COSEWIC
Assessment and Status Report

on the

Red-necked Phalarope
Phalaropus lobatus

in Canada

SPECIAL CONCERN
2014

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Red-necked Phalarope — Photo credit: Bree Walpole.

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COSEWIC
Assessment Summary

Assessment Summary – November 2014

Common name
Red-necked Phalarope

Scientific name
Phalaropus lobatus

Status
Special Concern

Reason for designation
This bird has declined over the last 40 years in an important staging area; however, overall population trends during the last three generations are unknown. The species faces potential threats on its breeding grounds including habitat degradation associated with climate change. It is also susceptible to pollutants and oil exposure on migration and during the winter. This is because birds gather in large numbers on the ocean, especially where currents concentrate pollutants.

Occurrence
Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, Pacific Ocean, Arctic Ocean, Atlantic Ocean

Status history
Designated Special Concern in November 2014.

COSEWIC
Executive Summary

Red-necked Phalarope
Phalaropus lobatus

Wildlife Species Description and Significance

The Red-necked Phalarope is a small shorebird, easily recognized in breeding plumage by the red-orange colour on the sides and base of its neck. The remainder of its plumage is primarily blue-grey and white. Females are more brightly coloured than males. Non-breeding plumage is white along the head, throat, breast and underparts, with dark upperparts, eye stripe and crown. Unlike most other shorebirds, the Red-necked Phalarope spends much of the non-breeding season at sea.

Distribution

The Red-necked Phalarope breeds across the entire circumpolar sub- and low-Arctic. However, the species' distribution, in particular while at sea, is not completely understood. The primary over-wintering sites for North American breeding Red-necked Phalaropes are believed to be off the western coast of Peru, with migration along the Pacific and Atlantic coasts of North America, and through the continent's interior towards the California shoreline. In Canada, the species breeds or migrates through every province and territory.

Habitat

While migrating and during the winter months, Red-necked Phalaropes concentrate at sea in areas where prey is forced to the surface (e.g., convergences and upwellings). To a lesser extent, migrants may also stop at lakes and ponds in interior North America, especially saline lakes with abundant aquatic invertebrates. Red-necked Phalaropes breed in low- and sub-Arctic wetlands, near freshwater ponds, lakes, or streams. The drying of freshwater ponds and the expansion of shrubs and trees into low- and sub-Arctic wetland habitats, with a changing climate, is expected to have a significant impact on habitat quality and availability for the species.

Biology

All phalarope species exhibit sex-role reversal, with males undertaking the majority of parental care. Females initiate the selection of a nesting site and may mate with multiple males. Nests are a simple scrape containing 4 eggs. Neither sex defends a territory. Shortly after laying, females desert incubating males in search of other mates. Females then congregate near the coast or leave the breeding grounds entirely, with males remaining until later in the season to tend young.

While at sea, Red-necked Phalaropes form large flocks and prey almost exclusively on zooplankton.

Population Sizes and Trends

Estimates of population size are based largely on expert opinion. The current estimate of abundance within North America is a minimum of 2 500 000 individuals, with about 74% or 1 850 000 individuals occurring in Canada. This is likely an underestimate, as it was derived by approximately summing the estimated number of individuals at known key stopover sites. Migration routes are incompletely known, so some unknown fraction of the population would not be included in this sum.

Trend estimates from various studies are imprecise and capture only a small fraction of the population, offering little insight into population status. Targeted surveys in the outer Bay of Fundy offer the most reliable information, albeit for a restricted area. Millions once passed through the area, with estimates of up to 3 000 000 in the outer Bay of Fundy in the 1970s. By 1990, they had declined drastically. In the most recent surveys (2009-2010), an estimated 550 000 Red-necked Phalaropes occurred between Grand Manan and Brier Island in the Bay of Fundy. Despite the significant uncertainty, experts generally agree that the species is less abundant in the Bay of Fundy than it once was. Declines have also been noted on the breeding grounds (e.g., Churchill and La Perouse Bay, Manitoba; Herschel Island, Shingle Point, and Old Crow Flats, Yukon), although observations are limited.

Threats and Limiting Factors

The many knowledge gaps relating to the species, particularly regarding adaptability, migration and over-wintering biology, make threat identification challenging. A change in climate, and associated habitat and food-web effects, is likely the single greatest threat to Red-necked Phalaropes on their breeding grounds. The build-up of contaminants in the Arctic environment, increase in industrial activities, and denuding of vegetation caused by increasing Snow Goose populations are also likely to have negative impacts on breeding birds and their habitat.

Changes in ocean temperature, salinity, and currents due to climate change are also likely to affect the species during the non-breeding season. A decline in the availability of prey at traditional staging areas and over-wintering sites could also have an impact on the species. Other possible threats during the non-breeding season include increased disturbance (e.g., shipping traffic) and a change in water quality. While at sea, Red-necked Phalaropes are also susceptible to the impacts caused by chronic oiling and point-source oil spills, as well as the ingestion of microplastics.

Protection, Status, and Ranks

The Red-necked Phalarope receives protection under the *Migratory Birds Convention Act*, 1994. It also receives protection through the Convention on Migratory Species, in which it is included under Appendix II. The species is ranked as ‘moderate concern’ in both the Canadian and United States Shorebird Conservation Plans. The global and national (Canada and United States) conservation status ranks for Red-necked Phalarope indicate that the species is apparently secure. The International Union for Conservation of Nature (IUCN) Red List ranks the species as “least concern” globally.

TECHNICAL SUMMARY

Phalaropus lobatus

Red-necked Phalarope — Phalarope à bec étroit

Range of occurrence in Canada: Yukon Territory, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, Newfoundland and Labrador, New Brunswick, Nova Scotia, Prince Edward Island, North Atlantic Ocean, North Pacific Ocean, Arctic Ocean

Demographic Information

Generation time Calculated assuming age at first breeding at 1 year, adult survival of 75% and juvenile survival of 60%	4 yrs
Is there an inferred continuing decline in number of mature individuals? Decline likely since 1970s, but short-term trends unknown	Unknown
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations	Unknown
Observed, estimated, inferred, or suspected percent reduction in total number of mature individuals over the last 10 years, or 3 generations. Decline likely since 1970s, but short-term trends unknown	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years, or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased? Causes of earlier declines unknown	No
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence	8 695 459 km²
Index of area of occupancy (IAO) IAO based on 2x2 km grids cannot be calculated because precise locations are unknown. However, given the population size and distribution, the estimated IAO exceeds the threshold of 2000 km^2.	> 2 000 km^2.
Is the population severely fragmented?	No
Number of locations	Unknown, but > 10
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	No
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Unknown

Is there an observed, inferred, or projected continuing decline in number of populations?	N/A
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown
Is there an observed, inferred, or projected continuing decline in area, extent and/or quality of habitat?	Yes
Are there extreme fluctuations in number of populations?	N/A
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	**N Mature Individuals**
Total Rough minimum estimate	1 850 000

Quantitative Analysis

Probability of extinction in the wild is at least 20% within 20 years or 5 generations, or 10% within 100 years.	Unknown

Threats (actual or imminent, to populations or habitats)

Scope and severity of threats are difficult to estimate due to substantial knowledge gaps. Breeding – habitat degradation and loss due to change in climate, contaminants, industrial activities and overabundant snow geese Migration and Over-wintering – change in prey availability and distribution, oil spills and chronic oiling, and ingestion of microplastics

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Status in Alaska likely similar to Canada. Unknown status throughout remainder of range.	Largely unknown
Is immigration known or possible? Immigration is possible due to strong migratory abilities and the observation that some individuals show low fidelity to breeding sites.	Yes
Would immigrants be adapted to survive in Canada?	Yes

Is there sufficient habitat for immigrants in Canada? Phalaropes do not defend territories and can occur at a high density in suitable habitat.	Yes
Is rescue from outside populations likely?	Possible

Data-Sensitive Species

Is this a data-sensitive species?	No

Status History

COSEWIC: Not yet assessed

Status and Reasons for Designation:

Status: Special Concern	**Alpha-numeric code:** Not applicable
Reasons for designation: This bird has declined over the last 40 years in an important staging area; however, overall population trends during the last three generations are unknown. The species faces potential threats on its breeding grounds including habitat degradation associated with climate change. It is also susceptible to pollutants and oil exposure on migration and during the winter. This is because birds gather in large numbers on the ocean, especially where currents concentrate pollutants.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Does not meet criterion. Population trends are unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Does not meet criterion. EO and IAO are above the thresholds.
Criterion C (Small and Declining Number of Mature Individuals): Does not meet criterion. Population size is above the thresholds.
Criterion D (Very Small or Restricted Population): Does not meet criterion. Population size, IAO and the number of locations are above the thresholds.
Criterion E (Quantitative Analysis): There are no quantitative analyses available.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2014)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

The Red-necked Phalarope (*Phalaropus lobatus*; Linnaeus 1758), or Phalarope à bec étroit (French), and formerly known as the Northern Phalarope, is a shorebird in the family Scolopacidae. It is most closely related to the Red Phalarope (*P. fulicarius*) and secondarily to Wilson's Phalarope (*P. tricolor*), a classification supported by morphological (e.g., Chu 1995) and molecular evidence (e.g., Gibson and Baker 2012). It was first described as *Tringa tobata*, then *T. lobata*, and was placed in the genus Lobipes for the first half of the 20th century (Rubega *et al.* 2000).

Morphological Description

The Red-necked Phalarope is the smallest species in the genus *Phalaropus* (Rubega *et al.* 2000), measuring approximately 18 cm in length. In breeding plumage (Fig. 1), birds are easily recognized by stripes of red-orange plumage at the base of the neck and along the sides of the face, running laterally along the back of the head and sides of the throat. The remainder of their breeding plumage is primarily dark (blue-grey) and white. The needle-like bill, legs, and feet are black. They have a dark head and neck, a white throat, cheeks, and eye spots (sometimes eye stripes). The dark breast fades into a white abdomen, and undertail, while the back, rump, tail, and upperwings are dark with golden-chestnut fringes along the mantle and scapulars. A white wingbar is visible in flight. As in other shorebird species that exhibit sex-role reversal, females tend to be slightly larger and brighter.

After moulting into non-breeding plumage in late summer, males and females are difficult to distinguish. Both are white along the head, throat, breast, and underparts except for a dark eye stripe and crown. Upperparts are predominantly dark to light grey with some light colouration along the scapulars and mantle. Juvenile colouration resembles non-breeding plumage of adults. Yearlings are difficult to distinguish from older Red-necked Phalaropes, except for measures of wing-length ratio (Schamel and Tracy 1988). Juveniles and non-breeding adults can be difficult to distinguish from the closely related Red Phalarope, which has a stouter bill and less prominent striping (Rubega *et al.* 2000).

Figure 1. Adult female Red-necked Phalarope in breeding plumage, Niglingtak Island, Mackenzie River Delta, Northwest Territories (Photo credit: Bree Walpole 2006).

Population Spatial Structure and Variability

A study using random amplified polymorphic DNA (RAPD) analyses found significant genetic variability (F_{ST} = 0.10, X^2 = 48.0, d.f. = 18, p = 0.00) among Red-necked Phalaropes from three breeding sites (Churchill, MB, Mackenzie Delta, NWT and Prudhoe Bay, AK) and a migratory stopover site (Quill Lakes, SK; Haig *et al.* 1997). Genetic comparisons of breeding populations from other parts of the range of this species, as well as with birds outside the Americas are lacking.

Designatable Units

There is insufficient evidence at this time to support more than one designatable unit.

Special Significance

All phalaropes, including the Red-necked Phalarope, exhibit the uncommon breeding behaviour of sex-role reversal, in which males are smaller, less colourful, and provide all parental care (i.e., tend the nest, eggs and young). Where conditions allow, females may take multiple mates. This polyandrous breeding system is rare among vertebrates, with shorebirds offering a disproportionate number of examples. Phalaropes are also unique in their feeding behaviour. When phytoplankton and aquatic invertebrates are not readily available at the water's surface, phalaropes use their feet and legs to create a vortex that draws this food towards the surface, within reach. As a result, feeding phalaropes can be seen "spinning" as they pluck food from the water with their needle-like bill.

Aboriginal traditional knowledge is not currently available for this species.

DISTRIBUTION

Global Range

The Red-necked Phalarope is the most widely distributed of the phalaropes, with breeding records across the whole of the circumpolar sub-Arctic. Breeding has been observed in Greenland, Spitsbergen, Iceland, Faeroes, Scotland, Ireland, Norway, Sweden, Finland, Estonia, Russia, the United States (Alaska), and Canada (Rubega *et al.* 2000).

In the Americas, Red-necked Phalaropes likely have a continuous breeding distribution across the northern reaches of the continent. Breeding observations have been reported as far west as the Alaska Peninsula and as far east as the Labrador coast (Rubega *et al.* 2000). Red-necked Phalaropes are at least as abundant in the Western Hemisphere as elsewhere in the range. Abundance within North America is estimated at approximately 2 500 000 individuals, determined by approximately summing the estimated number of individuals at key stopover sites (Morrison *et al.* 2006, Andres *et al.* 2012). Population size elsewhere in the range is also uncertain, but believed to be greater than 1 000 000 breeding individuals in the Arctic and sub-Arctic regions of western Eurasia from Scotland to the Taymyr Peninsula, Russia, and 100 000 to 1 000 000 breeding across central and eastern Siberia (Wetlands International 2013).

Red-necked Phalaropes over-winter in marine habitats at low latitudes. As with the breeding distribution, knowledge of the non-breeding distribution has been pieced together from opportunistic sightings. Birds that breed in North America are believed to winter primarily along the Pacific coast from Mexico south to Chile (Rubega *et al.* 2000), with a majority of the birds concentrated offshore of Panama and Peru. A regular concentration is associated with the Humboldt Current off the coast of Peru (Murphy 1936). Some wintering birds are sighted irregularly along the Atlantic coasts of Georgia and Florida, the Gulf of Mexico, as well as along the southwest coast of Central and South America (Rubega *et al.* 2000). Unlike the Red Phalarope, Red-necked Phalaropes are not commonly found in large numbers off the west coast of Africa, suggesting that Red-necked Phalaropes breeding in the Eastern Canadian Arctic cross over to the Pacific during migration. Recent information from a geolocator placed on a breeding Red-necked Phalarope from the Island of Fetlar (Scotland) provides some support for this theory. After crossing the Atlantic Ocean, passing south of Greenland to the coastal waters of Labrador, it followed the eastern seaboard, and crossed the Gulf of Mexico to the Pacific where it over-wintered east of the Galapagos Islands (Smith *et al.* 2014).

During northward migration, birds wintering off the Pacific coast of South America likely follow the shoreline to the Gulf of California, then some move inland through the Great Basin and Prairie Provinces while others continue their coastal path to Alaska (Rubega *et al.* 2000). Some are also likely to cross into the Gulf of Mexico, flying north along the eastern seaboard, as was the case for the tagged individual returning to the Island of Fetlar (Smith *et al.* 2014).

Congregations of southbound migrants numbering upwards of 3 000 000 were once observed staging in the Gulf of Maine and the Bay of Fundy (Finch *et al.* 1978). The breeding origin of these birds is unknown, but presumed to include individuals from the eastern Canadian Arctic and sub-Arctic. Indeed, the non-breeding distribution of Red-necked Phalaropes is very poorly known and the possibility remains that significant concentrations of wintering birds occur in unknown locations.

Canadian Range

In Canada, Red-necked Phalaropes occur in every territory and province as either breeders or migrants (Figs. 2, 3). In British Columbia, breeding has been reported in the Chilkat Pass region of the St. Elias Mountains (Godfrey 1986, Campbell *et al.* 1990), neighbouring the Alaskan border. British Columbia's Breeding Bird Atlas (2013) indicates a single confirmed breeding observation. The breeding range likely spans suitable habitat along the northern edge of the province, but confirmation is lacking due to the remoteness of this area. Breeding observations have been noted in north-central Alberta (e.g., Caribou Mountains; Höhn and Mussell 1980), northern Saskatchewan (e.g., Lake Athabasca), and along the southern coasts of Hudson and James Bays in northeast Manitoba (e.g., Churchill), northern Ontario (e.g., between Cape Henrietta Maria and Pen Islands; D. Sutherland pers. comm.; Nol and Beveridge 2007) and northern Québec. Breeding records in Québec also include the Lake Beinville area, islands in Ungava Bay, the Ungava Peninsula, Lake Bérard, Gregory Lake, the Schefferville region and Rupert Bay (Todd 1963, Godfrey 1986, Cotter 1996, Andres *et al.* 2006). Breeding observations have been confirmed along the coast of Labrador, as far south as Battle Harbour (Godfrey 1986), and possibly towards the Strait of Belle Isle (Todd 1963). Breeding has not been confirmed in Newfoundland (Peters and Burleigh 1951) or Prince Edward Island (NatureServe 2013). Reports from Prince Edward Island indicate that the species is seen occasionally (Rosemary Curley pers. comm.).

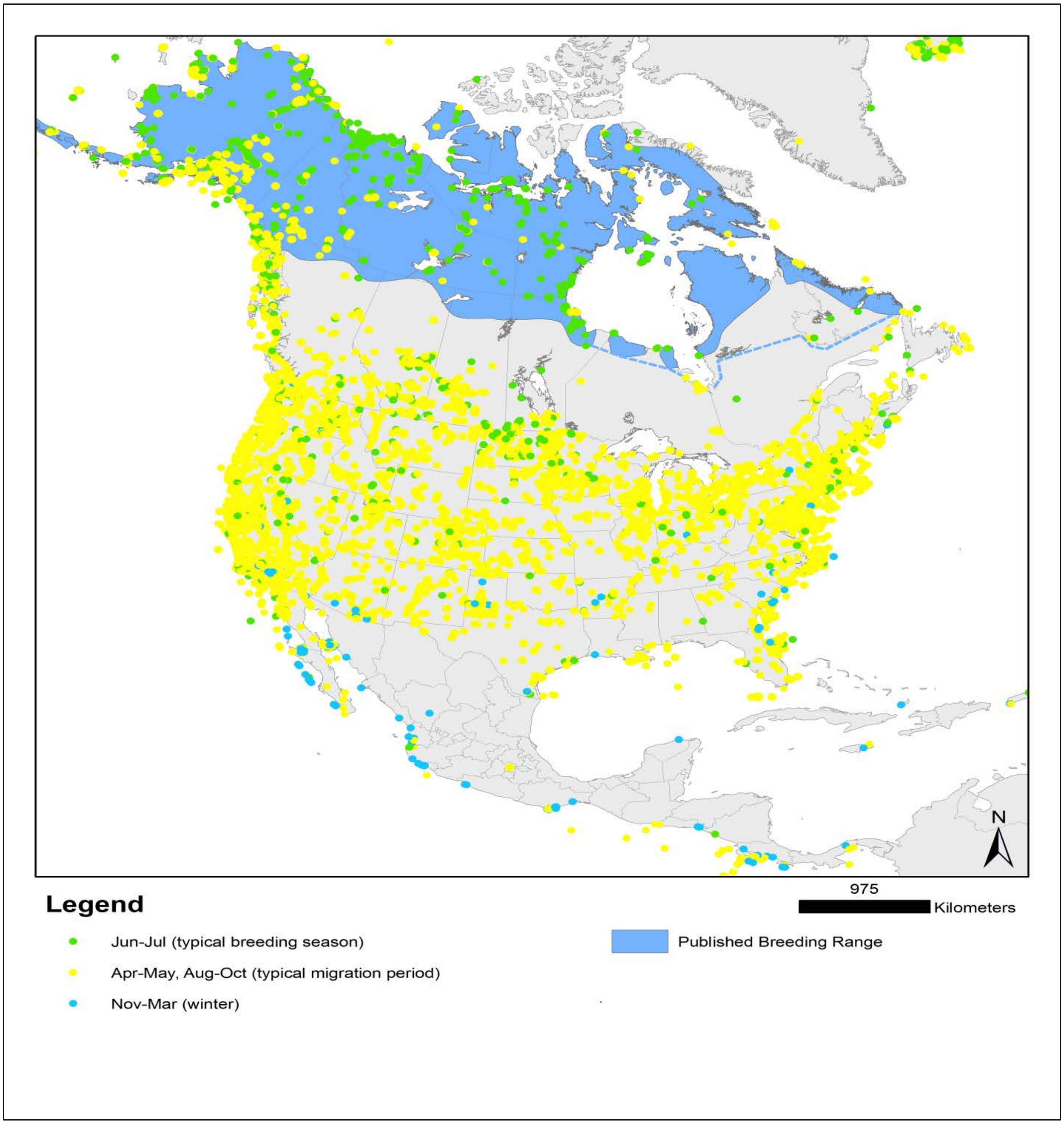

Figure 2. Sightings of Red-necked Phalaropes appearing in the CWS NWT-NU Checklist Database, eBird, and the most current published range information (Ridgely *et al.* 2007, CWS - PNR 2012). Note that both the northern and southeastern limits of the breeding range were moved north in comparison to earlier maps; consultation with regional experts suggests that the species might still breed along the entire Ontario coast of Hudson Bay and east towards the Quebec/Labrador border (see dashed lines). The breeding range still includes Greenland and Iceland, but these areas are not mapped here. Observations of birds south of the Boreal ecozone during the breeding season are presumably non-breeders.

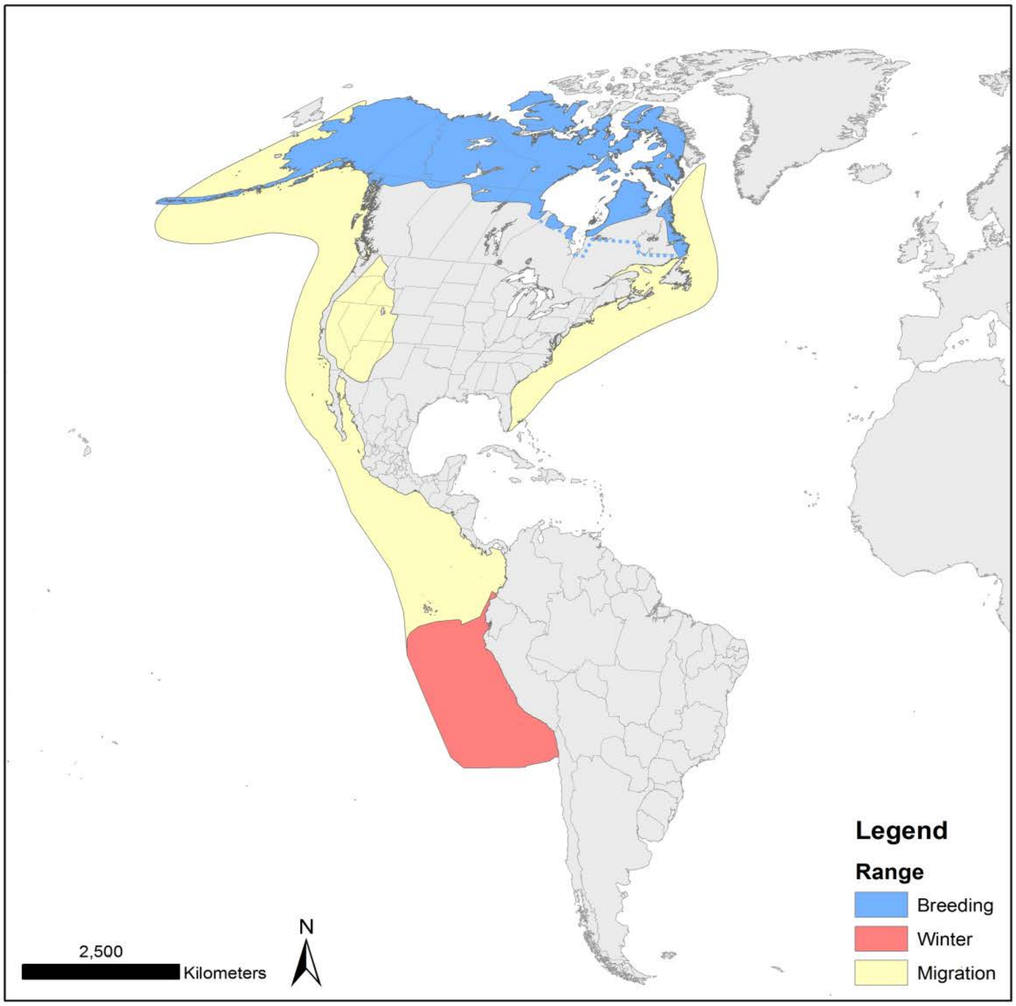

Figure 3. The published range throughout the year for Red-necked Phalaropes in the Western Hemisphere (Ridgely *et al.* 2007, CWS – PNR 2013). Dashed lines show additional areas with evidence of recent breeding. Migration areas denoted on this map are areas of major concentration; small numbers of individuals can occur anywhere in North America during migration (see Fig. 2).

Breeding and transient records are common in the northern territories, although the remoteness and lack of widespread survey coverage limits the number of confirmed occurrences. Red-necked Phalaropes breed throughout the Yukon Territory, with a concentration of observations along the coast and on Herschel Island (Sinclair *et al.* 2003, Cooley *et al.* 2012). They are also common throughout the Northwest Territories and eastward through Nunavut, as far north as Victoria Island and southern Baffin Island (Godfrey 1986; see also Fig. 2). Confirmed records from Prince Patrick Island (J. Rausch pers. comm.) may represent birds outside the normal breeding range. A number of observations appear in eBird and other survey databases (i.e., Canadian Wildlife Service, Northwest Territories and Nunavut Checklist Survey databases) from areas north of the previously described breeding range, including Banks Island and Northern Baffin Island. These observations could not be confirmed directly, and the absence of Red Phalaropes from some of these surveys suggests the possibility of identification errors. Although interspecific variation in breeding plumage makes misidentification unlikely, sightings of “fledged young” appearing in these databases might be confused between the two species. Very occasional confirmed records of non-breeding birds in the vicinity of Alert, on northern Ellesmere Island (82°30’N; R.I.G. Morrison pers. comm.) Nunavut, however, demonstrate that the birds do occur in the Canadian High Arctic. Due to confirmed sightings from these latitudes, the described breeding range was extended northwards in the most recent revision of the species’ range map (Fig. 2).

Within the Arctic portion of its range, the species is well captured by the Program for Regional and International Shorebird Monitoring (PRISM) Arctic Surveys. Red-necked Phalaropes are widespread across the Canadian and Alaskan Arctic, occurring in 16 of the 26 regions surveyed (Bart and Smith 2012a). Sightings were made from the Alaska Peninsula to the Queen Maud Gulf Migratory Bird Sanctuary, but notably were lacking from the Canadian Arctic Archipelago despite significant survey coverage in areas considered to be within the breeding range. As such, it is thought that the species is an uncommon to rare breeder in the most northern portion of its range. A direct example of this comes from Coats and Southampton islands in Nunavut. These islands are considered to be well within the species’ range, and are the location of several eBird and Canadian Wildlife Service, Northwest Territories and Nunavut Checklist records (Fig. 2). However, in 15 years of personal experience (by author Paul Smith) working in many locations on these two islands, the species has been sighted only three times (three individuals total).

During southward migration through Canada, Red-necked Phalaropes are most abundant in the lower Bay of Fundy (Fig. 4), where they once numbered up to 3 000 000. Unlike Red Phalaropes that are more abundant off Brier Island on the Nova Scotia side of the bay, Red-necked Phalaropes are more common along the New Brunswick coast, in the channels south and east of Deer Island, the ledges south of Grand Manan, and along adjacent northeastern Maine (Brown and Gaskin 1988). Although once very numerous, the species declined throughout the 1970s and 1980s, and by the 1990s sightings were rare in some previously important stopover locations (Duncan 1995; see below). Large numbers of phalaropes can still be seen between Grand Manan and Brier Island, but the passage population is greatly reduced from its former abundance (R. Hunnewell and A. Diamond, unpub).

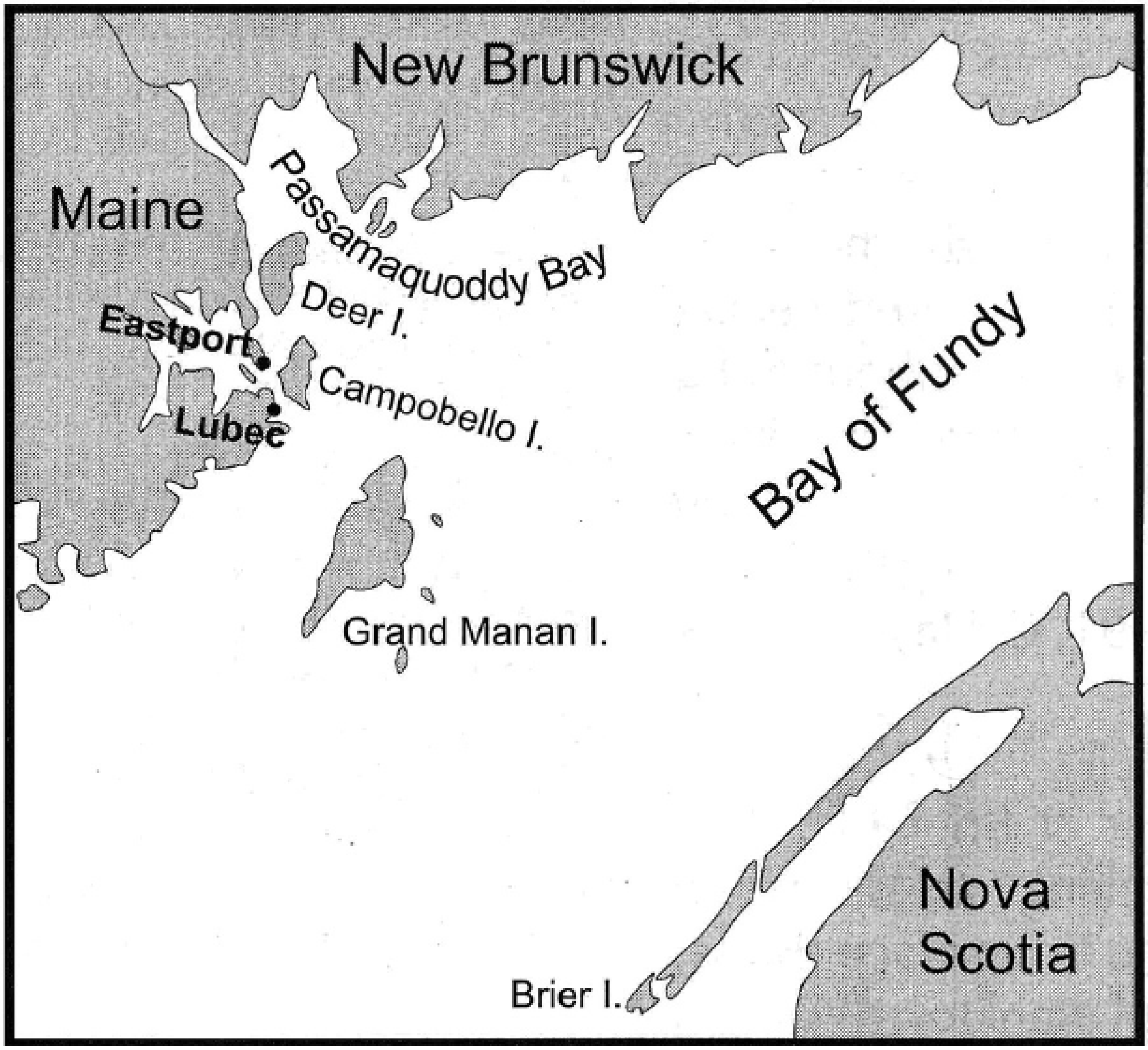

Figure 4. Bay of Fundy with locations of Deer, Campobello, Grand Manan and Brier islands (Duncan *et al.* 2001 as cited in Brown *et al.* 2010).

Migrants are also very common along the Pacific coast. Birds over-wintering offshore of South America travel north along the Pacific coast, with hundreds of thousands passing through the Gulf of Alaska, Copper River Delta, and Prince William Sound en route to interior Alaska. During migration, flocks numbering in the thousands are not uncommon, with the largest concentrations in the Queen Charlotte Strait, off Cleland Island on the west coast of Vancouver Island, and in the Strait of Juan de Fuca (Campbell *et al.* 1990).

Migrants also travel inland through the interior of British Columbia, Alberta, Saskatchewan, and Manitoba (Bent 1962, Godfrey 1986, Campbell *et al.* 1990). Birds travelling through interior British Columbia are sighted throughout the Peace Lowlands and Okanagan valley (Campbell *et al.* 1990). Beyersbergen (2009a,b,c) notes phalaropes at several wetlands and lakes in Alberta and Saskatchewan. In Saskatchewan, Last Mountain Lake, Chaplin Lake, the Quill Lakes (with upwards of 45 000 during spring migration), and Crane Lake region are notable stopover sites (Bent 1962, Colwell *et al.* 1988, Alexander and Gratto-Trevor 1997), and thousands use Chaplin Lake (Beyersbergen and Duncan 2007). Flocks between 20 and 200 individuals are often observed at smaller lakes and large wetlands throughout southern Saskatchewan (CWS 2013 unpub. survey data). Small flocks (i.e., 50-100) pass through Manitoba west of the Red River valley, with larger flocks observed near Oak Hammock Marsh, Hydro Road outside Churchill, and at Winnipeg's West End Water Pollution Control Centre (Reynolds 2003). In Quebec, the Red-necked Phalarope is a rare fall transient in the Montréal region, St. Lawrence Valley and Plain (Cotter 1996) with a maximum of 700 records in 1978 from the Mingan archipelago on the North side of the Saint Lawrence Gulf (Larivée 2013).

Extent of Occurrence and Area of Occupancy

Vast areas of this species' range are poorly monitored, if they have been surveyed at all. Consequently, quantitative estimates of the extent of occurrence (EO) and index of area of occupancy (IAO) are difficult to determine for this species and offer little information except to demonstrate that the species is widespread across a large Canadian range.

The EO in terrestrial habitats during the breeding season (June and July) based on the Minimum Convex Polygon of sightings appearing in the eBird and Checklist databases is roughly 8 695 459 km^2 (clipped to terrestrial habitats only, area calculated using an Albers Equal Area Projection). The EO clearly overestimates the breeding distribution because many sightings (of presumably non-breeding birds) are well south of the documented breeding range. The IAO for a grid of 2 km x 2 km cells cannot be calculated because precise locations for where birds are breeding are unknown. However, given the population size and distribution, the IAO will be greater than 2000 km^2.

The earlier range map (Ridgely *et al.* 2003) is thought to be a more accurate depiction of the species' regular breeding range than the updated version (Ridgely *et al.* 2007); the latter was expanded northwards into areas where the species is sparsely distributed at best. Based on the earlier map, 74% of the North American breeding range lies within Canada (4 053 666 km^2 of 5 476 430 km^2).

The species is widespread across Northern Europe and Asia, but because of significant uncertainty in the exact boundaries of the range, and also relative densities across the range, the percentage of global range in Canada is not a useful metric. Based on best available estimates of population size, 2 500 000 Red-necked Phalaropes breed in North America (Andres *et al.* 2012), out of a global population of 3 600 000 to 4 500 000 (Wetlands International 2014). If 74% of the North American birds breed in Canada, this equates to 41 to 51% of the global population breeding in Canada. The true fraction of North American birds breeding in Canada is probably lower, based on higher relative densities observed in Alaska versus Canada (see below).

Search Effort

Numerous observations of the species have been recorded across Canada (e.g., Fig. 2), but the coverage is far from exhaustive. The species is adequately surveyed in Arctic Canada, where it is well-captured by the Arctic surveys of the PRISM (Bart and Smith 2012b). These surveys, scheduled to achieve complete coverage of the Canadian Arctic by 2020, will provide a clearer understanding of the species' abundance in the northern extent of the breeding range. However, more than half of the species' breeding range lies south of Arctic areas, and survey coverage throughout this portion of the breeding range is sparse. In particular, few data are available from sub-Arctic Québec (with the exception of surveys along the Northwestern Ungava Peninsula, Andres 2006; and opportunistic surveys from the EPOQ database) and from the taiga habitats of the Northwest Territories, Yukon Territory, and Nunavut. Due to the low coverage in these areas, it is not possible to evaluate any changes or trends in distribution.

The marine range in Canadian waters during the non-breeding season is also poorly documented. Dedicated surveys have been limited to a small number of areas, especially the Bay of Fundy. Survey data from elsewhere during the migration period are sparse. Indeed, even within the Bay of Fundy, some uncertainty remains as to the current distribution and habitat use of the species. However, while limited search effort means that the distribution is not known with great resolution, it is evident that the species is widespread in Canada.

HABITAT

Habitat Requirements

<u>Breeding</u>

Red-necked Phalaropes breed in Arctic and sub-Arctic wetlands or in vegetation near other sources of freshwater, such as lakes, pools or small streams (Höhn 1968a, Reynolds 1987, Gratto-Trevor 1996, Rubega *et al.* 2000, Walpole *et al.* 2008a,b). Birds settle on home ranges dominated by grasses and sedges, emergent aquatic vegetation, and open freshwater, while avoiding areas of bare ground (i.e., mud) and dense shrub (Walpole *et al.* 2008b).

Nests consist of a simple scrape (Rubega *et al.* 2000) and are constructed by creating a shallow depression in the ground and pulling vegetation overhead for enhanced concealment from above. Nests are usually located in tufts of grass and/or sedge (Höhn 1968a, Rodrigues 1994, Gratto-Trevor 1996, Walpole *et al.* 2008b), and sometimes sparse shrubs (Reynolds 1987). As with home ranges, there appears to be a preference for nest sites dominated by grasses and sedges over areas dominated by shrubs (Rodrigues 1994, Walpole *et al.* 2008b).

Red-necked Phalaropes exhibit a strong affinity for water. Most foraging (Lipske 1998, Rubega *et al.* 2000, Walpole *et al.* 2008a) and social interactions (Höhn 1968a,1971, Rodrigues 1994, Walpole *et al.* 2008a) take place in aquatic habitats. Aquatic habitats are also crucial for chicks that must undergo rapid weight gain in preparation for fall migration. Pond use may not be linked to environmental features, but is more likely driven by the presence of other phalaropes (Walpole *et al.* 2008a). Although, food availability and other habitat characteristics could play a larger role in habitat use where certain features are limiting. For instance, other reports indicate that Red-necked Phalaropes aggregate on ponds during midge emergence (Rubega *et al.* 2000).

Studies of habitat use by chicks are lacking. Chicks are not capable of sustained flight until approximately 22 days (Rubega *et al.* 2000). As such, chicks are highly dependent on the area immediately surrounding nesting sites for concealment and shelter (e.g., graminoid wetlands), and prey (i.e., freshwater wetlands, ponds, and lakes).

Migration and Over-wintering

During migration, Red-necked Phalaropes are primarily pelagic, but may also stop over on inland wetlands or other non-riverine water bodies. Observations of stopover sites include estuaries, salt marshes, bays, inlets, pools, ponds, lakes, ditches, irrigated rice fields, intertidal lagoons, sewage and evaporation ponds (Rubega *et al.* 2000), sandy shores, and prairie sloughs (Salt and Wilk 1958). A small number of individuals over-winter inland, at evaporation ponds in southern California (Garrett and Dunn 1981). Some hypersaline habitats seem important to migrants such as Great Salt Lake Utah and Mono Lake, California. For example, up to 240 000 individuals stop annually at the Great Salt Lake, Utah (Western Hemisphere Shorebird Reserve Network 2009). This use of salt lakes is likely driven by the abundance of aquatic prey typical of these sites (Rubega *et al.* 2000).

In offshore areas, congregations occur where there are aggregations of prey, mostly along fronts, upwellings, and near the edge of pack ice (Orr *et al.* 1982). In the lower Bay of Fundy, Red-necked Phalaropes are concentrated along “streaks”; areas of calm caused by upwelling and sinking (Brown and Gaskin 1988). Streaks are formed by tidally induced upwellings that concentrate swarms of zooplankton, specifically *Calanus finmarchicus*, near the surface. The density of surface prey is particularly important for staging Red-necked Phalaropes, as the greatest densities of foraging birds coincide with areas where *C. finmarchicus* is most abundant within the top 20 cm of the water column. Without the upwellings, *C. finmarchicus* would remain at depth during the day, only migrating towards the surface at night (Brown and Gaskin 1988).

Elsewhere in the non-breeding range, Red-necked Phalaropes are often found at marine convergences. However, not all areas of convergence and upwelling are used equally by phalaropes. Food quality and quantity likely play a role in their habitat selection at sea (Brown and Gaskin 1988). Research conducted along the continental shelf of the southeastern United States indicates a particular attraction to the shoreward edge of middle shelf (20 to 40 m depth) habitat during winter months (Haney 1985). The middle shelf is likely favoured because wind stress and tidal stirring force prey (e.g., copepods) to the surface, making these areas particularly productive for foraging (Haney 1985). Haney (1985) also suggests that there is a correlation between temperature gradient and the presence of phalaropes along the middle shelf.

There is evidence of Red-necked Phalaropes being attracted to mats of floating algae (*Sargassum* spp.), which likely provide an abundance of prey (South Atlantic Bight, Haney 1986; coast of Southern California, Moser and Lee 2012). In fact, Moser and Lee (2012) suggest that Red-necked Phalaropes are *Sargassum* specialists from mid-April until early June, and again from mid-July until October. This relationship is likely not limited to California; mats of aquatic vegetation may also be important foraging areas for birds in the Bay of Fundy (Brown and Gaskin 1988), and kelp beds are used for foraging in waters off the coast of British Columbia (Campbell *et al.* 1990).

Little information is available on staging areas used before migration. Post-breeding Red-necked Phalaropes staging in Alaska’s North Slope use pond edge and gravel beach habitat in equal proportions, while avoiding mudflats and salt marshes (Powell *et al.* 2010).

Habitat Trends

Red-necked Phalaropes will be affected by climate and habitat change. While patterns vary at the regional scale, the general increase in global temperature observed since about 1880 has been and will continue to be most extreme at high latitudes (e.g., Serreze *et al.* 2000). Already, observations of freshwater lakes indicate that many are shrinking, drying earlier in the season, or disappearing altogether (Siberia, Smith *et al.* 2005; sub-Arctic Alaska, Riordan *et al.* 2006). The shallow wetlands preferred by phalaropes are susceptible to small changes in water levels, and could be lost as permafrost recedes with rising temperatures (ACIA 2005).

Alongside changes to freshwater lakes and wetlands, many researchers predict a northward shift in the tree line (e.g., Serreze *et al.* 2000 and references therein, ACIA 2005) and expansion of shrub habitat into northern latitudes (e.g., Chapin *et al.* 1995, Sturm *et al.* 2001, Myers-Smith *et al.* 2011). To date, the shrub line is not only advancing, but sparse shrubs are experiencing improved growth and infilling resulting in denser and larger areas of shrubby habitat (Myers-Smith *et al.* 2011). In some areas of the Alaskan Arctic, shrub cover has already increased as much as twofold (e.g., 10% to 20%; Sturm *et al.* 2001). The conversion of grass-sedge wetland into habitats dominated by shrubs or even trees would result in a reduction in the total amount of available Red-necked Phalarope breeding habitats.

Similarly, significant amounts of habitat could be lost to inundation by seawater. Thawing of perennial sea ice, coupled with the melting of glaciers, is predicted to result in rising sea levels, and flooding of substantial areas of low-lying coastal tundra. In 2012, sea ice cover in the Arctic reached an all-time low of 3 410 000- million km^2, approximately half the average coverage reported from 1979 to 2000 (Perovich *et al.* 2012). Concurrent with melting sea ice, models project increasing intensity and severity of storm surges, and these surges can push sea water well inland. In the short term, even minor flooding can lead to widespread reproductive failure (as was observed by author Bree Walpole at the Mackenzie Delta in 2006). In the longer term, this salinization can adversely affect habitats.

Overabundant geese, especially the midcontinent Lesser Snow Goose (*Chen caerulescens caerulescens*) and to a lesser extent the Ross's Goose (*C. rossii*), are agents of profound habitat change in some parts of the northern breeding grounds of the Red-necked Phalarope. Through repeated overgrazing of graminoid forage plants and grubbing of the below-ground parts, geese are fostering a shift towards habitats with more exposed substrate and reduced vegetative concealment (Henry and Jefferies 2008, Abraham *et al.* 2012). This habitat alteration should be detrimental to shorebirds by, for example, reducing the vegetative concealment of nests, but studies have shown mixed effects (Sammler *et al.* 2008, Latour *et al.* 2010). Comprehensive studies to evaluate the impacts are lacking. In an area of Wapusk National Park, Manitoba that has been impacted by geese, Rockwell *et al.* (2009) note that Red-necked Phalarope pair density has declined from more than 90 nests/2 km^2 (Reynolds 1987) to less than 1 nest annually since 1995. Within the range of the Red-necked Phalarope, habitat degradation caused by geese is known to be pronounced along the west coasts of Hudson and James bays, in the Queen Maud Gulf Migratory Bird Sanctuary, and across much of Southampton Island.

Habitat alteration caused by development in the North could also contribute to a decrease in suitable habitat. Albeit at a smaller scale, the cumulative impact of various local perturbations to habitat could have substantial consequences, particularly in the face of the landscape-scale habitat trends discussed above.

With migratory and over-wintering habitat encompassing such a large expanse, it is challenging to predict how habitat availability and quality will change over time. The threats discussed below provide some insight on potential impacts to these areas.

BIOLOGY

Aside from accounts of natural history, most research on phalaropes has focused on aspects of sex-role reversal and polyandry (e.g., Schamel and Tracy 1977, Colwell 1986, Reynolds 1987, Whitfield 1990, 1995, Dale *et al.* 1999, Schamel *et al.* 2004a,b). The majority of information below has been compiled from research conducted by Otto Höhn, Douglas Schamel, and Diane Tracy in Alaska, Cheri Gratto-Trevor and John Reynolds in Manitoba, and Olavi Hildén and Seppo Vuolanto in Finland. Information on Red-necked Phalarope migration along the east coast of the Americas is summarized from research by Francine Mercier, John Chardine, Robin Hunnewell, and Tony Diamond. The Red-necked Phalarope account in the Birds of North America (Rubega *et al.* 2000) provides useful information on the species.

Life Cycle and Reproduction

<u>Breeding</u>

Males and females both nest as early as their first year (Hildén and Vuolanto 1972, Reynolds 1987, Schamel and Tracy 1991). Similar to other species of phalaropes, females may precede males to the breeding grounds (Höhn 1968a, Reynolds *et al.* 1986, Whitfield 1990, 1995). Although arrival dates vary by location and year, arrival typically spans mid-May to early June throughout much of the breeding range (e.g., Höhn 1968a,b,1971, Hildén and Vuolanto 1972, Reynolds *et al.* 1986, Meltofte 2006).

Females initiate the selection of suitable nesting sites, which takes place about a week before laying (Rubega *et al.* 2000). Unlike most other shorebirds, Red-necked Phalaropes do not defend territories. They do, however, defend their mate (Schamel and Tracy 2003).

Once egg laying begins, males complete nest construction by rearranging surrounding vegetation to provide concealment from above (Rubega *et al.* 2000). Laying of the entire clutch of 4 eggs is usually completed within 4 days (Rubega *et al.* 2000). Although males will re-nest following predation early in the season, sequential nesting following a successful clutch is not possible due to the short breeding season. Females, on the other hand, are sequentially polyandrous, and seek other mates and lay additional clutches where possible. Schamel *et al.* (2004b) note that males typically have full paternity of their first clutch, but extra-pair young are present in 50% of replacement clutches (Schamel *et al.* 2004b).

Females do not provide parental care. Regular incubation by males is initiated once the clutch is nearly complete (Hildén and Vuolanto 1972, Reynolds 1987) and is carried out until hatch, at about 18 days (Rubega *et al.* 2000). Nest success varies by site and year. For example, success rates of 18% (Höhn 1968a), 59% (Walpole *et al.* 2008b), and 38% to 76% (Reynolds 1987) have been reported. In 2006, virtually all nests at a site in the Mackenzie River Delta failed due to a combination of predation (46%) and flooding caused by a storm (40%; Walpole *et al.* 2008b).

Chicks are precocial and generally leave the nest within a day of hatching (Rubega *et al.* 2000). During this time, the male continues to brood and rarely travels farther than 10 m from his chicks (Rubega *et al.* 2000). Family groups (male and chicks) tend to congregate at favoured ponds where prey is abundant before migration (Hildén and Vuolanto 1972). Birds leave the breeding grounds sequentially with females, non-breeding males, and males with failed nests leaving first, followed by the remaining adult males, and then juveniles at approximately 30 to 35 days of age (Reynolds 1987).

The diet of Red-necked Phalaropes early in the breeding season is unknown, but closely related Red Phalaropes have been observed foraging exclusively on spiders before snowmelt (Danks 1971). During breeding, Red-necked Phalaropes feed primarily on larval flies and fly eggs, beetles, and spiders (Baker 1977). Specifically, study of the stomach contents from 24 birds confirmed the presence of Diptera (eggs, Chironomidae larvae and adults, Tipulidae larvae and adults, and Psychodidae larvae), Coleoptera (Chrysomelidae adults, and Dytiscidae larvae and adults) and unidentified spiders (Baker 1977).

Red-necked Phalaropes are visual foragers, plucking prey from the water as they ramble or spin. Although the majority of feeding takes place on the water, birds also pick invertebrates from emergent and shoreline vegetation, or snap flying insects during emergence (B. Walpole pers. obs.).

Migration and Over-wintering

Comparatively little information is available on the biology of phalaropes that have left the breeding grounds. Non-breeding Red-necked Phalaropes feed exclusively on small, marine or freshwater aquatic invertebrates. In the Quoddy region of the Bay of Fundy, Mercier and Gaskin (1985) note that flocks of 5 000 to 20 000/km^2 (numbering between 100 and 100 000 individuals) fed almost exclusively (88.6%) on *C. finmarchicus*, the most common zooplankton in the area. Remaining prey included smaller copepods, seeds, and insects, with the largest prey reaching a size of 6 mm.

In Santa Monica Bay, California, birds typically congregate along linear oceanic features (i.e., streaks) where prey is abundant. Through an analysis of the gut contents of three individuals, DiGiacomo *et al.* (2002) noted the importance of fish eggs as prey, concluding that Red-necked Phalaropes are opportunistic, and will forage on any prey of an appropriate size that is available in high concentrations.

Mortality is probably highest during migration, but is also not uncommon during the rest of the year, as a result of harsh conditions associated with over-wintering at sea and breeding in the far north. Longevity of the species is unknown, although may be 10 years (Rubega *et al.* 2000, Schamel and Tracy 2003). Survival rates are likely comparable to those of other shorebirds. Assuming age at first breeding is 1 year, adult survival of 75% and juvenile survival of 60% (plausible values, similar to those of other shorebirds; Sandercock 2003), generation time is on the order of 4 years.

Physiology and Adaptability

Information on physiological requirements, including nutrition, energetics, metabolism, and temperature regulation is largely lacking. Staging Red-necked Phalaropes in the Quoddy region, New Brunswick accumulated fat stores at a rate of about 1 g/day for up to 20 days (Mercier 1985). In this region, birds primarily prey on *C. finmarchicus*. In total, Mercier (1985) measured maximum fat stores of 40 to 45% of fresh weight. Based on these measures, Mercier (1985) has calculated a non-stop migratory distance of 5 100 km, a distance that exceeds that for most other shorebirds breeding in the sub-Arctic.

Dispersal and Migration

Red-necked Phalaropes are long-distance migrants, travelling 6 000 km from tropical over-wintering sites to Arctic and sub-Arctic breeding grounds. During spring migration, Red-necked Phalaropes arrive in the southwest Davis Strait area in early June, and passage is complete by the middle of the month, consistent with observations in the Hudson Strait (Orr *et al.* 1982). Arrival of post-breeding birds on Alaska’s North Slope occurs in early to mid-August, with the number of staging adults peaking up to 12 days before the arrival of juveniles (Powell *et al.* 2010). Patterns in autumn arrival at staging areas in the Quoddy region, Bay of Fundy, reflect observations on the breeding grounds, with females arriving first (mid-July to early August), followed by males (mid- to late August), and juveniles (early to mid-September; Mercier 1985).

Although the length of stay at staging areas varies, it is likely similar to that observed for other shorebirds. Hunnewell and Diamond (unpub.) estimated length of stay for a sample of 27 radio-tagged Red and Red-necked Phalaropes near Brier Island as 15.2 ± 1.9 days. Mercier (1985) proposed an average stopover of 20 days in the Quoddy region based on the need to build fat as a percentage of fresh weight from 10% to 40%.

Observed measures of fat as a percentage of fresh weight of 40% is indicative of nonstop migration (Odum and Connell 1956 as cited in Mercier 1985). Although this suggests that Red-necked Phalaropes fly directly from northern stopover sites to over-wintering sites, it seems unlikely they travel all the way to the coast of Peru without replenishing fat reserves (Mercier 1985).

Exactly where birds stop en route to the coast of Peru is unknown as observations of Red-necked Phalaropes at more southern stopover sites in the fall are lacking. A likely suggestion is that birds fly directly to Panama and then make shorter flights along the productive northwest coast of South America (Mercier 1985). This would suggest a nonstop distance of 4 300 km (Mercier 1985). Another theory is that birds stopping over in eastern Canada winter elsewhere, although there are no known wintering areas in the Atlantic (Duncan 1996). Data from a recent study that used a geolocator to track the migratory route of a Red-necked Phalarope breeding in Scotland supports the former theory. The tagged individual migrated across the Atlantic where it presumably joined the Canadian-breeding Red-necked Phalaropes, and then continued its southern migration down the east coast to Florida before crossing the Gulf of Mexico into the Pacific Ocean. It is speculated that the bird moved inland for several days on two occasions to avoid unfavourable weather (Smith *et al.* 2014). Aside from Mercier (1985), few other studies have examined Red-necked Phalarope migration, although observations suggest that birds also migrate inland and along the west coast of North America, where some birds stage at Mono Lake and off the coast of California.

Aside from observations of return rates at specific breeding sites, little is known about Red-necked Phalarope dispersal. The highest site fidelity reported for phalaropes is from a breeding site for Red Phalaropes in northeast Iceland, where 100% of a small sample of banded males (n = 4) returned to the same area in consecutive years (Whitfield 1995). Return rates for adults do not appear to be strongly sex-biased. Estimates of Red-necked Phalarope fidelity to Cape Espenberg, Alaska, was 56% (males; n=99), and 61% (females; n=41; Schamel and Tracy 1991). Although, overall, fidelity was lower, the lack of a sex-bias is consistent with observations at La Perouse Bay, Manitoba (38% males [n=177] and 34% females [n=84] returned in subsequent years; Reynolds and Cooke 1988). Erckmann (1981) and Sandercock (1997) provide examples of lower rates of adult philoptary (0 to 17%). Variability in return rates may indicate a difference in fidelity across the species' range, or may be an artefact of differing sampling methodology. Interestingly, natal philopatry appears to be male-biased. At the same sites, Schamel and Tracy (1991) calculated natal return rates of 17% (male; n=161.5) and 2% (female; n=161.5), based on a 50:50 sex-ratio, and Colwell *et al.* (1988) observed 8% (male; n=23) and 2% (female; n=5) natal return rates. Reynolds and Cooke (1988) found over a 5-year period that 23 males and 5 females returned out of 555 chicks banded.

Interspecific Interactions

Hildén and Vuolanto (1972) speculate that Red-necked Phalaropes have a breeding association with Arctic Terns (*Sterna paradisaea*). Although the observation that Red-necked Phalarope nests were frequently located within Arctic Tern colonies may be a consequence of shared habitat preference, some behavioural observations suggest it is more likely an anti-predator defence strategy (Hildén and Vuolanto 1972).

Nest predators include Arctic Fox (*Vulpes lagopus*), Red Fox (*V. vulpes*), Short-tailed Weasel (*Mustela erminea*), Arctic Ground Squirrel (*Citellus parryi*), Parasitic Jaeger (*Stercorarius parasiticus*), Glaucous Gull (*Larus hyperboreus*), and Sandhill Crane (*Grus canadensis*; Rubega *et al.* 2000). Red-necked Phalaropes have a loose association with other shorebirds that share breeding sites. Some of the most notable species include the American Golden-plover (*Pluvialis dominica*), Semipalmated Plover (*Charadrius semipalmatus*), Semipalmated Sandpiper (*Calidris pusilla*), Least Sandpiper (*Calidris minutilla*) and Red Phalarope (Höhn 1959, Schamel and Tracy 1991, Latour *et al.* 2005, Andres 2006). In the Arctic National Wildlife Refuge of Alaska, post-breeding Red-necked Phalaropes aggregate with Semipalmated Sandpipers, Black-bellied Plovers (*Pluvialis squatarola*), Dunlin (*Calidris alpina*), Stilt Sandpipers (*Calidris himantopus*), and Pectoral Sandpipers (*Calidris melanotos*) in coastal mudflats (Brown *et al.* 2012). Along Alaska's North Slope, post-breeding Red-necked Phalaropes share pre-migratory staging sites with Semipalmated Sandpipers and Dunlin (Powell *et al.* 2010). At migratory stopover sites (e.g., Bay of Fundy), they commonly associate with Red Phalaropes, although preferred habitats may differ slightly (see above).

Red-necked Phalaropes may be weakly associated with other marine animals that stir zooplankton towards the surface. Accounts of associations with whales, Long-tailed Ducks (*Clangula hyemalis*; Schamel and Tracy 2003), and schools of fish (Bent 1962) have been documented. Predators of adults are likely similar to that of other small, pelagic shorebirds. Observed predators include Pomarine Jaeger (*Stercorarius pomarinus*), Sharp-shinned Hawk (*Accipiter striatus*), and Common Dolphin (*Coryphaena hippurus*; Rubega *et al.* 2000).

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Population size and status are difficult to monitor for this species because it uses remote and inaccessible breeding habitats and winters at sea. Consequently, phalaropes stand out as especially poorly monitored, even among shorebirds that as a group are generally under-monitored. Although targeted monitoring in the Bay of Fundy offers information for Red-necked Phalaropes, it deals with only a fraction of the Canadian breeding population. A small number of individuals are surveyed by migration monitoring programs such as the International Shorebird Survey, Atlantic Canada Shorebird Survey, and citizen science efforts, such as the Christmas Bird Count, but these surveys only count a fraction of the population and favour inland or nearshore habitats. Information collected on breeding birds through the PRISM surveys is more precise, but only captures the northernmost portion of the range.

Abundance

The most current estimate of the breeding population in North America is 2 500 000 (Andres *et al.* 2012). This estimate was first proposed by Morrison *et al.* (2001) and was carried over through revisions (Morrison *et al.* 2006, Andres *et al.* 2012) as survey data were too incomplete to provide additional information for revising the previous estimate. The estimate was derived by summing the estimated numbers at known key stopover sites, especially the outer Bay of Fundy and Great Salt Lake (Morrison *et al.* 2001). Consequently, the confidence assigned to this estimate is low and it is likely to be an underestimate as migration routes are incompletely known, so some unknown fraction of the population would not be included in this sum. With 74% of the Western Hemisphere range occurring in Canada, and assuming that breeding densities are consistent across the range, the Canadian estimate is roughly 1 850 000.

Although large declines had been observed in the outer Bay of Fundy, there was significant uncertainty as to whether this reflected true population change or redistribution (Morrison *et al.* 2001, 2006). It now seems likely that the number of individuals passing through the outer Bay of Fundy has declined more than can be explained on the basis of redistribution to known staging areas (R. Hunnewell and A. Diamond unpub.; see below), but the possibility remains that individuals are bypassing the Bay of Fundy region entirely in favour of other, unknown staging areas.

The PRISM surveys from the Arctic breeding grounds provide valuable additional information about population size. The surveys have not yet covered the whole of the Arctic, but for the portions surveyed to date, the population was estimated at 927 000 with a coefficient of variation of 0.17 (Bart and Smith 2012a). Perhaps half of the suitable habitat for the species in the Arctic has not yet been surveyed, and more than half of the breeding range falls outside Arctic areas, although densities are likely lower there. In the areas surveyed, Red-necked Phalarope was the fifth most abundant shorebird overall, and the sixth most abundant in Canada after Red Phalarope, Semipalmated Sandpiper, White-rumped Sandpiper (*Calidris fuscicollis*), Dunlin and Pectoral Sandpiper. Densities were highest in the Yukon-Kuskokwim Delta of Alaska (64 birds per km^2) and were generally higher in Alaska than in Canada. Many regions in Alaska had breeding densities in excess of 10 birds/km^2 in suitable habitats, and similarly high densities were observed in the eastern Queen Maud Gulf Migratory Bird Sanctuary, the Yukon North Slope and throughout the Mackenzie Delta (Bart and Smith 2012a).

Fluctuations and Trends

Migration

Migration monitoring programs provide some information about trends in the species' abundance, but only for those individuals migrating inland or close to shore. Bart *et al.* (2007) report significant declines in Midwest North America between 1974 and 1998 (22 sites, trend = -8% / year, $p<0.05$), and no significant trend in the North Atlantic (11 sites, trend = +1% / year, $p>0.05$). Smith *et al.* (unpub.) reanalyzed a similar dataset, including sites in both Canada and the United States from 1974 to 2009 using an Estimating Equations approach. Because the species is uncommon, the estimated trend across all regions was highly imprecise (95% CI= -25.4%/year to +22%/year, n = 65 sites). In the Pacific and Intermountain Region, the location of 665 000 of the circa 680 000 records in the database, the trend was also imprecise but tended towards positive (point estimate +18.5%/year, 95% CI=-9.9%/year to +55.9%/year). These imprecise trend estimates, capturing only a small fraction of the population, offer little insight into population status.

Targeted surveys in the outer Bay of Fundy offer more reliable information, albeit for a restricted area. Millions once passed through the area, with estimates of up to 3 000 000 at Passamaquoddy Bay in the 1970s (Finch *et al.* 1978). By 1990, they had largely disappeared from the area (Duncan 1996). At an important stopover site off the shores of Brier Island, Nova Scotia, mixed flocks of Red Phalaropes and Red-necked Phalaropes numbering 20 000 and 10 000 were recorded during fall migration in 1990 and 1996, respectively (Birdlife International 2012a).

While the species is still present in some abundance in the Bay of Fundy, numbers appear to be much lower than in the 1970s and 1980s, and it does not seem to be the case that these declines represent a redistribution to new stopover locations in their entirety. From the most recent surveys (2009-2010), covering 1 600 km^2 of the Outer Bay of Fundy between Brier Island, Nova Scotia and Grand Manan, New Brunswick, Hunnewell and Diamond (unpub.) conclude:

> *"Results from aerial line transect surveys conducted in this study suggest the disproportionate reduction in numbers of Red-necked Phalaropes (P. lobatus) from a migratory stopover in w. Bay of Fundy during the late 1980's does not represent a wholesale shift in numbers to a stopover currently used in the outer Bay of Fundy. Based on historical estimates, total stopover population size at Head Harbour Passage during July-September passage ranged from 1-2 million migrants of P. lobatus, with daily abundances of up to 5,000-20,000 birds/km^2 (Mercier and Gaskin 1985). By contrast, highest daily abundances comprising both species of phalarope evaluated for this study occurred in 2010, with estimated densities of up to 539 birds/km^2 [± SE of 156 birds/km^2] on Sept 23rd and 559 birds/km^2 [± 149] on Aug 30th in Brier and Grand Manan, respectively."*

Hunnewell and Diamond (pers. comm.) used ground counts to estimate proportions of Red versus Red-necked Phalaropes, radio tags to estimate length of stay, and distance methods to estimate detection during aerial surveys. Their estimate of the stopover population size of Red-necked Phalaropes, for the region between Brier Island and Grand Manan, was at most approximately 550 000. Although methods differed between this study and earlier studies, this number is significantly lower than what was previously observed at the key stopover locations in Passamaquoddy Bay/Head Harbour Passage. However, it should be noted that these declines had occurred by the late 1980s. The trend for the last three generations (i.e., since about 2001) is not known with any certainty, but is not likely as substantial a decline as that observed between the 1970s and 1990s.

Breeding

Few data are available to describe trends occurring on the breeding grounds. Regular monitoring in remote locations and across such a large area is challenging, although published literature provides some indications that the species may have declined in abundance. Jehl and Lin (2001) noted a “great decrease” in the number of nesting Red-necked Phalaropes from the 1930s to the 1990s in the area surrounding Churchill, Manitoba, with no clear trend since this time (E. Nol pers. comm.). Also in Manitoba, Gratto-Trevor (1994a) reported a decline from 46 males observed at Mast River Delta, La Perouse Bay, in 1985 to five in 1993. Rockwell *et al.* (2009) report drastic (99%) declines in pair density since the 1980s in areas impacted by over-abundant goose populations. Regular monitoring on Herschel Island, Yukon, indicates a pronounced decline throughout the 1990s (Cooley *et al.* 2012). Although the species was not detected through breeding surveys in the area since 1999 (Cooley *et al.* 2012), it has been observed as a rare migrant and local breeders are likely not being picked up through surveys due to their rarity (C. Eckert pers. comm.). This is consistent with moderate to severe declines along Yukon’s North Slope (i.e., Shingle Point) as observed by local residents [Wildlife Management Advisory Council (North Slope) and Aklavik Hunters and Trappers Committee 2003, Cooley *et al.* 2012]. Nesting and staging birds have almost disappeared from the vicinity of Crow Flats, Yukon Territory, in the last 40 years (D. Mossop pers. comm.). Although these negative trends may represent local phenomena, they appear to be widespread and consistent. This may indicate range-wide declines across the North American breeding range.

In summary, observations from the Bay of Fundy indicate a potentially serious decline in the North American Red-necked Phalarope population from the 1970s through to the 1990s. However, because survey effort is limited, it is possible that some portion of this decline reflects a shift in distribution to unsurveyed areas. Evidence from the breeding grounds is less conclusive, but also indicates the potential for range-wide declines. Thus, it seems most likely that the population has undergone a decline, potentially a substantial decline, in the last 40 or more years, since the 1970s. Information from the breeding grounds and key migratory sites offers little insight into the trend since about 2001 (i.e., the trend over the last three generations).

Rescue Effect

The Red-necked Phalarope has a circumpolar breeding distribution and shows varying degrees of fidelity to breeding sites. This suggests the possibility of rescue of the Canadian population from individuals breeding in Alaska or elsewhere in its circumpolar distribution. However, there are no records on band interchange to demonstrate dispersal of breeding individuals or young.

THREATS AND LIMITING FACTORS

Threats

The many knowledge gaps relating to the species, particularly regarding adaptability, migration, and over-wintering biology make threat identification challenging. As such, there is much uncertainty in predicting the scope (defined as the proportion of the population expected to be affected within 10 years) and severity (predicted level of damage to the species) of the threats listed below (see also Threat Calculator – Appendix 1).

Breeding

Climate Change

Alterations to habitat as a result of changes in the Arctic climate may be the greatest long-term threat to Red-necked Phalaropes on their breeding grounds. For instance, a change in climate could affect prey availability though (i) abundance, (ii) timing, and/or (iii) composition. As discussed previously, some important habitat changes are already occurring. Shrub encroachment into grass-sedge wetlands would result in a loss of suitable breeding sites, and the disappearance and premature drying of ponds would impact prey abundance for nesting birds and the ability of chicks to forage and obtain the energy necessary to support migration (Gratto-Trevor 1997, although see McKinnon *et al.* 2013). Not only could birds be affected by a reduction in prey, but changes in climate may also cause a shift in arthropod emergence towards earlier in the year resulting in a mismatch between the annual peak abundance of arthropods and the hatch of shorebird chicks (e.g., Tulp and Schekkerman 2008). Timing of breeding might be constrained by the conditions encountered during migration, for example, and Red-necked Phalaropes may not be able to shift their breeding phenology to adapt to the new timing of arthropod emergence (e.g., Gratto-Trevor 1994b). These mismatch effects are an important mechanism through which climate change might adversely affect reproductive success. However, Red-necked Phalaropes are likely to eat the most abundant aquatic invertebrates available, and so changes in aquatic invertebrate species composition resulting from a changing climate may not have large effects on breeding phalaropes (Gratto-Trevor 1994b).

Without further research, it is unclear whether the negative impacts resulting from a changing climate would outweigh the potential advantages incurred though a lengthened breeding season in a milder Arctic (McKinnon *et al.* 2013).

Air-borne Pollutants

The Canadian Arctic is linked to the industrialized world through atmospheric and water currents. Many contaminants travel over long distances and become concentrated in the North, despite the fact that it is far removed from point sources (Macdonald *et al.* 2000, Gamberg *et al.* 2005). In the Northwest Territories, mercury contamination in freshwater systems is on the rise, with the greatest increases in smaller waterbodies (Northwest Territories Environment and Natural Resources 2012). Hargreaves *et al.* (2010) found that the levels of mercury in the blood of three species of Arctic-nesting shorebirds; Ruddy Turnstone (*Arenaria interpres*) Black-bellied Plover, and Semipalmated Plover were approaching thresholds associated with toxicological effects in other birds. In particular, they found that blood mercury was as much as 10 times higher than that of samples from sites with more direct pollution input. They found a weak negative relationship between mercury and lead levels in tissue and reproductive success, and urged further study (Hargreaves *et al.* 2010). There is also evidence of DDT and PCBs accumulating in Arctic nesting shorebirds (Braune and Noble 2009). Foraging strategy may be partly responsible for observed variation in contaminant levels detected in a suite of shorebirds, with surface feeders being more at risk than others among the species studied (which did not include Red-necked Phalaropes; Braune and Noble 2009). However, it is unknown to what degree contaminants threaten the species. With Arctic shorebirds spending the majority of their lives south of their breeding grounds, the source of contaminants (i.e., breeding grounds, migratory stopover sites or over-wintering grounds) is also uncertain.

Industrial Activities

Industrial activities, in particular oil and gas exploration and mineral extraction, are becoming increasingly common in the North. Some forms of development, such as mines, airstrips, and outfitter camps effectively remove natural habitat, whereas other forms of development, including exploration activities, such as seismic surveys, can alter the vegetative structure (Ashenhurst and Hannon 2008, Jorgensen *et al.* 2010). Indirect impacts such as road dust may also impact the species, but no reductions in density were seen in the vicinity of the Ekati Diamond Mine, where effects of dust on habitat have been observed (Smith *et al.* 2005). Because of the sensitivity of permafrost soils and slow-growing nature of tundra vegetation, seemingly minor impacts to soil and vegetation can persist for decades (e.g., Forbes *et al.* 2001, Jorgensen *et al.* 2010). In the Mackenzie Delta, seismic lines have a density of 6 linear km per km^2, the greatest anywhere in the Canadian North (Northwest Territories Environment and Natural Resources 2012). Ashenhurst and Hannon (2008) found a non-significant tendency for Red-necked Phalaropes to be less abundant along seismic lines (average 0.27 birds per transect) than along reference lines (average 0.67 birds per transect) in suitable habitat in the Kendall Island Bird Sanctuary, suggesting the possibility of adverse effects of seismic exploration on bird abundance. While habitat removal or degradation can have clear detrimental effects at a local scale, the range-wide effects are unlikely to be pronounced given the limited footprint of development within the range of the species.

Other forms of development may have a null impact on the species, or could even be beneficial. Chaplin Lake, Saskatchewan, is an important stopover site where more than 2 000 Red-necked Phalaropes can be seen in any given year (Beyersbergen and Duncan 2007). Chaplin is a saline lake that is actively mined for sodium sulfate. This activity maintains consistent water levels across years that effectively protects shorebird habitat in a system that is otherwise quite variable (S. Wilson pers. comm.).

Snow Geese

Areas along the southern Hudson Bay and James Bay coasts have been altered by grubbing, grazing, and shoot-pulling by increasing Lesser Snow Goose populations (Abraham *et al.* 2005). As a result, once densely vegetated sedge meadows have become denuded (Abraham *et al.* 2005). Gratto-Trevor (1994) commented that the direct impacts of habitat alteration from Snow Geese may have contributed to the declines in Red-necked Phalaropes and Semipalmated Sandpipers nesting at La Perouse Bay, Manitoba. Aside from the loss of suitable nesting sites, the composition of prey (e.g., larval chironomids) and the structure of ponds are also likely impacted by the foraging behaviour of Snow Geese (Milakovic *et al.* 2001), with potential adverse effects on breeding Red-necked Phalaropes and their young that depend on freshwater ponds to forage.

Migration and Over-wintering

Changes in Prey

Threats to migrating phalaropes at sea have been most studied in relation to the observed declines in the Quoddy region of Atlantic Canada. Duncan (1996) proposed three possible explanations for the decline: (i) response to a crash in prey, (ii) result of perturbations on the breeding grounds and/or over-wintering sites, or (iii) staging populations have not collapsed but have shifted to undetected areas. Chardine's (2005) study supports Duncan's first hypothesis, providing evidence of a decline in prey availability. Some possible explanations for the change in prey abundance include: increased disturbance (e.g., rise in shipping traffic), increased consumption *of C. finmarchicus* by fish (e.g., salmon aquaculture), and/or changes in water quality (e.g., increased levels of pesticide run-off; Duncan 1996, Chardine 2005). Duncan (1996) also speculates that a decrease in the intensity of sunlight reaching the water's surface, possibly caused by changes in fog, could impact *C. finmarchicus*. Alternatively, changes in biological or physical oceanography (e.g., changing ocean currents, salinity and temperature due to climate change) and/or changes to *C. finmarchicus* phenology may make them unavailable to foraging phalaropes (Chardine 2005).

Some new staging areas have been located, and large numbers of Red-necked Phalaropes can still be seen off southern Grand Manan, New Brunswick, and Brier Island, Nova Scotia (R. Hunnewell and A. Diamond, unpub.), as well as the edge of the continental shelf between Labrador and Greenland (R.I.G. Morrison pers. comm.). However, while other staging areas may still remain undiscovered, it seems likely that the numbers of Red-necked Phalaropes passing through the whole of the Bay of Fundy have decreased.

Oil Spills, Chronic Oiling, and Tailing Ponds

Like other birds that spend all or part of their life cycle at sea, Red-necked Phalaropes are vulnerable to oiling. Page and Shuford (2000) argue that oil spills are the primary anthropogenic threat to offshore phalaropes. When exposed to oil, feathers become matted, wet, and lose their insulative value. In an attempt to clean their feathers, birds preen themselves, further spreading and ingesting oil. As such, even a slight exposure to oil can increase mortality risk through hypothermia and organ damage. Furthermore, oil in the environment can indirectly impact birds at sea through contamination of prey (Jenssen 1994).

Red-necked Phalaropes gather in large numbers at sea, with hundreds of thousands aggregating in small areas such as the outer Bay of Fundy (R. Hunnewell and A. Diamond, unpub.). As such, point-source oil contamination from a marine spill could have catastrophic effects on the species. Chronic oiling, caused by minor events such as leakage from boats, runoff from streets and parking lots, and natural seeps, may also be detrimental to phalaropes. Indeed, the cumulative impact of chronic oiling may be similar to that of a small-scale oil spill (Wiese and Robertson 2004, Nevins *et al.* 2011). Nevins *et al.* (2011) note that chronic oiling is responsible for as much as 4% of the annual mortality of seabirds in central California. With a sample of 2 out of 57 phalaropes showing signs of oil exposure, Nevins *et al.* (2011) suggest that phalaropes are among the birds at sea that are most affected by oiling (Nevins *et al.* 2011). This is likely because they tend to forage in the same areas where oil accumulates; along fronts, in tidal rips and eddies (D. Fraser pers. comm.). In general, minor oiling events (i.e., small oily-discharge) appear to be in decline (Lucas *et al.* 2009, Wilhelm *et al.* 2009, O'Hara *et al.* 2013), although the risk of contamination from oil may remain for Red-necked Phalaropes. Recent findings indicate that there is a relatively high level of hazard from oiling in a portion of the lower Bay of Fundy (Lieske *et al.* 2014) that encompasses important stopover locations such as the area around Deer, Campobello, Grand Manan and Brier islands.

There may also be indirect impacts of oil spills on Red-necked Phalaropes through alteration of habitat. Moser and Lee (2012) suggest that *Sargassum* mats, used by foraging Red-necked Phalaropes at sea, can be damaged by oil spills. This could be particularly troubling in areas (e.g., off the coast of California) where Red-necked Phalaropes are considered *Sargassum* specialists (Moser and Lee 2012).

Oiling may not be limited to birds migrating at sea, but those travelling inland may be susceptible to oiling at tailing ponds, particularly those lacking bird deterrents. Although there is no documentation of Red-necked Phalaropes using tailing ponds, impacts are possible, as has been documented for other species of shorebirds, including Semipalmated Sandpiper, Pectoral Sandpiper, Stilt Sandpiper, and Greater and Lesser Yellowlegs (*Tringa melanoleuca, T. flavipes,* respectively) (e.g., Timoney and Ronconi 2010 and references therein). Risks are likely greatest during inclement weather (Ronconi 2006).

Ingestion of Plastics

In the western North Atlantic, Moser and Lee (1992) documented 21 of 38 (55%) sampled seabird species had ingested plastics. Specifically, 12 of 25 (48%) species of charadriiformes showed signs of plastic ingestion, with the percent frequency of occurrence in Red and Red-necked Phalaropes at 69% (N=55) and 19% (N=36) respectively (Moser and Lee 1992). As such, phalaropes appear to be particularly vulnerable. Microplastics (width less than 5 mm) are the largest increasing class of plastics in the marine environment (J. Provencher pers. comm.) and so it is possible that rates of plastic ingestion may be higher today. What we do not know, is whether there are patterns to plastic ingestion or how plastic is impacting phalarope health and survival (e.g., through blockages, starvation and absorption of contaminants; J. Provencher pers. comm.).

Housing and Urban Areas

Rubega *et al.* (2000) summarize an account of "untold thousands" of Red-necked Phalaropes colliding with brilliantly lit casinos in downtown Reno, NV. Additional accounts include birds attracted to lit stadiums (Daytona Beach FL) and a lighthouse (NY). Reports such as this are rare, with uncertain population-level impacts.

Limiting Factors

Large concentrations of Red-necked Phalaropes staging in relatively small areas make the species vulnerable to local perturbations (e.g., pollution, habitat alteration, introduction of predators, declines in prey). During staging, the aggregations of hundreds of thousands of individuals in locations, such as the outer Bay of Fundy or Great Salt Lake, expose a significant fraction of the population to risks that might otherwise be considered localized. Harsh and unpredictable conditions associated with nesting in northern environments, combined with a short breeding season, with limited opportunities for re-nesting, are also limiting. An example of this was reported by Gratto-Trevor (1994a) from La Perouse Bay, Manitoba, where unusually low nesting success and population declines over 10 years were possibly an artefact of unusually cold weather resulting in delayed snow melt, very cold weather impacting prey availability, and unusually high predation rates caused by low microtine (small mammal) abundance. For single-parent incubators, such as the Red-necked Phalarope, the impacts of extreme weather are particularly severe as nests may be deserted for lengthy periods while the incubator searches for prey (Gratto-Trevor 1994a).

Number of Locations

Determining the number of locations for this species is challenging as the threats to the species are uncertain and the species is widespread across Canada, breeding or migrating through every territory and province. The number of locations is, however, undoubtedly greater than 10.

PROTECTION, STATUS AND RANKS

Legal Protection and Status

The Red-necked Phalarope receives protection under the *Migratory Birds Convention Act*, 1994. It also receives protection through the Convention on Migratory Species (Appendix II).

Non-Legal Status and Ranks

The Canadian Shorebird Conservation Plan suggests that the Red-necked Phalarope represents a "major conservation concern" due to the near disappearance of staging birds in the Bay of Fundy (Donaldson *et al.* 2000; this was before the discovery of large numbers of staging birds between Grand Manan and Brier Island). Overall, this plan ranks the species as a moderate conservation concern (Donaldson *et al.* 2000). The rank of moderate concern is consistent with the United States Shorebird Conservation Plan (Brown *et al.* 2001), and the Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2008). The Red-necked Phalarope is ranked as a vulnerable breeder (S3B) in the Yukon (Yukon Conservation Data Centre 2012). In British Columbia, the species is included on their Blue List, which highlights species of special concern in the province (S3S4B; B.C. Conservation Data Centre 2013). In Québec, the Red-necked Phalarope has been assessed as apparently secure by NatureServe (S4B; 2013). It has not been designated on the Québec Liste des espèces susceptibles d'être désignées menacées ou vulnérables.

The global and national (Canada and United States) conservation status ranks for Red-necked Phalarope indicate that the species is apparently secure (Rounded Global Status = G4; NatureServe 2013). The International Union for Conservation of Nature (IUCN) Red List ranks the species as "least concern" globally (Birdlife International 2012c). NatureServe (2013) indicates the following provincial and territorial conservation status ranks[1] for Red-necked Phalarope: British Columbia, S3S4B; Labrador, S4B; Manitoba, S4B; New Brunswick, S3M; Newfoundland Island S3S4; Northwest Territories, S3S4B; Nova Scotia, S2S3M, Nunavut, SNRB; Ontario, S3S4B; Prince Edward Island, SNA; Quebec, S4B, S3M; Yukon Territory, S3B.

[1] Conservation status ranks are defined as follows: S = sub-national; 2 = imperilled; 3 = vulnerable; 4 = apparently secure; NR = unranked; NA = not applicable; B = breeding; N = non-breeding; M = migrant.

Habitat Protection and Ownership

In Canada, the Red-necked Phalarope breeds across a vast area, from northern British Columbia in the west to Labrador in the east. The majority of this area is uninhabited and under provincial/territorial, or national management, with the majority of private land relating to land claim agreements. Some protection is afforded to the species through provincial, territorial and national protected areas. For example, 11 Migratory Bird Sanctuaries and four National Wildlife Areas are located within the Red-necked Phalarope breeding range, totalling more than 8 million hectares of protected habitat (Table 1). They are also found in 34 National Parks or National Historic Sites (Table 2; P. Nantel pers. comm.)

Table 1. Summary of Migratory Bird Sanctuaries (MBSs) and National Wildlife Areas (NWA) within the Canadian breeding range of Red-necked Phalarope. The primary purpose of MBSs is the protection of migratory birds from killing, harm, and harassment. There are rules and prohibitions against taking, injuring, and the destruction and molestation of migratory birds, their eggs, and nests within a sanctuary. National Wildlife Areas (NWAs) are created and managed for the purpose of conservation, research and interpretation. Wildlife Area Regulations define activities that are prohibited within NWAs, which may include, but are not limited to, fishing and hunting, damaging plants, damaging and molesting wildlife, eggs, and nests.

Province	Name of Protected Area	Type of Protected Area	Size (ha)
ON	Moose River	MBS	2690
ON	Hannah Bay	MBS	19119
QU	Boatswain Bay	MBS	9616
NU	McConnell River	MBS	36803
NU	Harry Gibbons	MBS	143811
NU	East Bay	MBS	112118
NU	Dewey Soper	MBS	816599
NU	Queen Maud Gulf	MBS	6292818
NWT	Cape Perry	MBS	227
NWT	Anderson River Delta	MBS	118417
NWT	Kendall Island	MBS	61241
NU	Akpait	NWA	79146
NU	Qaqulluit	NWA	39821
NU	Ninginganig	NWA	336397
YT	Nisutlin River Delta	NWA	5483

Table 2. Summary of National Parks and National Historic Sites with documented Red-necked Phalarope occurrences (P. Nantel pers. comm.)

Managed Area Name
Aulavik National Park of Canada
Auyuittuq National Park of Canada
Banff National Park of Canada
Bruce Peninsula National Park of Canada
Chilkoot Trail National Historic Site
Elk Island National Park of Canada
Fathom Five National Marine Park of Canada
Forillon National Park of Canada
Fundy National Park of Canada
Glacier National Park of Canada
Gros Morne National Park of Canada
Ivvavik National Park of Canada
Jasper National Park of Canada
Kluane National Park and Reserve of Canada
Kootenay National Park of Canada
La Mauricie National Park of Canada
Mingan Archipelago National Park Reserve of Canada
Nahanni National Park Reserve of Canada
Pacific Rim National Park Reserve of Canada
Point Pelee National Park of Canada
Prince Edward Island National Park of Canada
Pukaskwa National Park of Canada
Riding Mountain National Park of Canada
Saguenay-St.Lawrence National Marine Park of Canada
Sirmilik National Park of Canada
St. Lawrence Islands National Park of Canada
Tuktut Nogait National Park of Canada
Ukkusiksalik National Park of Canada
Wapusk National Park of Canada
Waterton Lakes National Park of Canada

Managed Area Name
Wood Buffalo National Park of Canada
Yoho National Park of Canada

Red-necked Phalarope staging areas are primarily pelagic, while over-wintering occurs entirely at sea. Until recently, the Quoddy region of the Bay of Fundy was inarguably the largest stopover site for migrating Red-necked Phalaropes in Canada. This area is recognized as a Canadian Important Bird Area, meaning that the site is of international importance for its significance to bird conservation and biodiversity (Birdlife International 2012b). The saline Mono Lake in California is another important staging area for the species. The area surrounding Mono Lake was designated a protected area in 1972 (Mono Basin National Scenic Area). Another important stopover site, Great Salt Lake in Utah, is also protected largely by the state, U.S. Fish and Wildlife Service and Nature Conservancy.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

Bree Walpole completed her B.Sc. at the University of Guelph. She obtained her M.Sc. through Trent University, where she studied habitat associations and nest success of Red-necked Phalaropes on Niglingtak Island, Northwest Territories. She has worked on a number of research projects on varying taxa across North America. She is currently a Species at Risk Policy Analyst for the Ontario Ministry of Natural Resources.

Paul Smith completed a B.Sc. at Trent University, an M.Sc. at the University of British Columbia and a Ph.D. at Carleton University. He has studied the shorebirds of the Eastern Arctic for 15 years. At the time of writing, Paul was lead consultant at Smith and Associates Ecological Research Limited. He now works as a Research Scientist with Environment Canada, specializing in the study of Arctic birds and ecosystems.

COLLECTIONS EXAMINED

No collections were examined for this report.

Appendix 1: Threats Classification Table for Red-necked Phalarope

Species or Ecosystem Scientific Name	Red-necked Phalarope			
Date:	07/03/2014			
Assessor(s):	Dave Fraser, Vivian Brownell, Bree Walpole, Paul Smith, Cheri Gratto-Trevor, Marty Leonard, Julie Paquet, Jon McCracken, Pam Sinclair, Ruben Boles, Julie Perrault			
Overall Threat Impact Calculation Help:			**Level 1 Threat Impact Counts**	
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	1	0
	C	Medium	0	0
	D	Low	1	2
	Calculated Overall Threat Impact:		High	Low

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	
1.1	Housing & urban areas		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	Some evidence in literature about birds being attracted to light in buildings at night (affects portion of population migrating through urban areas).
1.2	Commercial & industrial areas		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	Some evidence in literature about birds being attracted to flaring in oil rigs at night.
1.3	Tourism & recreation areas						
2	Agriculture & aquaculture		Negligible	Negligible (<1%)	Unknown	High (Continuing)	
2.1	Annual & perennial non-timber crops						
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching						
2.4	Marine & freshwater aquaculture		Negligible	Negligible (<1%)	Unknown	High (Continuing)	Speculative impacts due to toxic sludge at offshore shrimp farms.
3	Energy production & mining		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	
3.1	Oil & gas drilling		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
3.2	Mining & quarrying		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	
3.3	Renewable energy		Negligible	Negligible (<1%)	Unknown	High (Continuing)	
4	Transportation & service corridors		Negligible	Negligible (<1%)	Unknown	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.1	Roads & railroads		Negligible	Negligible (<1%)	Unknown	High (Continuing)	May be some evidence on effects of road dust (master's thesis from Trent?) or oil development indirect transport?
4.2	Utility & service lines		Negligible	Negligible (<1%)	Unknown	High (Continuing)	
4.3	Shipping lanes		Negligible	Negligible (<1%)	Unknown	High (Continuing)	
4.4	Flight paths						
5	Biological resource use		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Sometimes hunted by kids practising hunting skills - local effect.
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance						
6.1	Recreational activities						
6.2	War, civil unrest & military exercises						
6.3	Work & other activities						
7	Natural system modifications		Unknown	Small (1-10%)	Unknown	High (Continuing)	
7.1	Fire & fire suppression						
7.2	Dams & water management/use		Unknown	Small (1-10%)	Unknown	High (Continuing)	
7.3	Other ecosystem modifications		Negligible	Small (1-10%)	Negligible (<1%)	Unknown	Decline in prey may be occurring at stopover sites (see Brown, S., C. Duncan, J. Chardine, and M. Howe. 2010. Version 1.1. Red-necked Phalarope Research, Monitoring, and Conservation Plan for the Northeastern U.S. and Maritimes Canada. Manomet Center for Conservation Sciences, Manomet, Massachusetts USA.)
8	Invasive & other problematic species & genes	D	Low	Small (1-10%)	Serious - Moderate (11-70%)	High (Continuing)	
8.1	Invasive non-native/alien species						
8.2	Problematic native species	D	Low	Small (1-10%)	Serious - Moderate (11-70%)	High (Continuing)	Snow goose range overlaps only in a fraction of the breeding range.
8.3	Introduced genetic material						
9	Pollution		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.1	Household sewage & urban waste water						
9.2	Industrial & military effluents		Unknown	Restricted (11-30%)	Unknown	High (Continuing)	Birds are almost always offshore which increases chances of exposure. Winter ground not exactly known. Beaufort Sea and Grand Banks may be only areas likely to have oil development in range. On west coast, extensive shipping could increase. O-Hara is doing work on analysis of chance/effect of oil spills (not yet published) - could change the Severity rating of 'unknown'. Scope includes shipping and where (likely small scale) oil spills are a possibility (birds may be exposed to oil but not necessarily encountering oil). Birds that are exposed to oil would almost certainly die from impacts.
9.3	Agricultural & forestry effluents						
9.4	Garbage & solid waste		Unknown	Unknown	Unknown	Unknown	
9.5	Air-borne pollutants		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather	BD	High - Low	Pervasive (71-100%)	Serious - Slight(1-70%)	High (Continuing)	
11.1	Habitat shifting & alteration		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	This is the most likely threat driving the population down. Impacts on breeding grounds have been observed (premature drying of ponds, increased shrub). Impacts during migration may include changes in ocean currents and temperature, possibly altering prey abundance and distribution. El Niňo would almost certainly have impacts. The scope of these changes are uncertain. Cumulative impacts could be serious, but the timeframe is unknown. Climate change may have some short-term benefits on the breeding grounds, as permafrost melts and creates wetland habitat. Severity is the population decline that would be anticipated.
11.2	Droughts		Unknown	Restricted (11-30%)	Unknown	High (Continuing)	
11.3	Temperature extremes						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.4	Storms & flooding		Unknown	Unknown	Unknown	High (Continuing)	

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).