical habitat and habitat that is important to the recovery of right whales in North Pacific waters, research is needed both in Canadian waters and in other parts of the species' range. Table 5 outlines the studies required to gather information that will contribute to the possible future identification of critical habitat. Because of the long-term nature of this recovery strategy, the timelines represent benchmarks at which evaluations of progress towards the identification of critical habitat will be undertaken.

The schedule of studies has been divided into studies of potential and occupied habitat (also called realized habitat). From an ecological perspective, potential habitat represents areas where suitable habitat exists, while occupied habitat describes where species actually occur. Occupied habitat should typically be a smaller portion of the potential habitat, particularly for severely depleted species. The distinction makes it possible to distinguish between unsuitable habitat and suitable habitat that is merely unoccupied. Additionally, given the lack of baseline data on species distributions and the knowledge gaps surrounding habitat use, definition of potential habitat will help prioritize limited survey effort. It is recognized that defining potential and occupied habitats preceding critical habitat identification will be challenging given the species knowledge gaps, relative scarcity of sightings, and the dynamic nature of the marine environment potentially leading to shifts in habitat use on inter-annual and inter-decadal time scales.

In order to predict potential habitat, the effects of variation in oceanographic conditions on whale occurrence are to be determined through correlation of historic occurrence with long-term ocean conditions. Further, the continued development and testing of biogeographic methods through habitat modeling assist in the prediction of the potential distribution of prey species. The evaluation of information on preferred habitats worldwide will allow for the characterization of potential habitat in Pacific Canadian waters.

As previously detailed in 'Research in Canada' (Section 1.6.1), progress towards potential habitat identification has been made through the North Pacific Research Board (NPRB)-funded development of a conceptual framework to provide a prediction model for the distribution of prey patches (Gregr *et al.* 2006) and the hypotheses developed by Gregr and Coyle (2009) to guide the prediction of foraging habitat for the North Pacific Right Whale. Critical habitat is

[16] SARA requires that the recovery strategy identify "a schedule of studies to identify critical habitat, where available information is inadequate" [SARA s.41(1)(*c.1*)].

anticipated to include occupied habitat (i.e., occupied and required for survival) and those portions of potential habitat that are required for recovery but are unoccupied due to low species' abundance.

Although this schedule of studies focuses on the North Pacific Right Whale, the activities described herein are multi-species in nature, the majority of which are ongoing. Research and recovery activities directed at other baleen whales and cetacean species at risk overlap significantly, allowing for efficacious research and data collection methods (see Sections 2.5.2 'Narrative to Support Recovery Planning Table' and 2.8 'Effects on Other Species'). Specifically, ongoing vessel and aerial surveys directed at other SARA cetaceans may contribute to the identification of occupied habitat for the North Pacific Right Whale [17].

Table 5. Schedule of Studies

Description of Activity	Rationale or Outcome	Timeline
1. Identify potential habitat:		
Investigate effects of variation in oceanographic conditions on whale occurrence; relationship of right whales with primary prey species; and potential habitat characteristics in Pacific Canadian waters.	Determine extent of potential habitat in Pacific Canadian waters.	2003- 2013
2. Identify occupied habitat:		
Develop network of acoustic monitoring stations to determine whale occurrence from passive recording of distinctive vocalizations.	Confirm right whale presence in Pacific Canadian waters. Once/if presence is confirmed, determine seasonal distribution and abundance of whales.	2003- 2019*
3. Define critical habitat:		
Determine and characterize occupied high-use habitat and define potential critical habitat regions with similar characteristics.	Define high-use occupied habitat.	To be determined **

* Acoustic monitoring from 2010- 2019 will focus on offshore locations, with an emphasis on areas of historic whaling catches.

** This study is essential to the identification of critical habitat; however, initiation and completion is contingent upon the completion and results of the previously listed studies. Most importantly, right whale presence in Pacific Canadian waters must be confirmed before #3 can be initiated.

2.8 Effects on Other Species

As mentioned in Section 2.5.2 'Narrative to Support Recovery Planning Table', the recovery strategy includes measures that will not only enhance the prospects for the recovery of North Pacific Right Whales, but can also directly benefit other baleen whales (i.e., research activities are multi-species approaches that will contribute to knowledge on other marine mammals).

[17] Dedicated species at risk funded surveys have been performed since 2002. Additional data are available from approximately 20 years of non-species at risk funded surveys prior to 2002.

These strategies are not only beneficial to cetaceans, but also to other species, (e.g., fish, birds, etc.) that occupy the same habitats and may be vulnerable to the same threats.

2.9 Statement on Action Plans[18]

An action planning document will be posted within five years of final posting of the Recovery Strategy for the North Pacific Right Whale in Pacific Canadian waters.

[18] SARA requires that the recovery strategy include "a statement of when one or more action plans in relation to the recovery strategy will be completed" [SARA s.41(1)(*g*)].

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4. RECOVERY TEAM MEMBERS

4.1 2004 Draft Recovery Strategy

2004 North Pacific Right Whale Recovery Team

The draft "National Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters" was prepared by Fisheries and Oceans Canada in cooperation with the 2004 North Pacific Right Whale Recovery Team (Table 6) and was externally reviewed (Table 7). The draft was completed in July of 2004.

Table 6. 2004 North Pacific Right Whale Recovery Team Members

Name	**Affiliation** (*Affiliations listed as of 2003/2004*)
Bob Brownell	Senior Scientist for International Protected Resources. National Marine Fisheries Service.
Carole Eros	Recovery Plan Coordinator - Pacific Region. Fisheries and Oceans Canada.
Graeme Ellis	Science – Pacific Region. Fisheries and Oceans Canada.
Greg Silber	Coordinator, Large Whale Recovery Activities. NMFS, Office of Protected Resources.
Jerry Conway	Species at Risk Coordinator, Maritimes. Fisheries and Oceans Canada.
John Calambokidis	Research Biologist; COSEWIC Marine Mammal Subcommittee member.
John Ford – Chair and Co-author	Marine Mammal Scientist, Fisheries and Oceans Canada, Science Branch, Conservation Biology Section, Pacific Biological Station, Nanaimo, B.C., V9T 6N7. Phone (250) 729-8375. Email: John.K.Ford@dfo-mpo.gc.ca
Lance Barrett-Lennard	Marine Mammal Scientist. Vancouver Aquarium Marine Science Center.
Marilyn Joyce	Marine Mammal Coordinator – Pacific Region. Fisheries and Oceans Canada.
Miriam O – Co-author	Cetacean Biologist, Fisheries and Oceans Canada, Science Branch.
Moira Brown	Right whale scientist. Center for Coastal Studies.
Phil Clapham	Large cetacean scientist. Large Whale Biology Program. Northeast Fisheries Science Center.
Scott Wallace	Science Advisor. Sierra Club.
Sue Moore	Director, National Marine Mammal Laboratory. NMFS, Alaska Fisheries Science Center.

Table 7. External Peer Reviewers

Name	Affiliation
Randall Reeves	Okapi Wildlife Associates, Quebec.
Jim Scarff	Cetacean researcher, California.

Record of Cooperation and Consultation

Fisheries and Oceans Canada worked in cooperation with non-governmental organizations, academics and international experts as members on the recovery team established in 2003. Broad consultations were also undertaken on the recovery strategy to gain input and advice. The recovery team met on several occasions throughout 2003. The draft Right Whale Recovery Strategy was made available publicly via the Fisheries and Oceans Canada webpage. Notice of the web posting was made via a DFO news release. In collaboration with the Vancouver Aquarium Marine Science Centre a news release was issued via *Aquanews* and information posted on the Vancouver Aquarium's webpage (www.vanaqua.org). The document was also distributed through an international list serve via the Marine Mammal mailing list ('MARMAM'). DFO also requested input directly from other Federal government departments and non-governmental organizations that may have an interest in right whales including Parks Canada and World Wildlife Fund Canada. Peer reviews were also sought and received from experts in the field of right whale and baleen whale research.

The recovery team considered input from written submissions and external reviewers and incorporated many useful suggestions in the final document.

4.2 2011 Recovery Strategy

2009/2010 North Pacific Right Whale Recovery Team

The 2004 draft served as a basis for this 2011 recovery strategy. The 2011 draft "Recovery Strategy for the North Pacific Right Whale in Pacific Canadian Waters" was prepared by the 2009/2010 North Pacific Right Whale Recovery Team (Table 8).

Table 8. 2009/2010 North Pacific Right Whale Recovery Team

Name	Affiliation
Barbara Koot - Drafter	Contractor to Fisheries and Oceans Canada. Pacific Biological Station, Nanaimo.
John Ford – Co-chair	Marine Mammal Scientist. Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo.
Linda Nichol	Marine Mammal Biologist. Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo.
Lisa Spaven	Marine Mammal Response Coordinator Biologist. Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo.
Paul Cottrell – Co-chair	A/Regional Marine Mammal Coordinator. Fisheries and Oceans Canada, Vancouver.
Robin Abernethy	Research Technician. Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo.
Robyn Kenyon – Recovery Planner	A/SARA Recovery Planner. Fisheries and Oceans Canada, Vancouver.
Tatiana Lee	SARA Recovery Planner. Fisheries and Oceans Canada, Vancouver.

Record of Cooperation and Consultation[19]

The 2004 "Draft National Recovery Strategy for the North Pacific Right Whale (*Eubalaena japonica*) in Pacific Canadian Waters" was the foundation for this document which includes new information and was structured meet SARA content requirements. The 2009/2010 North Pacific Right Whale Recovery Team participated in an internal technical workshop in April 2009. The draft recovery strategy was sent to relevant government agencies and the SARA Directorate in August/September 2009 for early review.

The draft recovery strategy underwent regional consultations between January 14 and February 21, 2010. The draft was made available publicly via the DFO Pacific Region website for comment. Consultations were web-based, and also included direct mail-outs soliciting input from coastal First Nations. At the same time, the draft recovery strategy was sent to the 2004 North Pacific Right Whale Recovery Team, the B.C. Ministry of Environment, Environment Canada, Parks Canada Agency, Transport Canada, Department of National Defence, Natural Resources Canada, and Canadian Coast Guard for review. In addition, notification of regional consultation on the draft recovery strategy was sent to a marine mammal list serve (MARMAM) with a broad local and international distribution to marine mammal researchers and interested parties. Notification was also sent to a distribution list of marine mammal-related contacts provided to

[19] SARA requires that to the extent possible the recovery strategy must be prepared in cooperation with others [SARA s.39(1)] and in consultation with those whom the competent minister considers to be directly affected by the strategy [SARA s.39(3)].

DFO in recent years from environmental groups, government agencies, and the eco-tourism sector.

Over the consultation period, responses on the draft recovery strategy were received from the public, scientific experts, non-governmental environmental organizations, government agencies, and First Nations. Feedback has been carefully considered and incorporated where necessary in the production of the proposed recovery strategy. Input from the public during the regional consultation process is acknowledged and greatly appreciated.

APPENDIX A: SURVEY EFFORT

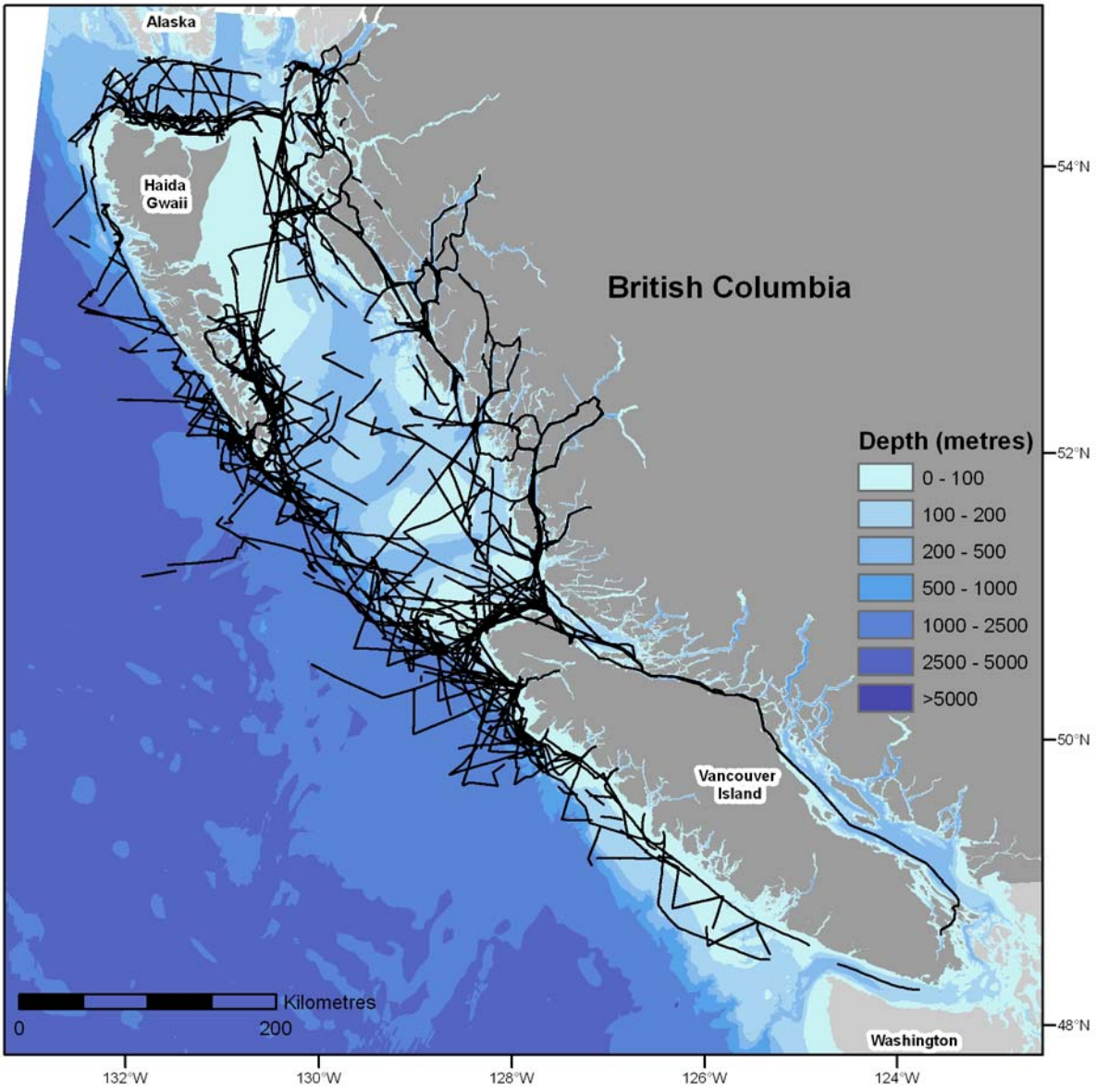

Figure 6. Locations of 21 DFO shipboard cetacean surveys between 2002-2008. Lines indicate on-effort survey track (Ford *et al.* 2010a). *Map of B.C. - Extracted Vector Shoreline Series, Government of Canada, Department of Fisheries and Oceans, Science, Canadian Hydrographic Service. Bathymetry layer - coastal digital elevation model produced by Government of Canada, Natural Resources Canada, Geological Survey of Canada (Pacific).*

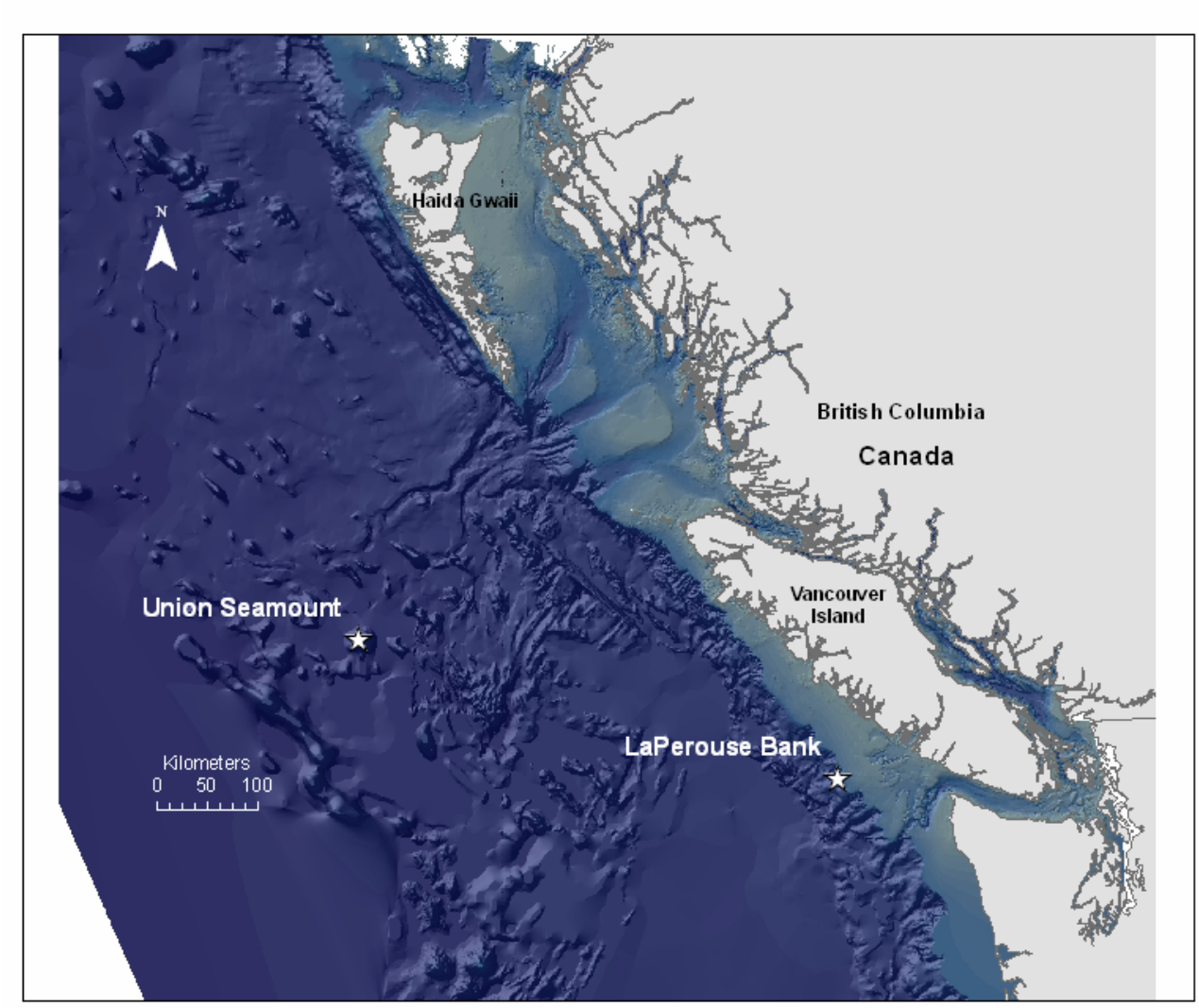

Figure 7. Locations of the initial phase (2006 and 2007) of passive acoustic monitoring conducted by Fisheries and Oceans Canada in Pacific Canadian waters (Ford *et al*. 2010b). *Map of B.C. - Extracted Vector Shoreline Series, Government of Canada, Department of Fisheries and Oceans, Science, Canadian Hydrographic Service. Bathymetry layer - Pacific Offshore Bathymetry Surface, Fisheries and Oceans Canada, Oceans, Habitat and Enhancement Branch GIS Unit (Pacific).*