

**Recovery Plan for Red Knot, *rufa* subspecies (*Calidris canutus rufa*),
in Newfoundland and Labrador**



Prepared By:

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RESPONSIBLE JURISDICTION(S)

Environment Canada – Canadian Wildlife Service
Parks Canada Agency
Newfoundland and Labrador Department of Environment and Conservation

DISCLAIMER

This Recovery Plan for the Red Knot, *rufa* subspecies (*Calidris canutus rufa*), has been prepared by the Newfoundland and Labrador Red Knot Recovery Team. The document defines the goals and objectives deemed necessary to conserve the Red Knot in Newfoundland and Labrador. It does not necessarily represent the official positions of the governments involved. The recovery goals and objectives identified in this strategy are based upon the best knowledge available and may change over time in light of new findings and revised priorities. Implementation of the goals and objectives identified in this document depend upon program priorities and budgetary constraints of participating jurisdictions and organizations.

AUTHORS

This recovery plan was prepared by the Newfoundland and Labrador Red Knot Recovery Team (Shelley Garland, Wildlife Division, Newfoundland and Labrador Department of Environment and Conservation, and Peter Thomas, Canadian Wildlife Service, Environment Canada).

ACKNOWLEDGMENTS

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RECOMMENDED CITATION

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PREFACE

The Red Knot, *rufa* subspecies, is a migratory bird protected by the *Migratory Birds Convention Act, 1994* and is under the management jurisdiction of the federal government. The Newfoundland and Labrador *Endangered Species Act* requires the development of a recovery plan within one year of listing for an endangered species. The Red Knot was listed as Endangered under the Newfoundland and Labrador *Endangered Species Act* in 2008.

EXECUTIVE SUMMARY

The Red Knot, *rufa* subspecies (*Calidris canutus rufa*), is a medium-sized, migratory shorebird that winters in Tierra del Fuego in South America and breeds in the Canadian Arctic. During fall migration, *rufa* Red Knots stop over in Newfoundland and Labrador. Red Knots are currently protected by the *Migratory Birds Convention Act*. There are six subspecies of Red Knot worldwide, three of which occur in Canada, and one of these in Newfoundland and Labrador.

The *rufa* subspecies of Red Knot was designated as Endangered under the Newfoundland and Labrador *Endangered Species Act* in 2008 following an assessment and recommendation by COSEWIC in 2007. This designation is due to a 70% decline in abundance of this subspecies over the past 15 years. The major threat to this subspecies has been the decline of food during spring migration. Horseshoe crabs eggs are a major dietary component for Red Knot during their final spring migration stopover in Delaware Bay. As a result of overfishing of horseshoe crab, this major food source has been almost decimated.

In Newfoundland and Labrador, Red Knots stop over during their southward migration in the fall. Although little is known about Red Knots in this Province, possible threats to the species include habitat loss and degradation, and disturbance from humans and development. The primary goal of the Newfoundland and Labrador Red Knot Recovery Team is to ensure that there is sufficient habitat to support migratory Red Knots as they pass through the Province during migration. The specific recovery objectives needed to achieve this recovery goal and address knowledge gaps in our understanding of the biology and ecology of Red Knot, *rufa* subspecies in Newfoundland and Labrador, as outlined by the Recovery Team, are:

1. to identify key migratory stopover locations in Newfoundland and Labrador and the arrival and departure dates of Red Knots at these locations;
2. to determine the population size and demographics of Red Knots at migratory stopover locations;
3. to identify existing threat potential (extent, frequency, severity) and complete threat assessments at key stopover locations; and
4. to ensure appropriate levels of protection are in place to maintain current Newfoundland and Labrador population levels and migratory stopover habitat quality.

Specific recovery actions that will be completed to achieve these objectives include:

- Surveys and monitoring
- Identifying and assessing threats
- Determining appropriate levels of habitat protection
- Educating the public and protecting Red Knot habitat through stewardship

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1. BACKGROUND

1.1 Species Assessment Information from COSEWIC

Date of Assessment: April 2007

Common Name: Red Knot

Scientific Name: *Calidris canutus rufa*

COSEWIC Status: *rufa* subspecies assessed as Endangered in 2007

Reason for Assessment: This subspecies is a medium-sized shorebird that breeds only in Arctic Canada and migrates thousands of kilometers between its Arctic breeding grounds and wintering areas at the southern tip of South America. The subspecies has experienced a 70% decline in abundance over the past 15 years, and is threatened by increasing loss of food. There is no potential for rescue from other populations.

Canadian Occurrence: Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

COSEWIC Status History: Assessed as Endangered in April 2007. Assessment based on a new status report.

1.2 Description

Red Knots are medium-sized shorebirds measuring 25 cm in length. They have a long, straight bill, small head, short neck, long legs, and long tapered wings, with an elongated and streamlined body profile. In breeding plumage, the Red Knot's face, neck, breast, and much of the underparts are reddish-brown. Wings have a white stripe and feathers of upper parts are dark brown or black interspersed with red or grey. The breeding plumage of the *rufa* subspecies tends to be a lighter shade of red than that of other Red Knots. Winter plumage is similar between sexes and among subspecies. Red Knots have a plain grey back with light fringes on scapulars and wing-coverts, and a white underbody (COSEWIC 2007).

1.3 Populations and Distribution

Six subspecies are recognized worldwide, with three occurring in Canada and only one occurring in Newfoundland and Labrador (*Calidris canutus rufa*). Red Knots breed in the Central Arctic and winters at the southern tip of South America, in Tierra del Fuego (COSEWIC 2007). This subspecies usually passes through Newfoundland and Labrador during fall migration (D. Whitaker, pers.

comm.). In the late 1990s, the national *rufa* population size was estimated at approximately 60,000 individuals. In 2005, the population was estimated to have declined to approximately 18,000-20,000 individuals (Morrison *et al.* 2004).

Newfoundland

Red Knot sightings have been reported around almost the entire coast of Newfoundland, however, the majority of sightings have been on the west coast of the island at Stephenville Crossing, Sandy Point, and St. Paul's Inlet, and on the east coast at Bellevue Beach in Trinity Bay (P. Linegar, pers. comm.; D Whitaker, pers. comm.; B. Mactavish, pers. comm.).

Labrador

There were approximately 5-10 historical Red Knot sightings (presumed to be *rufa* subspecies) reported in Labrador between 1860 and 1950, the majority of which were during fall migration along the east and south coasts (Todd 1963). There is no mention of Red Knot in the inventory of fauna completed for the Torngat Mountains area in northern Labrador (Harrington 1994). There is a noticeable lack of data from the Labrador coast, and therefore very few records of Red Knots from areas where they are expected to occur during migration (B. Mactavish, pers. comm.). One of the few spring sightings reported in Labrador was inland near Labrador City and was part of a grounding of migrant shorebirds during a spring snowstorm (G. Parsons, pers. comm.; B. Mactavish, pers. comm.).

General Status Ranks

Newfoundland:

GS1 – At risk

Labrador:

GS1 – At risk

NatureServe Conservation Status (assessed in October 2005)

Global:

G4T1 – Critically imperiled subspecies of an apparently secure species

National:

N1B, N1N – Critically imperiled breeding and non-breeding populations

Provincial:

NF: S3N – Vulnerable non-breeding population

LB: S3N – Vulnerable non-breeding population

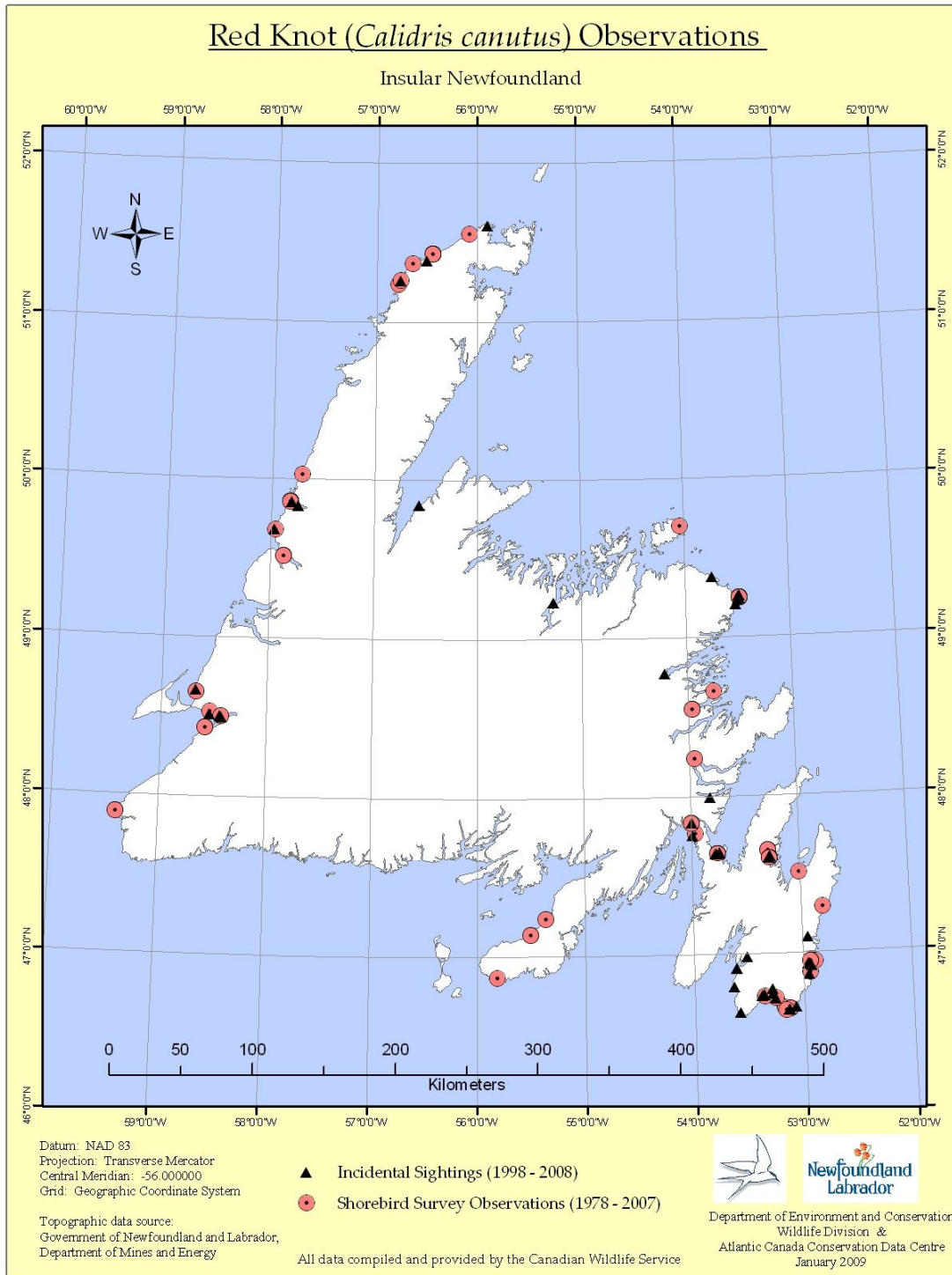


Figure 1. Incidental sightings (black triangles) and Canadian Wildlife Service Shorebird Survey observations (red circles) of Red Knot (*Calidris canutus*) in insular Newfoundland, 1978-2008. All sightings are presumed to be of the *rufa* subspecies.

1.4 Needs of the Red Knot

1.4.1 Habitat and biological requirements

Habitat use by Red Knots of the *rufa* subspecies differs among breeding, wintering, and migration periods; however, their habitat requirements during all periods include suitable roosting sites which are situated near foraging areas that are free from predators and human disturbance (COSEWIC 2007). During the breeding season, Red Knots are generally found in coastal areas characterized by elevated tundra and barren habitats, such as windswept ridges, slopes, or plateaus in the Arctic (Harrington 2001). Knots tend to forage in damp or barren areas that can be up to 10 km from the nest. They feed on terrestrial invertebrates during the breeding season, and on bivalve molluscs, crustaceans, eggs of horseshoe crabs, and other small invertebrates along beaches during the non-breeding season. In Delaware Bay, an important Red Knot migratory stopover on the eastern seaboard of the USA, a large percentage of the population relies almost completely on horseshoe crab eggs as their source of food. The drastic decrease in this food source, due to horseshoe crab overfishing, has caused a major decline in *rufa* Red Knot numbers (Harrington 2001, COSEWIC 2007).

During migration and on wintering grounds, *rufa* Red Knots tend to frequent coastal mudflats and sandflats, and have also been seen on peat-rich banks, brackish areas, salt marshes, and mussel beds (COSEWIC 2007). In Newfoundland, sightings during fall migration have been recorded along coastal areas, mostly on shorelines, sandflats, and salt marshes (D. Whitaker, pers. comm.). Open, sandy estuaries have been identified as prime habitat for this species in Newfoundland and Labrador, with rotting kelp deposits ranked as the second best habitat type (B. Mactavish, pers. comm.). This observation is supported by the relatively high number and concentration of Red Knot sightings in St. Paul's Inlet, NL. The habitat of St. Paul's Inlet has been identified as one of insular Newfoundland's best examples of a hummocky salt marsh (Roberts and Robertson 1986).

1.4.2 Limiting factors

During migration, *C. c. rufa* congregate in large groups in traditional staging areas, which possibly makes them more vulnerable to disturbance, pollution, and loss of resources than other species of shorebirds (COSEWIC 2007).

Due to their low fecundity, delayed maturity, specializations in physiology, and low genetic variability, Red Knots may be particularly vulnerable to rapid environmental changes, including changes in food and habitat abundance (Piersma and Baker 2000, Sandercock 2003). This observation is based on a rapid decline in their population size that followed a decrease in food resources

in Delaware Bay. Red Knot numbers may have declined because they were unable to find alternative food sources or foraging areas (COSEWIC 2007).

1.5 Threats in Newfoundland and Labrador

It is widely accepted that the primary threats to *C. c. rufa* are decreases in food resources, habitat degradation, and disturbance in Delaware Bay (COSEWIC 2007). Little is known about direct threats to Red Knots in this Province. Threats considered to be of national concern to this species, such as loss of food resources, habitat loss and degradation, and human disturbance, are also potential threats in Newfoundland and Labrador, but to a far lesser extent. Newfoundland and Labrador has a lower population density compared to some other migratory stopover locations, and therefore, associated threats are relatively less severe. According to local bird experts, there are few if any, threats to this species that would cause any significant decrease in their numbers (B. Mactavish, pers. comm.; D. Whitaker, pers. comm.).

1.5.1 Description of threats

Habitat loss and degradation

Due to the nature of historical settlement in Newfoundland and Labrador, many municipalities are associated with wetlands and coastal salt marshes. Areas like these have been particularly attractive and in considerable demand to residential and coastal development as they present very few obstacles with respect to construction (Roberts and Robertson 1986). It is felt that the cumulative effects of continued development within these municipalities could threaten the surrounding sensitive wetland habitat. For example, changes to water drainage regimes and introduction of pollutants into areas that are of importance to Red Knot may have adverse effects on their food sources and the protection provided to them by vegetation. Salt marshes, like those found in St. Paul's Inlet, are particularly sensitive to disturbances from development and construction, walking paths and all-terrain vehicle (ATV) trails, and oil development (Roberts and Robertson 1986).

Disturbance

Frequent disturbance by both humans and roaming dogs within close vicinity to flocks of Red Knots can cause the birds to flush and unnecessarily expend tremendous amounts of energy. This can be detrimental to individuals of the *rufa* subspecies, as they migrate long distances and must retain as much energy and body fat as possible to both fly the long distance to and from wintering grounds and successfully breed when they reach the Arctic (COSEWIC 2007). Unlike elsewhere along the Red Knot migratory route, human disturbance is likely not a

major threat at stopovers in Newfoundland and Labrador. However, humans and dogs use areas identified as important migratory habitat for Red Knots in this province, such as Stephenville Crossing and St. Paul's Inlet. There have also been reports of ATV use in these areas. The presence of ATVs can result in habitat degradation and/or destruction and causes noise disturbance (D. Whitaker, pers. comm.).

Severe Weather and Climate Change

Red Knot numbers have been known to vary from year to year, similar to the variations in numbers noted for other uncommon migrants. These fluctuations can possibly be attributed to changes in wind patterns which may shift the migratory route farther east than other years (B. Mactavish, pers. comm.). Severe weather along the migratory route may cause fluctuations in the number of Red Knots that make it to Newfoundland and Labrador, but is not likely to affect them while they are resting in the Province.

Climate change has the potential to cause sea levels to rise, resulting in a loss of intertidal habitats (COSEWIC 2007). As many sightings of Red Knot in Newfoundland and Labrador have been along the coast and Red Knots are known to use coastal mudflats and salt marshes, there is the possibility that the amount of suitable habitat used by Red Knots may decrease or increase. The scale of loss and effects are difficult to predict throughout the entire range of *rufa* Red Knots (COSEWIC 2007).

1.6 Knowledge Gaps

To assist in the recovery of Red Knot, *rufa* subspecies, in Newfoundland and Labrador, additional information is needed in the following areas:

1. Locations of key migratory stopovers in Newfoundland and Labrador.
2. Timing and duration of Red Knot presence at migratory stopovers in Newfoundland and Labrador.
3. Population size and demographics, and associated trends at migration stopovers.
4. The extent, frequency, and severity of threats to Red Knots at migratory stopovers.

2. RECOVERY

2.1 Recovery Feasibility

This recovery plan outlines the Province's role in helping to conserve this migratory species. The feasibility of recovery can only be addressed through a national assessment which will be carried out as part of Canada's national recovery strategy preparation process.

2.2 Recovery Goal

The goal and objectives identified in this recovery plan reflect the Province of Newfoundland and Labrador's responsibilities as they relate to the protection of Red Knots. Red Knots have not been recorded to breed in this province.

The recovery goal for Red Knot is to ensure that there is sufficient habitat to support migratory Red Knot as they pass through the province. To achieve this goal, it is essential to manage the habitats which are important to Red Knots during migration.

2.3 Recovery Objectives

The following recovery objectives will assist in achieving the recovery goal for the Red Knot, *rufa* subspecies, in Newfoundland and Labrador:

1. to identify key migratory stopover locations and the arrival and departure dates of Red Knots at these locations;
2. to determine the population size and demographics of Red Knots at migratory stopover location;
3. to identify existing threat potential (extent, frequency, severity) and complete threat assessments at key stopover locations; and
4. to ensure appropriate levels of protection are in place to maintain current Newfoundland and Labrador population levels and migratory stopover habitat quality.

2.4 Approaches Recommended to Meet Recovery Objectives and Performance Measures

2.4.1 Recovery planning

Table 1. Recovery Planning Table

Priority	Recovery Objective	Specific Actions to meet Recovery Objectives	Performance Measure
Urgent	Identify key stopover locations and timing	<ul style="list-style-type: none"> Identify suitable habitat features (physical surveys, GIS, satellite imagery, aerial photos, etc.) Review past sightings and survey data for locations and dates of possible key stopovers Select and implement standardized survey protocol of migratory stopovers from the literature and/or established survey techniques 	<ul style="list-style-type: none"> Maps of suitable habitat and areas with high concentrations of sightings Standard survey protocol selected Key stopover locations identified along with Red Knot arrival and departure dates
Beneficial	Determine population size and demographics at key stopover locations	<ul style="list-style-type: none"> Through a standardized survey protocol, record number and sex ratio of Red Knots at each stopover and assess changes over time 	<ul style="list-style-type: none"> Numbers and sex ratios of monitored Red Knots recorded and compared from year to year
Necessary	Identify threat potential	<ul style="list-style-type: none"> Identify threats to migratory stopover habitat quality (disturbance, pollution, change in habitat size, prey abundance and/or available roosting locations, etc) Complete threat assessments 	<ul style="list-style-type: none"> Threat assessments completed for identified threats
Necessary	Ensure appropriate levels of habitat protection to maintain NL population levels and habitat quality	<ul style="list-style-type: none"> Assess current protection associated with each key migratory stopover Based on threat assessments, determine appropriate level of protection Notify municipalities, businesses, and potential developers of the presence of Red Knot and encourage them to maintain local wetlands and minimize disturbance from development Through stewardship initiatives, encourage the responsible use of Red Knot key stopover locations to minimize human disturbance 	<ul style="list-style-type: none"> List of stopover locations with and without other forms of protection (parks, reserves, municipal agreements, etc.) Notifications with Red Knot information and locations prepared and distributed to municipalities, businesses, and potential developers Brochures and information sheets, outlining potential disturbances, prepared and distributed to the public

2.5 Critical Habitat

2.5.1 Identification of the species' critical habitat

Critical habitat for Red Knot will be addressed during the development of a National Recovery Strategy. From a regional perspective, key migratory stopovers are considered to be important. Further analysis will determine if these areas are critical to the species survival and recovery.

2.5.2 Examples of activities likely to result in degradation or loss of critical habitat

The following list are examples likely to result in the destruction, fragmentation or degradation of Red Knot critical habitat:

1. Development on or adjacent to critical habitat. Examples include hiking trails, ATV trails, and housing, among others.
2. Any activity that causes the physical destruction or alteration of Red Knot habitat. Examples include compaction of muddy areas or habitat alteration that restricts access by Red Knot.
3. Pollution, such as oil spills, has the potential to have both short- and long-term effects on vegetation and invertebrates within critical habitat, both of which are food sources for Red Knots.

2.6 Existing and Recommended Approaches to Habitat Protection

Habitat protection specifically related to Red Knot within Newfoundland and Labrador does not currently exist. However, the Department of Environment and Conservation, under the auspices of the Eastern Habitat Joint Venture (EHJV) program has worked with the municipality of Stephenville Crossing to sign a municipal stewardship agreement. As part of this agreement, the town has set aside an area of land as a Management Unit, considered a "no loss area", in which development applications are assessed in light their potential impact on wildlife, namely waterfowl and shorebirds. Although not the original intent of the agreement many Red Knot sightings in the Stephenville Crossing area, coincidentally fall within this Management Unit. There is potential for a similar agreement associated with coastal habitat in the town of St. Paul's which would offer some protection to this previously identified Red Knot migratory stopover area (J. Sharpe, pers. comm.).

Observations of Red Knots during shorebird surveys and incidental sightings are reported to the Canadian Wildlife Service; these data are then provided to the

Atlantic Canada Conservation Data Centre (AC CDC). The recovery team will work with the Habitat Management Program of the Wildlife Division to ensure that this information, along with other information within the AC CDC-managed Endangered Species and Biodiversity databases will be taken into consideration during the Environmental Assessment and Crown Land application processes.

It is also important to collaborate with other government and non-government organizations to protect areas of importance to Red Knot in Newfoundland and Labrador. The Nature Conservancy of Canada (NCC) secures properties which are important for maintaining and protecting habitat for rare or endangered species (Nature Conservancy Canada, 2009). In 2008, the NCC presented a portion of Sandy Point on the southwest coast of insular Newfoundland as Newfoundland and Labrador's Gift to Canadians. Sandy Point was acquired by the NCC because of its significant biological and historical value. Sandy Point has been identified as one of the four best areas for Red Knot sightings in Newfoundland (B. Mactavish, pers. comm.; D. Whitaker, pers. comm.). In the future, it will be important for the Newfoundland and Labrador Red Knot Recovery Team to work with organizations like NCC, residents, municipalities, developers, and other government agencies, to protect other Red Knot habitat.

Public education and stewardship will be very beneficial to the protection of Red Knot habitat. It will be important to notify the public as to the presence of Red Knots and the potential threats to the species. This will help to minimize both direct human disturbance and disturbance due to development. Public education could include informational materials such as brochures, fact sheets, and posters, as well as public meetings and species identification workshops. Such action will help to inform the people in communities surrounding the areas used by Red Knots of the importance of their support in the protection of this species and its habitat.

2.7 Effects on Other Species

Protection of key habitat used by *C. c. rufa* will have no known negative effect on other species. It is anticipated that this protection will also protect other species using the same habitat such as other shorebirds, plants, and invertebrates.

3. PERSONAL COMMUNICATIONS

Linegar, P. Local ornithologist, St. John's, NL.

Mactavish, B. Senior Environmental Consultant Technician, LGL Ltd. St. John's, NL.

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4. REFERENCES

COSEWIC 2007. COSEWIC assessment and status report on the Red Knot *Calidris canutus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, vii + 58 p (www.sararegistry.gc.ca/status/status_e.cfm).

Harrington, B.A. 2001. Red Knot (*Calidris canutus*). 32 pp. The Birds of North America, Inc., Philadelphia, PA.

Morrison, R.I.G, R.K. Ross, and L.J. Niles. 2004. Declines in wintering populations of Red Knots in southern South America. *Condor* 106: 60-70.

Nature Conservancy of Canada. 2009. Reclaiming a natural legacy – Sandy Point. The Ark – A publication of the Nature Conservancy of Canada. Summer 2009. Toronto, Ontario, Canada. pp 3-4.

Piersma, T. and A.J. Baker. 2000. Life history characteristics and the conservation of migratory shorebirds. pp. 105-124, in *Behaviour and Conservation*, Gosling, L.M. and W.J. Sutherland (eds.). Cambridge University Press, Cambridge, UK

Roberts, B.A., and A. Roberston. 1986. Salt marshes of Atlantic Canada: their ecology and distribution. *Canadian Journal of Botany* 64: 455-467.

Sandercock, B.K. 2003. Estimation of survival rates for wader populations: a review of mark-recapture methods. *Wader Study Group Bulletin* 100: 163-174.

Todd, W.E.C. 1963. *Calidris canutus rufa* (Wilson) American Knot. The birds of the Labrador Peninsula and adjacent areas. Univ. Toronto Press, Toronto, Ontario, pp. 321-322.

Webster, P.J., G.J. Holland, J.A. Curry, and H.-R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science* 309: 1844-1846.

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