

**IMPORTANT BIRD  
AREAS OF CANADA**



**LES ZONES IMPORTANTES  
POUR LA CONSERVATION  
DES OISEAUX AU CANADA**

# **Important Bird Area Conservation Plan For the Scott Islands**

by Mark Drever

for the Canadian Nature Federation

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## Executive Summary

The Scott Islands have been recognized as a globally significant Important Bird Area (IBA) as part of an international program spearheaded by BirdLife International. The Canadian Nature Federation and Bird Studies Canada coordinate the Canadian IBA program. The Scott Islands stretch 46 km in a northwesterly direction from Cape Scott, at the northwest tip of Vancouver Island, British Columbia. More than 2 million seabirds nest on the islands every year, including 55 % of the world's population of Cassin's Auklets, 7 % of the world's population of Rhinoceros Auklets, and 2 % of the world's population of Tufted Puffins. The islands are well protected by their remoteness, existing legislation and solid governmental and public support for their conservation. The three outermost islands (Beresford, Sartine and Triangle islands) are ecological reserves, managed by BC Parks, for which access is limited to research and requires a permit. The two innermost islands (Lanz and Cox islands) have been designated under the British Columbia *Park Act* as a Class A park. These five separate provincial protected areas comprise the Scott Islands.

Five threats have been identified for seabird populations of the Scott Islands: consequences of animal introductions, oil pollution, fisheries, disturbance, and climate change. Raccoon and Mink were intentionally introduced in the 1930s to Cox and Lanz islands and likely decimated nesting seabirds on those islands. These introduced animals take young seabirds prospecting for burrows and thus may still represent a drain on bird populations. The introduction of rats, cats or other introduced mammals to the ecological reserves would have disastrous consequences, as it has in seabird colonies elsewhere in British Columbia and around the world. Large oil spills kill seabirds directly, whereas low-volume chronic spills have sublethal effects, such as lowered reproductive performance. The possible lifting of the moratorium on offshore oil and gas exploration may result in increased risk of oil pollution, disturbance and reduction of food supply. The impact of fisheries on seabirds remains an unquantified phenomenon, but anecdotal information suggests that some of the bird species, which nest in the Scott Islands, are caught in gill-net fisheries, and may be indirectly affected by the effects on their prey from commercial fisheries. Disturbance to nesting seabirds from visitors and researchers can cause birds to abandon their nests, particularly if it occurs during the egg-incubation period. However, this is likely a minor problem, as the islands' remoteness limits the number of visitors, and researchers primarily focus their activities during the chick-rearing period. Climate change represents a potentially major threat to the seabird populations by changing the abundance and distribution of the food supply. This phenomenon however is largely unmanageable at the local scale.

This conservation plan outlines a series of action items necessary for the conservation of the bird populations of the Scott Islands. It focuses primarily on research, particularly on monitoring population trends and changes in reproductive performance, identifying feeding areas and prey items, and quantifying the threats to seabirds from fisheries and introduced predators on Cox and Lanz islands. The protection of the islands as secure breeding habitat can be accomplished by preventing the introduction of rats and other mammals, establishing

a response-system in case of their introduction, eradicating Mink and Raccoon from Cox and Lanz islands, and potentially securing feeding areas via the creation of a nearby Marine Protected Area (MPA). In addition, this conservation plan outlines an education program to sensitize the public on the need for conservation measures for the protection of seabirds.

The conservation of seabirds on the Scott Islands provides a number of opportunities, including an increased understanding of ocean ecosystems, limited local economic development, and partnerships between government agencies, First Nations, resource organizations and conservation groups concerned with the Scott Islands. The uniqueness and value for global biodiversity make the Scott Islands an extremely valuable natural resource for Canada, and for British Columbia in particular. Failure to protect the birds and their habitat would result in a significant decrease in the world's population of seabirds.

<b><u>Table of Contents</u></b>	
<b>0 Executive Summary</b>	<b>2</b>
<b>1 Introduction</b>	<b>5</b>
<b>2 The IBA Program</b>	<b>6</b>
<b>3 IBA Site Information</b>	<b>7</b>
3.1 Infrastructure	9
3.2 Marine Conditions	9
3.3 Climate	9
3.4 Areas of Importance for IBA Species Within the Site	10
3.5 Areas of Strategic Importance Outside of the IBA Site	10
<b>4 IBA Species Information</b>	<b>11</b>
4.1 IBA Species	11
4.2 IBA Species Accounts	13
<b>5 Other Elements of High Conservation Value</b>	<b>17</b>
<b>6 Human Context Information</b>	<b>18</b>
6.1 Land and Water Ownership	18
6.2 Land and Water Use	18
<b>7 Threats</b>	<b>20</b>
7.1 Oil Pollution	20
7.2 Climate Change	21
7.3 Fisheries	22
7.4 Consequences of Animal Introductions	22
7.5 Human Disturbance to Birds	23
<b>8 Conservation Management Achieved at the IBA Site</b>	<b>24</b>
8.1 Stakeholders	25
<b>9 Opportunities</b>	<b>27</b>
9.1 Marine Protected Areas	27
<b>10 Conservation Goals and Objectives</b>	<b>29</b>
10.1 Vision Statement	29
10.2 Goals and Objectives	29
<b>11 Evaluating Success</b>	<b>37</b>
11.1 Feasibility	37
11.2 Marine Protected Areas	37
11.3 Education Program	38
<b>Acknowledgements</b>	<b>38</b>
<b>Bibliography</b>	<b>39</b>
<b>Appendix 1: Summary Of The Most Recent Estimates Of Seabird Breeding Populations In The Scott Islands.<sup>1</sup></b>	<b>44</b>
<b>Appendix 2: Protocol For Preventing The Introduction Of Rats</b>	<b>45</b>
<b>Appendix 3: Laws And Policies Which Protect The Seabirds Of The Scott Islands</b>	<b>46</b>
<b>Appendix 4: Contacts</b>	<b>47</b>
<b>Appendix 5: Scott Islands Provincial Park – Draft Vision Statement</b>	<b>50</b>
<b>Appendix 6: SFU Core Research Program at Triangle Island, British Columbia.<sup>1</sup></b>	<b>51</b>
<b>Figure 1: Northwest Tip of Vancouver Island: Scott Islands And Cape Scott Provincial Parks.</b>	<b>8</b>
<b>Figure 2: Area of concentration of Cassin’s auklet foraging activity in 1999 and 2000</b>	<b>15</b>

## **1 Introduction**

Seabirds are loosely defined as those birds that obtain at least part of their food from the sea, by wading into it from shore or by traveling long distances over its surface; in addition, they typically breed on offshore islands or coastal areas (Furness and Monaghan 1987). Seabirds enrich human lives by their intrinsic aesthetic appeal and may serve as useful biological indicators of the health and productivity of the ocean. Managing seabirds successfully will prevent large-scale destruction of a uniquely rich group of marine animals, and contribute to maintaining the health of Canada's oceans. British Columbia has 30,000 km of shoreline and 450,000 km<sup>2</sup> of ocean and thus a large potential as seabird habitat (Zacharias and Howes 1998).

Between March and September, the Scott Islands at the northwest tip of Vancouver Island support an estimated 2.2 million breeding seabirds of 13 species. This is the densest congregation of breeding seabirds in the eastern North Pacific Ocean south of Alaska (Carl et al. 1951; Rodway et al. 1990, 1992) and makes the Scott Islands the most important breeding grounds for seabirds in British Columbia.

Historically, First Nations people used the Scott Islands and surrounding areas for fishing, hunting, and spiritual purposes. Today the region is primarily used for commercial fisheries, wildlife research, transportation, and some recreation. In spite of the natural significance of the area, continued over fishing, habitat destruction, exotic species introduction, climate change, and marine pollution are threatening the well being of the islands. In 1997, Environment Canada (Canadian Wildlife Service) nominated the Scott Islands as an Important Bird Area (IBA) site, and this conservation plan arose as a consequence of this successful nomination.

## 2 The IBA Program

The IBA program is an international initiative coordinated by BirdLife International, a global partnership of over 100 countries seeking to identify and protect sites important to the conservation of bird species worldwide. Through the protection of birds and habitats, IBAs also promote the conservation of the world's biodiversity. IBA programs are currently in place in Europe, Africa, the Middle East, Asia, and the Americas.

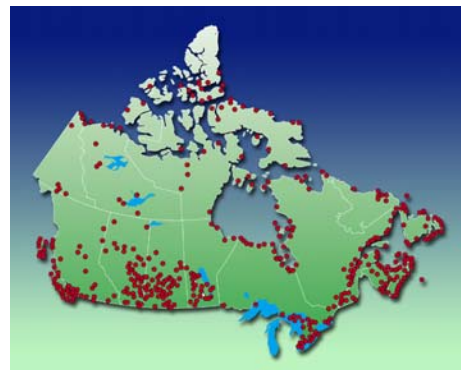
The Canadian BirdLife co-partners are the Canadian Nature Federation (CNF) and Bird Studies Canada (BSC). The Canadian IBA program forms part of the Americas IBA program, which includes the United States, Mexico, and 17 countries in Central and South America.

The goals of the Canadian IBA program are to:

- identify a network of sites that conserve the natural diversity of Canadian bird species and are critical to the long-term viability of naturally occurring bird populations;
- determine the type of protection or stewardship required for each site, and ensure the conservation of sites through partnerships of local stakeholders who develop and implement appropriate on-the-ground conservation plans; and
- establish ongoing local involvement in site protection and monitoring.

IBA sites are identified by the presence of birds falling under one or more of the following internationally agreed-upon categories:

1. Sites regularly holding significant numbers of an endangered, threatened, or vulnerable species,
2. Sites regularly holding an endemic species, or species with restricted-ranges,
3. Sites regularly holding an assemblage of species largely restricted to a particular biome.
4. Sites where birds congregate in significant numbers when breeding, in winter, or during migration.



Important Bird Areas in Canada

### 3 IBA Site Information

**Name:** Scott Islands Important Bird Area

**IBA site number:** CABC006G

**Central Coordinates (Lat/Lon):** 50°47'N, 128°46'W

**Altitude (m):** sea level to 312m

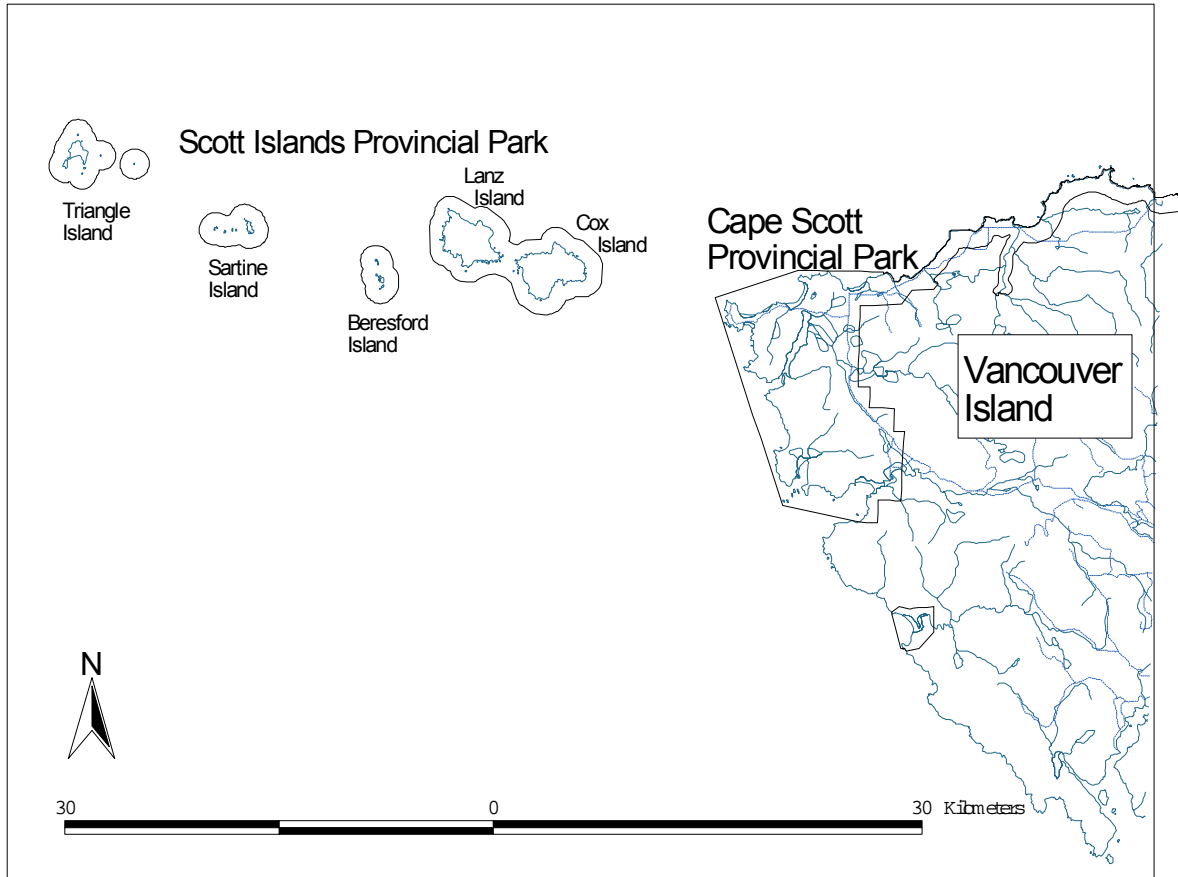
**NTS Sheet or other site map:** 103I 14/15

**Area:** 144,000 ha (includes marine area)

The Scott Islands are a group of five major islands extending 10 to 46 km offshore of Cape Scott at the northwestern tip of Vancouver Island, British Columbia. The five islands are aligned in a northwesterly direction, and from east to west are: Cox, Lanz, Beresford, Sartine and Triangle (see Figure 1). Coniferous woods with coastal cliffs and rocky shores cover the two easternmost islands, whereas the three outermost islands and their accompanying rock stacks and islets have few or no trees. The islands are remote and in pristine condition. The nearest towns are Holberg (pop. ~150), Coal Harbour (pop. ~500), Port Alice (pop. ~1500), Port McNeil (pop. 3,024), and Port Hardy (pop. 5,500) on Vancouver Island, whose economies depend largely on forestry, fishing and tourism.

Cox Island (978 ha) has a rugged, rocky shoreline and rises to an elevation of 312 m. A forest of Sitka Spruce *Picea sitchensis*, Western Hemlock *Tsuga heterophylla* and Western Redcedar *Thuja plicata* covers 90% of the island, with a thick understory of Salal *Gaultheria shallon* and Salmonberry *Rubus spectabilis*. Grasses and forbes fringe forest slopes, especially above steep rock faces, but there are no extensive grassy areas. Much of the forest behind the north bay appears diseased.

Lanz Island (764 ha) is similar to Cox Island, but is slightly smaller, rising to a maximum elevation of 212 m. The forest is similar to Cox Island; Sitka Spruce, Western Hemlock and Western Red cedar trees cover an understory of Salal and Salmonberry. Twinberry *Lonicera involucrata*, Elderberry *Sambucus racemosa*, and willows are common along the shore. Grass, primarily *Calamagrostis nutkaensis*, and forbs grow along much of the forest fringe. The trees on the higher slopes appear diseased.



**Figure 1:** Northwest tip of Vancouver Island: Scott Islands and Cape Scott Provincial Parks.

Beresford Island (14.5 ha), the smallest of the Scott Islands, is a dome-shaped island, of which only about a third is covered by vegetation. The island has steep rocky sides and attached rocks and pinnacles. The crest of the island supports a sparse stand of old Sitka Spruce above slopes of grass and areas of dense shrubbery.

Sartine Island (28 ha) is a windswept, treeless island with steep rocky sides, rising to a maximum elevation of 113m. Several species of grasses and herbaceous plants cover 60% of the landmass. In addition, Sartine Island has three associated islets, Little Sartine, First Sealion Rocks, and Second Sealion Rocks, as named by Vermeer et al. (1976).

Triangle Island (144 ha), the outermost of the Scott Island chain, rises to a maximum elevation of 194 m. Vegetation covers about 75% of the island. A mantle of salmonberry, mixed with stunted wild crabapple *Pyrus fusca* and several other shrubs in sporadic pockets, cover the more gently sloping crown of the island. Grasses cover the steep perimeter slopes of the island and mix with salmonberry on the precipitous slopes. Off the western point and joined to it at low tide is a secondary island (Puffin Rock), about 600 m in length, rising to a height of 100 m above the sea.



### **3.1 Infrastructure**

The Scott Islands contain little infrastructure. Triangle Island has an abandoned lighthouse and communications facility, which was operational between 1910 and 1921. Only the rusted rails of an inclined railway, the concrete foundations of the buildings, and the concrete shell of the lighthouse remain on top of the island. In 1994, a research cabin was constructed in South Bay, replacing a trailer, which had been there since 1974. This research cabin is currently authorized by BC Parks under the British Columbia *Ecological Reserve Act*, and is being used between March and August by the Canadian Wildlife Service and Simon Fraser University for research on seabird ecology and demography. Sartine Island contains an automatic weather station, established on top of main section of island in 1984 and operated by Environment Canada. Both Cox and Lanz islands house rotted wooden cabins previously used by trappers, and the wreck of an old Riv-Tow barge lies in the large south bay of Cox Island.

### **3.2 Marine Conditions**

The marine areas around the Scott Islands include the open Pacific Ocean (BC Land Use Coordination Office (LUCO), unpub. data; Zacharias et al. 1998). They have a high wave exposure, and waves can travel without obstruction for distances greater than 500 km. Currents within 50 km of the islands do not generally exceed 3 knots, except for the area within 5 km of Cox and Lanz islands, where maximum currents exceed 3 knots. The waters within 15 km of the islands have a depth no greater than 200 m. Beyond this distance and running parallel to the general direction of the islands lies the continental shelf, after which the depth of the water drops to distances greater than 1000 m. The ocean bottom around the islands has low relief and undulates gently, except for the ocean bottom within 3 km of Triangle, Sartine and Beresford Islands, which has abundant cover and diversity of habitats. The seabed substrate within 3 km of the islands is primarily composed of bedrock, boulders, and cobble, with some sand/gravel areas. Beyond this distance, the substrate is composed of sand and/or gravel with some muddy areas with the exception of Cook Bank, some 30 km directly north of the islands. This area is roughly rectangular (6 km wide and 24 km long) and has a hard substrate, similar to the ocean bottom directly surrounding the islands. The seabed substrate beyond the continental shelf is unknown.

### **3.3 Climate**

The islands lie in the southern very wet hypermaritime variant of the Coastal Western Hemlock biogeoclimatic zone (CWHvh1) (Green and Klinka 1994). Climate is cool with very little snowfall. The Pacific Ocean moderates temperatures, and fog, cloud, and drizzle are common throughout the year.

### **3.4 Areas of Importance for IBA Species Within the Site**

Virtually all seabird nesting activity occurs on Triangle, Sartine, and Beresford islands, the three outermost islands in the group. The two larger islands, Lanz and Cox islands, do not have large populations of seabirds, likely due to the presence of introduced predators. Lanz and Cox islands have suitable habitat for nesting birds and could potentially become important breeding areas if introduced predators are removed. The marine areas surrounding the islands provide the food base for these birds.

### **3.5 Areas of Strategic Importance Outside of the IBA Site**

The Cape Scott Provincial Park, which covers 22,220 ha (17,348 ha upland, and 4,871 ha of foreshore) of the northwest corner of Vancouver Island (Figure 1), was established in 1973 to protect, exhibit and interpret an example of the natural features and processes of the Nahwitti Lowland Natural Region. In 1995, the Nahwitti-Shushartie section was identified during the Vancouver Island Land Use Planning and was added to Cape Scott Provincial Park. Education programs at Cape Scott could provide an opportunity to inform visitors of the importance of the Scott Islands as breeding habitat for seabirds. The park is currently being managed for recreation and conservation by BC Parks (BC Parks 1998).

The marine environment around the islands provides the food supply for seabird populations. Because seabirds can travel great distances in short amounts of time, foraging areas are far away from breeding sites. In addition, the condition of wintering sites will affect seabird populations breeding in the Scott Islands. The location of these wintering sites is largely unknown.

## 4 IBA Species Information

### 4.1 IBA Species

Twelve IBA species in the Scott Islands Important Bird Area fall under the Canadian IBA Criteria, Category 4: Congregatory Species, which identifies species that concentrate in significant numbers (> 1% of their global, biogeographical, or national population) at an IBA site (Table 1). Three species occur in globally significant numbers (i.e., greater than 1% of the world's population, actual percents in Table 1): Cassin's Auklet, Rhinoceros Auklet and Tufted Puffin (Can. IBA Database 1998). Other seabirds present in nationally significant numbers (i.e., greater than 1% of the national population) include: Common Murre, Brandt's Cormorant, Pelagic Cormorant, Pigeon Guillemot, Glaucous-winged Gull, Black Oystercatcher, Leach's Storm-Petrel; and Fork-tailed Storm-Petrel.



*Pigeon Guillemots*

**Table 1:** IBA species in the Scott Islands and their occurrence at the global or national level

Common Name ( <i>scientific name</i> )	IBA Category	Numbers breeding (pairs) <sup>1</sup>	Percent of Global Population <sup>2</sup>	Percent of National Population <sup>2</sup>
Cassin's Auklet <i>Ptychoramphus aleuticus</i>	4	990,000	55	73
Rhinoceros Auklet <i>Cerohinca monocerata</i>	4	41,700	7	12
Tufted Puffin <i>Fratercula cirrhata</i>	4	34,900	2	90
Common Murre <i>Uria aalge</i>	4	4,100	-	95 <sup>w</sup>
Brandt's Cormorant <i>Phalacrocorax penicillatus</i>	4	39	-	40
Pelagic Cormorant <i>Phalacrocorax pelagicus</i>	4	741	-	17.5
Pigeon Guillemot <i>Cepphus columba</i>	4	310	-	6
Glaucous-winged Gull <i>Larus glaucescens</i>	4	1,077	-	4
Black Oystercatcher <i>Haematopus bachmani</i>	4	29	-	3
Leach's Storm-Petrel <i>Oceanodroma leucorhoa</i>	4	12,700	-	2.3 <sup>w</sup>
Fork-tailed Storm-Petrel <i>Oceanodroma furcata</i>	4	3,000	-	1.5
Thick-billed Murre <i>Uria lomvia</i>	4	7	-	100 <sup>w</sup>
Horned Puffin <i>Fratercula corniculata</i>	4	11 <sup>t</sup>	-	~30 <sup>w</sup>
Peregrine Falcons <i>Falco peregrinus (Pealei)</i>	1	~13	-	N/a

<sup>1</sup> Numbers from Rodway et al. (1990,1992), break-down by island in Appendix 1.

<sup>2</sup> Percents from the Canadian IBA database (1998)

<sup>w</sup> from western Canada only

<sup>t</sup> based on total counts of birds

## 4.2 IBA Species Accounts

### *Alcids*

Seven species of alcids, or auks, nest in the Scott Islands: Cassin's Auklet, Rhinoceros Auklet, Tufted Puffin, Common Murre, Pigeon Guillemot, Thick-billed Murre and Horned Puffin. These closely related species all dive for their food and share similar traits, although the specific environmental requirements vary among species (Campbell et al. 1990b). All lay one large, robust egg (except the Pigeon Guillemot, which lays two), which is incubated by both parents for 30-40 days. The exact incubation period varies by species and individual, but generally occurs between late March and early July. During this time, the breeding birds are most vulnerable to disturbance, since they can easily abandon the nest. After the eggs hatch, abandonment is less likely, and parents rear chicks until they fledge some 30-50 days later. Tufted Puffins and auklets nest in long burrows dug into the turf, whereas murrens choose ledges on sheer rock cliffs. Pigeon Guillemots nest singly in rock crevices or under large pieces of driftwood on rocky beaches. Horned Puffins nest in rock crevices. The larger alcids feed on fish obtained from the open ocean, particularly Pacific Sandlance *Ammodytes hexapterus* and juvenile rockfish *Sebastes* spp., whereas the smaller Cassin's Auklets feed predominantly on small oil-rich crustaceans, such as euphausiids and copepods. By late summer, the auks have finished breeding and spend the winter in the open ocean, hundreds of kilometres from shore. Cassin's Auklets and Rhinoceros Auklets winter as far south as the coast of California, but many congregate in the mouth of the Strait of Juan de Fuca.



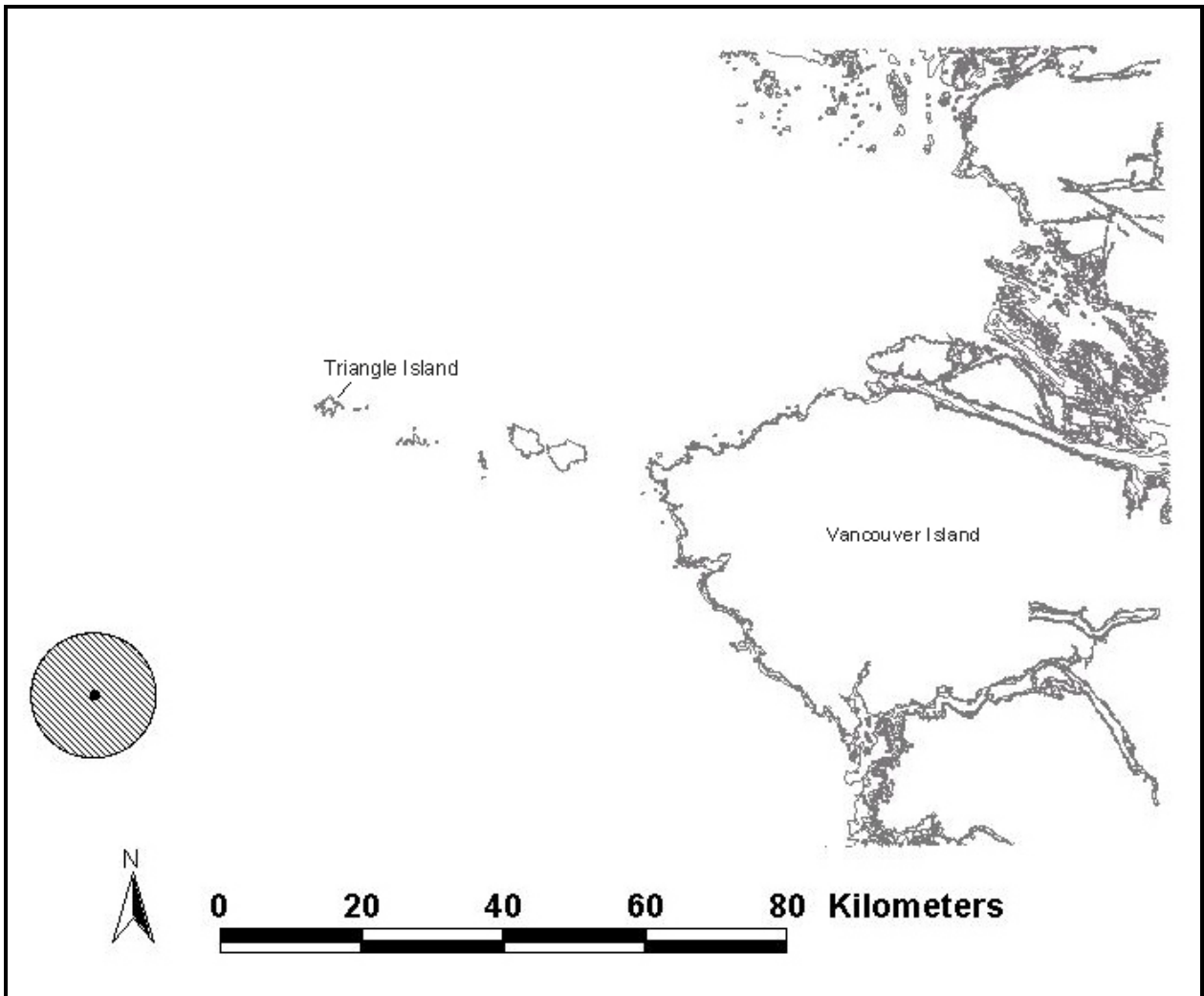
*Immature Cassin's Auklet*

The Scott Islands were last surveyed in 1989, and estimates of population sizes were obtained for all present species of seabirds (Appendix 1). However, data on population trends exist only for Cassin's Auklets, Rhinoceros Auklets, Tufted Puffins and Common

Murres on Triangle Island. More data are necessary to make rigorous conclusions, but it appears that the populations of Cassin's Auklets are declining due to a combination of low survival rates and reduced burrow occupancy (Bertram et al. 2000; M. Lemon, unpub. data). Large-scale oceanographic changes have occurred in the North Pacific Ocean in the past 20 years, which may be reducing the food supply available to these birds. Other populations show no evidence of declines, and the population of Common Murres appear to be increasing.

Recent studies by research staff on Triangle Island have provided new information on the foraging range of the Cassin's Auklet and Rhinoceros Auklet, two of the most highly concentrated species utilizing the island. Attachment of radio transmitters to individual Cassin's Auklets and subsequent aerial surveys in 1999 and 2000 has provided data on at-sea distribution during the sensitive chick-rearing period when adults are provisioning nestlings. Results from 1999 indicated that birds were concentrated at distances 45-75 km southwest of Triangle island, approximately 35-50 km beyond the continental shelf break in waters greater than 1000m in depth (Boyd et al. 2000). Additional data from 2000 provided similar results, with most birds located 30 to 60 km southwest of the island, once again in deep waters off of the shelf break (Ryder et al. 2001). These distributions compare closely to reports of high abundance of preferred prey items for these birds in both years. It appears that this area may provide a reasonably predictable prey source for birds from year to year. A recent Rhinoceros Auklet radio-telemetry study being conducted by research staff in 2002 found the majority of birds foraging in an area 60km north/northwest of Triangle Island (unpub.).

Figure 2 depicts the foraging range of the Cassin's Auklet over these two years. Analyses of data indicate a high degree of overlap in distribution between years, in a southwesterly direction from the outermost island, Triangle, with an average shift in the center of activity of only 12.5 km. Home range analyses estimated 50% of individuals were found within a small core area encompassing 83,417 ha. The overlap in area of core activity in this region between years was 25,401 ha. (Ryder et al., unpub.).



**Figure 2:** Area of concentration of Cassin's auklet foraging activity in 1999 and 2000, approximately 40km SW of Triangle Island. Solid point indicates a geographical reference of 129°32'43"W 50°29'33"N. Shaded circle approximates an area of 25 400 ha, representing the core area of distribution overlap across years.

### *Glaucous-winged Gull*

This common gull breeds along coastal waters all over British Columbia, predominantly on small, off-shore islands (Campbell et al. 1990b). The populations on the Scott Islands are likely a mix of resident and migratory birds, with mostly immature individuals shifting southward along the coast in the winter. Clutch size is usually 3 eggs, which are incubated for about 27 days. Fledging period, the time from egg hatch to when the chicks can live independently from parents, lasts an average of 44 days. Glaucous-winged gulls can often be seen congregating with other marine birds over schools of sandlance and Pacific herring. The colonies of the Scott Islands were last surveyed in 1989 (Rodway et al. 1990), and populations are likely stable or increasing in size, as they are all over British Columbia (Campbell et al. 1990b).

### *Storm-petrels*

Fork-tailed and Leach's Storm-petrels are small swallow-like seabirds found primarily on the extreme outer coast of British Columbia (Campbell et al. 1990b; Ehrlich et al. 1988). Storm-petrels breed in the Scott Islands from March to October, and nest in burrows excavated into soft soil of grassy areas. They lay one small fragile egg, which is incubated for 37-67 days (Fork-tailed) or 38-46 days (Leach's). Young are reared for an average of 62 days (Fork-tailed) or 40 days (Leach's), and then leave for the sea. In the winter, these birds are highly pelagic, and may be found as far away as Japan, Hawaii, and California. Little is known about the foraging habits of these birds in British Columbia, but they are known to feed on small fish, oil and animal detritus picked from ocean surface (Ehrlich et al. 1988). No population size or trend data exist for the Scott Islands other than the surveys done in 1989 (Rodway et al. 1990).

### *Black Oystercatcher*

Black Oystercatchers are large black shorebirds with conspicuous red bills and pink legs, which may reside year-round in the islands (Andres and Falxa 1995). They nest just above the high tide lines on beaches, laying 3 highly camouflaged eggs, which are incubated for 26-28 days. The young can move around soon after hatching. The chicks can fly within 35 days, but are dependent on parents for food (mostly intertidal invertebrates such as mussels and limpets) for an extended period of time (Hazlitt 1999). No population size or trend data exist for the Scott Islands other than the surveys done in 1989 (Rodway et al. 1990).

### *Cormorants*

These large dark fish-eating birds breed all along the Pacific coast of North America, from northern Alaska to California (Campbell et al. 1990a). They breed in the Scott Islands from March to August, nesting on bare rock islets or cliffs, along with Glaucous-winged Gulls. Clutch sizes range from 1 to 8 eggs, which are incubated for 28-32 days. Young fledge after 40-42 days for Brandt's Cormorant, and the fledgling/nestling period is unknown for the Pelagic Cormorant. No population size or trend data exist for the Scott Islands other than the surveys done in 1989 (Rodway et al. 1990).

### *Peregrine Falcon*

The Islands support several breeding pairs of Peregrine Falcons, a species considered nationally vulnerable. Peregrine Falcons breed along the outer and inner coasts but populations are usually localised in the vicinity of colonial nesting seabirds (Campbell et al. 1990b). Falcons nest on vertical rocky cliffs, with clutches of 1-5 eggs. Incubation period last 32-34 days, and chicks fledge 41-43 days after hatching. Cassin's Auklets are the major prey item of falcons on Triangle Island. Populations are likely stable, although no data exist for population size or trends except for anecdotal counts in Rodway et al. (1990).



*Peregrine Falcon*



## 5 Other Elements Of High Conservation Value

The Scott Islands contain the only known nesting site of Thick-billed Murres in western Canada (Vallée and Cannings 1983; Rodway 1991), and house a small nesting population of Horned Puffins, which represents the southern limit of this species. Bald Eagles *Haliaeetus leucocephalus* nest throughout the islands (Carl et al. 1951) and the marine environment surrounding the islands provides an important feeding area for the breeding seabirds as well as other non-breeding seabirds such as Sooty Shearwaters *Puffinus griseus*. Large flocks of migrating and wintering seaducks such as White-winged Scoters *Melanita fusca* also use the surrounding marine areas.

In addition to nesting seabirds, the islands provide breeding sites for Northern Sea Lions (also known as Steller's Sea Lions) *Eumetopias jubatus* and Harbour Seals *Phoca vitulina* on Triangle, Sartine and Beresford islands. Harbour Seals likely breed on Lanz and Cox islands as well. The islands have two endemic species of small mammals, namely Keen's Mouse *Peromyscus keeni* (formerly Deer Mouse *P. maniculatus trianguralis*) and Meadow Vole *Microtus pennsylvanicus* (Carl et al. 1951). Both species exhibit evidence of gigantism, which may have resulted from longer life, abundant food supply in summer, absence of predation, and possible absence of parasitic or non-parasitic diseases (Carl et al. 1951). The Triangle Island Vole *Microtus townsendii cowanii* is recognized as a provincial "red list" subspecies. The provincial Red List includes any indigenous species or subspecies considered to be Extirpated, Endangered, or Threatened in British Columbia. In addition, all the Scott Islands are visited by River Otter *Lutra canadensis*, which breed, on Cox and Lanz islands and occasionally by Sea Otter *Enhydra lutris* (L. Blight, pers. comm.).

The Scott Islands are an important groundfish area, and squid spawning occurs along the shorelines. Geoduck *Panope abrupta* and red sea urchin *Strongylocentrotus franciscanus* beds occur around Cox and Lanz islands (BC Parks 1998).

## **6 Human Context Information**

### **6.1 Land and Water Ownership**

The islands themselves and the ocean bottom to within 1 km of the shoreline of each island are Provincial Crown land, and under the jurisdiction of the province of British Columbia. They are administered by BC Parks of the Ministry of the Water, Land and Air Protection, as enabled by the *British Columbia Ecological Reserves Act* and *Park Act*. Cape Scott Provincial Park is also provincial Crown land, and is administered by BC Parks, Strathcona District. The Department of Fisheries and Oceans (DFO) manage the fisheries within the provincial protected areas, as well as the seabird foraging areas outside these areas.

First Nations have a strong cultural connection to the Scott Islands and surrounding areas. Historically, the islands were the traditional territory of the Yutlinuk, Tlatlasikwala, Nakumgilisala and the Kwakwakawakw people. According to an unpublished report, the Yutlinuk were known to have used the area for gathering seabird eggs, and archaeological evidence suggests that the Kwakwakawakw people extensively used Triangle Island for fishing, hunting and cultural purposes. Today there are two First Nations that have territorial claims to the Scott Islands, the people of the Quatsino and the Tlatlasikwala First Nations, collectively known as the Nahwitti. The Quatsino territory covers the northwest portion of Vancouver Island from the north side of Brooks Peninsula to Cape Scott, including Holberg Inlet and Alice Lake. The Tlatlasikwalas territory includes the Scott Islands, Cape Scott and the Nigei Island group. In addition, the territorial claims of the Owekeeno, the Heiltsuk and the Kwakiutl First Nations extends into the Scott Islands study area. Today, the First Nations primarily use the area for commercial fishing, and while some of their reserves are within the Cape Scott area, they are mainly uninhabited.

A variety of petroleum companies hold rights to exploration licenses in the offshore areas of the northern BC mainland and Queen Charlotte Islands regions. Although the moratorium on offshore exploration is ongoing, leases continue to be renewed.

### **6.2 Land and Water Use**

The Scott Islands and surrounding ocean are primarily used for four purposes: wildlife conservation/research, fisheries, recreation/tourism, and transport. Triangle Island has been a site for ecological studies of seabirds sponsored by the Canadian Wildlife Service (CWS) for many years beginning in the mid 1970s. It is now the site of a research station sponsored by the National Science and Engineering Research Council (NSERC)/CWS Wildlife Ecology Chair, a cooperative research venture between government and academia that began in 1993 at Simon Fraser University (SFU). Environment Canada operates an automatic marine weather station on Sartine Island.

Little or no sport fishing takes place around the Scott Islands. A number of commercial fisheries occur, including hook and line fisheries for rockfish, halibut and other groundfish, a trawl fishery for groundfish, and a limited salmon troll between June and July (Cam

Blacklock, Fisheries Officer, DFO, Port Hardy office, pers. comm.).

It is illegal to visit Triangle, Sartine, or Beresford Islands unless authorized by permit under the provincial Ecological Reserves Act. No permits are issued unless they are consistent with the purpose of the Ecological Reserves and contribute to the protection of the areas natural values. Triangle Island is reported to receive 5-10 visitors each summer, primarily fishermen and recreational boaters who wish to explore the lighthouse and walk on the beach (J. Ryder, pers. comm.). An estimated 10-30 visitors, primarily fishermen and kayakers, land on Cox and Lanz islands yearly (BC Parks 1998). While the use of these islands is regulated under the provincial Park Act, unlike the Ecological Reserves, use of the park land does not have any special restrictions. The park islands do provide temporary anchorage in poor weather. In addition, log booms, transport ships, cruise ships and oil ships move through the area.

## 7 Threats

Five threats have been identified for the Scott Islands Important Bird Area. Four of these threats (oil pollution, climate change, fisheries, and consequences of animal introductions) rank Medium and one ranks Low (disturbance to birds) according to the prioritization scheme of BirdLife International.

### 7.1 Oil Pollution

The annual shipment of crude oil and refined petroleum products (RPPs) along the west coast of Vancouver Island presents a serious threat to the breeding seabirds of the Scott Islands, both through chronic low-level oiling of ocean waters and through less frequent major oil spills (Vermeer and Vermeer 1975, Burger 1992). Oil can kill birds by removing the insulative property of their feathers (causing hypothermia) and through toxicological effects after ingestion. In addition, oiling can have sublethal effects, such as reduced reproductive performance, developmental effects on the young, and the induction of Heinz-body haemolytic anaemia (Nisbet 1994). Among northern seabirds, alcids are the most vulnerable to oiling, especially the Common Murre (Piatt et al. 1990). Alcids dive for their food so that when they break surface in an oil slick, they become covered in oil.

Over 300 tankers and 50 barges bearing over 26 million m<sup>3</sup> (160 million barrels) of crude oil pass within 110 km (55 nautical miles) of Triangle Island and down Vancouver Island to enter the Strait of Juan de Fuca each year, and many more pass farther offshore en route to the southern states (Burger 1992). Approximately 20% of the tankers used in this trade, which involves rough winter travel conditions, are classified by the Tanker Advisory Center of New York as “poor” or “fair,” below the average for the U.S. fleet (Anderson 1989). In addition, an average of 2.3 million m<sup>3</sup> (14 million barrels) of RPPs are shipped along the west coast of Vancouver Island, primarily carried in barges (Burger 1992). Bunker and heavy oils constitute 10% of volume of RPPs, and the risk of spills from barges and small tankers making deliveries to coastal depots is high. The greatest risk for the Scott Islands likely comes from a barge that travels from refineries in the US and delivers 10,000 tonnes of Bunker C oil to the pulp mill in Port Alice (W. duTrizac, pers. comm.). Port Alice, a mill town at the end of Neroutsos Inlet, is more than 100 km by boat from Cape Scott. Spills could occur if this barge collided with other vessels or had mechanical trouble. However, once at the site, the barge is pre-boomed before transfer, and oil containment equipment (skimmer, Vac-truck, and 2200 feet of booms) is ready for use, and thus has a reduced risk of oil spills.

Burger (1992) estimates that spills exceeding 1000 barrels are likely to affect the west coast of Vancouver Island every 4-5 years. Each individual section, however, has much more reduced probability of being affected by an oil spill (e.g., Burger (1992) reports that 74 km of southwest Vancouver Island faces a risk of a spill exceeding 1000 barrels once every 40 years). The areas on the coast of Vancouver Island at highest risk of oil spills include the Juan de Fuca Strait and Puget Sound due to poor navigational conditions, presence of reefs

and islands, irregular currents and tidal streams, and complex traffic patterns (Vermeer and Vermeer 1975). The Coast Guard currently has regional response plans for the entire coast of British Columbia, including the Scott Islands (Port Hardy area). These plans detail inventories of available equipment in the area, contacts of appropriate management agencies, and protocols for clean-up. The regional plan was partly tested in February 1999, when two freighters lost power and began drifting towards the Scott Islands. Together, these vessels contained a total of almost 3000 metric tonnes of intermediate fuel and distillate and 100 tonnes of hazardous materials. Environment Canada activated the Regional Environmental Emergency Team (REET), circulated trajectory analysis from DFO/IOS and along with Coast Guard, stepped up preparedness for environmental response. The outcome of the incident could have had disastrous consequences if the vessels had not been rescued in time and had run aground on Triangle Island. Fortunately, the M.V. *Elizabeth* was able to regain power, while a rescue tug reached the M.V. *Caria* and towed it to shelter. This incident provides strong evidence of the ongoing threat from possible spills.

A moratorium on offshore oil and gas exploration in coastal waters of British Columbia may soon be lifted due to political pressures to revive the flailing economy of the north coast. Offshore drilling presents a number of threats for seabirds, including increased risk of oil spills, fatal light attraction to oil rigs, gas flares, toxic materials released from drilling operations, and increased marine traffic (G. Kaiser, pers. comm.). Cook Bank and adjacent shelf regions have oil and gas leases on them as well as potential for seabed mining of titaniferous sands in the area. Mining results in disruption of ocean substrates, and may have negative effects on ocean food webs. The maintenance of the moratorium or a conservation designation would be necessary to protect this area.

## **7.2 Climate Change**

Large-scale oceanographic changes are taking place in the Pacific Ocean that have repercussions for marine trophic webs. The B.C. coast has experienced its warmest decade this century during the 1990s. Recent studies have shown that during this time, the Triangle Island population of Cassin's Auklet has declined substantially (Bertram et al. 2000). In the California Current, production of zooplankton has declined significantly in recent years (Roemmich and McGowan 1995), a trend which has been linked to decreased seabird abundance (Ainley et al. 1996).

Although populations of the fish eating Rhinoceros Auklet and Tufted Puffin have been stable during the 1990s, the timing of their breeding season was significantly earlier. Nestling growth rates for all three species show poor performance during the 1990s. The poor nestling growth rate for Cassin's Auklet has been attributed to a mismatch between the timing of zooplankton availability and the timing of breeding (Bertram, Mackas, and McKinnell 2001). The reasons for the decline in nestling growth rate for the Rhinoceros Auklet are less clear.

### 7.3 Fisheries

Fishing activities by humans can affect seabirds either directly, through death and drowning, or indirectly, through effects on prey of marine birds (Duffy and Schneider 1994). The inadvertent take of seabirds in fisheries remains an enigma for British Columbia, although recent evidence suggests that some by-catch of alcids occurs in net fisheries. Test gill-net fisheries for salmon in Johnstone Strait and on the southwest coast of Vancouver Island have captured Common Murres and Rhinoceros Auklets (DFO, unpub. data). Only one published study exists for the west coast of Vancouver Island (Carter and Sealy 1984), where Common Murres, Rhinoceros Auklets and up to 7.6% of the fall population of Marbled Murrelets were killed in the local gill-net fishery for sockeye salmon *Oncorhynchus nerka*. Evidence also suggests that commercial fisheries have an indirect impact on seabirds. According to an Environmental Assessment written by the Pacific Fisheries Management Council in 1999, fisheries affect seabirds indirectly by resulting in competition for prey, a dependency on fishery waste, an increase in gull populations that prey on alcids, and marine pollution. Thus, more research is needed to determine the extent to which fishing presents a threat to the seabird populations of the Scott Islands.

### 7.4 Consequences of Animal Introductions

During the late 1930's, Mink *Mustela vison* were introduced to Lanz Island, and Raccoon *Procyon lotor* to Cox Island, for the fur industry. These animals were trapped until the late 1960s, and the trap lines are now canceled (K. Morrison, BC Ministry of Environment, Lands and Parks, pers. comm.). Mink have since spread to Cox Island as well (Rodway et al. 1990). Introductions of Mink and Raccoon to islands in British Columbia and elsewhere in the world have had disastrous results for breeding seabirds (Moors and Atkinson 1984, Hartmann et al. 1997), and presumably resulted in the decimation of Cassin's Auklets and Rhinoceros Auklets which may have previously nested on those islands (Carl et al. 1951; Bailey and Kaiser 1993). In 1987, Rodway et al. (1990) noted that Mink had killed small numbers of Cassin's Auklets that were apparently prospecting old burrows on the west side of Lanz Island. Thus, these predators may affect seabird populations of the other islands. The spread of these introduced predators to the outer three islands has not occurred, and will likely not occur due to long distance between the outer islands and the inner two islands.



The feral European rabbits *Oryctolagus cuniculus* introduced to Triangle Island by the lighthouse-keepers apparently have not affected the breeding seabirds (Rodway et al. 1990; Bailey and Kaiser 1993). However, introduced rabbits have dramatically altered plant communities on islands all over the world, and may have subtle effects by causing burrow instability and promoting the growth of herbivore resistant plants (Chapius et al. 1994; J. Ryder, pers. comm).

The possible introduction of rats *Rattus* spp. to the outer three islands could have disastrous consequences for breeding birds, as it has throughout the world and in British Columbia (Moors and Atkinson 1984, Bailey and Kaiser 1993). Currently, all supplies for the research team on Triangle Island are visually checked according to protocol (Appendix 2) prior to delivery to the island. Rats might also be introduced to the islands via shipwrecks. In addition, domestic cats are periodically left on the islands by fishers.

### 7.5 Human Disturbance to Birds

The intense concentration of breeding seabirds and sea lions makes the colonies highly vulnerable to any form of human visitation. Boats, aircraft, or people that approach too closely easily disturbs nesting birds and sea lion rookeries. For seabirds, most damage is done during the incubation period, when birds are most prone to abandon their eggs. In addition, biologists conducting surveys and research on seabird colonies may trample some burrows and cause desertion (Gaston et al. 1988).

Researcher disturbance on Triangle Island is likely minimal. The research techniques used have been cleared by the Animal Care Committee of SFU. Accidentally trampled burrows are repaired immediately using cedar shingles. The frequency of visits to the burrow is highest during chick rearing period, when abandonment by the parents is least likely. Ladders placed on the colony and use of established trails prevents soil erosion previously caused by researchers walking on the slopes of Triangle Island.

Visitor disturbance on Triangle Island is also likely minimal. Unauthorized visitors mostly restrict their exploration to the beaches, where they do not come into contact with seabird nests, with the exception of those of Black Oystercatchers. SFU researchers talk to visitors and inform them that the island is an ecological reserve, and walking on the slopes requires a permit from BC Parks. In addition, SFU researchers keep records of boats anchoring near South Bay and submit yearly reports to BC Parks for maintenance of research permits. Sartine and Beresford islands likely are protected by their steep slopes and lack safe landing sites, which restrict access.

The Coast Guard infrequently uses the saddle of Puffin Rock on Triangle Island as the site of coordination for search and rescue operations because it provides a secure landing area for helicopters and a clear line of sight for visual and radio communications. This area holds dense breeding concentrations of Cassin's Auklets, Common Murres, Pelagic Cormorants and Tufted Puffins, and the use of this area could potentially lead to reduced reproductive performance by these species (Vermeer 1978).



*Tufted Puffin*

## 8 Conservation Management Achieved at the IBA Site

Remoteness and difficult ocean conditions limit visitation to the Scott Islands, and generally provide a relative degree of protection since the islands can only be accessed by boat or aircraft. Enforcement of any legislation is costly and possibly technically unfeasible in the open ocean. Management is primarily dependent on fostering good relations and encouraging self-policing by users of the area.

The outer three islands (Triangle, Beresford, and Sartine) were designated as separate Ecological Reserves in 1971. In 1982, Triangle Island Ecological Reserve was renamed Anee Vallée Ecological Reserve in honour of a graduate student who died while studying puffins on the island. Access to these ecological reserves is restricted to scientific research and monitoring and requires a permit. Lanz and Cox Islands Provincial Park was identified for protection in the Vancouver Island Land-Use Plan and was designated under the provincial Park Act in 1995. The boundaries of these three Ecological Reserves and one provincial park include the seabed extending one kilometre from each of the islands. Under the draft federal – provincial Marine Protected Areas Strategy, each of these provincial designations constitute a marine protected area.

The seabirds and their habitats in the Scott Islands are protected by a series of laws and treaties at the provincial, federal and international levels of government (Harrison et al. 1992; Appendix 3). These include the *Ecological Reserves Act*, *Park Act*, and *Wildlife Act* at the provincial level. Access to the three ecological reserves is restricted to scientific research and monitoring and requires a permit from BC Parks of the Ministry of Water, Land and Air Protection. The birds themselves are the responsibility of the federal government under the *Migratory Birds Convention Act*. In addition, the birds receive some protection from the federal government via the *Environmental Protection Act* and the *Fisheries Act*. Seabirds are considered in the International Convention for High Seas Fisheries of the North Pacific, the Law of the Sea Convention and International Convention on Biodiversity.

BC Parks is currently drafting a management plan for the Scott Islands (K. Kennett, pers. comm.). After a public consultation process, BC Parks has developed a draft vision statement, which seeks to protect the islands' natural and cultural heritage values (Appendix 5). This IBA conservation plan must be consistent with and complement the British Columbia authority for the management of the designated protected areas. In addition to protecting the Scott Islands as secure breeding habitat for seabirds, steps taken to protect the birds in their wintering habitat would minimize winter mortality. Significant losses of birds during winter could offset any conservation gains realized in implementing this plan. The need to protect seabirds in their wintering habitat will be explored in the North American Colonial Waterbird Conservation Plan (NACWCP), which is currently being developed.

The Scott Islands and adjacent area are currently being considered by the Canadian Wildlife Service for designation as a Marine Protected Area under the *Canada Wildlife Act* as a way of complementing the existing level of protection provided under provincial law, and



enhancing the level of protection to the seabirds of the area. The exact boundaries and logistics of this designation remain undetermined. Minimum protection standards for any type of marine protected area, as defined under the draft federal-provincial Marine Protected Areas Strategy include the prohibition of ocean dumping, dredging, and the exploration for, or development of, non-renewable resources (MPA discussion paper 1998). However, some sites may receive increased protection depending on the particular MPA protection objectives.

## **8.1 Stakeholders**

*BC Ministry of Environment, Lands and Parks, Parks Division (BC Parks):* This provincial government agency has legislated responsibility for the islands and can be considered the primary delivery agency for conservation management initiatives. Any on-site activities must receive their approval.

*First Nations:* The people of the Quatsino and the Tlatlasikwala First Nations have territorial claims to the Scott Islands and the surrounding areas. The territorial claims of the Owekeeno, the Heiltsuk and the Kwakiutl First Nations also encompass areas of the Scott Islands and surrounding marine waters. The peoples of these First Nations use the area seasonally for commercial fishing.

*Simon Fraser University (SFU):* Under permit from BC Parks, SFU is currently involved in a cooperative research venture with the Canadian Wildlife Service which includes numerous graduate and undergraduate students studying the birds of Triangle Island.

*Environment Canada (CWS):* This federal government agency has legislated responsibility for migratory birds, which includes the majority of species nesting on the Scott Islands. Federal access to the Ecological Reserves is subject to provincial jurisdiction and requires specific authorization by permit.

*Coast Guard:* This federal government agency forms part of the response team for oil spills, routinely helps the SFU research team with trips out to Triangle Island, and is part of the safety network for the area.

*Department of Fisheries and Oceans (DFO):* This federal government agency regulates fishing activities, and has responsibility for marine mammals and much of the marine area.

*Fishers:* Fishers are the primary users of the marine portion of the area of interest. Their activities may be affecting bird populations of the Scott Islands.

*Oil industry:* These stakeholders include those involved in transport of oil products, as well as companies that would benefit from offshore oil and gas exploration.

*Recreational boaters:* This group may disturb birds if they illegally come ashore on the ecological reserves. To date, the number of illegal visitors is not deemed to be a significant source of impact.

*Ecotourism operators:* While the opportunities for ecotourism are limited due to the islands' remoteness and the rough ocean conditions, operators may be able to construct a viable industry in the future. Commercial operations would not be allowed within the Ecological Reserves. Commercial operations may be allowed in the park when consistent with the objectives for the park and when authorized by permit under the provincial "Park Act".

*Conservation Groups:* These groups include Wildbird Trust of BC, Federation of BC Naturalists (FBCN) and larger groups such as the Canadian Park and Wilderness Society (CPAWS) whose members are concerned with the general welfare of birds and parks in the province.

## 9 Opportunities

The seabirds of the Scott Islands do not figure largely in the cultural landscape of British Columbia; the majority of British Columbians remain unaware of the Scott Islands. However, the puffins of Triangle Island provide an easy cultural icon, and the islands are regularly the subject of a number of magazine and newspaper articles, and documentary films. The intrinsic aesthetic appeal of the seabirds nesting on the islands enriches the lives of all those who have contact with them.

There are at least two types of protection required for the seabirds. The first is the protection of the seabird nesting areas. The existing provincial protected areas provide the highest level of authority to achieve the protection of these land-based areas. A second area of needed protection is for the offshore areas used by the seabirds. Protection in this realm, using formal MPA designations, falls primarily within the federal realm of jurisdiction. Full protection of the seabirds will require the application of both federal and provincial jurisdictions, as well as cooperation of First Nations, other nations, organizations and interest groups.

The conservation of the seabird populations of the Scott Islands creates a series of opportunities for research and education, partnerships, and the potential to enhance local economic development. Understanding how ocean conditions affect seabird populations might lead to insights into how similar conditions affect species that occupy similar trophic levels as seabirds, species such as steelhead trout *Oncorhynchus mykiss* and coho salmon *Oncorhynchus kisutch* (Bertram et al. 2000). Because management must rely on fostering good relations, conservation of the islands creates the opportunities for creating partnerships between government agencies, conservation groups, resource organizations and members of the local communities. Currently, the three outer islands have the most diverse bird communities but their remoteness and rough ocean conditions limit development of an ecotourism industry. However, if more breeding habitat is made for seabirds by eradicating Mink and Raccoon from Cox and Lanz islands, the two islands closest to Vancouver Island, then ecotourism may become more viable.

### 9.1 Marine Protected Area

Currently, the ocean area in a one-kilometer radius surrounding each island in the ecological reserve is managed and protected under the B.C. *Parks Act*. This area may provide some protection for bird species that forage primarily inshore such as pigeon guillemots, cormorants and shorebirds but are not likely to be adequate for farther ranging species like rhinoceros auklets, murre, tufted puffins and Cassin's auklets. The propensity of these latter species to forage over large areas leaves them vulnerable to risks beyond current conservation measures. This additional level of protection is being considered as part of the CWS MPA initiative.

Additional waters surrounding the Scott Islands may therefore need to be protected. Consideration of marine habitat can prevent seabird by-catch, excessive competition with fisheries or other risks from offshore oil and gas exploration and mining as well as ocean transport traffic. Protection of offshore areas where large numbers of birds congregate and forage may be afforded by a type of marine protected designation as has been previously created in other areas by Canadian federal and provincial agencies (Jamieson and Levings 2001).

Should a decision be made to proceed with the establishment of a Marine Protected Area, recent research on the foraging range of the Cassin's Auklet and the Rhinoceros Auklet may be helpful in informing its specifications. These ranges may also provide some protection for other far ranging breeding and transient seabird species. It would be helpful if further information were gathered on the overlap between the foraging ranges of other seabird species within the ecological reserve.

Two key considerations in the establishment of a marine protected area are the measure of protection such a designation provides and the objectives to be met. The open ocean nature of the area proposed for protection as part of the Scott Islands IBA and its location away from coastal headlands leaves federal authorities responsible for its designation (Jamieson and Levings 2001). Options for legal provisions may be considered under the separate or combined efforts of Fisheries and Oceans Canada, Environment Canada and Parks Canada.

The isolated nature of the area also presents enforcement challenges. Therefore, a strong awareness and education initiative for industry and the public is needed to ensure compliance with protection measures. Consideration and consultation should be given to the fishing industry and others with whom this protected area may affect in order to reduce confrontation and opposition.

## 10 Conservation Goals and Objectives

### 10.1 Vision Statement

The full level of protection of the seabirds of the Scott Islands requires the cooperative and coordinated application of the federal and provincial governments, as well as the support from First Nations, other governments, commercial fishers, conservation groups and the public. The Vision for the Scott Islands area is to ensure the long-term well being of the sea bird populations through coordination and cooperation.

The Scott Islands harbor the densest congregation of breeding seabirds on the western coast of Canada and contribute significantly to the world's diversity and abundance of seabirds. These islands support 55% of the world's population of Cassin's Auklets, 7% of the world's population of Rhinoceros Auklets and hold the biggest Common Murre and Tufted Puffin colonies in British Columbia. Seabirds serve as useful biological indicators of the health and productivity of the ocean and enrich human lives by their intrinsic aesthetic appeal. This conservation plan has 3 desired outcomes: (1) to ensure the long-term viability of naturally occurring seabird populations in the Scott Islands, (2) to improve human knowledge, attitudes and behavior towards seabirds through research and education, and (3) to generate public support and assistance in the management process.



*Rhinoceros Auklet*

### 10.2 Goals and Objectives

Comprehensive management planning for seabird populations includes a balance of four components: research, enforcement, habitat protection and education (Blanchard 1994). The four components form a coordinated strategy that involves a number of governments and their agencies, First Nations, non-government organizations and the local people. The involvement of the First Nations and local communities needs to be handled diligently to ensure an effective working relationship and to make certain that their rights and interests are not impaired. This plan outlines a series of steps needed to achieve the above goals. Because the terrestrial boundaries of the islands are well protected via their remoteness and existing legislation, future management initiatives should depend largely on research results (e.g., results of research on by-catch in fisheries). However, bird populations on the islands fluctuate with oceanic conditions and may be thus to some degree unmanageable.

Individual items within each of four components are listed in order of priority such that present breeding habitat is maintained, and if more resources become available, then more breeding habitat can be created. Each item has a priority rank. Priority 1 items are those that definitively result in the protection of seabirds nesting in the Scott Islands, and should be

implemented. Priority 2 items are those that also result in the protection of seabirds nesting in the Scott Islands, but should not be completed at the expense of Priority 1 items. Priority 3 items are those which complement other items and will likely contribute to protection goals, but need only be completed if resources become available.

*1. RESEARCH*

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
1. Monitor population trends and breeding chronology of seabirds on the islands.	These data provide baseline information from which to base management decisions and will ultimately gauge the effectiveness of any management actions. Correlating population changes with climate and ocean conditions will demonstrate to what extent bird populations are a manageable resource.	1	SFU, CWS	The last population counts of seabirds on the Scott Islands occurred in the late 1980s (Rodway et al. 1990). CWS has permanent plots in place on Triangle Island, which are designed to monitor trends in populations of Cassin's Auklets, Rhinoceros Auklets and Tufted Puffins. These are checked every 5 years, and the next check is scheduled for summer 1999 (M. Lemon, pers. comm.). Similarly, SFU conducts studies on the demography of Cassin's Auklets and Rhinoceros Auklets, reproductive parameters such as mean lay date and mean fledgling date. These will continue into the future (D. Bertram, pers. comm.).
2. Determine the foraging ecology of seabirds, that is, where and how the seabirds feed.	In particular, information such as the density and distribution of birds at sea, foraging activity budgets, dynamics of foraging trips, and the effects of variable food resources and ocean conditions on foraging behavior should be determined. This information will provide insights into the mechanisms that govern seabird populations, as well as allow risk assessment of seabirds to fisheries and oils spills.	1	SFU, CWS	Presently, SFU collects information on prey items and their relative amounts brought back to chicks of Cassin's Auklets, Rhinoceros Auklets, and Tufted Puffins. SFU researchers have been examining foraging ranges of Cassin's Auklets in 1999, 2000 and 2001 by attaching radio-transmitters and following these birds during their foraging trips (D. Bertram, pers. comm.). In 2002 a Rhinoceros Auklet radio telemetry study was conducted at Traingle Island (J.Ryder, pers.comm.).

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
3. Identify and quantify interactions between seabirds and fisheries.	In particular, the mortality of birds due to fisheries must be assessed. The by-catch of seabirds in fishing gear is highly variable and depends on the abundance and distribution of prey, mesh size and type of nets involved, fish and seabird migration patterns, and the proximity of fishing effort to colony sites.	1	CWS, DFO	Virtually nothing is known about the specific interactions of seabirds and fisheries of the Scott Islands. Existing DFO observer programs could be used to gather these data. CWS and DFO organized a workshop on seabird by-catch in fisheries in December 1998. This workshop recognized the need for research, acknowledged US experience with this issue and considered the creation of BC working group (K. Morgan, pers. comm.). K. Morgan is applying for funds to do so from the Nestucca Environmental Recovery Trust Fund, a large fund for projects on conservation of seabirds on the west coast of Vancouver Island.
4. Quantify the level of predation occurring on Cox and Lanz islands by Mink and raccoon.	This predation could be a drain on the seabird population and prevents major recolonization or expansion of seabird colonies. Concrete evidence of this impact would validate efforts to eradicate these introduced animals.	1	BC Parks, CWS	Only anecdotal information exists; Rodway et al. (1990) reported Mink predation on Cassin's Auklets prospecting burrows on Lanz Island. Funds and interested parties need to be identified. Visiting the islands and walking transects, looking for evidence of predation on seabirds would provide good preliminary data.
5. Assess the impact of introduced rabbits on the vegetation and seabirds of Triangle Island.	Rabbits are an unknown but potential threat to seabirds on Triangle Island.	3	BC Parks, SFU	Possible research projects include removal or exclusion experiments. BC Parks has expressed interest in the research, although funds need to be identified.
6. Determine the distribution and abundance of Mink and Raccoon on	This information would provide the baseline information for designing a possible eradication	3	BC Parks, CWS	Only presence or absence data for these species exists for Scott Islands. This research could form part of the preliminary assessment for eradication. Funds and



Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
Cox and Lanz islands.	campaign.			interested parties need to be identified.
7. Determine if alternate sites exist for the coordination of search and rescue activities.	The safety of search and rescue operation should not be compromised, but if an alternate site exists of equal quality, then perhaps it should be used.	3	BC Parks, CWS, Coast Guard	This research would likely involve examination of maps and identification of sites with similar characteristics as the saddle of Puffin Rock. Funds and interested parties need to be identified.
8. Assess the relationship between number of oiled birds detected onshore and the number affected at sea.	In particular, how bird density, wind and ocean conditions affect the number of oiled birds detected on shore. These data would then be used in case of an oil spill to estimate the number of birds killed.	3	CWS, Coast Guard	Possible studies include radio-tracking drifting carcasses, using drift-blocks, and measuring sinking and scavenging rates. Funds and interested parties need to be identified.

## *2. ENFORCEMENT*

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
1. Maintain existing restrictions of access and enforce	This minimizes disturbance and the probability of introducing rats to seabird colonies.	1	BC Parks, Research permittees, SFU, CWS.	Access to ecological reserves is limited by their remoteness and by BC Parks via a permit system. The presence of researchers on Triangle Island likely deters visitors from walking on slopes.

### 3. HABITAT PROTECTION

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
1. Prevent introduction of rats and other predators to the islands	The introduction of predators could irreparably damage the islands as nesting habitat for seabirds.	1	SFU, CWS, BC Parks	The islands' remoteness and the rough ocean conditions that surround them provide protection by limiting access. The existing protocol must be adhered to.
2. Establish a response-system for introduction of rats	These animals are the most likely to be introduced and contingency plans must be drawn up.	1	CWS, SFU, BC Parks, Coast Guard	Such a program is in place for the Pribilof Islands in Alaska. Perhaps that model could be applied to the Scott Islands. A cache of equipment at Cape Scott lighthouse would improve response efficiency. Funds and interested parties need to be identified, and the legalities surrounding rodenticide use on ecological reserves needs to be examined.
3. Provide an area surrounding the Scott Islands where no actions detrimental to seabirds can take place.	This area would protect the marine habitat, including the prey base, as well as provide waters for, not only those birds breeding on the Scott Islands, but for non-breeding and wintering users of the marine area.	1	BC Parks, CWS, MSRM, DFO.	Petition for maintenance of moratorium on offshore oil and gas exploration. Although no formal process exists for nominating sites for the MPA Strategy, the Scott Islands marine area is currently being assessed for a marine wildlife area, as enabled by the "Canada Wildlife Act". Currently, seabird data collected from aboard a DFO research vessel are in the first stage of processing. Subsequent analysis of the distribution of breeding and non-breeding/wintering seabirds will define an area around the Scott Group that merits protection.
3. Eradicate Mink and Raccoon from Cox and Lanz islands	This eradication would likely create new habitat for colonization by dispersing young seabirds.	2	CWS, BC Parks	A preliminary feasibility study has been completed which details legal, but not practical feasibility (Fox 1990). Funds must be secured, and appropriate techniques carried out.

#### 4. EDUCATION

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
1. Publish research findings in scientific journals and other formats, such as local newspapers.	This activity serves two purposes, (1) it increases knowledge about the birds that can aid in managing and understanding their populations, and (2) ensures a presence sympathetic to the birds on the islands. Publication in refereed journals ensures high quality of science.	1	SFU,CWS, CNF	The birds of the Scott Islands have been the topic of numerous scientific articles since the 1940's. Currently, an alcid research program at Triangle Island is being offered through the Centre for Wildlife Ecology, a partnership between the Canadian Wildlife Service and Simon Fraser University. In the summer of 2002, there were two MSc students working on this research. Useful venues for distributing information about the Scott Islands include Cape Scott Provincial Park, the Royal British Columbia Museum in Victoria, and the Vancouver Aquarium.
2. Include seabirds in interpretative program at Cape Scott Provincial Park	Personal contact with interpreters serves to foster a conservation ethic and builds local support for wildlife policies and regulations.	1	BC Parks, Coast Guard	BC Parks has no personal interaction program at Cape Scott Provincial Park, and lack of resources prevents them from establishing one. Perhaps the Cape Scott lighthouse keepers could be involved. Funds and interested parties need to be identified.
3. Signs at docks at Port Hardy, Holberg and other coastal communities.	These signs would indicate that use is prohibited in ecological reserves and depict seabirds with standard ornithological and local names, IBA program,	2	CWS, local communities, BC Parks, Transport Canada, CNF	No such signs exist. Funds and interested parties need to be identified. The creation and installation of signs provides a good opportunity for partnership between agencies (e.g., BC Parks, NGOs and the IBA Community Action Fund).

Item	Rationale	Priority Rank	Key Contacts	Current Status/Action Required
4. Create and disseminate educational materials on seabirds to local communities.	<p>and basic natural history.</p> <p>Ideas for materials include newspaper columns, brochures, books, posters, and videos.</p>	2	CWS, BC Parks	No such materials specific for the Scott Islands exist, although other sources could be used as templates. Funds and interested parties need to be identified.
5. Presentations about the seabirds of the Scott Islands to local school groups.	Education programs that involved children had the best success in instilling a conservation ethic.	2	SFU, BC Parks, CPAWS, CNF	SFU researchers currently do presentations on an ad hoc basis. BC Parks has an outreach program for local schools and communities.

## **11 Evaluating Success**

The size and health of seabird populations remains the best gauge of the effectiveness of any management actions. However, because these data are difficult to gather and current techniques only detect large changes in population size, progress would be better evaluated by the completion of the above-mentioned goals.

### **11.1 Feasibility**

The steps outlined here essentially represent a continuation of current activities. Thus, the outlined research and enforcement goals are all feasible if resources continue to be available. Research goals are best evaluated by the production of government reports and articles in scientific journals. All research goals with Priority 1 are being carried out or actively pursued. Priority 2 and 3 research items currently require funding before they can be achieved. All enforcement goals are currently met.

New projects include the eradication of Mink and Raccoon from Cox and Lanz islands, the protection of the prey base, and the education program. Given the combined capacity of BC Parks, CWS and SFU, all goals are technically feasible if the resources become available.

#### *Eradication of Mink and Raccoon from Cox and Lanz islands*

More than 10 km of ocean separates Cox and Lanz islands from Vancouver Island. Re-introduction of these animals following eradication would be very unlikely, and thus eradication is a viable management option. However, Cox (978 ha) and Lanz (794 ha) islands are considerably larger than any island where mustelids have been removed (namely Maud (309 ha), Otata (22 ha) and Adele (87 ha) islands in New Zealand (Veitch and Bell 1990)). Furthermore, both islands would likely have to be eradicated simultaneously since only a distance of 1100 m separates the two islands. An island needs to be at least 1200 m away from a source population of mustelids to be really safe from re-colonization (Veitch and Bell 1990). Similarly, little experience exists dealing with eradication of raccoons. Raccoons have been able to access islands in British Columbia up to 680 m away from the source population (Summers and Rodway 1988). The best technique to eradicate both species from the islands likely involves a combination of poisoning and kill-trapping (B. Bell, pers. comm.). If use of poison is untenable in provincial parks or presents too high a risk of non-target poisoning for native mammals, then eradication could be achieved by trapping, either as commercial venture with registered trappers, or as a non-commercial venture with registered or non-registered trappers (Fox 1990). However, trapping alone would take longer and likely be more expensive. In addition, eradicating raccoons and mink as humanely as possible would ensure the eradication is conducted ethically and would minimize the probability of incurring the ire of animal rights groups.

### **11.2 Marine Protected Areas**

The surrounding waters need to be protected to prevent seabird by-catch, excessive competition with fishers, or other risks from offshore oil and gas exploration and mining,

perhaps through the application of a national marine wildlife area.

### **11.3 Education Program**

A broad education public awareness program will heighten attention about the importance of marine natural values along the B.C. coast, and the need for the establishment of a system of marine protected areas. Care must be taken to ensure that public education activities do not increase visitation of the Scott Islands area at the expense of their protection. The implementation of the education program depends largely on funding. However, such programs provide a good return per dollar invested, as well as create opportunities for partnerships between stakeholders.

### **Acknowledgements**

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**Appendix 1: Summary Of The Most Recent Estimates Of Seabird Breeding Populations In The Scott Islands.<sup>1</sup>**

Site Name	Number of nesting pairs <sup>a,b</sup>													Total no. of birds
	FTSP	LSPE	BRCO	PECO	BLOY	GWGU	COMU	TBMU	PIGU	CAAU	RHAU	TUPU	HOPU	
Triangle Island	100e	200e		433	25	577e	4 100	7e(41 )	x(331)	548 000t	41 700t	26 400t	S(4)	1 243 419
Sartine Island			39	168	S(1)	390e	0(113)		x(116)	376 000t		6 400t	S(6)	766 118
Beresford Island	2 900t	12 500t		6	S(3)	110e	0		x(146)	66 000t		2 100t	S(1)	167 385
Lanz Island				56(0)					S(26)	0	0			138
Cox Island				78(0)										156
Total nesting pairs	3 000	12 700	39	741	29	1 077	4 100	7		990 000	41 700	34 900		
Total breeding birds	6 000	25 400	78	1 482	58	2 154	8 200	14	619	1 980 000	83 400	69 800	11	2 177 216
Percent of national population	1.5	2.3w	40	17.5	3	4	95w	100w	6	73	12	90	22w	
Percent of continental population	-	-	-	1	-	-	-	-	-	-	9		-	
Percent of global population	-	-	-	-	-	-	-	-	-	55	7	2	-	

<sup>1</sup> from Rodway et al. (1992), Can. IBA database (1998).

<sup>a</sup> Numbers in parentheses refer to total number of birds in breeding plumage sighted around the colony.

<sup>b</sup> Acronyms for species names:

FTSP = Fork-tailed Storm-Petrel    PECO = Pelagic Cormorant    COMU = Common Murre    CAAU = Cassin's Auklet    HOPU = Horned Puffin  
 LSPE = Leach's Storm-Petrel    BLOY = Black Oystercatcher    TBMU = Thick-billed Murre    RHAU = Rhinoceros Auklet  
 BRCO = Brandt's Cormorant    GWGU = Glaucous-winged Gull    PIGU = Pigeon Guillemot    TUPU = Tufted Puffin

e = population estimated from numbers of breeding birds seen

x = breeding confirmed, but population not estimated

t = population estimate derived from systematic sampling along transects

S = suspected breeding

w = western Canada

## **Appendix 2: Protocol For Preventing The Introduction Of Rats.**

Introduced rats have destroyed many of the world's richest seabird colonies on islands. The introduction of rats to Triangle Island would destroy the world's largest Cassin's Auklet colony within a few decades and would render this island uninhabitable to most other seabird species. Removal of rats from the island once they become established would be difficult, irreparably damaging to the fauna of the island, and extremely expensive. Introduction of rats to Triangle would arguably be nothing less than the worst ecological disaster in British Columbia history.

We must do everything in our power to make sure we do not introduce rats (or any other exotic fauna or flora) to the island. This is the responsibility of everyone working with the seabird station.

The most likely sources of rat introduction to Triangle are: 1) shipwrecks and 2) transport to the island in boxes of equipment and supplies destined for our station. We can do little about source #1. Some guidelines for preventing source #2 follow:

- All gear and supplies destined for Triangle will be transported in boxes completely sealed with tape at the time of packing.
- The boxes must be known to not contain a rat before they are sealed, and they must be sealed in such a way that if a rat has entered the box, its entry will be obvious from a hole chewed in the box.
- During transport the boxes must not be left in an area accessible to rats.
- The boxes are to be inspected before they are loaded on to the ship or helicopter taking them to the island. Any boxes with open tears or signs of entry must be immediately emptied, repacked and resealed. Furthermore, the boxes must be carefully inspected again on the ship before they are brought ashore. Rats are commonly found in ship holds, and are likely to try to enter food boxes left in the hold during transportation.
- The boxes should be checked as they are put into the work boats to be taken ashore. Any box that looks suspicious should be set aside and repacked before it goes ashore. It may be necessary to politely explain the concern about rats to Coast Guard personnel so they understand any necessary delays. Better to cause a delay than destroy Triangle!
- Large equipment items that cannot be boxed must be checked carefully at each stage of transportation to ensure they do not contain a rat. Rats have been known to enter outboard motors!

### **Appendix 3: Laws And Policies Which Protect The Seabirds Of The Scott Islands.**

#### **At the provincial level:**

- *Ecological Reserves Act* (British Columbia Revised Statutes, chapter 103 (1996)) disallows resource extraction, allows for ecological purposes only and gives jurisdiction over ecological reserves to the minister. Order in Council 1574-71 reserved Beresford, Sartine and Triangle islands for these purposes.
- *Park Act* (British Columbia Revised Statutes, chapter 344 (1996) Schedule D) establishes the Scott Islands Provincial Park, outlines restrictions and procedures on land use. Order in Council 1920-77 closed the islands to all uses and entry without issuance of a permit.
- *Wildlife Act* (British Columbia Revised Statutes, chapter 488, (1996)) designates the injury of a bird or its egg without an appropriate permit as an offence.
- *Land Act* (British Columbia Revised Status, chapter 245 (1996)). Order in Council 469-82 reserves all unsurveyed islands and islets in tidal waters from disposition.

#### **At the federal level:**

- *Migratory Birds Convention Act* (Canada Revised Statutes, chapter M-7.01 (1994, chapter 22)) regulates the exploitation of seabirds, including young birds and eggs. It allows the taking of seabirds for scientific purposes and subsistence or traditional hunting. The Act defines the taking of a bird fairly broadly, and has been used successfully to sue oil companies for bird mortalities following oil spills, e.g., *Nestucca* oil spill of 1989.
- *Canadian Environmental Protection Act* (Canada Revised Statutes, chapter C-15.3 (1985, chapter 16)) and its implementing Garbage Pollution Prevention Regulations (Canada Consolidated Regulations, chapter 1424 (1978)) control intentional dumping of oil, noxious liquids and plastics at sea, which applies to the 12-mile territorial sea or 200-mile Exclusive Economic Zone (EEZ), according to the Law of the Sea Convention (Article 220(1)).
- *Fisheries Act* (Canada Revised Statutes, chapter F-14 (1985), § 43(e)), which by order of the Minister of Fisheries and Oceans (November 1987), invoking his authority to regulate gear in Canada, does not allow large-scale drift-net fishing in its EEZ.

#### **International Laws:**

- The International Convention for High Seas Fisheries of the North Pacific.
- Law of the Sea Convention, which outlines that standards for vessel construction and staffing in the oil transportation business are set by the United Nations International Maritime Organisation (IMO), although enforcement of these standards falls on the flag states of the vessels (Article 220(1)). In addition, the Law of the Sea Convention (Article 194 [5] and 119 [1][b]) “requires fishing nations to protect and preserve the habitat of endangered species and to consider the effect of fishing on species ‘associated with or dependent on harvested species’” (Harrison et al. 1992).
- International Convention on Biodiversity (implemented in Canada by Canadian Biodiversity Strategy).

**Appendix 4: Contacts.**

Name	Organization	Address	Telephone
Bell, Brian	Managing Director, Wildlife Management International Ltd.	PO Box 14492, Wellington, New Zealand	64-04-388- 9053
Doug Bertram	Environment Canada, CWS C/O Institute of Ocean Sciences	P.O. Box 6000 Sydney, BC V8L 4B2	(250) 363- 6735
Blacklock, Cam	Fisheries Officer, DFO	PO Box 10 Port Hardy, British Columbia V0N 2P0	(250) 949- 6422
Clulow, George	Director Wild Bird Trust of BC	124-1489 Marine Drive, West Vancouver, British Columbia V7T 1B8	(604) 924- 2581
Mark C. Drever	Department of Zoology University of Guelph	Department of Zoology University of Guelph Guelph, Ontario N1G 2W1	
duTrizac, Bill	Senior Planning Officer Environmental Response Canadian Coast Guard	4260 Inglis Drive, Box #3 Richmond, British Columbia V7B 1L7	(604) 209- 6206
Dunn, Michael	MPA contact CWS - PWRC	5421 Robertson Road, RR#1, Delta, British Columbia, V4K 3N2	(604) 940- 4658
Heggelund, Henry	Hook and Line Groundfish Association	P.O. Box 476 Sooke, BC V0S 1N0	(250) 642- 3316
Mark Hipfner	Seabird Research Director, SFU-CWS	5421 Robertson Road, RR#1, Delta, British Columbia, V4K 3N2	(604) 940- 4720

Name	Organization	Address	Telephone
Johnson, Marc	IBA Manager, Canadian Nature Federation	1 Nicholas St. Suite 606 Ottawa, Ontario K1N 7B7	613-562- 3447
Kennett, Kris	Planner Ministry of Environment, Lands and Parks (Parks Division)	BC Parks, Strathcona District. P.O. Box 1479, Parksville, British Columbia, V9P 2H4	(250) 954- 4610
Lemon, Maira	Wildlife Research Technician CWS - PWRC	5421 Robertson Road, RR#1, Delta, British Columbia, V4K 3N2	(604) 940- 4689
Lewis, Kaaren	B.C. Land Use Coordination Office	PO Box 9426 Stn. Prov. Govt. Victoria, British Columbia V8W 9V1	(250) 356- 7723
McGill, Lloyd	Sea Legend Charters	Port Hardy	(250) 949- 6541
McLellan, Ian	Area supervisor, Cape Scott BC Parks	Bag 11000 8785 Gray Street, Port Hardy, British Columbia V0N 2P0	(250) 949- 2815
Morgan, Ken	CWS - IOS Pelagic Bird Ecologist	PO Box 6000 Sidney, British Columbia V8L 4B2	(250) 363- 6537



Name	Organization	Address	Telephone
Morrison, Karen	BC Environment, Lands and Parks, Nanaimo Office	2080 Labieux Road Nanaimo, British Columbia, V9T 6J9	(250) 751- 3100
Ryder, John	Triangle Island Camp Manager, SFU	5421 Robertson Road, RR#1, Delta, British Columbia, V4K 3N2	(604) 940- 4675
Symington, Keith	Canadian Parks and Wilderness Society - BC MPA Coordinator	502-475 Howe Street Vancouver, British Columbia, V6C 2B3	(604) 685- 7445 (604) 685- 6449 (fax)

## **Appendix 5: Scott Islands Provincial Park - Draft Vision Statement**

(In the year 2008) Scott Islands Provincial Park is the most important breeding grounds for seabirds and sea lions in British Columbia. The islands' unique biological and cultural values are protected and presented through off-site exhibits and information resources. The surrounding marine area is protected through the cooperative efforts of federal and provincial agencies.

Access to the three outer islands (ecological reserves) is restricted by permit for research purposes only. Access is permitted on Lanz and Cox Islands, but no facilities are available.

The remote off-shore wilderness character of the islands still pervades. The islands continue to provide safe anchorage for shipping in adverse weather conditions, and occasional boat tours circumnavigate at an appropriate distance so as not to disturb the colonies. Otherwise, the islands are left as nature created them; beautiful, wild and remote.

**Appendix 6: SFU Core Research Program at Triangle Island, British Columbia.<sup>1</sup>**

<b>Project #:</b>	<b>Project title:</b>	<b>Relevant data to meet SFU/CWS objectives:</b>
1	CAAU phenology, nestling development and reproductive performance	Time series of interannual variation in timing of zooplankton availability and breeding performance at the individual and population level
2	CAAU demographics (Capture-Mark-Recapture banding)	CAAU adult and sub-adult annual survival estimates, age at first breeding, philopatry, recruitment, morphometrics, body condition, and seasonal mass loss
3	CAAU foraging ecology (radio-telemetry study)	CAAU at-sea distribution of individuals in relation to zooplankton prey availability, CAAU pelagic habitat use, CAAU colony attendance patterns, and Scott Islands Marine protected area reserve design
4	CAAU Food Habits	Nestling diet time series of zooplankton community composition by oceanographic region. Total food delivery may reflect interannual variation in zooplankton biomass and availability of prey to upper trophic level predators
5	RHAU phenology, nestling development and reproductive performance	Time series of interannual variation in timing of fish prey availability and breeding performance at the individual and population level
6	RHAU demographics (Capture-Mark-Recapture banding)	RHAU adult annual survival estimates, age at first breeding, philopatry, recruitment, morphometrics, body condition, and seasonal mass loss
7	RHAU Food Habits	Nestling diet time series of prey fish composition. Total food delivery may reflect interannual variation in the availability of fish prey populations
8	TUPU phenology, nestling development and reproductive performance	Time series of interannual variation in breeding performance
9	COMU phenology, provisioning effort, food habits, and breeding performance	Time series of variation in breeding performance and provisioning rate (a key variable in quantifying effort) at the individual and population level
10	PECO phenology, provisioning, and breeding performance [TIME PERMITTING]	Time series of variation in breeding performance and provisioning rate at the individual and population level