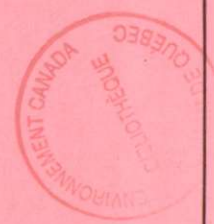
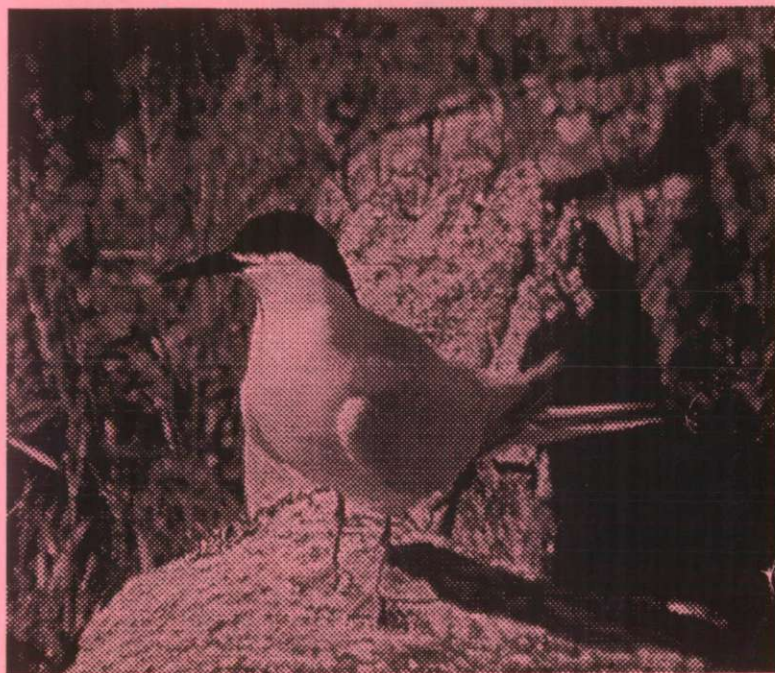


Update
COSEWIC STATUS REPORT

on

ROSEATE TERN
(Sterna dougallii)

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Rebecca M. Whittam

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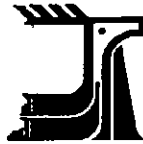
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Roseate Tern

Reason for status: Based on updated information, the population remains very small. Most breeding birds are concentrated at three main colonies (only one appears stable). Recruitment is poor due to predation and disturbance. [Designated threatened in 1986 and uplisted to endangered in 1999.]

Occurrence: Nova Scotia and Quebec

NOTES

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COSEWIC

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Un comité de représentants d'organismes fédéraux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril ainsi que des président(e)s des groupes des spécialistes scientifiques.

Update
COSEWIC Status Report

on

Roseate Tern
(Sterna dougallii)

by

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EXECUTIVE SUMMARY

Introduction

Roseate Terns were listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1986. The Canadian population of Roseate Terns was estimated at 101-125 pairs between 1982-1985, which constituted 3% of the northeastern population (~3100 pairs). While the number of Roseate Terns in Canada had probably always been small, it appeared as though the population had declined since the 1930s. The two most important factors limiting the distribution and abundance of Roseate Terns in northeastern North America were thought to be trapping of adults on the wintering grounds for sale at local markets, and predation and displacement by gulls on the breeding grounds. Since the original COSEWIC designation, a number of studies have provided new information on Roseate Terns in Canada.

Population size and trend

Estimates of breeding pairs in 1996 and 1997 place the Canadian Roseate Tern population between 88 and 137 pairs breeding in six locations. Roseates currently nest in only three of nine sites noted in the original status report. The Brothers, N. S., is the only large colony (*i.e.* greater than 20 pairs) in Canada known to have maintained a stable population of Roseate Terns for the last 15 years. Two new relatively large Roseate Tern colonies, Country Island and Grassy Island, were discovered in 1987 and 1993, respectively. These three large colonies support up to 94% of the Canadian population. Machias Seal Island is the only known breeding site for Roseate Terns in New Brunswick, and only 1-2 pairs breed in this colony annually. Fewer than five pairs breed on the Magdalen Islands, the only known breeding location for Roseate Terns in Quebec.

The number of breeding pairs in the U. S. has been increasing slowly since 1988. In 1997, 3382 pairs bred in the U. S.. Ninety-three per cent of the U. S. population currently nests in the five largest colonies, and 78% nests in the two largest colonies. This concentration makes the species extremely vulnerable to disturbance and was the primary reason for the designation of this population as endangered in the U. S..

Limiting factors

Predation at breeding colonies appears to be the most important factor limiting the distribution and productivity of Roseate Terns in Canada. The major predators at Canadian Roseate Tern colonies are Herring (*Larus argentatus*) and Great Black-backed (*L. marinus*) Gulls. Adult mortality during migration or at wintering grounds is probably the main factor limiting population size in the U. S., where predators are controlled at most breeding colonies. Roseate Terns were trapped intensively between 1968-1981 in Guyana for sale at local markets, but this practice has since reportedly stopped. More information is required to determine the causes of winter mortality. A shortage of males may limit the productivity of Roseate Terns at some colonies in northeastern North America. In one colony, 20% of breeding females do not obtain male mates, and instead pair together to produce supernormal clutches of three to four eggs. Fertilization is achieved through extra-pair copulations, however female-female pairs produce 75% fewer fledgings per female than male-female pairs. As a result, average colony productivity is reduced by about 16%.

Habitat

In Canada, Roseate Terns have almost completely abandoned both Sable Island and Country Island, the latter due almost certainly to gull predation. In the absence of predation, these two islands are high-quality breeding sites, primarily because they are located far from the mainland (160 km and 5 km, respectively) and are thus less susceptible to terrestrial predators and human disturbance. In general, Roseate Terns in Canada currently breed on small sites close to the mainland. Colonies that are deemed essential to the survival of this species in Canada need to be monitored yearly and kept free of breeding gulls. Gulls currently nest on three of the six Canadian Roseate Tern

colony sites. In the U. S., 97% of the Roseate Tern population nests at sites that are managed and protected by biologists or wardens. Predator management is clearly necessary for the survival of this species.

Proposed status

It is recommend that Roseate Terns be upgraded from "Threatened" to "Endangered" in Canada based on the following points: 1) The Canadian Roseate Tern population is small (88-137 pairs); 2) 94% of the Canadian Roseate Tern population is concentrated into only three main sites, making it extremely vulnerable to existing environmental threats; 3) Two of the three main breeding colonies are near-shore sites that are vulnerable to human disturbance and terrestrial predators, and the third colony is neither productive nor stable due to heavy predation on eggs and chicks by corvids and gulls; 4) In Canada, high-quality breeding habitat such as that found on Country Island continues to be lost due to displacement by Herring and Great Black-backed Gulls; 5) Several Canadian sites where Roseate Terns nested in the past have been abandoned; 6) Mortality during migration or at wintering areas is limiting adult survival; and 7) Roseate Terns in Canada constitute 3-4% of the northeastern North American population. The remaining 96-97% of this population is already listed as Endangered.

RÉSUMÉ

Introduction

Le Comité sur la situation des espèces en péril au Canada (COSEPAC) a inscrit la Sterne de Dougall sur la liste 1986. On estime que pendant la période s'étendant de 1982 à 1985, entre 101 et 125 couples de Stermes de Dougall se trouvaient au Canada, ce qui représentait 3 p. 100 de la population du nord-est (environ 3 100 couples). Bien que les Stermes de Dougall n'aient probablement jamais été nombreuses au Canada, il semble que la population ait décliné depuis les années 1930. On croit que les deux facteurs les plus importants qui limitent la distribution et l'abondance de la Sterne de Dougall dans le nord-est de l'Amérique du Nord sont, dans leur aire d'hivernage, le piégeage des adultes pour leur vente dans les marchés locaux et, dans les aires de reproduction, la prédation et le déplacement par les goélands et mouettes. Depuis sa désignation originale par le COSEPAC, un certain nombre d'études ont fourni de nouveaux renseignements sur la Sterne de Dougall au Canada.

Taille et tendance de la population

En 1996 et 1997, l'estimation de couples reproducteurs dans six emplacements plaçait le nombre de couples de Stermes de Dougall entre 88 et 137. À l'heure actuelle, les sternes nichent dans seulement trois des neuf sites signalés dans le premier rapport sur la situation de l'espèce. Au Canada, la seule grande colonie connue (plus de 20 couples) ayant gardé une population stable pendant les quinze dernières années se situe dans les îles Brothers, en Nouvelle-Écosse. Deux nouvelles colonies de sternes relativement grandes ont été découvertes dans les îles Country et Grassy en 1987 et en 1993, respectivement. Dans ces trois grandes colonies, on retrouve jusqu'à 94 p. 100 de la population canadienne. L'île Machias Seal est l'unique site de reproduction connu des Stermes de Dougall au Nouveau-Brunswick et seulement un ou deux couples s'y reproduisent annuellement. Moins de cinq couples se reproduisent dans les îles de la Madeleine, la seule aire de reproduction connue des sternes au Québec.

Aux États-Unis, le nombre de couples reproducteurs s'est lentement accru depuis 1988. En 1997, 3 382 couples se sont reproduits aux États-Unis. Quatre-vingt-treize pour cent de la population américaine niche actuellement dans les cinq plus grandes colonies et 78 p. 100, dans les deux plus grandes. Cette concentration rend l'espèce particulièrement vulnérable aux perturbations et a été la raison principale pour laquelle les États-Unis lui ont attribué le statut d'espèce en danger de disparition.

Facteurs limitatifs

La prédation dans les colonies de reproduction semble être le facteur le plus important limitant la distribution et la reproduction des Stermes de Dougall au Canada. Dans les colonies canadiennes de Stermes de Dougall, les deux principaux prédateurs sont les Goélands argentés (*Larus argentatus*) et les Goélands marins (*L. marinus*). Le principal facteur limitant la taille de la population aux États-Unis est probablement la mortalité des adultes pendant la migration ou dans les aires d'hivernage. La prédation est jugulée dans la plupart des colonies de reproduction. Entre 1968 et 1981, les Stermes de Dougall ont été piégées intensivement en Guyane en vue de leur vente sur les marchés locaux; on rapporte que depuis on a cessé cette pratique. Il est nécessaire d'obtenir plus d'information pour déterminer les causes de la mortalité hivernale. L'insuffisance de mâles peut limiter la reproduction des Stermes de Dougall dans certaines colonies du nord-est de l'Amérique du Nord. Dans une des colonies, 20 p. 100 des femelles reproductrices n'ont pu trouver un partenaire mâle; elles ont alors niché ensemble et obtenu des pontes supranormales de trois ou quatre œufs. La copulation hors couple permet la fécondation. Cependant, les couples femelle-femelle produisent 75 p. 100 moins d'oisillons par femelle que les couples mâle-femelle. En conséquence, le succès reproductif moyen de la colonie est réduit d'environ 16 p. 100.

Habitat

Au Canada, les Sternes de Dougall ont abandonné presque complètement l'île de Sable et l'île Country. L'abandon de cette dernière est dû surtout à la prédation par les goélands et mouettes. S'il n'était de la prédation, ces deux îles seraient d'excellents sites de reproduction, surtout à cause de leur distance du continent (respectivement 160 et 5 km), qui les rend moins sujettes aux prédateurs terrestres et aux perturbations anthropiques. À l'heure actuelle, au Canada, les Sternes de Dougall se reproduisent généralement dans de petits sites près du continent. Les colonies jugées essentielles à la survie de l'espèce au Canada doivent donc être observées annuellement et débarrassées des goélands et mouettes reproducteurs. Des goélands nichent actuellement dans trois des six colonies canadiennes de Sternes de Dougall. Aux États-Unis, 97 p. 100 des Sternes de Dougall nichent dans des sites gérés et protégés par des biologistes ou des gardes. Manifestement, la gestion des prédateurs est nécessaire à la survie de cette espèce.

Statut proposé

Il est recommandé que le statut de la Sterne de Dougall soit porté d'espèce menacée à celui d'espèce en danger de disparition au Canada en s'appuyant sur les points suivants : 1) la population canadienne de Sternes de Dougall est faible (entre 88 et 137 couples); 2) on retrouve 94 p. 100 de la population canadienne de Sternes de Dougall dans seulement trois sites principaux, ce qui rend l'espèce extrêmement vulnérable aux menaces environnementales existantes; 3) deux des trois principales colonies de reproduction sont dans des sites situés près du rivage qui sont vulnérables aux perturbations anthropiques et aux prédateurs terrestres; une troisième colonie n'est ni productive ni stable à cause de la forte prédation qu'exercent les corvidés et les goélands et mouettes sur les œufs et les oisillons; 4) au Canada, les habitats de reproduction de grande qualité comme celui de l'île Country continuent à disparaître à cause du déplacement par le Goéland argenté et le Goéland marin; 5) plusieurs sites canadiens où nichait la Sterne de Dougall ont été abandonnés; 6) la mortalité au cours de la migration ou dans les sites d'hivernage limite la survie des adultes; 7) les Sternes de Dougall du Canada forment de 3 à 4 p. 100 de la population du nord-est de l'Amérique du Nord. On a déjà déclaré les autres 96 ou 97 p. 100 de la population en danger de disparition.

INTRODUCTION

Summary of Information from Original Status Report (Kirkham and Nettleship 1985)

The Roseate Tern (*Sterna dougallii*) occurs on six continents where it breeds colonially on small marine islands that are generally free from terrestrial predators (Gochfeld 1983). In North America, Roseate Terns breed on the Atlantic coast in two distinct locations. The northeastern population breeds from the Magdalen Islands in the Gulf of St. Lawrence south to New York. These birds always nest in association with other tern species, especially Common Terns (*S. hirundo*, Nisbet 1981). The second population breeds from Florida and the Bahamas to the Lesser Antilles (Cramp 1985). Both populations winter in South America, from Colombia to eastern Brazil (Nisbet 1984, Hays et al. 1997).

Roseate Terns were listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1986. This designation was a result of the decline in the northeastern population, from approximately 8,500 pairs in the 1930s to 2,600 pairs in 1976 (Kress et al. 1983). This decline was accompanied by a contraction of the species' range, a decrease in the number of breeding sites, and a concentration of more than 90% of the population into a small area between Long Island, NY and Cape Cod, MA (Nisbet 1981).

The Canadian population of Roseate Terns was formerly estimated at 101-125 pairs between 1982-1985 breeding almost exclusively in Nova Scotia (Kirkham and Nettleship 1985). This constituted 3% of the northeastern population (~ 3100 pairs; Kress et al. 1983). While the number of Roseate Terns in Canada had probably always been small, it appeared as though the population had declined since the 1930s, based on historical observations of numbers breeding on Sable Island, Nova Scotia (Kirkham and Nettleship 1985). The most rapid period of decline on Sable Island occurred between 1971 (130 pairs) and 1976 (18 birds). This corresponded to a major period of decline in the U. S. from 4800 pairs in 1972 to 2600 pairs in 1976 (Kress et al. 1983). The largest Roseate Tern colony in Canada at the time of the original status report was located on The Brothers Islands, NS, with 55-60 pairs breeding in association with several hundred Arctic and Common Terns (Kirkham and Nettleship 1985).

The two most important factors limiting the distribution and abundance of Roseate Terns in northeastern North America were thought to be trapping of adults on the wintering grounds for sale at local markets (Hamilton 1981), and predation and displacement by gulls on the breeding grounds (Nisbet 1981). Increases in the numbers of Herring (*Larus argentatus*) and Great Black-backed (*L. marinus*) Gulls in North America (Kadlec and Drury 1968) were closely associated with declines in tern numbers (Kress et al. 1983). Gulls are known to prey on tern eggs, chicks, and occasionally adults (e.g. Hatch 1970), and to displace terns from traditional breeding sites (Nisbet 1981). Little, however, was known about the effects of gulls on the breeding biology or success of Roseate Terns in Canada.

Purpose of revised status report

After the species was designated threatened in Canada in 1986, the Roseate Tern Recovery Team and RENEW (Recovery of Nationally Endangered Wildlife) developed a Roseate Tern Recovery Plan (Lock et al. 1993). The two objectives of this plan were: 1) to increase the Canadian population of Roseate Terns to 200 pairs by the year 2010; and 2) to maintain colony productivity at greater than one fledgling per pair per year. These goals would be met by providing a sufficient number of predator-free sites for Roseate, Arctic, and Common Terns, protection for Roseate Terns on their wintering grounds, and long-term reductions in gull populations.

Since the original COSEWIC designation, a number of studies (e.g. D'Eon 1991-1997, Boates et al. 1993, Boates and Sam 1996 and Whittam 1997) have provided new information on Roseate Terns in Canada. In the U.S., the "Cooperative Long-Term Roseate Tern Metapopulation Project", with co-investigators from Massachusetts, Connecticut and New York (see appendix), was begun in 1987. Co-investigators have coordinated comprehensive studies of chick growth, productivity, dispersal, recruitment, survival, feeding, and behaviour of this species in the

northeastern U. S. over the last 10 years (reviewed in Nisbet and Spendelow 1998). In addition, the American portion of the northeastern population was designated endangered in 1987 (U. S. Fish and Wildlife Service 1987).

In this report I review recent information on the population size, distribution, and habitat of Roseate Terns in northeastern North America. I also review any progress that has been made toward fulfilling the goals of the Canadian Roseate Tern Recovery Plan, and re-evaluate the threatened status of this species in Canada.

POPULATION SIZE AND TREND

Canada represents the northern limit of the Roseate Tern's range in northeastern North America. Determining trends in size and distribution of this population therefore requires a review of data from both the U. S. and Canada.

United States

The numbers of "peak period" and "total season" breeding pairs in the U. S. have been increasing slowly since 1988, except between 1991 and 1992 when they dropped by 17% (Table 1). In 1997, 3382 pairs bred in the U. S. during the peak period. "Total season" pairs, estimated at 3980 in 1997, are generally 10-20% higher than peak period pairs (U.S. Fish and Wildlife Service 1998), and probably include failed and late breeders.

Roseate Terns have bred in 44 colonies from Maine to New York since 1988 (U.S. Fish and Wildlife Service 1998). In any given year, however, only 16-20 of these colonies are used by Roseate Terns. Some colonies are occupied annually, while others are used occasionally by small numbers of Roseate Terns. Since 1988, some historic colonies in the U. S. have been recolonized (e.g. Eastern Egg Rock, ME; Kress 1983; Ram Island, MA; Nisbet and Spendelow 1998) while others have declined (e.g. Nauset-New Island, MA) or been completely abandoned (e.g. East Inlet Island, N Y and Cedar Beach, NY). Currently the five largest colonies in the United States are Great Gull Island, NY (1455 pairs in 1997), Bird Island, MA (1179 pairs in 1997), Ram Island, MA (253 pairs in 1997), Eastern Egg Rock, ME (138 pairs in 1997) and Falkner Island, CT (136 pairs in 1997). The population has declined at Bird and Falkner Islands, but has remained stable at Great Gull Island, and increased at Eastern Egg Rock and Ram Island over the last ten years (U.S. Fish and Wildlife Service 1998).

Ninety-three per cent of the U. S. population currently nests in the five largest colonies, and 78% nests in the two largest colonies (Table 1). This concentration makes the species extremely vulnerable to disturbance and was the primary reason for the designation of this population as endangered (U.S. Fish and Wildlife Service 1987, 1998).

Canada

Estimates of breeding pairs in 1996 and 1997 place the Canadian Roseate Tern population between 88 and 137 pairs breeding in six locations (Table 2). These estimates are based on a combination of "total season" numbers for The Brothers Islands and Country Island, and primarily "single-visit" numbers for all other sites. This estimate is similar to Kirkham and Nettleship's (1985) estimate of 101-125 pairs breeding in nine locations. Roseate Terns have therefore remained stable in Canada since 1985 (Table 2). Three per cent of the northeastern population currently nests in Canada.

The distribution of Roseate Terns in Canada has changed since the early 1980s (Table 2, Fig. 1). Roseates currently nest in only three of nine sites noted in the original status report. These are Sable Island, NS, The Brothers Islands, NS, and the Magdalen Islands, PQ (Table 2). Several new sites have also been colonized (Table 2). Changes in distribution by province are described below.

Nova Scotia

At least 95% (86-130 pairs) of the Canadian Roseate Tern population nests in Nova Scotia. Roseate Terns breed at four sites in this province, two of which (Sable Island and The Brothers) were noted by Kirkham and Nettleship in 1985 (Table 2). Roseates have nearly disappeared at Sable Island, whereas the number currently breeding on The Brothers is almost the same as the 1982 estimate (Table 3). This makes The Brothers the only large colony (*i.e.* greater than 20 pairs) in Canada known to have maintained a stable population of Roseate Terns for the last 15 years (Table 3).

Two new relatively large Roseate Tern colonies, Country Island and Grassy Island, were discovered in 1987 and 1993, respectively (Field notes from Erskine 1992, Boates *et al.* 1993). Each colony has been known to support one-third of the Canadian Roseate Tern population (Table 3). Grassy Island may prove to be a stable breeding site, but more information on both population size and productivity of terns at this site needs to be collected. Numbers on Country Island have fluctuated considerably since the colony was discovered, as illustrated by the drop from 25 pairs in 1987 to one pair in 1997 (Table 3). Some of the birds that abandoned Country Island in 1997 are believed to have moved to three sites that were previously not confirmed as Roseate breeding sites. These were Charlos Cove, Fisherman's Harbour, and Inner West Bird Island (Whittam 1997). I have not included these sites as current Roseate Tern colonies (*i.e.*, in Table 2) because it remains to be seen whether Roseate Terns will continue to use them, or whether the birds will instead return to Country Island. These three sites, along with Country Island, are referred to as the "Country Island complex" (Table 2) because of the likelihood that birds at these sites came from the same large colony on Country Island (Whittam 1997). Interestingly, in 1987 several pairs of Roseate Terns were suspected nesting at one of the Bird Islands, and at two sites in Tor Bay (Cooks Island and Hog Island; Table 3, Fig. 1), suggesting that the "Country Island complex" has been in existence for some time.

Peter's, Mud, Wedge, and Sambro Islands were noted as Roseate Tern breeding sites by Kirkham and Nettleship (1985), but have since been abandoned by all species of terns (Lock *et al.* 1993, Boates and Sam 1996, D. Currie - Nova Scotia Bird Society - pers. comm.). Westhaver Island, also in Nova Scotia, was reported to have 8 pairs of Roseates in 1985 (Kirkham and Nettleship 1985), but none have bred since. Approximately 168 pairs of Arctic and Common Terns nested at this site in 1997 (Gregoire 1998), and Roseate Terns were observed foraging in the area, but nesting was not confirmed (D. Currie pers. comm.). Grassy Island is only 16 km from Westhaver Island, so terns seen foraging near Westhaver may have been breeding at Grassy Island.

New Brunswick

Machias Seal Island is the only known breeding site for Roseate Terns in New Brunswick, and only 1-2 pairs breed in this colony annually. Roseates were first discovered breeding in 1979 and again in 1982, but they did not breed in 1983-85 (Kirkham and Nettleship 1985). A single pair was observed in 1988, and a nest was identified in 1994. In 1995-97 two nests were suspected based on courtship feeding and flying displays, but breeding was not confirmed (K. Amey pers. comm.).

Quebec

The Magdalen Islands is the only known breeding location for Roseate Terns in Quebec. Fewer than five pairs of Roseate Terns breed in this area annually (Shaffer and LaPorte 1996). Roseates were first reported on the islets off Pointe-aux-Loups, then at the tip of Dune du Sud and on Baie du Havre aux Basques, although the latter two sites have not been occupied since the early 1970s and 1980s, respectively (Shaffer and Robert 1996). Since 1987 Roseate Terns have been confirmed breeding in small numbers (1 to 3 pairs) at three colonies, one on île aux Cochons, one on the islets off Pointe-aux-Loups (Deuxieme îlot), and one on an artificial islet (îlot C) off Grande-Entrée. Not every colony is occupied annually (Shaffer and Robert 1996, Shaffer and LaPorte 1996).

Limiting Factors

Predation during the breeding season

Predation at breeding colonies appears to be the most important factor limiting the distribution and productivity of Roseate Terns in Canada. Red foxes (*Vulpes vulpes*) are major predators of tern eggs on the Magdalen Islands (Shaffer and LaPorte 1996), and Northern Ravens (*Corvus corax*) and American Crows (*Corvus brachyrhynchos*) have been known to take tern eggs (including Roseate eggs) at several Nova Scotian colonies (Whittam 1997, D'Eon 1997). Great Horned Owls (*Bubo virginianus*) are major predators of Roseate Tern adults, chicks, and fledglings in the U. S. (reviewed in Nisbet and Spendelow 1998). Hunting owls cause adult terns to abandon their nests at night, leading to exposure of embryos and chicks, and greater predation by nocturnal species such as Black-crowned Night-Herons (*Nycticorax nycticorax*) and ants (Nisbet and Spendelow 1998). Great Horned Owl predation on adult Common Terns has been reported in Pubnico Harbour, Nova Scotia (D'Eon 1997), but it is not known whether Roseate Terns are also affected. Nothing is known about potential Black-crowned Night-Heron or ant predation on Roseate Terns in Canada. There are few Black-crowned Night-Heron colonies in Atlantic Canada, none of which are located near Roseate Tern colonies (D. Amirault pers. comm.).

The major predators at Canadian tern colonies are Herring (*Larus argentatus*) and Great Black-backed (*L. marinus*) Gulls. These species prey on tern eggs, chicks, and adults (Hatch 1970, Nisbet 1981). A recent study of the Country Island tern colony provides in-depth information on gull predation at this site (Whittam 1997). Country Island supported almost half of the Canadian Roseate Tern population in 1996 (i.e. 45 pairs; Table 3). Only one pair nested in 1997, however, and they abandoned their egg after 10 days of incubation. The combined number of breeding Arctic and Common Terns also dropped by more than half between 1996 (500 pairs) and 1997 (220 pairs).

The reason for this large-scale abandonment was thought to be predation by corvids on tern eggs, and gulls on tern adults, chicks, and eggs. A Great Black-backed Gull was observed depredating an adult Roseate Tern, and gulls took more than half of all tern chicks hatched from this colony in 1996 (i.e. about 600 chicks). Only 0.08 Roseate chicks per nest, or about five chicks in total, survived to fledge in 1996. This level of productivity is well below the level needed to maintain the colony at its current size (Whittam 1997).

Adult overwintering survival

Adult mortality during migration or at wintering grounds is probably the main factor limiting population size in the U. S., where predators are controlled at most breeding colonies (Nisbet and Spendelow 1998). The average annual survival rate for adult Roseate Terns from four major U. S. colonies is approximately 81-84%, which is low relative to other seabirds (Spendelow and Nichols 1989, Spendelow et al. 1995). In the 1980s only Bird Island and Great Gull Island produced enough chicks to offset adult mortality (Ratcliffe 1997). Because adult mortality is rarely observed at breeding colonies, Roseate Terns are probably dying during migration or at their wintering grounds. Roseate Terns were trapped intensively between 1968-1981 in Guyana for sale at local markets, but this practice has since reportedly stopped (Nisbet 1984). More information is required to determine the causes of winter mortality (Spendelow et al. 1995).

Extreme weather

Major storms, such as Hurricane "Bob" which passed through the principal staging area for Roseate Terns in August of 1991, may hinder population recovery (Nisbet and Spendelow 1998). Circumstantial evidence suggests that "Bob" was responsible for the crash in the U. S. Roseate Tern population between 1991 and 1992 (Table 1). Adult mortality increased from 17% to 33% in 1991-1992. Furthermore, 80% of fledglings raised in 1991 were lost (Nisbet and Spendelow 1998). Hurricane "Bob" is the only storm for which tern demographic data are available. More cases need to be documented to clarify the role of extreme weather in population crashes (Nisbet and Spendelow 1998).

Skewed sex ratio

A shortage of males may limit the productivity of Roseate Terns at some colonies in northeastern North America (Nisbet and Hatch in press). The sex-ratio of breeders on Bird Island, MA is 127 females: 100 males. Twenty per cent of breeding females do not obtain male mates, and instead pair together to produce supernormal clutches of three to four eggs. Fertilization is achieved through extra-pair copulations. Female-female pairs produce 75% fewer fledgings per female than male-female pairs. As a result, average colony productivity at Bird Island is reduced by about 16%, compared to the value expected if all females had male mates (Nisbet and Hatch in press.). It is not known whether the sex ratio is skewed at hatching or fledging, or is due to subsequent sex-specific mortality (Nisbet and Hatch in press.).

Synopsis

While the population of Roseate Terns in northeastern North America has been increasing slowly since 1987, more than 90% of the population is concentrated into five predator-controlled sites in the United States. Three to four per cent of the northeastern population nests in Canada, where there are currently only three large colonies supporting up to 94% of the Canadian population. These are The Brothers Islands, Grassy Island and the Country Island complex (Table 2, Fig. 1). Only The Brothers is known to be a stable breeding colony. The concentration of the population into few sites is cause for concern, because any disturbance at these sites due to environmental contamination, human interference, a major storm, or an increase in predation pressure could lead to the extirpation of Roseate Terns from Canada.

HABITAT

Foraging habitat of breeding Roseate Terns

Roseate Terns generally forage in shallow areas close to shore, near shoals and tide rips (Safina 1990). At some colonies, Roseate Terns travel up to 30 km round trip to find food (Heinemann 1992). Common Terns forage under a wider range of habitat conditions, and are less restricted by physical oceanography (Safina 1990). As a result, Roseate Terns prey on a limited number of fish species, whereas Common Terns have a more diverse diet (Richards and Schew 1989, Safina *et al.* 1990). The specialized nature of Roseate Tern foraging habitat may partially explain why this species is both less abundant and less widely-distributed than Common Terns (Safina 1990, Nisbet and Spendelow 1998). Furthermore, because Roseates in given colonies prey primarily on only one or two species, they are vulnerable to environmental perturbations affecting these fish (Safina *et al.* 1988, 1990).

The northeastern Roseate Tern population is divided into two groups based on differences in oceanography and diet. These are: a) the "warm-water" group, that nests mostly between Long Island, NY, and Cape Cod, MA, and feeds primarily on American sand lance (*Ammodytes americanus*) and lesser numbers of bluefish (*Pomatomus saltatrix*), mackerel (*Scomber scombrus*) and anchovies (*Anchoa* spp.); and b) the "cold-water" group that nests in the upper Gulf of Maine and southeastern Canada and feeds primarily on Atlantic herring (*Clupea harengus harengus*) and white hake (*Urophycis tenuis*, Nisbet and Spendelow 1998).

While there has been no thorough study of prey selection by Roseate Terns in Canada, some information has been gathered. On Country Island, Roseate Terns prey primarily on equal numbers of sand lance and white hake, although butterfish (*Peprilus triacanthus*) and lumpfish (*Cyclopterus lumpus*) are also taken (Whittam and Leonard unpubl. data). Sand lance are commonly taken on Sable Island (I. McLaren pers. comm.). On The Brothers, Roseate Terns have been observed feeding on Atlantic silversides (*Menidia menidia*), butterfish and Atlantic herring (D'Eon 1994, 1996).

Staging and wintering habitat

After fledging in early August, juvenile Roseate Terns from the northeastern population disperse with their parents to staging areas located from Long Island to Nantucket and Cape Cod, and in the Gulf of Maine (e.g. Stratton Island; Shealer and Kress 1994). At these sites, terns feed offshore on abundant sand lance and return to roost at night (Shealer and Kress 1994).

Roseate Terns migrate south in late August and early September. They arrive in South America by October, where they have been recovered along the north coast from western Colombia to eastern Brazil, between 11° and 18° S (Nisbet 1984, Hays et al. 1997). A large concentration of about 10,000 terns, including up to 3,000 Roseate Terns, was discovered in 1997 at Mangue Secco, Bahia, Brazil (Hays et al. in press). This concentration contained banded Roseate Terns from every major breeding colony in the U. S. (Hays et al. in press). Almost nothing is known about the winter ecology and behaviour of Roseate Terns from the northeastern population (Nisbet and Spendelow 1998).

Breeding habitat

Roseate Terns nest in colonies almost exclusively on small islands, frequently vegetated with beach grass and herbaceous plants (Nisbet 1981). In northeastern North America Roseate Terns always nest in association with Common or Arctic Terns. Terns require colony sites that are relatively free from predators, and will abandon a colony after a season of heavy predation (Nisbet 1981). Roseate Terns breeding in North America are limited by the number of available predator-free (or predator-controlled) colony sites that are also in close proximity to good foraging sites.

Within a colony, Roseate Terns nest at sites that provide more cover than nest sites of Arctic or Common Terns (Burger and Gochfeld 1988, Ramos and del Nevo 1995, Whittam 1997, Whittam unpubl. data). This cover is usually in the form of dense vegetation or strewn rocks, boards, or driftwood (Nisbet 1981, Spendelow 1982). Roseate Terns will nest in boxes, half-buried tires, or other shelters provided by humans (Spendelow 1982). Reproductive success has been found to be greater under artificial shelters than in natural sites (Spendelow 1996). Table 4 provides information on the type of nesting habitat used by Roseate Terns at major Canadian breeding colonies. Similar descriptions of nest sites at U.S. colonies can be found in Nisbet (1981, 1989).

The effect of gulls on Roseate Tern breeding habitat

Many tern colonies have been abandoned this century due to the presence of gulls (Crowell and Crowell 1946, Kress 1983, Howes and Montevecchi 1993). In Canada, Roseate Terns have almost completely abandoned both Sable Island and Country Island, the latter due almost certainly to gull predation (Whittam 1997). In the absence of predation, these two islands are high-quality breeding sites, primarily because they are located far from the mainland (160 km and 5 km, respectively) and are thus less susceptible to terrestrial predators and human disturbance (Lock et al. 1993, Whittam 1997).

In general, Roseate Terns in Canada currently breed on small sites close to the mainland. For example, The Brothers Islands are only 600 m from the shore. Furthermore, evidence suggests that Roseate Terns that abandoned Country Island in 1997 moved to three sites, two of which were either attached to, or very close to, the mainland (Fisherman's Harbour and Charles Cove, respectively). In the U.S., gulls have forced terns to move to nearshore sites which now form the bulk of Roseate Tern breeding colonies (U. S. Fish and Wildlife Service 1989, Nisbet and Spendelow 1998).

It would be valuable to determine whether the gull population in eastern Canada is increasing or decreasing. In 1987 there were an estimated 30,000 pairs of Great Black-backed Gulls and 28,000 pairs of Herring Gulls nesting in Nova Scotia (Lock 1987). Lock et al. (1993, p. 16) stated that "Gull populations are not expected to increase greatly in the future, but neither are they expected to decrease greatly over the next few decades." Unfortunately there has been no census of gull numbers in Atlantic Canada over the last 10 years. The only recent

information is from Gros Morne National Park in Newfoundland, where gulls on Stearing Island increased from 0 pairs in 1976 to 615 pairs in 1992 (Howes and Montevecchi 1993). The population dropped to 282 pairs in 1993, however, probably due to the fisheries moratorium imposed in 1992 (Deichmann 1993).

Protection of breeding habitat

The presence of Herring and Great Black-backed Gulls at Roseate Tern breeding colonies is the most serious threat to this species in Canada. Simply acquiring habitat and assigning protected status will not solve this problem, although it should expedite the solution. Colonies that are deemed essential to the survival of this species in Canada need to be monitored yearly and kept free of breeding gulls. Gulls currently nest on three of the six Canadian Roseate Tern colony sites (Table 2). In the U. S., 97% of the Roseate Tern population nests at sites that are managed and protected by biologists or wardens. Management includes destroying gull nests, harassing adult gulls, and removing persistent predators (gulls and other species; reviewed in Nisbet and Spendelow 1998). Predator management is clearly necessary for the survival of this species (Nisbet 1981, 1989).

Essential breeding colony sites

Below is a list of the essential colony sites (*i.e.* "core colonies", defined in Lock *et al.* 1993) for Roseate Terns in Canada, along with a description of current ownership, degree of protection, and threats to terns. A summary of current knowledge on tern reproductive success at each colony is also given. Numbers in brackets refer to each site's position in Fig. 1. General habitat descriptions for each site are in Table 4.

The Brother's Islands, Nova Scotia (7)

These islands were recently acquired by the Province of Nova Scotia (S. Boates pers. comm.). Both islands are censused 2-3 times each breeding season by T. D'Eon, who has recorded the number of nests since 1991 (Table 3), and clutch sizes of nests since 1996 (see Table 5). The colony appears to be productive because Roseate Tern fledglings were observed in 1996 and 1997 (D'Eon 1996, 1997). Productivity at this colony was estimated to be at least 0.62 fledglings per nest in 1997 (data from D'Eon 1997, calculated by Whittam 1997). It should be noted, however, that mean annual clutch size of Roseate Terns at this site (Table 5) is considerably lower than that of Roseate Terns at the Country Island colony (Table 6), and at most U. S. colonies (*i.e.* 1.5 to 1.8 eggs; Nisbet 1981).

D'Eon also maintains nest shelters, and destroys nests and eggs of Herring and Great Black-backed Gulls on The Brother's. A Department of Natural Resources (DNR) "Tern Colony" sign has been placed on North Brother Island to discourage human disturbance. In 1994 a finfish aquaculture site was set up 60 m from the northeast site of North Brother Island (Boates and Sam 1996). There was concern that this operation would attract gulls to the area and threaten the nearby nesting terns, or that associated human disturbance would disrupt the terns' breeding behaviour. As of the 1997 breeding season, it appears that there has been no negative effect on the terns (Boates and Sam 1996, T. D'Eon pers. comm.). If the operation expands, however, it may threaten the suitability of this site for Roseate Terns.

Grassy Island, Nova Scotia (10)

This island is owned by the Province of Nova Scotia. Roseate Terns were discovered breeding at this site in 1993, but they have not been closely monitored. Productivity of this colony needs to be ascertained, as do factors potentially affecting productivity (*i.e.* predation). Gulls are not known to nest on Grassy Island, but they do nest on many nearby islands (P. Mills pers. comm.). In 1994, nest shelters were placed to encourage tern breeding, and a DNR "Tern Colony" sign was erected to discourage human disturbance. Both Grassy Island and The Brother's, including a 250 m circle of water surrounding the islands, will eventually be designated Nova Scotia Wildlife Management Areas (S. Boates pers. comm.).

Country Island, Nova Scotia (17)

This island is owned by the Department of Fisheries and Oceans and is under the jurisdiction of the Canadian Coast Guard. Environment Canada is considering the establishment of a Migratory Bird Sanctuary at this site. If the island is surplus by the Department of Fisheries and Oceans Environment Canada would seek to obtain title to the property. National Wildlife Area status may eventually be given, which will afford protection to both terns and their habitat (Boyne 1998).

As mentioned earlier, Roseate Terns are known to have nested on Country Island in relatively high numbers in 1987, 1995 and 1996 (Table 3), but they produced almost zero chicks in 1996 (Table 6). Only one pair nested in 1997, and they abandoned their egg after 10 days of incubation (Whittam 1997).

The Canadian Wildlife Service (CWS) has designed a Tern Restoration Plan for Country Island with the support of the Canadian Roseate Tern Recovery Team, the Nova Scotia DNR, and the Canadian Coast Guard. A two-year pilot study beginning in April of 1998 will examine the viability of non-lethal gull and corvid control to re-establish Roseate and other terns at this site (Boyne 1998). Common Eiders (*Somateria mollissima*) and Leach's Storm Petrels (*Oceanodroma leucorhoa*) also nest on Country Island (pers. obs.), and are expected to benefit from predator management (Boyne 1998). Currently 60-90 pairs of Herring Gulls, 20 pairs of Great Black-backed Gulls, 2 pairs of American Crows, and 1 pair of Northern Ravens nest on Country Island (Whittam 1997).

While predation is the most immediate threat to this colony, an indirect threat is posed by the construction of the Sable Offshore Energy Project (SOEP) pipeline. This pipeline will transport natural gas from underwater oil fields near Sable Island to Country Harbour, Nova Scotia. The pipeline will fall within 5-6 km of Country Island, and concerns were raised that its construction could disrupt local prey fish and affect tern foraging behaviour. Furthermore, the associated increase in ship traffic, noise, and possibly pollution, could affect tern breeding behaviour (Whittam and Leonard 1996). As a result, construction of the portion of the pipeline that lies within 20 km of Country Island has been restricted to the non-breeding season (September - April) (Fournier et al. 1997).

Sable Island, Nova Scotia (21)

This island is administered by the Department of Fisheries and Oceans and is under the jurisdiction of the Canadian Coast Guard. It was designated a Migratory Bird Sanctuary by CWS to protect nesting migratory bird populations, especially terns and Ipswich Sparrows (*Passerculus sandwichensis princeps*). Access to the island is restricted by Coast Guard regulations (Lock et al. 1993).

There is a long history of Roseate Terns breeding on Sable, and 10-20 pairs were reported breeding in 1985 (Kirkham and Nettleship 1985). Only one or two pairs currently breed on Sable, however, and nothing is known about their breeding success. Approximately 2570 Common Terns, and 286 Arctic Terns, nested in 20 colonies on Sable Island in 1995 (Z. Lucas unpubl. data).

About 2800 pairs of Herring Gulls and 1200 pairs of Great Black-backed Gulls were known to nest on the island in the early 1970s (Lock 1973). Z. Lucas censused gulls on Sable in 1997, but the results of this census are not yet available. Lucas also monitored potential effects of gull predation on tern reproductive success on Sable Island in 1997. She found that predation occurred at only one of five colonies studied (Z. Lucas unpubl. data). While she did not monitor the colony where Roseate Terns nest ("East Light"), casual observations indicate that gull predation is probably not a problem at this colony (Z. Lucas pers. comm.).

SOEP has the potential to disrupt terns and other birds breeding on Sable Island. According to current understanding, only occasional visits to Sable will be made as a result of SOEP, and these visits will be subject to a code of practice (Fournier et al. 1997). Furthermore, SOEP must conduct an environmental effects monitoring program for at least five years to ascertain any effects on Sable Island birds (Fournier et al. 1997).

The developing "Sable Island Conservancy" is a non-profit partnership formed between private industries, government, and local nature groups to preserve the integrity of Sable Island's flora and fauna. If federal funding is provided, this organization could help manage and conserve terns on Sable Island (I. McLaren pers. comm.).

Two ancillary sites where Roseate Terns have nested in small numbers for at least five years include:

Machias-Seal Island (2), which is a Migratory Bird Sanctuary. It supports 67% of all terns breeding in the Bay of Fundy (Lock et al. 1994), and 1-2 pairs of Roseates have bred at this site since 1979 (Kirkham and Nettleship 1985, K. Amey pers. comm.). Nothing is known about the productivity of these birds. A resident warden keeps gulls from nesting on the island and controls human access.

Magdalen Islands (1). The three colonies where Roseate Terns currently breed are of mixed ownership. Ile aux Cochons is privately owned, Deuxieme flot is crown land and the ownership of flot C is unknown (F. Shaffer pers. comm.). Predation by Great Black-backed Gulls is a problem, but no predator management has been planned (F. Shaffer pers. comm.). Fox predation is also a serious concern, and since 1994 electric fences have been placed around two major tern colonies to prevent foxes from entering (F. Shaffer pers. comm.).

EVALUATION OF RECOVERY PLAN ACTIONS

Many of the actions outlined in the Recovery Plan (see Fig. 2 in Lock *et al.* 1993) have been implemented over the last three years, and it is imperative that these actions be continued annually. For example:

- Population surveys have been updated by the Nova Scotia Department of Natural Resources (Action 1.1.1; Boates and Sam 1996);
- Breeding success has been monitored (Action 1.1.3.1) at two essential colonies: The Brothers (D'Eon 1991-1997) and Country Island (Whittam 1997);
- Some (17) adult Roseate Terns from Country Island have been banded with colour bands and special "field-readable" bands (Whittam 1997) to help determine dispersal and migration patterns of the Canadian population (Actions 1.1.2 and 1.1.3.3); and
- Breeding habitat has been enhanced by the Nova Scotia DNR (Action 3.1.1), who placed nest boxes on The Brother's Islands, Grassy Island, and Country Island. Providing nest boxes is an easy method of creating cover for Roseate Tern nests, and the degree of cover over a nest has been found to influence egg predation (Whittam 1997). Boxes have also been placed on Holmes, Westhaver, Wedge and Peter's Islands by the Nova Scotia Bird Society and local naturalists to provide suitable nesting habitat should Roseates ever re-colonize these sites (Boates and Sam 1996).

On the other hand, many top-priority actions outlined in the Recovery Plan have not been implemented. For example:

- Nothing is known about the productivity of Roseate Terns at Grassy Island (Action 1.1.3.1), even though it may be one of only two stable colonies in Canada;
- Little is known about prey availability and choice at The Brother's, Grassy and Sable Islands, and the locations of feeding sites around the three largest Canadian colonies are unknown (Actions 2.1.3 and 3.1.2.2);
- There is no information about recent changes in the gull population in Atlantic Canada (Action 2.4.1);
- Contingency plans for major disruptions such as gull predation, a crash in prey populations, or the effects of environmental contaminants have not been developed (Actions 3.1.2.1, 3.1.2.2 and 3.1.2.3);

• Very little effort, aside from that expended at The Brother's, has been made to provide predator-free sites for Roseate Terns (Action 3.1.2a). Gull management that was set to begin in 1993 on Sable Island was blocked by the public response, and no further plans for management at this colony have been made. Gull management has not been undertaken at the Magdalen Islands (F. Shaffer pers. comm.). As mentioned earlier, CWS has designed a tern restoration plan for Country Island set to begin in the spring of 1998. This is the first such project to be undertaken since the Recovery Plan was published five years ago.

In conclusion, little substantive progress has been made toward fulfilling the goals of the Roseate Tern Recovery Plan (Lock *et al.* 1993). There has been no increase in the number of Roseate Terns breeding in Canada between 1985 and 1997, and data gathered on The Brothers Islands (0.62 fledglings/nest) and Country Island (0.08 fledglings/nest) suggest that productivity of Roseate Terns in Canada is well below the goal of one fledgling per pair per year. The recovery actions summarized above must be implemented immediately if goals are to be met.

EVALUATION AND PROPOSED STATUS

I recommend that Roseate Terns be upgraded from "Threatened" to "Endangered" in Canada based on the following points:

1. The Canadian Roseate Tern population is small. Only 88-137 pairs breed in the country.
2. Ninety-four per cent of the Canadian Roseate Tern population is concentrated into only three main sites in Nova Scotia, making it extremely vulnerable to existing environmental threats. Any major disturbance to these sites could lead to the extirpation of Roseate Terns from Canada.
3. Of the three main breeding colonies, The Brothers Islands and Grassy Island are both near-shore sites that are vulnerable to human disturbance and terrestrial predators. The third colony, on Country Island, is neither productive nor stable due to heavy predation on eggs and chicks by corvids and gulls. Roseate Terns produced only 0.08 fledglings/nest on Country Island in 1996, and only one pair returned to breed in 1997 (Whittam 1997).
4. The distribution of Roseate Terns in North America is limited by the number of predator-controlled colony sites in close proximity to good foraging sites. In Canada, high-quality breeding habitat such as that found on Country Island continues to be lost due to displacement by Herring and Great Black-backed Gulls. Until predator management is implemented, the amount of Roseate Tern breeding habitat available in Canada will not increase.
5. Mortality during migration or at wintering areas is limiting adult survival. Roseate Terns have the lowest survival rate of any seabird species measured to date (Spendelow *et al.* 1995).
6. Roseate Terns in Canada constitute 3-4% of the northeastern North American population at the northern limit of their breeding range. The remaining 96-97% of this population was listed as Endangered in the United States in 1987 and will retain this designation until the criteria for downlisting are met (see U.S. Fish and Wildlife Service 1998). Leading authorities on the U. S. Roseate Tern population believe that the Canadian portion of this population should be listed as endangered based on its small size and limited distribution (I. C. T. Nisbet and J. Spendelow pers. comm.).
7. In a recent review of the status of seabirds in eastern Canada, the Roseate Tern was designated "highest priority" for species at risk (Nettleship 1998). Moreover, D. N. Nettleship (pers. comm.) asserts that Roseate Terns met the criteria for listing as "Endangered" in 1985, but "Threatened" status was recommended (Kirkham and Nettleship 1985) primarily to maintain access to important Roseate Tern breeding sites. This allowed the monitoring of population status to proceed without the strict regulations associated with obtaining access to breeding sites of endangered species. Now that more information has been gathered on Roseate Terns in Canada, an endangered listing is warranted (D. N. Nettleship pers. comm.).

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BIOGRAPHICAL SUMMARY OF AUTHOR

Rebecca Whittam obtained her B.Sc. (Hons.) in 1995 from Queen's University in Kingston, Ontario, where she studied song variation in Yellow Warblers with Dr. Bob Montgomerie. She then moved to Halifax to study Roseate Terns with Dr. Marty Leonard of Dalhousie University. Her M.Sc. thesis, on the effects of predation on Roseate, Arctic and Common Terns on Country Island, was the first in-depth study of Roseate Terns in Canada. She also documented the first known case of hybridization between Roseate and Arctic Terns. Rebecca graduated from Dalhousie University in May of 1998, then worked for the Canadian Wildlife Service as coordinator of the Country Island Tern Restoration Project.

Table 1. 1988-1997 estimates of "peak period" nesting pairs of Roseate Terns in the northeastern U.S. by state (reprinted from U.S. Fish and Wildlife Service 1998). See text for the names and locations of the five largest colonies. The "total season" numbers are generally 10-20% higher than "peak period" numbers, and can be found in U.S. Fish and Wildlife Service 1998.

State	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Maine	68	77	102	123	119	141	142	152	161	237
Massachusetts	1656	1576	1585	1778	1413	1355	1341	1480	1743	1454
Connecticut	149	106	150	149	107	130	124	125	135	136
New York	1122	1074	1159	1380	1104	1149	1265	1345	1131	1555
Total Pairs	2995	2833	2996	3430	2743	2775	2872	3102	3170	3382
Total colonies in use	19	20	16	18	16	19	17	18	17	20
Concentration in largest colonies										
% in 2 colonies	86	86	86	85	85	85	83	74	65	78
% in 5 colonies	96	94	96	95	94	94	92	90	96	93

Table 2. Estimated number of Roseate Tern pairs breeding in Canada in 1982-85 (from Kirkham and Nettleship 1985) and 1997 (see Table 3 for sources). The presence or absence of nesting gulls at each site is also indicated.

Site	1982-85 estimate	1997 estimate	Gulls nests
Several colonies on the Magdalen Inlands, PQ	1 - 5	1 - 5	yes
Machias Seal Island, NB	0	1 - 2	no; gulls are discouraged
Peter's Island, NS	1	0	yes
The Brother's, NS	55 - 60	54	no; nests are destroyed
Mud Island, NS	2	0	yes
Tusket Island, NS	15 - 20	0	?
Westhaver Island, NS	8	0	?
Grassy Island, NS	0	12 - 30	no
Wedge Island, NS	6	0	yes
Sambros Island, NS	3	0	?
Country Island complex*, NS	0	18 - 45	yes
Sable Island, NS	10 - 20	1	yes
TOTAL	101 - 125	87 - 137	
*includes birds breeding on Country Island, Charlos Cover, Fisherman's Harbour and Inner West Bird Island in 1997 (see text)			

Table 3. Canadian Roseate Tern breeding sites occupied since the early 1980's. Bold entries are from the original status report (Kirkham and Nettleship 1985).

Breeding Site	Year	Details	Source
QUEBEC			
1. Magdalen Islands * = breeding confirmed	1972-1983	1-5 pr	Kirkham and Nettleship 1985
	1987	2 adults*	Shaffer and Robert 1996
	1988	6 adults*	Shaffer and Robert 1996
	1989	3 adults*	Shaffer and Robert 1996
	1990	5 adults	Fradette 1990
	1991	4 adults	Shaffer and LaPorte 1996
	1992	2 adults*	Shaffer and LaPorte 1996
	1993	7 adults*	Shaffer and LaPorte 1996
	1994	2 adults	Shaffer and LaPorte 1996
	1995	4 adults	Shaffer and LaPorte 1996
	1996	3 adults	Shaffer and LaPorte 1996
	1997	2 adults*	F. Shaffer pers. comm.
NEW BRUNSWICK			
2. Machias Seal Island 44°30'N 67°06'W	1982	1 pr	Kirkham and Nettleship 1985
	1983-5	absent	Kirkham and Nettleship 1985
	1988	1 pr	Kennedy 1988
	1992	absent	anonymous 1992
	1993	14 adults	P. Dooley unpubl. Data
	1994	1 nest, second suspected	K. Amey pers. comm.
	1995	2 nests suspected	K. Amey pers. comm.
	1996	2 nests suspected	K. Amey pers. comm.
	1997	5 adults	J. Hudson pers. comm.
NOVA SCOTIA			
3. Peter's Island 44°16'N 66°20'W	1981	1-2 adults	Kirkham and Nettleship 1985
	1982	1 pr	Kirkham and Nettleship 1985
	1988	1-2 prs	J. Cohrs pers. comm.
	1995	1 pr	Boates and Sam 1996

... **Table 3.** Continued
Breeding Site

		Year	Details	Source
		1996	absent	D. Currie pers. comm.
		1997	absent	D. Currie pers. comm.
4. Holmes Island	43°38'N 66°04'W	1991	1 adult	D'Eon 1991
		1993	1 adult	Boates et al. 1993
		1994-7	absent	D'Eon 1994-1997
5. Tusket Island	43°39'N 66°02'W	1983	15-20 prs	Kirkham and Nettleship 1985
		1997	absent	D'Eon 1997
6. Ile Chesapeake	43°40'N 65°47'N	1996	2 prs, questionable	D'Eon 1996
		1997	absent	D'Eon 1997
7. The Brothers	43°38'N 65°49'W	1982	55-60 prs	Kirkham and Nettleship 1985
		1984	36+ prs	T. D'Eon unpubl. data
		1991	20 prs	D'Eon 1991
		1992	23 prs	D'Eon 1992
		1993	30 prs	D'Eon 1993
		1994	34 prs	D'Eon 1994
		1995	33 prs	D'Eon 1995
		1996	48 prs	D'Eon 1996
		1997	54 prs	D'Eon 1997
8. Mud Island	43°29'N 65°59'W	1982	2-3 adults	Kirkham and Nettleship 1985
		1991	absent	D'Eon 1991
		1995	absent	Boates and Sam 1996
9. Westhaver Island	44°26'N 64°20'W	1982	8 prs	Kirkham and Nettleship 1985
		1997	adults foraging Nearby	D. Currie pers. comm.

...Table 3 .Continued

10. Grassy Island	44°27'N 64°09'W	1993 1994 1995 1997	40 adults 15-20 prs 30 prs 12 prs	Boates et al. 1993 Dickie 1994 Boates and Sam 1996 P. Mills pers. comm.
Breeding Site		Year	Details	Source
11. Wedge Island	44°37'N 63°57'W	1985 1995	6 prs absent	Kirkham and Nettleship 1985 Boates and Sam 1996
12. Sambro Island	44°26'N 63°34'W	1982 1995	6 adults absent	Kirkham and Nettleship 1985 Boates and Sam 1996
13. Fisherman's Beach	44°41'N 63°13'W	1982 1983	7 prs absent	Kirkham and Nettleship 1985 Kirkham and Nettleship 1985
14. Inner West Bird Island	44°53'N 62°18'W	1987 1997	probable 8 prs	Erskine 1992 Whittam 1997
15. Thrumcap Island	44°57'N 62°02'W	1982 1995	2 prs absent	Kirkham and Nettleship 1985 Boates and Sam 1996
16. Spit off Fisherman's Harbour*	45°06'N 61°41'W	1997	5 prs	Whittam 1997
17. Country Island	45°04'N 61°33'W	1987 1995 1996 1997	25 prs 30 prs 45 prs 1 pr	Field notes, Erskine 1992 Boates and Sam 1996 Whittam 1997 Whittam 1997
18. Unnamed Island off Charlos Cove*	45°14'N 61°21'W	1997	4 prs	Whittam 1997
19. Hog Island suspected nesting	45°14'N 61°13'W	1987	several pairs,	Field notes, Erskine 1992
20. Cooks Island	45°13'N 61°14'W	1987 1997	several pairs, suspected nesting absent	Field notes, Erskine 1992 NSDNR unpubl. data (aerial survey)

Table 3. Continued

21. Sable Island	43 °57N 59°55'W	1985	10-20 prs	Kirkham and Nettleship 1985
		1993	4 prs	Z. Lucas pers. comm.
		1994	3 prs	Z. Lucas pers. comm.
		1995	2 prs	Z. Lucas pers. comm.
		1997	1 pr	Z. Lucas pers. comm.

*Roseate Terns at these sites were believed to have immigrated from Country Island in 1997 (Whittam 1997).

** Erskine (1992) noted Roseate Terns "probably" breeding in square 20TNE56. The Bird Islands are in this square; however, original field notes for this square (unavailable at the time of writing) should be consulted to confirm this record.

Table 4. Nesting habitat used by Roseate Terns in Canada.

Location	Habitat	Nest-sites	Source
The Brothers Islands	Two 1/3 ha rocky islands, 600 m apart, vegetated with low grasses.	60% concealed near or under shelter such as lobster crates, nest boxes, tires, dory bottom, plywood; 20% concealed near or under vegetation; 20% in the open.	D'Eon 1997
Grassy Island	1/3 ha rocky island surrounded by narrow cobble beach. Center covered in grasses, plants, especially seaside sedges and herbaceous plants.	Concealed under nest shelters and under patches of herbaceous	Dickie 1994 P. Mills pers. comm
Country Island	19 ha rocky island with organic soils supporting grasses, herbaceous plants, especially sedges, herbaceous plants and small copses of white spruce.	Mostly concealed under patches of seaside angelica and raspberry. Some under rocks, 1 under nest box in 1997.	Whittam 1997
Sable Island	40 km long, 1.5 km wide island. Sand dunes covered in marram grass and herbaceous plants.	Normally in clumps of marram grass.	Kirkham and Nettleship 1985

Table 5. Number of nests (n) and average clutch size for Roseate Terns nesting on The Brothers Islands in 1996 and 1997 (D'Eon 1996, 1997).

Year	n	Clutch size (\pm 1SE)
1996	48	1.29 \pm 0.07
1997	54	1.30 \pm 0.06

Table 6. Summary of breeding data for Roseate Terns on Country Island in 1996 (reprinted from Whittam 1997).

Breeding Characteristic	Data
1-egg nests	15
2-egg nests	30
Mean clutch size	1.67
Modal clutch initiation date	June 10
Mean incubation period (days)	23.4
Hatching success (eggs hatched/nest)	1.04
Eggs hatched (%)	47 (63)
Eggs depredated (%)	18 (24)
Unhatched eggs (%)	10 (13)
Nests where at least one egg hatched (%)	29 (64)
Fledging success (fledglings/hatchlings)	0.07
Productivity (fledglings/nest)	0.08

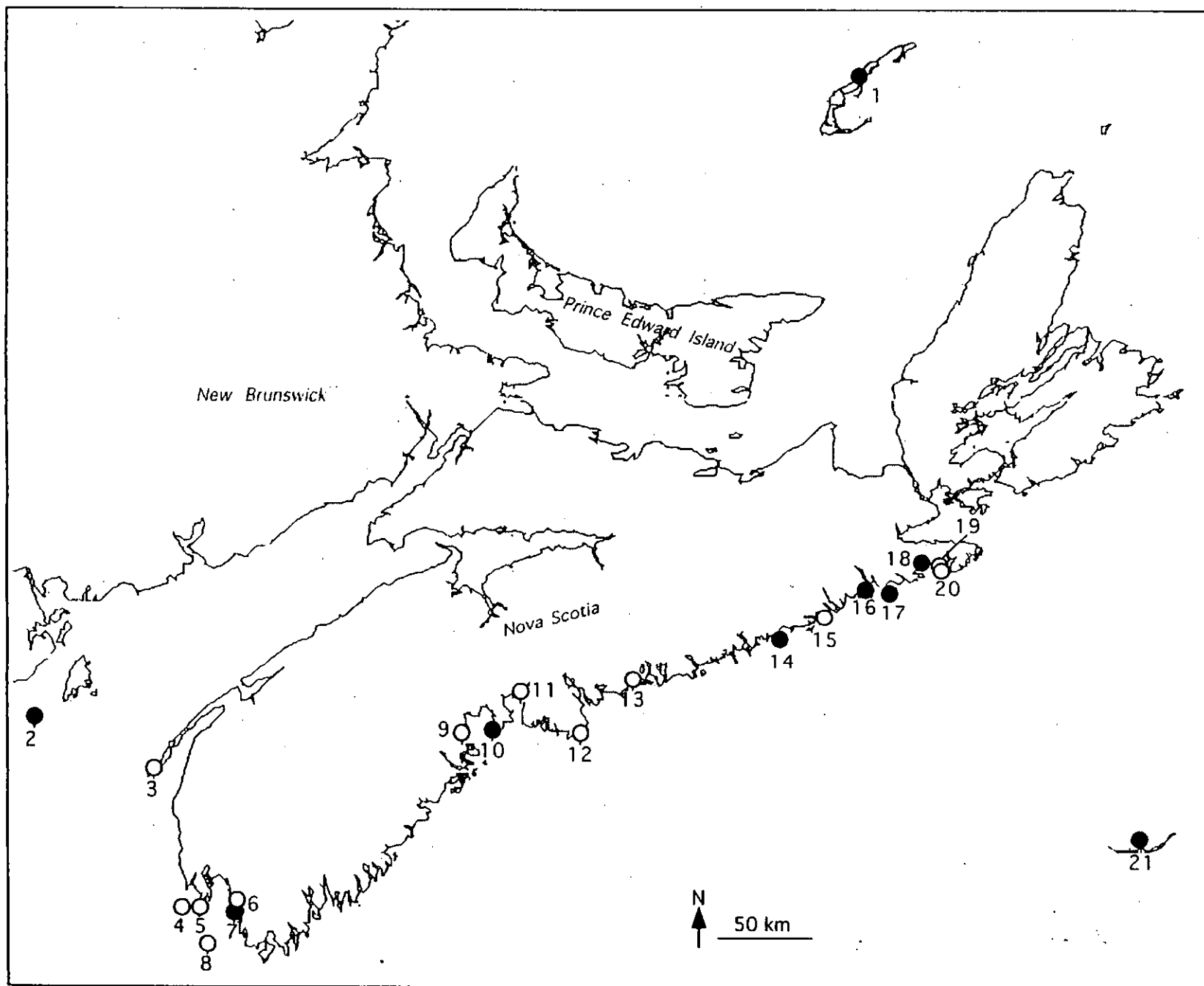


Figure 1. The locations of recent Roseate Tern colonies in Canada, including sites occupied in 1997 (filled circles), and sites occupied at least once in the 1980s or 1990s (open circles). Details, including colony names, are given in Table 3. See Kirkham and Nettleship (1985, Fig. 2) for colonies occupied prior to 1980.

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Appendix I.

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MANDATE

COSEWIC determines the national status of wild species, subspecies, varieties and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following groups: fish, amphibians, reptiles, birds, mammals, molluscs, lepidoptera, vascular plants, mosses and lichens.

MEMBERSHIP

COSEWIC is comprised of representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada, Fisheries and Oceans, Canadian Museum of Nature), three national conservation organizations (Canadian Nature Federation, Canadian Wildlife Federation, and World Wildlife Fund Canada) and the chairs of the scientific species specialist groups. The Committee meets annually in April to consider status reports on candidate species.

DEFINITIONS

Species	- Any indigenous species, subspecies, variety or geographically defined population of wild fauna and flora.
Extinct (X)	- A species that no longer exists.
Extirpated (XT)	- A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	- A species facing imminent extirpation or extinction.
Threatened (T)	- A species likely to become endangered if limiting factors are not reversed.
Vulnerable (V)	- A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)	- A species that has been evaluated and found to be not at risk.
Indeterminate (I)	- A species for which there is insufficient scientific information to support status designation.



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. COSEWIC meets annually in April each year. Species designated at this meeting are added to the list.



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