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Distribution and Abundance of Birds
on Western Victoria Island,
1992 to 1994

Beth J. Cornish
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EXECUTIVE SUMMARY

A three-year study to determine the distribution and abundance of birds nesting on western Victoria Island was initiated jointly by the Canadian Wildlife Service and Inuvialuit in 1992. Although emphasis was on the King Eider, which is an important food source for the people of Holman, observations were recorded for all bird species. There were two components to the study: aerial surveys conducted over much of the western half of the island, and surveys on the ground at a site in the Kagloryuak River valley.

Aerial Surveys

Aerial surveys for breeding birds were conducted between 16 June and 1 July each year from 1992 to 1994. The study area in 1992 and 1994 was northwest Victoria Island (82 749 km²), but in 1993 was expanded to include southwest Victoria Island (an additional 22 104 km²). Straight-line transects were flown by helicopter across each of six strata (eight in 1993), and two observers recorded all birds seen within 200 m of each side of the aircraft. A total of 27 bird species were identified during the aerial surveys, the most abundant of which was the King Eider.

There were an estimated 33 000 King Eiders on northwest Victoria Island in the first two years of surveys, and 51 000 in the third year. Southwest Victoria Island had an estimated 11 000 King Eiders in the one year that it was surveyed. The number of breeding pairs did not vary significantly among years. The higher population estimate in the third year was due to the presence of more eiders in flocks of greater than four birds. The highest densities of King Eiders occurred in the Kagloryuak River valley and near Tahiryuak Lake. The results of this study as well as other research (Alexander et al 1994; Suydam et al in prep.) suggest a decline in the western Arctic King Eider population over the past two to three decades.

Other common waterfowl species were the Canada Goose, Brant, Tundra Swan and Oldsquaw. Population estimates for Canada Geese in northwest Victoria Island ranged from approximately 16 000 to 25 000, with an additional 19 000 in southwest Victoria Island. We estimated between 900 and 1200 Brant, 3200 to 3800 Tundra Swans and 4600 to 7800 Oldsquaw in northwest Victoria Island. Population estimates for these species in southwest Victoria Island were approximately 200 Brant, 4200 Tundra Swans and 1800 Oldsquaw. The strata encompassing the Kagloryuak River valley and area from Tassijuak Lake south to Coronation Gulf supported the highest densities of Canada Geese and Tundra Swans. Brant observations were primarily in only two strata, the Kagloryuak River valley and Prince Albert Peninsula, while Oldsquaws were scattered across the study area. A comparison of our population estimates to the results of similar aerial surveys in 1980 (Allen 1982; McLaren and Alliston 1981) as well as other studies (Parmelee et al 1967; Lok and Vink 1986) suggests that Canada Geese may be expanding their range northward on Victoria Island, while numbers of Brant and Oldsquaw appear to be declining.

Pacific Loons were the most common loons, representing between 63 and 81% of the loons identified to species. The population estimate in northwest Victoria Island ranged from 2500 to 5300 loons, with an additional 1200 in southwest Victoria Island. Densities of this species were

generally highest in the Kagloryuak River valley. Other species observed were Yellow-billed and Red-throated loons.

The only abundant raptor species observed during the aerial surveys were Rough-legged Hawks and Snowy Owls. Population estimates for Rough-legged Hawks in northwest Victoria Island ranged from approximately 1000 to 2000 birds, while fewer than 100 were estimated for the southwest portion of the study area. Numbers of Snowy Owls varied dramatically over the three years of the study. The 1994 population estimate was less than one-third the 1993 estimate of 3566 ± 1494 owls in northwest Victoria Island. Both Rough-legged Hawks and Snowy Owls were most abundant on Prince Albert Peninsula.

Six Peregrine Falcons and 1 Gyrfalcon were observed during our surveys. Four of the 6 Peregrine Falcon sightings were on the cliffs of Diamond Jenness Peninsula which concurs with previous reports of the importance of these cliffs for nesting Peregrine Falcon (Allen 1982; McLaren and Alliston 1981).

Three species of jaegers were observed in the study area: Pomarine, Parasitic and Long-tailed jaegers. The most abundant jaeger during our surveys, as well as the 1980 surveys by McLaren and Alliston (1981), was the Pomarine Jaeger. Like the Snowy Owl, Pomarine Jaegers experienced a major decline in numbers in 1994, falling from an estimated 7340 ± 490 in 1993 to 1236 ± 267 in 1994. The decline in both species is attributed to a crash in lemming populations, their primary prey.

Glaucous Gulls were widespread and fairly evenly distributed in the study area. They occurred in greatest abundance in 1992 when an estimated $11\,525 \pm 4718$ occurred in northwest Victoria Island. The only other common gull species was the Sabine's Gull. We estimated about 1500 Sabine's Gulls each year on northwest Victoria Island, almost 90% of which were in the Kagloryuak River valley or near Tahiryuak Lake. Very few were seen in southwest Victoria Island. Arctic Terns were more widely distributed, and population estimates ranged from about 2300 to 3700 birds in northwest Victoria Island, with an additional 975 in southwest Victoria Island. Thayer's Gulls were locally abundant in northwest Prince Albert Sound where we found six colonies on cliffs on the islands and along the coast. One other colony was found in Minto Inlet.

Terrestrial Surveys

Between 10 and 22 July in 1992 and from 20 June to 2 July in 1993, we conducted bird surveys on the ground in a 50 km² study area in the Kagloryuak River valley. This area was selected because of its potential to support high densities of nesting King Eiders. The objective of the terrestrial surveys was to obtain further information on bird abundance, nesting distribution and habitat use in this area. Bird observations were recorded during 87 hours of surveying in 1992. In 1993, we surveyed a total of 50.8 km along 12 transects.

The Kagloryuak River valley has a rich and diverse bird life relative to the rest of western Victoria

Island. During the terrestrial surveys, we recorded 34 species of birds and found evidence of nesting (unfledged young or a nest with eggs) for 18 species. These surveys allowed us to identify the smaller bird species, including 10 shorebird and 5 passerine species, which we were unable to accurately distinguish during the aerial surveys. The most common bird recorded was the Lapland Longspur, with a density in 1993 of 58 birds/km², but shorebird populations were also abundant. Eight shorebird species together comprised 53% of total birds seen. Over the two years of surveys, the most common shorebirds were Semipalmated Sandpiper, Pectoral Sandpiper, Red Phalarope, White-rumped Sandpiper, Lesser Golden Plover and Stilt Sandpiper. We recorded seven waterfowl species during these surveys, the most abundant being the Canada Goose, King Eider and Tundra Swan. All three species of jaegers were observed, but Pomarine Jaegers predominated.

Thirteen habitat types were recognized and described in the Kagloryuak River valley study area. Well-vegetated graminoid-dominated lowlands were the most abundant habitats. Pondered lowland habitats of this type received the heaviest use by birds and had the greatest species richness. Similar observations were recorded by McLaren and Alliston (1981). The gently sloped upland habitats supported a less diverse bird population, but were favoured by some species.

SOMMAIRE

En 1992, le Service canadien de la faune et les Inuvialuits lançaient une étude de trois ans, qui devait leur permettre de déterminer la distribution et l'abondance des oiseaux nichant dans l'ouest de l'île Victoria. Bien que l'accent ait été mis surtout sur l'Eider à tête grise, qui tient une place importante dans l'alimentation des gens de Holman, on a enregistré les observations de toutes les espèces d'oiseaux. L'étude avait deux volets : les relevés aériens, couvrant la plus grande partie de la moitié ouest de l'île, et les relevés au sol, à un site proche de la vallée de la Kagloryuak.

Relevés aériens

De 1992 à 1994, on a effectué tous les ans des relevés aériens des oiseaux nicheurs, entre le 16 juin et le 1^{er} juillet. La zone étudiée en 1992 et 1994 était le nord-ouest de l'île Victoria (82 749 km²), élargie en 1993 pour couvrir le sud-ouest de l'île (22 104 km² de plus). Des transects rectilignes ont été parcourus en hélicoptère dans chacune de six strates (huit en 1993), et deux observateurs notaient tous les oiseaux vus dans les 200 m de chaque côté de l'aéronef. Les relevés aériens ont permis d'identifier un total de 27 espèces, dont la plus abondante était l'Eider à tête grise.

On a estimé la population d'Eiders à tête grise sur le nord-ouest de l'île Victoria à 33 000 pour les deux premières années de l'étude, et à 51 000 la troisième année. Dans le sud-ouest de l'île, on l'a évaluée à 11 000 l'année où on y a fait des relevés. Le nombre de couples reproducteurs n'a pas varié de façon significative d'une année à l'autre. L'estimation plus élevée de la troisième année tenait à la présence de plus d'Eiders en troupeaux de plus de quatre individus. C'était dans la vallée de la Kagloryuak et près du lac Tahiryuak que se rencontraient les densités les plus fortes. Cette étude, ainsi que d'autres (Alexander *et al.*, 1994; Suydam *et al.*, en prép.), suggère que la population d'Eider à tête grise de l'ouest de l'Arctique a décliné dans les vingt à trente dernières années.

Les autres espèces communes d'oiseaux aquatiques étaient la Bernache du Canada, la Bernache cravant, le Cygne siffleur et l'Harelda kakawi. Les populations estimatives de la Bernache du Canada variaient d'environ 16 000 à 25 000 dans le nord-ouest de l'île Victoria, avec 19 000 individus de plus dans le sud-ouest. Nous avons identifié de 900 à 1 200 Bernaches cravants, 3 200 à 3 800 Cygnes siffleurs et 4 600 à 7 800 Hareldes kakawis dans le nord-ouest de l'île. Dans le sud-ouest, les estimations des populations de ces espèces étaient respectivement de 200, 4 200 et 1 800. C'est dans les strates couvrant la vallée de la Kagloryuak et dans la zone s'étendant au sud du lac Tassijuak jusqu'à la baie du Couronnement que l'on a constaté les plus fortes densités de Bernache du Canada et de Cygne siffleur. La Bernache cravant se rencontrait surtout dans deux strates seulement, la vallée de la Kagloryuak et la péninsule du Prince-Albert, alors que les Hareldes kakawis étaient présents sur tout le territoire étudié. Une comparaison de nos estimations de populations avec les résultats de relevés aériens similaires effectués en 1980 (Allen, 1982; McLaren et Alliston, 1981) et avec ceux d'autres études (Parmelee *et al.*, 1967; Lok et Wink, 1986) suggère que la Bernache du Canada peut être en train d'étendre son aire de répartition vers le nord sur l'île Victoria, alors que les effectifs de Bernache cravant et d'Harelda

kakawi semblent décliner.

Les canards plongeurs les plus fréquents étaient les Plongeurs du Pacifique, qui constituaient entre 63 et 81 % des plongeurs identifiés comme tels. L'estimation de la population dans le nord-ouest de l'île Vancouver variait de 2 500 à 5 300 individus, avec 1 200 de plus dans le sud-ouest de l'île. C'est dans la vallée de la Kagloryuak que les densités de population étaient généralement les plus élevées. Les autres espèces observées étaient le Plongeur à bec blanc et le Plongeur catmarin.

Les seules espèces abondantes de rapaces observées pendant les relevés aériens étaient la Buse pattue et le Harfang des neiges. Les populations estimatives de la première se situaient à environ 1 000 à 2 000 individus dans le nord-ouest de l'île Victoria, et étaient inférieures à une centaine dans le sud-ouest de la région étudiée. La population de Harfangs des neiges a considérablement varié sur les trois ans de l'étude. En 1994, elle a été estimée à moins du tiers du chiffre de 1993 ($3\,566 \pm 1\,494$ individus) dans le nord-ouest de l'île Victoria. C'est sur la péninsule du Prince-Albert que se retrouvent les plus grandes abondances tant de Buses pattues que de Harfangs des neiges.

Pendant les études, on a observé six Faucons pèlerins et un Faucon gerfaut. Quatre des six Faucons pèlerins ont été vus sur les falaises de la péninsule Diamond Jenness, ce qui confirme les précédentes indications de l'importance qu'ont ces falaises comme zone de nidification pour l'espèce (Allen, 1982; McLaren et Alliston, 1981).

L'étude a mis en évidence la présence de trois espèces de labbes : le Labbe pomarin, le Labbe parasite et le Labbe à longue queue. Le plus abondant au cours de notre étude, comme lors des relevés de 1980 de McLaren et Alliston (1981), était le Labbe pomarin. De même que le Harfang des neiges, l'effectif du Labbe pomarin a connu une importante baisse en 1994, passant d'un chiffre estimatif de $7\,340 \pm 490$ individus en 1993 à $1\,236 \pm 267$ en 1994. Le déclin des deux espèces est attribué à un effondrement des populations de lemming, leur principale proie.

Les Goélands bourgmestres étaient courants et régulièrement répartis sur la région d'étude. L'année d'abondance maximale a été 1992, avec un effectif estimé à $11\,525 \pm 4\,718$ pour le nord-ouest de l'île Victoria. Le seul autre laridé commun était la Mouette de Sabine. Nous avons estimé qu'il y avait chaque année, sur le nord-ouest de l'île, environ 1 500 Mouettes de Sabine, dont presque 90 % dans la vallée de la Kagloryuak ou près du lac Tahiryuak. Nous n'en avons vu que très peu dans le sud-ouest de l'île. Les Sternes arctiques étaient encore plus largement distribuées; les populations estimatives étaient d'environ 2 300 à 3 700 oiseaux dans le nord-ouest de l'île Victoria, et environ 975 de plus dans le sud-ouest. Les Goélands de Thayer étaient localement abondants dans le nord-ouest de la baie Prince-Albert, où nous avons trouvé six colonies dans les falaises sur les îles et le long de la côte. Une autre colonie a été observée dans l'inlet Minto.

Relevés au sol

Du 10 au 22 juillet 1992 et du 20 juin au 2 juillet 1993, nous avons effectué des relevés au sol des oiseaux sur une zone de 50 km² de la vallée de la Kagloryuak; cette zone avait en effet le potentiel d'assurer la subsistance de fortes densités d'Eiders à tête grise. Les relevés au sol devaient permettre la collecte d'information supplémentaire sur l'abondance des oiseaux, la distribution des sites de nidification et l'utilisation de l'habitat dans la zone. Les observations d'oiseaux ont été enregistrées pendant 87 heures de relevés en 1992. En 1993, nous avons effectué des relevés sur un total de 50,8 km sur 12 transects.

La vallée de la Kagloryuak renferme une faune aviaire riche et diversifiée, comparativement au reste de l'ouest de l'île Victoria. Pendant les relevés au sol, nous avons observé 34 espèces d'oiseaux et trouvé des preuves de nidification (jeunes ou oeufs au nid) pour 18. Ces relevés nous ont permis d'identifier les espèces plus petites, dont 10 espèces d'oiseaux de rivage et 5 de passereaux, que nous n'avions pas pu distinguer avec précision pendant les relevés aériens. L'oiseau le plus commun enregistré était le Bruant lapon, avec une densité de 58 individus au km² en 1993, mais les oiseaux de rivage avaient aussi des populations abondantes. Huit espèces d'oiseaux de rivage composaient à elles seules 53 % du total des oiseaux vus. Pendant les deux années de relevés, les oiseaux de rivage les plus courants étaient le Bécasseau semipalmé, le Bécasseau à poitrine cendrée, le Phalarope à bec large, le Bécasseau à croupion blanc, le Pluvier bronzé et le Bécasseau à échasses. Ces relevés ont mis en évidence la présence de sept espèces d'oiseaux aquatiques, dont les plus abondantes étaient la Bernache du Canada, l'Eider à tête grise et le Cygne siffleur. Trois espèces de labbes ont été observées, mais le Labbe pomarin prédominait.

Dans la zone étudiée de la vallée de la Kagloryuak, treize types d'habitats ont été identifiés et décrits. Les basses terres riches en végétation et dominées par les graminées étaient les habitats les plus abondants. Ce sont les habitats de ce type et pourvus de mares qui étaient les plus fréquentés par les oiseaux et qui présentaient la plus grande diversité d'espèces. McLaren et Alliston (1981) avaient fait des constatations similaires. Les habitats en pente douce situés dans l'intérieur des terres abritaient une population aviaire moins diversifiée, mais étaient appréciés de certaines espèces.

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1.0 INTRODUCTION

Limited information has been collected on the abundance and distribution of birds on western Victoria Island, and most consists of non-quantitative data. Preliminary checklists based on incidental bird observations were recorded by Smith (1973) along the coast in the Holman area north to Minto Inlet and in Prince Albert Sound, and Porsild (1951) at 11 sites on Victoria Island, while conducting other studies. Inventories of the birds of southeastern Victoria Island were carried out by Parmelee et al (1967) and by Lok and Vink (1986). Barry (1960) conducted a waterfowl reconnaissance across the western Arctic including parts of Victoria Island. The most useful quantitative information on the birds of western Victoria Island was collected by Allen (1982) and McLaren and Alliston (1981). These studies consisted of systematic aerial and ground surveys along a proposed Polar Gas pipeline route south-north across western Victoria Island from Lady Franklin Point to Richard Collinson Inlet, and along much of the adjacent coastline, cliffs and river valleys. Bird studies have also been conducted in areas adjacent to Victoria Island, specifically Banks Island (Manning et al 1956, Cotter et al 1993 and 1994), mainland south of Amundsen Gulf (Hines and Westover 1991, Hines et al 1992), Adelaide Peninsula (Macpherson and Manning 1959) and Melville Island (Maltby 1978).

With settlement of the Inuvialuit land claim in the western Arctic came the need to improve our knowledge of harvested bird species within the Inuvialuit Settlement Region. As part of the final agreement, the Inuvialuit were granted preferential hunting rights for wildlife on their land. Information on the status of hunted bird species was needed in order to set harvest limits that would ensure stable bird populations. Thus, in 1992 the Canadian Wildlife Service in cooperation with the Inuvialuit initiated a study to determine the distribution and abundance of the larger species of birds on western Victoria Island. Objectives of the 3-year study were to:

- obtain an estimate of the abundance of King Eiders and other bird species nesting on western Victoria Island
- identify areas and habitat types that are particularly important to birds on western Victoria Island
- establish a baseline for monitoring the health of bird populations, especially King and Pacific eider populations, in the future.

The study consisted of two components, annual aerial surveys from 1992 to 1994, and terrestrial surveys conducted in 1992 and 1993 in a study area north of the Kagloryuak River. Emphasis was on enumeration of the King Eider breeding population; however, in both aerial and ground components of the study, observations of other bird species were also recorded.

2.0 METHODS

2.1 Aerial Surveys

The study area chosen for the aerial surveys was the portion of Victoria Island which falls within the Inuvialuit Settlement Region (west of 110° W and north of 70° N), that is, northwest Victoria Island. In 1993 only, the study area was expanded to include the southern part of Victoria Island west of 112° W (southwest Victoria Island). We divided the study area into strata (Table 1; Fig. 1) based on physiographic and habitat similarities. Landsat Thematic Mapper satellite imagery that had been enhanced to show the amount of vegetation cover and moisture (colour bands 3,5,4 with histogram enhancement) was used to determine the boundaries of the strata. Within each stratum, we surveyed plots representing each of the dominant habitat types.

To allow comparisons between years, the same methods and observers were used for the aerial surveys each year. The aerial surveys consisted of straight lines flown generally perpendicular to the coast (Fig. 2). Transect lines were 10 km apart, except in the two study plots which appeared to have the most suitable habitat for nesting King Eider. There, the transects were 5 km apart. Transect width was 0.4 km. We surveyed a total of 3533, 4574 and 3503 km in 1992, 1993 and 1994 respectively (Table 1).

The surveys were conducted from a Bell 206B helicopter flown at 30 m above ground level at 145 kph. There were two observers, one in the left front seat and the other in the right rear seat which had a bubble window for easier viewing. Each recorded all birds within 200 m of their side of the aircraft. Bird species, number, flock size, and, whenever possible, sex and age, were noted. The transects were divided into 2-km segments to identify the approximate location of all bird sightings. At the beginning of each day of surveys or when starting to survey a different plot, the date, time and weather (temperature, wind speed and direction, cloud cover, precipitation) were recorded. At the beginning of each transect, the transect number, direction of travel, time and survey conditions (e.g. glare, rain showers) were noted. All data were recorded on a cassette tape recorder, so that observers never had to look away from the transect. Dates of surveys were 19 June to 1 July in 1992, 18 to 29 June in 1993 and 16 to 28 June in 1994.

Bird densities and variances were calculated for each study plot following Kingsley and Smith (1980). In order to calculate the population estimate for a stratum it was assumed that the density and variance throughout the stratum was similar to that found within the survey plot. If there was more than one survey plot within the stratum, we used the average density and maximum variance, thus conservatively assuming that the worst variance applied to the entire stratum. The total population was calculated by taking the sum of the population estimates for each stratum. Likewise, the variance for the entire region was calculated by taking the sum of the variances for each stratum (Caughley 1977), and the standard error by taking the square root of the variance.

The King Eider and Canada Goose population estimates were based on total indicated birds (Appendix A), whereas all other population estimates were based on the observed number of birds

(Appendix B). The King Eider Indicated Breeding Population estimate was calculated based on the standard operating procedures for waterfowl breeding and population surveys developed by the U.S. Fish and Wildlife Service and Canadian Wildlife Service (Anonymous 1987). King Eider observations were recorded as one of the following: lone drake, lone hen, flock of two to four drakes, flock of two to four hens, pair, or group of five or more birds. An observation of one hen and two drakes was treated as a pair and lone drake. Likewise, a hen and three drakes was treated as a pair and two drakes. The number of Indicated Pairs was calculated by adding lone drakes, drakes in flocks of four or less, and pairs (Appendix A2). To calculate Total Indicated Birds, the number of Indicated Pairs was multiplied by two, and added to the number of birds in groups of five or more. Observations of one to four hens were not included in the calculations. To calculate Canada Goose Indicated Breeding Population, observations of single birds or pairs were multiplied by two, whereas groups of more than two birds were multiplied by one (Appendix A4).

Among year comparisons in the number of birds in the study area were made using the Randomized Complete Blocks method (a type of two-way ANOVA), in which the years were treatments and the strata were the blocks (Sokal and Rohlf 1981). Densities were used for the comparisons (Appendix C).

2.2 Terrestrial Surveys

To obtain more detailed information on relative abundance, breeding biology and habitat preferences of birds, we conducted surveys on the ground at a study area within the Kagloryuak River valley at approximately 70°10' N and 111°15' W (Figs. 1 and 3). This area was selected based on its suitability as nesting habitat for King Eider. It is flat to gently rolling, and a diversity of habitats is present, ranging from well-vegetated graminoid meadows dotted with many ponds and small lakes to scarcely vegetated gentle slopes.

2.2.1 Abundance and distribution of birds

The methods used to assess abundance and distribution of bird species varied between years. The main objective of the surveys in 1992 was to locate King Eider nests. Thus the entire study area (about 50 km²) was searched on foot from 10 - 22 July. Observers walked parallel to each other 10 to 20 m apart criss-crossing each wetland and ridge. As we searched for nests, we kept a record of all species observed. In 1993, surveys were conducted from 20 June to 2 July, specifically to determine breeding bird densities and the habitat types they utilized. A transect survey method was used, where two observers walked side by side 25 m apart and recorded all birds seen along a 55 m wide strip. Birds outside of the transect width were recorded as "off transect". The position of the observers along the transects was monitored by pace counting, so that observations of birds could be located along the transect. For each bird observation, the species, number, age, and sex were recorded. Overall mean densities of each bird species were calculated by dividing the total number of observations by the total area surveyed. Only "on transect" observations were used in the data analysis. In addition, in both years, whenever a nest

or brood was encountered, we recorded species, location and clutch or brood size.

2.2.2 Habitat types and use by birds

Habitat descriptions were made during the transect surveys in 1993. The observers continued along the transect surveying for birds in that habitat until they were familiar with its characteristics. At that point they would describe the habitat by recording the following details: macro relief (for example, lowland), micro relief (such as hummocky), moisture, total percent cover of vegetation, dominant classes of vegetation and amount of cover represented by each class (estimated to the nearest 5%), substrate, dominant species of vegetation (representing more than 30% cover), and presence of waterbodies in the habitat and within 100 m of the transect. Amount of vegetative cover was estimated visually. Plant collections were made in order to verify the identification of the dominant species of vegetation in each habitat type.

Transects passed through several different habitat types. Whenever the habitat changed along the transect, the pace was noted. In this way, the relative abundance of each habitat type could be determined based on the frequency of encounters or sampling points, and the number of meters surveyed within each habitat. Densities of birds in each habitat type was determined by dividing the number of on transect observations of each species by the area surveyed.

3.0 RESULTS

3.1 Aerial Surveys

The results of the aerial surveys are summarized in Tables 2 and 3, and presented in detail in Appendix B. Strata 1 to 6 in northwest Victoria Island were surveyed in all three years, whereas strata 7 and 8 in southwest Victoria Island were surveyed only in 1993.

The most abundant bird species recorded each year on northwest Victoria Island during aerial surveys was the King Eider. Population estimates ranged from $32\,874 \pm 3405$ to $50\,560 \pm 5765$ birds in the northwest, with an additional $11\,150 \pm 1695$ in the southwest portion of the study area (Table 3). There were no significant differences in the number of indicated breeding pairs of King Eiders among the three years ($p < 0.05$; Appendix C). However, the total number of King Eiders in the study area was greater in 1994 than in the previous two years due to an increased number occurring in groups of more than four birds. About one-quarter of the King Eider observations in 1994 were groups.

The highest densities of King Eiders were observed each year in the Kagloryuak River valley (Stratum 2) and near Tahiryuak Lake (Stratum 3) where we recorded up to 1.9 eiders/km² (Table 2; Fig. 4). Densities were lowest in the dry interior (Stratum 5) and on Wollaston Peninsula (Stratum 7).

The Canada Goose was the second most abundant species in northwest Victoria Island. However, in southwest Victoria Island they outnumbered King Eider. Greatest densities of Canada Geese (up to 1.9 birds/km²; Table 2; Fig. 5) were observed in the Kagloryuak River valley and in southwest Victoria Island. Estimated numbers of Canada Geese in northwest Victoria Island ranged from 16 100 ± 3727 to 25 054 ± 2164 (Table 3), although this variation was not statistically significant (Appendix C). In southwest Victoria Island we estimated a population of 19 075 ± 1703. Most Canada Goose observations were of single birds or pairs on nesting territories.

Other goose species observed were the Brant, Lesser Snow Goose, and Greater White-fronted Goose (Tables 2 and 3). Observations of Brant and Snow Geese were highly clumped: frequently in flocks of up to 25 birds. We estimated from 900 to 1200 Brant and 700 to 1900 Lesser Snow Geese in northwest Victoria Island. There were an estimated 205 Brant and 276 Snow Geese in southwest Victoria Island (Table 3). Both species were most common in the Kagloryuak River valley and on Prince Albert Peninsula (Table 2). White-fronted Geese were relatively abundant in the southwest part of the study area, especially in the Tassijuak Lake stratum (0.13 birds/km²), but were rarely seen further north. We estimated a population of 1020 ± 444 Greater White-fronted Geese in southwest Victoria Island. About half of the birds were singles or pairs on territories, and the other half in flocks.

The annual population estimate for Tundra Swans in northwest Victoria Island was about 3500 birds, with no significant change in number among years (Table 3, Appendix C). There were an additional 4227 ± 973 swans in the southern two strata. Like the Canada Goose, swans occurred in greatest densities in the Kagloryuak River valley and south of Tassijuak Lake (up to 0.4 swans/km²) (Table 2, Fig. 6).

Oldsquaws, on the other hand, were less common in southwest than northwest Victoria Island (Table 3). Population estimates for Oldsquaws in northwest Victoria Island varied among years from a low of 4648 ± 1050 to a maximum of 7763 ± 2294, although the difference was not significant (Appendix C). Oldsquaws had a scattered distribution, and were found in low numbers throughout the study area (Fig. 7). Relatively higher densities were recorded near Tahiryuak Lake in 1992, but not in other years.

During our aerial surveys, Common Eiders, the only other commonly encountered duck, were seen primarily along the coasts of Prince Albert Sound and Minto Inlet. A few were also seen at the western edge of Stratum 6 in Prince of Wales Strait. Few Northern Pintail (maximum 11, in 1993) were observed, and they occurred only in the Kagloryuak River valley and in the two southern most strata.

Three species of loons were observed during the surveys: the Pacific, Yellow-billed and Red-throated loon. The Pacific Loon was most common, accounting for between 63 and 81% of all loons identified to species each year. It was found throughout the study area, but, on average, densities were slightly higher in the Kagloryuak River valley (Fig. 8). Significantly more Pacific

Loons were recorded in 1994 (5292 ± 832) in northwest Victoria Island, than in 1992 (Table 3; Appendix C). The Yellow-billed Loon represented between 10 and 24% of loons identified to species. We estimated an average of about 950 each year in northwestern Victoria Island, nearly half of which were on Prince Albert Peninsula (Tables 2 and 3). The Red-throated Loon was the least common of the loons, except in the Kagloryuak River valley, where it was more abundant than the Yellow-billed Loon. We estimated less than 600 birds each year in northwestern Victoria Island. No Red-throated Loons were seen in the dry interior of Stratum 5.

We recorded a total of 6 Peregrine Falcons over the three years of surveys, 4 on cliffs on Diamond Jenness Peninsula, 1 on Wollaston Peninsula and 1 north of Lady Franklin Point. A single Gyrfalcon was recorded north of Minto Inlet. One other falcon, unidentified to species, was seen on a cliff on Diamond Jenness Peninsula. Rough-legged Hawks occurred in all strata, although slightly greater densities occurred at the north end of the study area on Prince Albert Peninsula (Table 2). Population estimates for northwest Victoria Island ranged from approximately 1000 to 2000 Rough-legged Hawks, while fewer than 100 were estimated for the southwest portion of the study area.

We encountered low densities of ptarmigan throughout the study area each year, with greatest densities in the areas with lush vegetation: Kagloryuak River valley, Tahiryuak Lake wetlands, Prince Albert Peninsula and in southwest Victoria Island south of Tassijuak Lake. Sandhill Cranes occurred in low numbers at widely scattered locations in the study area. They were found in greatest abundance south of Tassijuak Lake (Table 2).

Three species of jaegers occurred in the study area: Pomarine, Parasitic and Long-tailed jaegers. On average, Pomarine Jaegers were most common, accounting for 48% of observations. Population estimates for Pomarine and Parasitic jaegers were significantly lower in northwest Victoria Island in 1994 than in the other two years. (Appendix C). Estimated numbers of Pomarine Jaegers declined from 7340 ± 490 birds in 1993 to 1236 ± 267 in 1994, while Parasitic Jaeger populations declined from an estimated 4639 ± 738 in 1992 to 813 ± 330 in 1994 (Table 3). The Kagloryuak River valley supported the greatest densities of Parasitic Jaegers, whereas Pomarine Jaegers were, on average, most abundant near Tahiryuak Lake (Figs. 9 and 10). Long-tailed Jaegers were slightly more common on Prince Albert Peninsula than in other areas (Table 2).

Glaucous Gulls were widespread and fairly evenly distributed in the study area in all three years of surveys (Table 2; Fig. 11). They occurred in greatest abundance in 1992, when an estimated $11\,525 \pm 4718$ birds were in the study area. By 1994 numbers of Glaucous Gulls had dropped to about half the 1992 estimate, although this difference was not detected statistically (Appendix C).

We estimated about 1500 Sabine's Gulls each year on northwest Victoria Island, and almost 90% of observations were in the Kagloryuak River valley or near Tahiryuak Lake (Table 3; Fig. 12). Only 4 Sabine's Gulls were observed in southwest Victoria Island (1993). There were no Sabine's Gulls observed in the dry interior of Stratum 5 in either 1993 or 1994.

Arctic Terns were more common and more evenly distributed in the study area than Sabine's Gulls, although, like Sabine's Gulls, terns were rare in the dry interior (Fig. 13). An average of 75 terns was recorded each year. Population estimates for Arctic Terns did not vary widely between years, ranging from 2340 ± 830 to 3732 ± 1730 in northwest Victoria Island (Table 3), with an additional 975 ± 158 in southwest Victoria Island (Table 3).

Most observations of Thayer's Gulls were along the coastline of Diamond Jenness Peninsula (Table 2). The only other observations of Thayer's Gulls were along the coast of Prince Albert Peninsula (total 3 observations), and near Tahiryuak Lake (1 observation). Six Thayer's Gull nesting colonies were located on cliffs on the islands and coastline of northwest Prince Albert Sound, and one on a cliff on the north side of Diamond Jenness Peninsula (Fig. 14). All but one colony were sightings incidental to the aerial transect surveys.

Snowy Owls occurred in all strata, although densities were consistently higher on Prince Albert Peninsula. High densities also occurred in 1992 in the Kagloryuak River valley, and in 1993 in the dry interior of Stratum 5, but numbers were lower in these areas in other years (Table 2). Like the jaegers, the Snowy Owl population drastically declined in 1994, falling to less than one-third the 1993 estimate of 3566 ± 1494 owls (Table 3).

Single observations of Short-eared Owls were noted in 1994 only: one each in the Kagloryuak River valley and near Tahiryuak Lake. We saw few Common Ravens during the aerial surveys, with a maximum of 4 in a single year.

3.2 Terrestrial Surveys

In 1992, we recorded bird observations in the Kagloryuak River study area during approximately 87 hours of surveying over 13 days (mean 6.7 hours/day). At the same site in 1993, we surveyed a total of 50.8 km along 12 transects recording both bird and habitat observations. Although not directly comparable between years, these data can be used to give an index of relative abundance of species. Except when specified otherwise, reference to the 1993 data in the following discussion applies to 'on transect' data.

3.2.1 Bird Abundance

We encountered 33 different species of birds in the Kagloryuak River study area in 1992, and 34 in 1993 (13 of which were seen only off transect)(Tables 4 and 5). Evidence of nesting (fledged young or a nest with eggs) was found for 18 species. Average clutch size for each species is listed in Table 6.

Lapland Longspurs were the most common bird species recorded during the surveys, representing 22% of total observations in 1992 and 49% of birds seen on transect in 1993. Other passerine species observed, each representing one percent or less of total observations, included Horned Lark, Snow Bunting, Common Raven, and, in 1992 only, a Water Pipit.

Shorebird populations (Scolopacidae and Charadriidae) were abundant and diverse in both years. Eight shorebird species together comprised 53% birds seen in 1992, while in 1993 there were 7 shorebird species recorded, representing 36% of total birds. Over the two years of surveys the most frequently observed shorebirds were Semipalmated and Pectoral sandpipers, followed by Red Phalaropes, White-rumped Sandpipers, Lesser Golden Plovers, and Stilt Sandpiper in decreasing order of abundance (Tables 4 and 5). Evidence of nesting was found for all but the Red Knot and Black-bellied Plover (Tables 4 and 6).

Nearly all geese recorded during the ground surveys were Canada Geese, although two other species, Brant and Lesser Snow Geese, were also seen in low numbers. Eleven Canada Goose nests were found in 1992 with a mean clutch size of 3.4 (range 1 to 6) (Table 6). We recorded an average of three Tundra Swans per day in 1992, and a total of 13 off transect in 1993. There was evidence of nesting in the first year only. King Eiders and Oldsquaw were the only diving ducks observed, and in 1992 the King Eider outnumbered Oldsquaw by a ratio of 5:1. Only two King Eiders were observed on transect in 1993, but if off transect birds were included, King Eiders were about three times more common than Oldsquaw (Table 5). No dabbling ducks were observed in 1992, but one Northern Pintail was recorded off transect during the 1993 surveys.

All three jaeger species (Pomarine, Parasitic and Long-tailed jaegers) were observed during the surveys on the ground in the Kagloyuak River valley (Tables 4 and 5). However, the Pomarine Jaeger was more than twice as abundant as the other species, representing about 65% of jaeger observations each year. Nests of all three species were found (Table 6).

We recorded one adult Snowy Owl per day on average in 1992, but none in 1993. Two broods of 2 and 4 young were found in 1992 (Table 6). Other raptor species seen each year were Short-eared Owl, Rough-legged Hawk and Peregrine Falcon.

3.2.2 Habitat Use

Thirteen habitat types were recognized in the Kagloyuak River valley study area, based on 50 802 m surveyed. Table 7 gives detailed information about each habitat type, including the number of meters surveyed within each habitat type.

The habitat types were loosely grouped into categories, based on a hierarchy of criteria, including macrorelief, presence of ponds, and amount and type of vegetation. For example, ponded lowland habitats with greater than 60% vegetation cover were separated into those that were dominated by graminoids, and those that were dominated by both graminoids and *Dryas*. Well-vegetated graminoid-dominated lowlands, with or without ponds, (L1 and L5) were the most abundant habitats, representing respectively 14 137 and 11 351 m of surveyed area (Table 7).

Well-vegetated lowland areas with ponds received the heaviest use by birds and had the greatest species richness (Table 8). An average of 10 species was recorded in each of the well-vegetated ponded lowland habitats. As expected, certain water birds and shorebird species, including

Pacific Loon, Oldsquaw and Red Phalarope were restricted to ponded lowlands. Canada Geese were most abundant in well-vegetated ponded habitats, although they also heavily utilized the ponds on the ridgetops.

Willow Ptarmigan were found in a variety of lowland habitats, but were slightly more common in well-vegetated habitats. Sandhill Cranes were recorded only in lowland areas without continuous vegetative cover.

The gently sloped upland habitats supported a less diverse bird population, but were favoured by some species. Pomarine and Long-tailed jaegers were found in greater densities in upland (ridge top and gently sloped) habitats, in contrast to the Parasitic Jaeger which was observed only in the lowland habitats. The Red Knot selected gently sloped well-vegetated areas which had significant cover of *Dryas* as well as graminoids. Observations of Rock Ptarmigan and Snow Bunting were limited to sparsely vegetated upland areas with no ponds. Horned Larks were also characteristic of the drier habitats, that is, gentle slopes and lowlands without ponds and with incomplete vegetative cover. The surveyed areas within some of the gently sloped habitats were small; for example, less than 1000 m were surveyed in S3 and S4, making interpretation of the observations difficult.

Some species were present in several quite different habitat types. Lapland Longspurs were ubiquitous, being the most abundant species in all 13 habitat types. Lesser Golden Plover were found in a variety of habitats, but showed a preference for the well-vegetated areas with ponds, either gently sloped uplands or graminoid-dominated lowland habitats. Densities of shorebirds were greatest in the ponded areas, but several species, including Semipalmated, White-rumped, Pectoral and Stilt sandpipers, were also encountered in lowland areas without ponds. However, standing water was usually present in the unponded habitats where these shorebirds were observed.

In summary, more bird species utilized the flat lowlands than the ridgetops or gently sloped areas (Table 8). Also, within each category of macrorelief, ponded areas supported more species than areas without ponds.

4.0 DISCUSSION

4.1 Abundance and distribution of birds

Not all of the birds on a transect strip are detected during aerial surveys. For example, when Cotter et al (1994) resurveyed transects on Banks Island at a slower speed, he found about 25% more King Eiders than had been detected during the first survey. Unfortunately, there are no visibility correction factors available for Victoria Island. Thus our population estimates have not been corrected for visibility error, and should be regarded as minimum values.

4.1.1 Waterfowl

The King Eider is the most abundant and widespread waterfowl species on western Victoria Island (this study; Allen 1982; McLaren and Alliston 1981; and Smith 1973), and in southeastern Victoria Island (Parmelee et al 1967).

In 1994, groups of more than four birds represented a significant proportion of the King Eider population estimate. It is unknown whether these groups were non-breeders or nesting birds which failed shortly after egg-laying. Nesting in 1994 was not delayed or prevented by the weather, as spring thaw occurred early that year. However, Victoria Island probably experienced a lemming population crash late in 1993, with a subsequent high rate of nest failure the following spring due to nest predation by foxes (Summers and Underhill 1987). Although we have no quantitative information about lemming densities on Victoria Island, a lemming population crash was reported in two nearby regions: Kent Peninsula to the south of Victoria Island (R. Bromley, NWT Wildl. Serv., pers. comm.); and Bathurst Island to the northeast (F. Miller, Can. Wildl. Serv., pers. comm.). Lemming population cycles are thought to be synchronous across the Arctic (Etlon 1942). Hence, we suspect the lemming population also crashed on Victoria Island.

Regardless of why there were more groups of eiders, they likely biased upwards our 1994 population estimate. Groups of non-nesting birds are easier to see than nesting pairs due to the number of birds, as well as their tendency to flush more readily than nesting birds (Bromley et al. 1995).

The King Eider population estimate obtained during this study was less than expected based on the results of other studies. Counts during eider migration past Point Barrow, Alaska in 1970 and 1976 indicated a population of about 800 000 King Eiders in the western Arctic (Johnson 1971, Woodby and Divoky 1982). An aerial reconnaissance of Victoria Island (Barry 1960) resulted in an estimate of 800 000 King Eiders. Given our survey coverage of nearly half the island, one would have expected an estimate closer to 400 000 birds. Thus the results of our surveys from 1992 to 1994 suggest that the population has decreased. More recent counts of King Eiders during spring migration past Point Barrow, Alaska in 1987 (Suydam et al, in prep.) and in offshore leads in the Beaufort Sea in the spring of 1992 and 1993 (Alexander et al 1994) also indicate a decline since 1976.

The Canada Goose was the second most abundant species of waterfowl observed during our aerial surveys on western Victoria Island. Canada Geese were more common in the southern than the northern half of our study area in all three years. However, the nesting range of this species might have spread northward on Victoria Island in recent years. We estimated about 1000 to 2600 Canada Geese nesting on Prince Albert Peninsula from 1992 to 1994, whereas McLaren and Alliston (1981) saw no Canada Geese north of the Kuujjua River in 1980.

Pacific Black Brant populations on the other hand may be declining. Populations of Brant on southeastern Victoria Island and Prince Albert Peninsula were estimated by Barry (1960) at 3000

birds. Lok and Vink (1986) noted that there were fewer Brant on southeastern Victoria Island in 1983 than in 1960. This decline has apparently continued into the 1990s. In 1980, 36% of goose observations recorded by Allen (1982) were Brant, compared to only 4% of the geese identified during our surveys from 1992 to 1994. Other evidence that numbers of this species have declined in recent years comes from counts on the wintering grounds (Ward et al 1992).

Most of the Lesser Snow Goose population in the western Canadian Arctic nests on Banks Island (Manning et al 1956; Cotter et al 1994; Bellrose 1976). The Lesser Snow Goose is uncommon in southeast Victoria Island (Parmelee et al 1967), and near Holman (Smith 1973). Few were seen during the 1980 surveys (Allen 1982; McLaren and Alliston 1981) on western Victoria Island. Observations of scattered pairs were noted during the 1992 to 1994 surveys, but most of the Snow Geese observed were flocks of failed or non-breeding birds.

Nesting Greater White-fronted Geese were relatively abundant in the southern most stratum of our study area, but rare elsewhere. McLaren and Alliston (1981) noted only 3 observations of this species, 2 of which were near Lady Franklin Point. Allen (1982) recorded a total of 8 observations on western Victoria Island, 5 of which were near the coastline south of Tassijuak Lake. This goose is a locally abundant breeder in southeastern Victoria Island (Parmelee et al 1967; Lok and Vink 1986).

Numbers of swans on western Victoria Island generally decrease from south to north. We found a substantial breeding population of swans in two areas: south of Tassijuak Lake and in the Kagloryuak River valley. In contrast, few swans utilize the areas north of Prince Albert Sound. Allen (1982) and McLaren and Alliston (1981) reported a similar distribution of swans on the island. On Banks Island, Cotter et al (1993) also noted that there was a northern limit of swan observations (at about latitude $72^{\circ} 30' N$) beyond which no swans were recorded. Other studies have shown that this species inhabits large ponds and lakes during the nesting season (Derksen et al 1981). The availability of suitable breeding habitat is unlikely limiting swan numbers on northern Victoria Island, since lakes and ponds in well-vegetated wetlands are numerous on Prince Albert Peninsula. Gaston et al (1985) suggested that a similar trend of declining swan populations from southwest to northeast in their northern Hudson Bay study area was tied to the length of the ice-free period for freshwater lakes.

There may be fewer Oldsquaw nesting on western Victoria Island now than in the recent past. McLaren and Alliston (1981) reported 1.05 birds/km² in the Kagloryuak River valley in 1980 (total distance surveyed was 123 km), while we observed densities of 0.15, 0.17 and 0.09 birds/km² in 1992 to 1994 respectively. Evidence suggesting a general decline of Oldsquaw populations in the North Pacific Rim was collected by Goudie et al (1994), who found lower than expected populations of Oldsquaw in Alaska and Yukon.

Most of the Common Eiders seen during our surveys were close to the coastline. The design of our aerial surveys, with transect lines perpendicular to the coast, did not allow sufficient sampling of the prime nesting habitat of the Common Eider which tends to be small offshore islands (Barry

1986). In a separate study conducted in 1992 and 1993 (Cornish and Dickson in press), all of the islands in Prince Albert Sound and Minto Inlet were searched for Common Eider nests. Three large colonies ranging in size from 136 to 317 nests were found as well as 3 smaller colonies of 5 to 40 nests.

We saw few Northern Pintail during aerial surveys, and none in 1994. Both McLaren and Alliston (1981) and Parmelee et al (1967) reported small flocks of Northern Pintail on the southern half of Victoria Island, but neither found evidence of breeding. Smith (1973) noted they were rare near Holman.

4.1.2 Loons

Pacific Loons were the most common loons recorded during our study. We saw more Pacific Loons in inland areas in northwest Victoria Island than previous researchers. Only 15 were seen during aerial surveys by McLaren and Alliston (1981), and almost half of these occurred near the head of Prince Albert Sound (maximum density 0.04 birds/ km²). In contrast, in all but one of our surveyed strata, the average 3-year density of Pacific Loons was 0.05 birds/km² or greater.

4.1.3 Falcons

Aerial surveys in 1980 of cliffs adjacent to Minto Inlet, between Holman and Minto Inlet, in the Kuujjua valley and the cliffs east of Holman confirmed the importance of these areas for nesting Peregrine Falcons (Allen 1982; McLaren and Alliston 1981). The absence of Peregrine Falcons in some areas (strata 1 to 3 during this study) is likely due to the lack of nesting cliffs which may be the most important factor limiting the population of this species over much of Victoria Island (McLaren and Alliston 1981). The only previous record of Gyrfalcons on western Victoria Island was a sighting by McLaren and Alliston (1981) on a cliff in the Kuujjua River valley.

4.1.4 Ptarmigan

We saw more Willow than Rock Ptarmigan on our Kagloryuak River valley study area. However, on the island as a whole, Rock Ptarmigan are likely more common (Parmelee et al 1967; McLaren and Alliston 1981). On Banks Island, Cotter et al (1993) found slightly more Rock than Willow Ptarmigan. During ground surveys in 1980 on Victoria Island, both species showed a preference for better vegetated sites (McLaren and Alliston 1981), although Rock Ptarmigan were occasionally found on incompletely vegetated tundra, which was avoided by Willow Ptarmigan. Allen (1982) recorded highest ptarmigan densities close to Lady Franklin Point, and generally fewer in the northern half of Victoria Island.

4.1.5 Gulls, Terns and Jaegers

Glaucous Gulls nest in two very different habitats: on islets in ponds, and along cliffs, either singly or in colonies, while Thayer's Gulls nest on precipitous cliffs, often in mixed colonies with

Glaucous Gulls (Godfrey 1966; Parmelee et al 1967; this study). We found Glaucous Gulls throughout the study area in moderate densities. A similar widespread and scattered Glaucous Gull density distribution was observed by Allen (1982) and McLaren and Alliston (1981). Glaucous Gull and Thayer's Gull nesting colonies have previously been noted in Prince Albert Sound, Prince of Wales Strait and Minto Inlet (Allen 1982; Barry et al 1981; Porsild 1951).

In contrast to Glaucous Gulls, Sabine's Gulls are only locally common on western Victoria Island. We observed them in much greater densities in the well vegetated ponded tundra habitats in the Kagloryuak River valley and near Tahiryuak Lake than elsewhere in the study area. Similarly, the majority of Sabine's Gulls seen by both Allen (1982) and McLaren and Alliston (1981) were in the Kagloryuak River valley. Smith (1973) did not record the Sabine's Gull near Holman Island. This species is fairly common in southeast Victoria Island (Parmelee et al 1967).

Arctic Terns were more common along coastlines than inland (this study; Allen 1982; McLaren and Alliston 1981). The species was also generally less abundant in the northern half of the island, although they occurred in moderate densities in the coastal lowlands near Richard Collinson Inlet. In southeastern Victoria Island, terns were thinly scattered, nesting as solitary pairs or small colonies on islands and peninsulas in lakes (Parmelee et al 1967).

The areas on Victoria Island where we observed the highest jaeger densities during the aerial surveys all had continuous vegetation cover, where lemming numbers are likely to be greater. The Pomarine Jaeger, the most abundant jaeger on Victoria Island (this study; McLaren and Alliston 1981) is an obligate lemming predator, and numbers in a given year or area are directly dependent on local levels of lemmings (Taylor 1974). Thus, the significant drop in Pomarine Jaeger numbers in 1994 was likely due to the lemming population crash in late 1993. Similarly, in southeast Victoria Island in 1983, Lok and Vink (1986) also attributed the absence of Pomarine Jaeger to a scarcity of lemmings that year. There, and on our study area in 1994, the Long-tailed Jaeger was more abundant. Although the Long-tailed Jaeger is primarily a lemming predator, both Parasitic and Long-tailed jaegers also prey on birds and insects, and are thus less tied to lemming population cycles (Taylor 1974).

4.1.6 Owls

Numbers of Snowy Owls are also directly dependent on lemming populations, their primary prey on the nesting grounds (Taylor 1974; Parker 1974). The estimated population of Snowy Owls in northwest Victoria Island in 1994 was only one quarter the 1993 estimate. Short-eared Owls probably occasionally nest on Victoria Island (Parmelee et al 1967), but they are rare (Allen 1982; McLaren and Alliston 1981, this study).

4.1.7 Shorebirds and Passerines

Only a small proportion of less visible or smaller birds such as shorebirds and passerines are observed during aerial surveys. For example, Haddock and Evans (1975) reported that only 14%

of shorebirds are detected during helicopter surveys compared to ground surveys. We made no attempt to differentiate these small bird species during the aerial surveys, and the following discussion is based on observations during ground surveys in the Kagloryuak River valley.

Species composition of shorebirds during 1980 ground surveys in other parts of western Victoria Island (McLaren and Alliston 1981) did not substantially differ from our observations in the Kagloryuak River valley. Semipalmated Sandpiper, Pectoral Sandpiper and Red Phalarope were the most abundant shorebird species on our Kagloryuak River valley study area in 1992 and 1993. McLaren and Alliston (1981) also found more Red Phalaropes and Semipalmated Sandpipers than other shorebirds at sites across western Victoria Island, while Pectoral Sandpipers were widespread but less common, occurring at 12 of their 15 sites. Semipalmated Sandpipers and Red Phalaropes were also the most frequently encountered shorebird species near Cambridge Bay (Lok and Vink 1986), and are abundant throughout southeast Victoria Island (Parmelee et al 1967). However, Smith (1973) did not record either species in the Holman area.

We found more Lesser Golden Plovers than Black-bellied Plovers in the Kagloryuak River valley, an observation corroborated by McLaren and Alliston (1981). However, during surveys by Parmelee et al (1967) in southeastern Victoria Island, Black-bellied Plovers were more common, especially in inland areas.

4.2 Habitat utilization in the Kagloryuak River valley

The Kagloryuak River valley is among the richest areas on the island in terms of diversity and abundance of bird life. It provides nesting habitat for over 30 species, many of which are found in higher densities here than in other parts of western Victoria Island. The ground surveys provide an insight into the species composition, relative abundance, nesting distribution and habitat preferences of birds in the Kagloryuak River valley. The distribution of ponds and the amount of vegetation cover were two environmental factors governing bird distribution. McLaren and Alliston (1981) also found that nesting birds generally occurred in greatest densities in lowland areas where there was continuous vegetation cover and numerous ponds.

There are limitations to the conclusions to be drawn from the habitat analysis. The results should be considered preliminary given the small sample sizes, especially for less common species and habitat types. Also, the types of habitat used by some species, for example, White-rumped Sandpiper, may vary somewhat across their range on Victoria Island (McLaren and Alliston 1981). Further, there may be considerable variation in habitat use from year to year (Pitelka 1959), and within a given year depending on season of use (Connors et al 1979).

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Table 1. Extent of aerial surveys for breeding populations of birds on western Victoria Island, 1992 to 1994.

Stratum			Transects surveyed					
			1992		1993		1994	
No.	Location	Area (km ²)	No.	Length (km)	No.	Length (km)	No.	Length (km)
1	Quunnguq Lake	3971	7	172	7	324	7	324
2	Kagloryuak R. valley	4573	8	608	9	688	9	688
3	Tahiryuak Lake	2298	8	282	9	322	9	322
4	Diamond Jenness Peninsula	15866	24	817	16	527	21	709
5	Minto Inlet to Wynniatt Bay	39676	16	690	6	338	9	476
6	Prince Albert Peninsula	16365	29	964	26	914	29	984
7*	Wollaston Peninsula	16596	---	---	6	662	---	---
8*	Tassijuak Lake	5508	---	---	12	799	---	---

*surveyed only in 1993

Table 2. Density (number per 100 sq km) of birds observed in each stratum during aerial surveys on Victoria Island, 1992 to 1994. Numbers in brackets represent standard errors.

	Year	Stratum							
		1	2	3	4	5	6	7	8
Pacific Loon	1992	2.9 (1.5)	9.0 (2.9)	8.0 (4.5)	1.8 (1.1)	1.2 (1.9)	5.9 (4.0)	nd ---	nd ---
	1993	11.6 (4.1)	9.8 (2.7)	8.5 (5.8)	5.2 (1.6)	3.0 (2.1)	6.9 (4.9)	5.0 (2.0)	8.0 (2.0)
	1994	2.3 (1.7)	17.4 (2.8)	10.9 (4.5)	12.3 (2.6)	3.2 (1.5)	5.8 (2.4)	nd ---	nd ---
Red-throated Loon	1992	0.0 (0.0)	3.3 (2.2)	1.8 (1.2)	0.9 (0.5)	0.0 (0.0)	0.9 (1.3)	nd ---	nd ---
	1993	0.0 (0.0)	0.7 (0.5)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.9 (0.9)	0.0 (0.0)	0.9 (0.5)
	1994	1.5 (1.7)	2.5 (1.8)	0.0 (0.0)	1.4 (1.4)	0.0 (0.0)	1.1 (1.1)	nd ---	nd ---
Yellow-billed Loon	1992	0.0 (0.0)	0.0 (0.0)	0.9 (0.6)	0.6 (0.4)	0.8 (1.9)	3.1 (2.9)	nd ---	nd ---
	1993	0.0 (0.0)	2.2 (1.8)	0.8 (0.6)	1.4 (0.4)	0.7 (0.8)	3.5 (1.6)	0.8 (0.5)	1.3 (0.6)
	1994	1.5 (0.8)	0.4 (0.4)	0.0 (0.0)	0.7 (0.7)	0.5 (0.0)	1.6 (1.8)	nd ---	nd ---
Loon sp.	1992	0.0 (0.0)	4.5 (1.6)	2.7 (1.9)	0.6 (0.6)	0.6 (1.2)	0.5 (1.1)	nd ---	nd ---
	1993	1.5 (1.6)	1.5 (0.5)	0.0 (0.0)	1.9 (1.1)	1.5 (1.6)	4.6 (3.2)	0.0 (0.0)	1.3 (0.5)
	1994	3.1 (2.2)	4.0 (1.9)	0.8 (0.8)	2.8 (1.0)	2.6 (0.0)	7.2 (1.3)	nd ---	nd ---
Tundra Swan	1992	5.8 (4.4)	34.5 (5.8)	5.3 (4.7)	5.5 (1.2)	1.1 (2.0)	2.0 (2.0)	nd ---	nd ---
	1993	10.8 (3.5)	28.3 (2.8)	7.0 (1.6)	6.6 (2.3)	0.0 (0.0)	1.6 (1.4)	13.2 (4.0)	36.9 (5.2)
	1994	13.9 (3.2)	41.4 (3.2)	4.7 (2.7)	5.3 (2.1)	1.1 (1.1)	0.2 (0.3)	nd ---	nd ---
Canada Goose*	1992	23.2 (6.3)	153.4 (20.6)	38.1 (12.9)	58.1 (7.5)	10.9 (7.9)	10.9 (4.4)	nd ---	nd ---
	1993	94.9 (20.7)	151.2 (30.6)	29.5 (4.9)	19.4 (4.7)	1.5 (1.6)	6.5 (3.8)	65.7 (3.4)	148.3 (14.4)
	1994	66.4 (6.6)	187.1 (11.7)	48.1 (7.8)	45.5 (8.8)	7.4 (3.1)	16.0 (5.6)	nd ---	nd ---
Brant	1992	0.0 (0.0)	4.5 (4.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	6.1 (6.5)	nd ---	nd ---
	1993	0.0 (0.0)	1.5 (0.9)	0.0 (0.0)	1.9 (1.9)	0.0 (0.0)	3.3 (2.1)	1.1 (0.9)	0.3 (0.3)
	1994	0.8 (0.6)	11.3 (8.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.6 (5.5)	nd ---	nd ---
Greater White-fronted Goose	1992	1.5 (1.0)	0.0 (0.0)	0.0 (0.0)	1.2 (1.2)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.9 (1.5)	12.8 (6.8)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---

(Table 2 cont'd)

	Year	1	2	3	4	5	6	7	8
Snow Goose	1992	0.0 (0.0)	1.6 (0.7)	0.0 (0.0)	0.3 (0.3)	0.0 (0.0)	3.4 (6.4)	nd ---	nd ---
	1993	3.1 (2.4)	1.1 (1.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	3.8 (6.3)	0.0 (0.0)	5.0 (3.5)
	1994	9.3 (9.5)	20.0 (10.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	3.8 (6.8)	nd ---	nd ---
Dark Goose	1992	0.0 (0.0)	0.4 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.8 (1.0)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.4 (0.7)	0.0 (0.0)	1.9 (0.8)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
Northern Pintail	1992	0.0 (0.0)	1.6 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
	1993	0.0 (0.0)	0.7 (0.7)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.5 (1.2)	1.6 (1.3)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
Common Eider	1992	39.2 (28.9)	0.0 (0.0)	0.0 (0.0)	34.3 (21.1)	7.8 (11.0)	5.4 (5.9)	nd ---	nd ---
	1993	6.2 (6.5)	1.5 (1.5)	0.0 (0.0)	0.9 (0.5)	0.0 (0.0)	0.7 (0.7)	0.0 (0.0)	0.6 (0.4)
	1994	1.5 (1.6)	0.7 (0.7)	0.0 (0.0)	10.2 (4.0)	0.0 (0.0)	3.6 (4.1)	nd ---	nd ---
King Eider*	1992	81.4 (17.1)	135.7 (17.8)	140.1 (33.9)	41.0 (7.7)	9.7 (6.2)	60.4 (9.2)	nd ---	nd ---
	1993	84.1 (17.5)	130.1 (11.9)	132.8 (21.9)	38.9 (4.8)	17.8 (5.0)	47.5 (18.7)	38.5 (9.6)	86.4 (10.5)
	1994	79.5 (13.3)	186.0 (17.5)	166.1 (26.0)	49.4 (10.1)	37.8 (11.5)	74.8 (17.9)	nd ---	nd ---
Oldsquaw	1992	10.2 (3.2)	15.2 (3.7)	52.3 (20.5)	11.9 (2.7)	8.0 (5.5)	2.5 (2.1)	nd ---	nd ---
	1993	4.6 (1.9)	17.0 (3.5)	5.4 (2.3)	7.6 (2.6)	11.1 (3.6)	4.8 (5.4)	8.3 (0.9)	7.2 (2.1)
	1994	5.4 (5.0)	9.4 (3.0)	10.1 (3.1)	13.8 (4.6)	1.6 (1.6)	5.9 (2.0)	nd ---	nd ---
Falcon sp.	1992	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.1 (1.4)	0.2 (0.4)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.9 (0.6)	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	0.3 (0.3)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
Rough-legged Hawk	1992	1.5 (1.6)	1.2 (0.9)	0.0 (0.0)	0.9 (0.5)	3.3 (3.7)	2.4 (1.4)	nd ---	nd ---
	1993	0.8 (0.8)	0.4 (0.3)	0.8 (0.6)	2.4 (1.0)	0.0 (0.0)	3.4 (1.2)	0.4 (0.4)	0.6 (0.4)
	1994	1.5 (1.1)	0.4 (0.3)	1.6 (1.1)	0.0 (0.0)	1.1 (0.7)	4.2 (2.8)	nd ---	nd ---
Ptarmigan sp.	1992	0.0 (0.0)	2.5 (0.8)	4.4 (1.7)	0.3 (0.3)	1.3 (3.5)	2.7 (2.2)	nd ---	nd ---
	1993	0.0 (0.0)	4.0 (1.4)	0.8 (0.8)	0.5 (0.5)	0.0 (0.0)	2.1 (1.7)	1.1 (0.9)	4.7 (0.9)
	1994	0.8 (0.8)	2.5 (0.9)	3.1 (1.9)	0.7 (0.5)	1.6 (0.9)	5.7 (2.5)	nd ---	nd ---
Sandhill Crane	1992	0.0 (0.0)	4.9 (1.2)	0.0 (0.0)	0.6 (0.4)	4.8 (4.3)	2.2 (2.0)	nd ---	nd ---
	1993	0.0 (0.0)	1.8 (0.9)	0.8 (0.8)	0.5 (0.3)	0.7 (0.5)	2.0 (1.4)	0.0 (0.0)	5.6 (1.4)
	1994	3.9 (4.0)	1.5 (0.7)	1.6 (1.6)	3.2 (1.1)	0.0 (0.0)	2.3 (1.7)	nd ---	nd ---

(Table 2 cont'd)

	Year	1	2	3	4	5	6	7	8
Shorebird sp.	1992	61.0 (9.8)	90.9 (13.6)	88.7 (15.8)	25.4 (4.3)	22.0 (4.8)	74.4 (21.9)	nd ---	nd ---
	1993	10.8 (2.6)	28.7 (4.2)	33.4 (7.2)	7.6 (2.0)	12.6 (3.8)	21.9 (7.9)	10.6 (2.6)	41.9 (6.0)
	1994	17.7 (3.7)	32.3 (6.7)	40.4 (12.0)	14.5 (3.2)	7.4 (2.4)	18.8 (4.9)	nd ---	nd ---
Pomarine Jaeger	1992	4.4 (3.3)	16.8 (1.3)	10.6 (4.0)	2.1 (0.7)	1.0 (1.7)	11.8 (3.2)	nd ---	nd ---
	1993	3.9 (2.2)	14.5 (2.2)	42.7 (7.2)	1.4 (0.8)	5.2 (3.1)	19.9 (9.3)	5.7 (1.5)	4.1 (0.6)
	1994	0.0 (0.0)	4.0 (1.8)	4.7 (2.5)	1.8 (0.9)	0.0 (0.0)	4.1 (1.2)	nd ---	nd ---
Parasitic Jaeger	1992	7.3 (2.6)	25.1 (2.8)	3.5 (1.1)	4.6 (1.4)	1.1 (1.2)	11.9 (2.9)	nd ---	nd ---
	1993	2.3 (1.0)	5.8 (1.1)	3.9 (2.1)	1.4 (0.7)	2.2 (1.4)	8.5 (3.6)	3.4 (0.9)	1.6 (0.4)
	1994	1.5 (1.3)	2.2 (1.0)	2.3 (1.3)	0.0 (0.0)	0.0 (0.0)	3.7 (2.0)	nd ---	nd ---
Long-tailed Jaeger	1992	2.9 (2.2)	6.2 (0.8)	0.9 (0.9)	0.9 (0.5)	2.5 (2.1)	6.4 (2.5)	nd ---	nd ---
	1993	1.5 (1.0)	2.2 (0.7)	2.3 (2.3)	0.9 (0.7)	0.0 (0.0)	3.5 (1.8)	1.1 (0.5)	1.6 (0.6)
	1994	3.1 (2.1)	2.5 (1.0)	3.1 (1.8)	0.4 (0.4)	1.1 (1.1)	4.8 (2.5)	nd ---	nd ---
Jaeger sp.	1992	1.5 (1.6)	5.8 (1.9)	1.8 (1.3)	0.3 (0.2)	0.6 (1.2)	3.9 (1.4)	nd ---	nd ---
	1993	0.0 (0.0)	1.1 (0.8)	0.8 (0.8)	0.0 (0.0)	1.5 (1.6)	0.2 (2.6)	1.1 (0.9)	1.9 (0.8)
	1994	0.0 (0.0)	0.7 (0.4)	0.0 (0.0)	0.4 (0.4)	0.0 (0.0)	1.5 (1.2)	nd ---	nd ---
Glaucous Gull	1992	16.0 (7.0)	4.1 (1.2)	14.2 (5.4)	18.7 (6.9)	16.2 (11.5)	6.1 (2.3)	nd ---	nd ---
	1993	6.9 (1.9)	10.2 (3.6)	3.9 (2.1)	11.4 (3.0)	8.1 (2.3)	10.9 (3.6)	7.2 (2.8)	17.5 (3.6)
	1994	10.0 (1.1)	14.5 (2.8)	8.5 (5.3)	12.3 (2.3)	3.7 (1.6)	6.8 (3.1)	nd ---	nd ---
Thayer's Gull	1992	0.0 (0.0)	0.0 (0.0)	0.9 (0.9)	7.6 (6.1)	0.0 (0.0)	0.4 (0.4)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.2 (2.6)	0.0 (0.0)	0.2 (0.4)	0.0 (0.0)	0.0 (0.0)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.3 (4.7)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
Sabine's Gull	1992	7.3 (7.9)	12.7 (5.8)	4.4 (2.4)	0.6 (0.6)	0.6 (1.2)	1.1 (1.8)	nd ---	nd ---
	1993	0.0 (0.0)	17.4 (8.2)	20.2 (10.5)	0.0 (0.0)	0.0 (0.0)	0.8 (1.2)	0.8 (0.8)	0.6 (0.6)
	1994	0.0 (0.0)	18.5 (8.3)	24.1 (20.2)	0.0 (0.0)	0.0 (0.0)	1.6 (1.8)	nd ---	nd ---
Arctic Tern	1992	5.8 (2.9)	6.2 (1.8)	5.3 (2.6)	4.0 (2.0)	0.2 (0.5)	6.4 (2.1)	nd ---	nd ---
	1993	9.3 (4.6)	7.6 (3.0)	14.8 (6.6)	0.0 (0.0)	0.7 (0.6)	6.1 (2.2)	1.5 (1.1)	13.1 (3.4)
	1994	17.0 (9.0)	8.0 (2.7)	11.6 (4.6)	1.4 (1.0)	2.6 (2.0)	7.1 (9.1)	nd ---	nd ---
Snowy Owl	1992	1.5 (1.5)	10.3 (3.0)	0.0 (0.0)	2.1 (0.9)	1.1 (1.7)	9.1 (2.3)	nd ---	nd ---
	1993	0.0 (0.0)	2.5 (0.9)	3.1 (1.2)	0.9 (0.7)	8.1 (3.8)	12.3 (4.5)	1.5 (0.4)	1.9 (1.1)
	1994	0.8 (0.6)	0.7 (0.5)	1.6 (1.1)	1.8 (0.7)	0.0 (0.0)	3.5 (2.0)	nd ---	nd ---

(Table 2 cont'd)

	Year	1	2	3	4	5	6	7	8
Short-eared Owl	1992	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
	1994	0.0 (0.0)	0.4 (0.4)	0.8 (0.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	nd ---	nd ---
Common Raven	1992	0.0 (0.0)	0.4 (0.4)	0.0 (0.0)	0.3 (0.3)	0.2 (0.5)	0.5 (1.0)	nd ---	nd ---
	1993	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	0.3 (0.3)
	1994	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.5 (0.5)	0.2 (0.4)	nd ---	nd ---

* - based on indicated number

nd - not surveyed

Table 3. Population estimates for birds observed during aerial surveys on western Victoria Island, 1992 to 1994.

SPECIES	NW Victoria Island ^a						SW Victoria Is. ^b	
	1992		1993		1994		1993	
	Pop.est	(SE) ^c	Pop.est	(SE) ^c	Pop.est	(SE) ^c	Pop.est	(SE) ^c
Pacific Loon	2453	(996)	4235	(1736)	5292	(832)	1217	(188)
Red-throated Loon	483	(252)	179	(150)	575	(310)	52	(30)
Yellow-billed Loon	941	(906)	1237	(425)	659	(386)	194	(89)
Loon sp.	676	(514)	1771	(848)	2983	(526)	69	(27)
Tundra Swan	3575	(930)	3202	(1999)	3838	(586)	4227	(973)
Canada Goose ^d	24146	(3567)	16100	(3727)	25054	(2164)	19075	(1703)
Brant	1205	(1084)	904	(465)	978	(970)	205	(145)
Greater White-fronted Goose	252	(199)	0	---	0	---	1020	(444)
Lesser Snow Goose	679	(1056)	786	(1043)	1909	(1275)	276	(195)
Dark Goose	155	(161)	58	(119)	0	---	103	(42)
Northern Pintail	75	(45)	33	(33)	0	---	337	(205)
Common Eider	10983	(5690)	579	(299)	2301	(933)	34	(24)
King Eider ^d	32874	(3405)	33320	(3865)	50560	(5665)	11150	(1695)
Oldsquaw	7763	(2294)	7457	(469)	4648	(1050)	1775	(774)
Falcon	459	(573)	151	(92)	56	(57)	80	(69)
Rough-legged Hawk	1963	(1480)	990	(263)	1226	(533)	97	(71)

Table 3. (continued)

SPECIES	NW Victoria Island ^a						SW Victoria Is. ^b	
	1992		1993		1994		1993	
	Pop.est	(SE) ^c	Pop.est	(SE) ^c	Pop.est	(SE) ^c	Pop.est	(SE) ^c
Ptarmigan sp.	1215	(1447)	627	(293)	1896	(562)	447	(159)
Sandhill Crane	2588	(1740)	791	(322)	1139	(363)	310	(78)
Pomarine Jaeger	3856	(889)	7340	(490)	1236	(267)	1164	(139)
Parasitic Jaeger	4639	(738)	2947	(1977)	813	(330)	650	(248)
Long-tailed Jaeger	2624	(949)	936	(450)	1564	(612)	274	(88)
Jaeger sp.	1265	(530)	684	(651)	337	(198)	291	(157)
Glaucous Gull	11525	(4718)	7644	(499)	5794	(916)	2156	(268)
Thayer's Gull	1293	(964)	857	(422)	839	(744)	0	---
Sabine's Gull	1469	(700)	1386	(1225)	1661	(668)	160	(282)
Arctic Tern	2399	(532)	2340	(830)	3732	(1730)	975	(158)
Snowy Owl	2802	(809)	3566	(1494)	944	(351)	354	(91)
Short-eared Owl	0	---	0	---	34	(21)	0	---
Common Raven	230	(250)	0	---	238	(226)	80	(69)

^a Strata 1 to 6^b Strata 7 and 8^c SE - standard error^d based on indicated number; see Appendix A for calculation

Table 4. Summary of data from daily records of bird sightings at Kagloryuak River study area, July 10 - 22, 1992.

Species	Total observed		Number per day*			
	Adults	Young	Adults		Young	
			Mean	(Range)	Mean	(Range)
Lapland Longspur	381	30	29.3	(8 - 22)	2.3	(0 - 9)
Pectoral Sandpiper	215	4	16.5	(4 - 44)	0.3	(0 - 3)
Semipalmated Sandpiper	208	20	16.0	(6 - 26)	1.5	(0 - 7)
Red Phalarope	155	3	11.9	(0 - 43)	0.2	(0 - 3)
White-rumped Sandpiper	134	11	10.3	(3 - 21)	0.8	(0 - 9)
Lesser Golden Plover	112	5	8.6	(1 - 24)	0.4	(0 - 4)
Stilt Sandpiper	102	9	7.8	(1 - 21)	0.7	(0 - 4)
Canada Goose	80	23	6.2	(0 - 12)	1.8	(0 - 6)
King Eider	80	28	6.2	(0 - 27)	2.2	(0 - 20)
Pomarine Jaeger	62		4.8	(0 - 9)		
Pacific Loon	40	1	3.1	(0 - 7)	0.1	(0 - 1)
Tundra Swan	40	7	3.1	(0 - 8)	0.5	(0 - 7)
Parasitic Jaeger	17	1	1.3	(0 - 4)	0.1	(0 - 1)
Long-tailed Jaeger	16		1.2	(0 - 3)		
Oldsquaw	15		1.2	(0 - 4)		
Snowy Owl	14	6	1.1	(0 - 4)	0.5	(0 - 4)
Willow Ptarmigan	13	8	1.0	(0 - 6)	0.6	(0 - 8)
Horned Lark	12		0.9	(0 - 5)		
Sabine's Gull	8	1	0.6	(0 - 3)	0.1	(0 - 1)
Snow Bunting	7		0.5	(0 - 6)		
Black-bellied Plover	6		0.5	(0 - 5)		
Arctic Tern	5		0.4	(0 - 3)		
Glaucous Gull	5		0.4	(0 - 1)		
Sandhill Crane	4		0.3	(0 - 2)		
Common Raven	4		0.3	(0 - 2)		
Brant	2		0.2	(0 - 2)		
Rough-legged Hawk	2		0.2	(0 - 2)		
Lesser Snow Goose	2		0.2	(0 - 2)		
Yellow-billed Loon	2		0.2	(0 - 2)		
Peregrine Falcon	1		0.1	(0 - 1)		
Short-eared Owl	1		0.1	(0 - 1)		
Red Knot	1		0.1	(0 - 1)		
Water Pipit	1		0.1	(0 - 1)		

*total 13 days of surveys, average 6.7 hours/day

Table 5. Number and density of birds observed during terrestrial surveys in the Kagloryuak River study area, 20 June - 2 July 1993.

Species	Total number		Density (no./km ²)*	
	On transect	Off transect	Mean	Range
Lapland Longspur	162	149	58.0	(0-120.2)
Semipalmated Sandpiper	37	30	13.2	(0-48.2)
Lesser Golden Plover	21	43	7.5	(0-23.1)
White-rumped Sandpiper	19	4	6.8	(0-21.0)
Red Phalarope	17	8	6.4	(0-53.9)
Pomarine Jaeger	12	36	4.3	(0-49.9)
Pectoral Sandpiper	12	8	4.3	(0-20.2)
Canada Goose	10	95	3.6	(0-20.2)
Stilt Sandpiper	8	13	2.9	(0-10.9)
Long-tailed Jaeger	6	7	2.1	(0-15.4)
Willow Ptarmigan	5	6	1.8	(0-6.7)
Oldsquaw	4	15	1.4	(0-13.5)
Horned Lark	3	6	1.1	(0-7.0)
Red Knot	3	2	1.1	(0-7.3)
King Eider	2	46	0.7	(0-8.0)
Pacific Loon	2	12	0.7	(0-13.5)
Short-eared Owl	2	0	0.7	(0-4.4)
Parasitic Jaeger	1	10	0.4	(0-1.7)
Sandhill Crane	1	5	0.4	(0-4.0)
Snow Bunting	1	1	0.4	(0-4.8)
Rock Ptarmigan	1	0	0.4	(0-4.8)
<u>Off transect only:</u>				
Tundra Swan	0	13	0	—
Arctic Tern	0	6	0	—
Glaucous Gull	0	4	0	—
Jaeger sp.	0	3	0	—
Dowitcher sp.	0	2	0	—
Lesser Snow Goose	0	2	0	—
Sabine's Gull	0	2	0	—
Common Raven	0	1	0	—
Thayer's Gull	0	1	0	—
Peregrine Falcon	0	1	0	—
Rough-legged Hawk	0	1	0	—
Black-bellied Plover	0	1	0	—
Northern Pintail	0	1	0	—

*Km surveyed = 50.8; No. of transects = 12

Table 6. Clutch and brood sizes recorded in the Kagloryuak River study area in 1992 and 1993.

Species	1992				1993*		
	Total nests	Clutch size Mean Range	Total broods	Brood size Mean Range	Total nests	Clutch size Mean Range	
Pacific Loon	3	1.7 (1 - 2)	1	1.0 ---	1	1.0 ---	
Canada Goose	11	3.4 (1 - 6)	3	2.3 (2 - 3)			
King Eider	4	4.2 (3 - 5)	7	3.7 (2 - 5)			
Oldsquaw	1	8.0 ---					
Willow Ptarmigan	2	5.5 (3 - 8)					
Pomarine Jaeger	2	2.0 ---					
Parasitic Jaeger	1	2.0 ---					
Long-tailed Jaeger	1	1.0 ---					
Lesser Golden Plover	1	4.0 ---			2	4.0 ---	
Semipalmated Sandpiper					1	4.0 ---	
White-rumped Sandpiper	2	4.0 ---			1	4.0 ---	
Pectoral Sandpiper	1	4.0 ---					
Red Phalarope	2	4.0 ---			1	3.0 ---	
Snowy Owl			2	3.0 (2 - 4)			
Lapland Longspur	2	4.0 ---			2	4.5 (4 - 5)	

* no broods recorded in 1993 due to timing of surveys

Table 7. Description of types of habitats encountered during terrestrial surveys from 20 June to 2 July 1993 in the Kagloryuak River study area, Victoria Island.

Habitat	Macrorelief	Ponds Present*	Vegetation Class (% cover)	Metres Surveyed	No. of Sampling Points	Vegetation type (% cover) ^b					Micro relief	Substrate	Moisture	Dominant Species
						<i>Dryas</i>	Graminoid	Shrub	Forbs	Moss/Lichen				
R	Ridge top	Yes	≤60	2065	7	25	20	P	P	P	(Frost boils) (Rocks) (Hummocks)	Organic (Mud) (Rock) (Gravel)	Dry-moist	<i>Dryas integrifolia</i> <i>Carex misandra</i> <i>Carex rupestris</i> <i>Saxifraga oppositifolia</i>
S1	Gentle slope	Yes	>60	1293	2	50	30	5	P	P	Hummocks (Frost boils) (Rocks)	Organic (Mud) (Rock) (Gravel)	Dry-moist	<i>Dryas integrifolia</i> <i>Carex rupestris</i> <i>Carex misandra</i> <i>Carex aquatilis</i> <i>Salix arctica</i>
S2	Gentle slope	Yes	>60	1023	1	5	80	10	P	P	Hummocks Frost boils	Organic Mud	Moist-wet	<i>Carex misandra</i> <i>Kobresia sp.</i>
S3	Gentle slope	Yes	≤60	760	2	25	25	P	P	P	(Frost boils) (Gravel/ Cobble) (Hummocks)	Gravel Mud Rock Organic (Sand)	Dry-wet	<i>Dryas integrifolia</i> <i>Carex rupestris</i> <i>Carex misandra</i> <i>Kobresia sp.</i> <i>Saxifraga oppositifolia</i>
S4	Gentle slope	No	>60	512	3	15	70	10	P	P	Hummocks (Frost boils)	Organic (Mud)	Moist-wet with standing water	<i>Carex misandra</i> <i>Dryas integrifolia</i> <i>Salix arctica</i>
S5	Gentle slope	No	≤60	3349	8	25	15	P	P	P	Rocks (Gravel) (Frost boils)	Rock Gravel (Mud) (Organic) (Sand)	Dry	<i>Dryas integrifolia</i> <i>Carex rupestris</i> <i>Saxifraga oppositifolia</i>
L1	Flat lowland	Yes	>60	14137	16	10	80	5	P	P	Hummocks (Tussocks)	Organic (Mud) (Rock) (Gravel)	Dry-wet with standing water	<i>Carex misandra</i> <i>Carex aquatilis</i> <i>Kobresia sp.</i> <i>Dryas integrifolia</i> <i>Salix arctica</i>

Table 7. continued

Habitat	Macrorelief	Ponds Present	Vegetation Class (% cover)	Metres Surveyed	No. of Sampling Points	Vegetation class (% cover)					Micro relief	Substrate	Moisture	Dominant Species
						<i>Dryas</i>	Graminoid	Shrub	Forbs	Moss/Lichen				
L2	Flat lowland	Yes	>60	4092	6	35	45	10	P	5/P	Hummocks (Tussocks) (Low centred polygons) (High centred polygons)	Organic (Mud)	Dry-wet	<i>Dryas integrifolia</i> <i>Carex misandra</i> <i>Carex aquatilis</i> <i>Carex rupestris</i> <i>Salix arctica</i> <i>Salix alaxensis</i>
L3	Wet sedge meadow	Yes	>60	3920	6	P	90	3	P	5/0	Flat (Low centred polygons)	Organic	Wet with standing water	<i>Carex aquatilis</i> <i>Carex membranacea</i> <i>Eriophorum angustifolium</i> <i>Eriophorum triste</i>
L4	Flat lowland	Yes	≤60	1169	3	15	20	5	P	P	Rocks Hummocks (Frost boils)	Rock Gravel Mud Organic	Dry-wet with standing water	<i>Carex misandra</i> <i>Carex rupestris</i> <i>Dryas integrifolia</i> <i>Salix alaxensis</i>
L5	Flat lowland	No	>60	11351	8	10	80	5	P	P	Hummocks (Tussocks)	Organic (Mud)	Dry-wet with standing water	<i>Carex misandra</i> <i>Carex membranacea</i> <i>Dryas integrifolia</i> <i>Salix arctica</i>
L6	Flat lowland	No	>60	3397	5	50	25	5	5	P	Hummocks (Frost boils)	Organic Mud	Dry-wet	<i>Dryas integrifolia</i> <i>Carex misandra</i> <i>Carex aquatilis</i> <i>Carex rupestris</i> <i>Salix alaxensis</i> <i>Salix arctica</i>
L7	Flat lowland	No	≤60	3787	5	35	15	P	P	P	Frost boils (Rocks)	Mud Organic (Rock,sand)	Dry-moist	<i>Dryas integrifolia</i> <i>Carex rupestris</i>

^a ponds in the habitat within 100 m

^b P = Present

Table 8. Densities (number per sq km) of birds within different habitat types, based on terrestrial surveys in the Kagloryuak River study area, Victoria Island, 1993.

Species	No. of observations	Ridge-top R	Habitat type*												
			Gentle slopes					Flat lowland							
			Ponds			No ponds		Ponds				No ponds			
			S1	S2	S3	S4	S5	L1	L2	L3	L4	L5	L6	L7	
Pacific Loon	2									8.9					
Canada Goose	10	17.6							13.3	23.2					
King Eider	2							3.2							
Oldsquaw	4							3.9		4.6					
Rock Ptarmigan	1					5.4									
Willow Ptarmigan	5							2.6	4.4			1.6		4.8	
Sandhill Crane	1										15.6				
Lesser Golden Plover	21	8.8	14.7	71.0			5.4	3.9	4.4	23.2		6.4		4.8	
Red Knot	3		29.3					1.3							
Semipalmated Sandpiper	37	26.4	14.7	53.5				19.3	13.3	18.6		9.6	5.4	4.8	
White-rumped Sandpiper	19			35.5				14.1	4.4	4.6		6.4			
Pectoral Sandpiper	12							3.9	13.3	9.3		6.4			
Stilt Sandpiper	8	8.8		35.5				1.3		13.9		1.6			
Red Phalarope	17							7.7	4.4	37.1	15.6				
Pomarine Jaeger	12	26.4		35.5				5.1							14.4
Parasitic Jaeger	1											1.6			
Long-tailed Jaeger	6	8.8				35.5	5.4	2.6							4.8
Short-eared Owl	2											1.6			4.8
Horned Lark	3						5.4							10.7	
Lapland Longspur	162	44.0	73.3	88.8	23.9	212.8	10.9	43.7	71.1	134.5	93.3	56.1	53.5	38.4	
Snow Bunting	1						5.4								
Km surveyed		2.0	1.2	1.0	0.8	0.5	3.4	14.1	4.1	3.9	1.2	11.4	3.4	3.8	

* refer to Table 7 for description of habitat types.

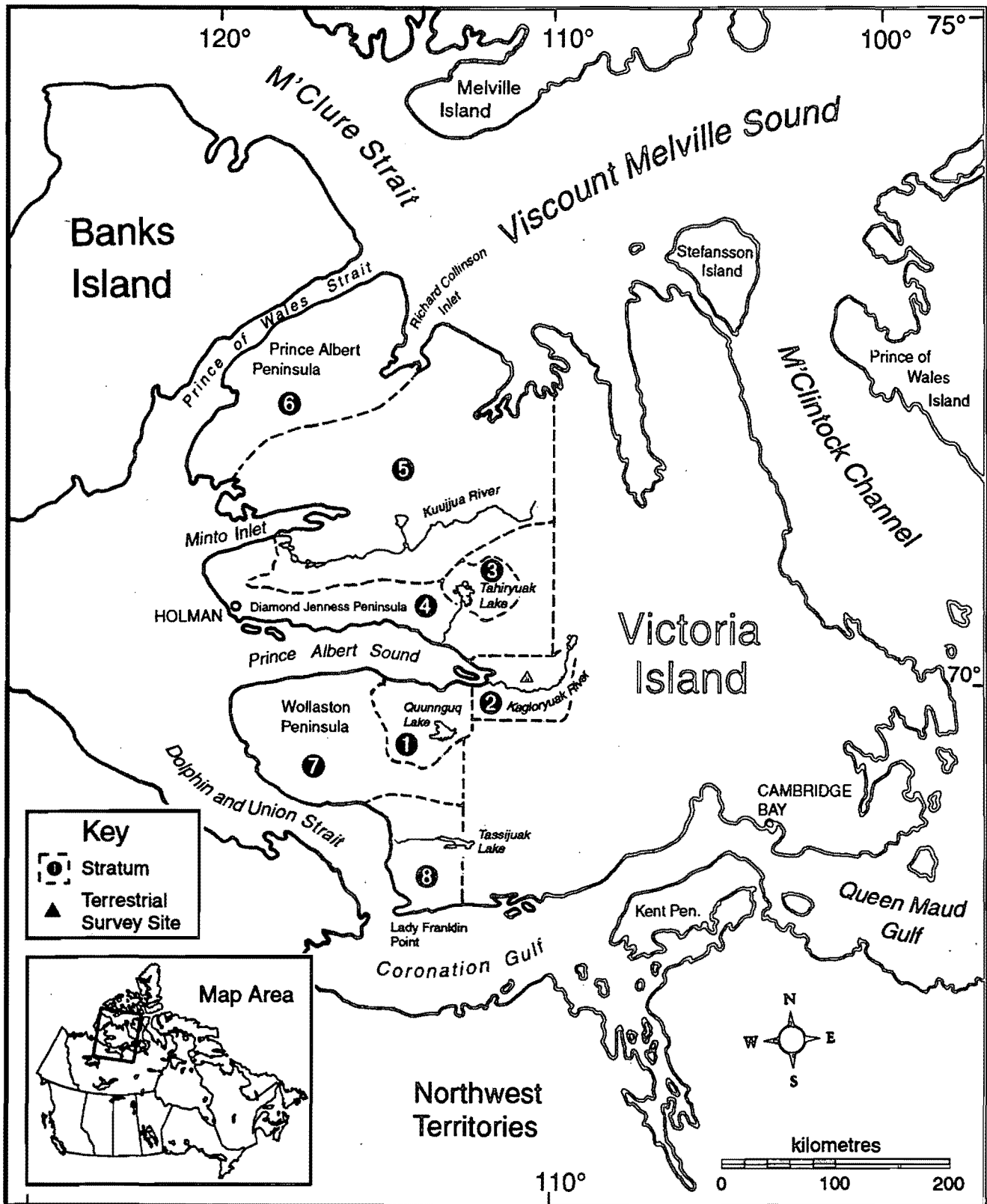


Figure 1. Location of the study area and boundaries of the strata used to estimate bird populations on western Victoria Island, 1992 to 1994.

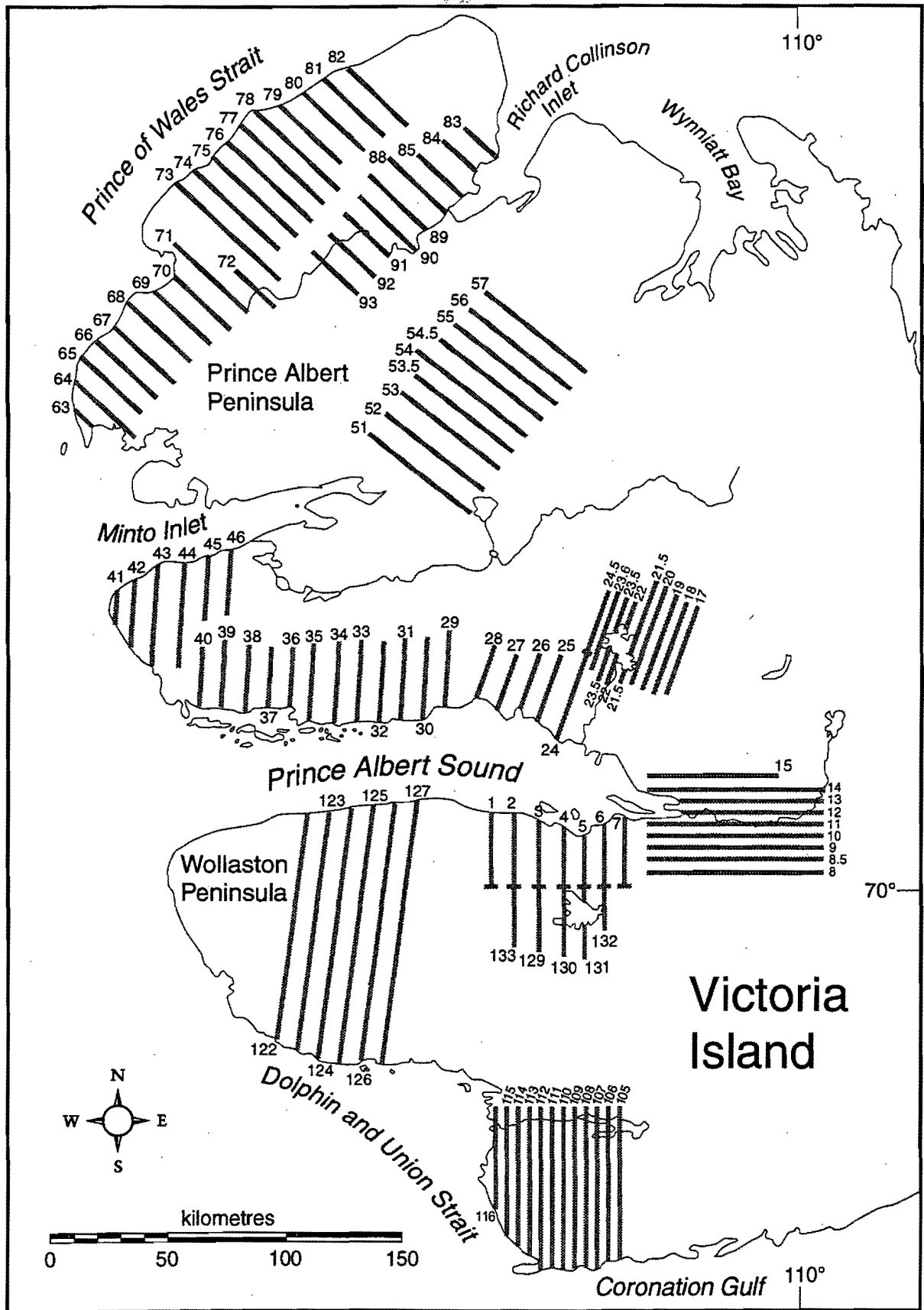


Figure 2. Location of the transects surveyed by helicopter on western Victoria Island in June 1992 to 1994.

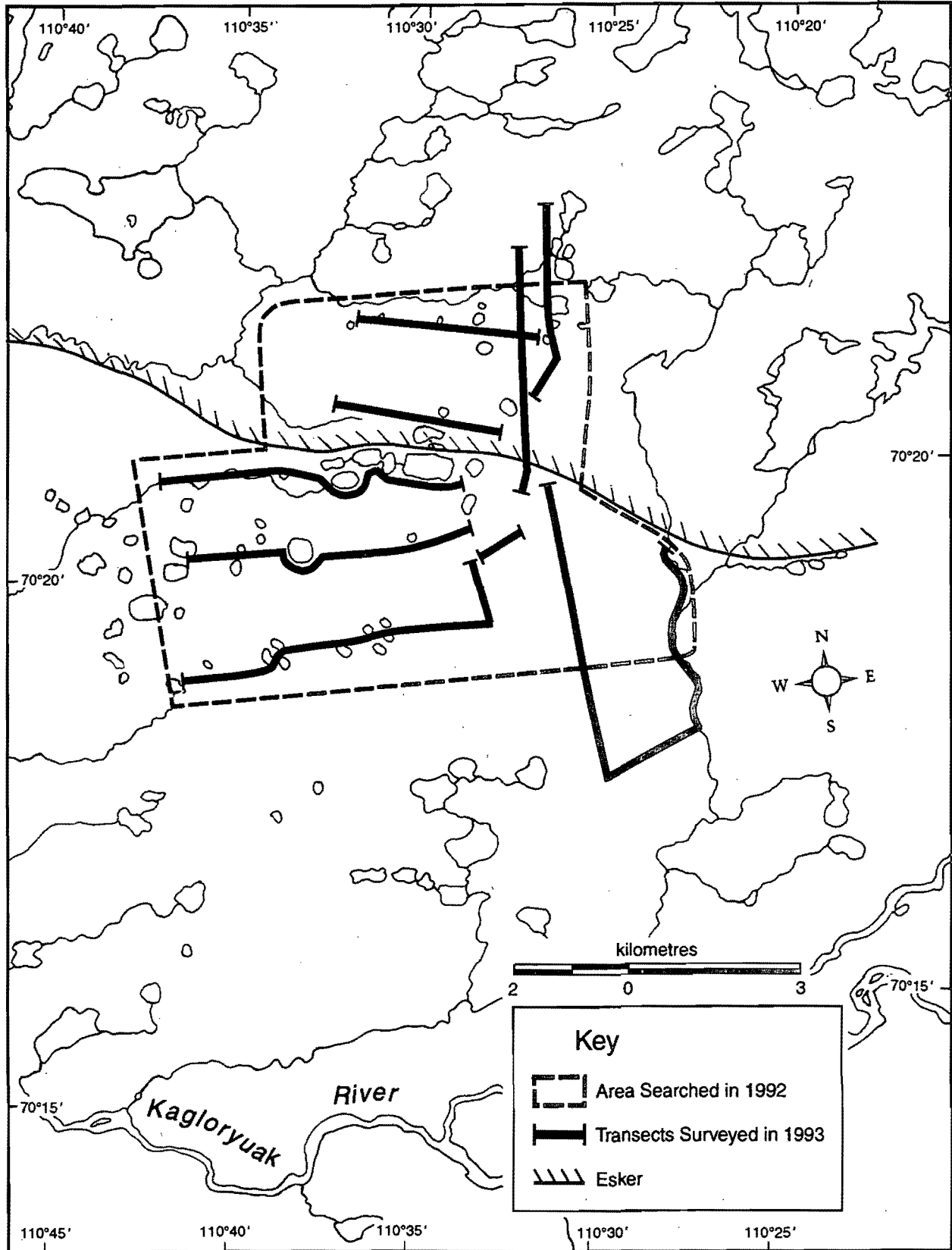


Figure 3. The study area used for terrestrial surveys in the Kagloryuak River valley, 1992 and 1993.

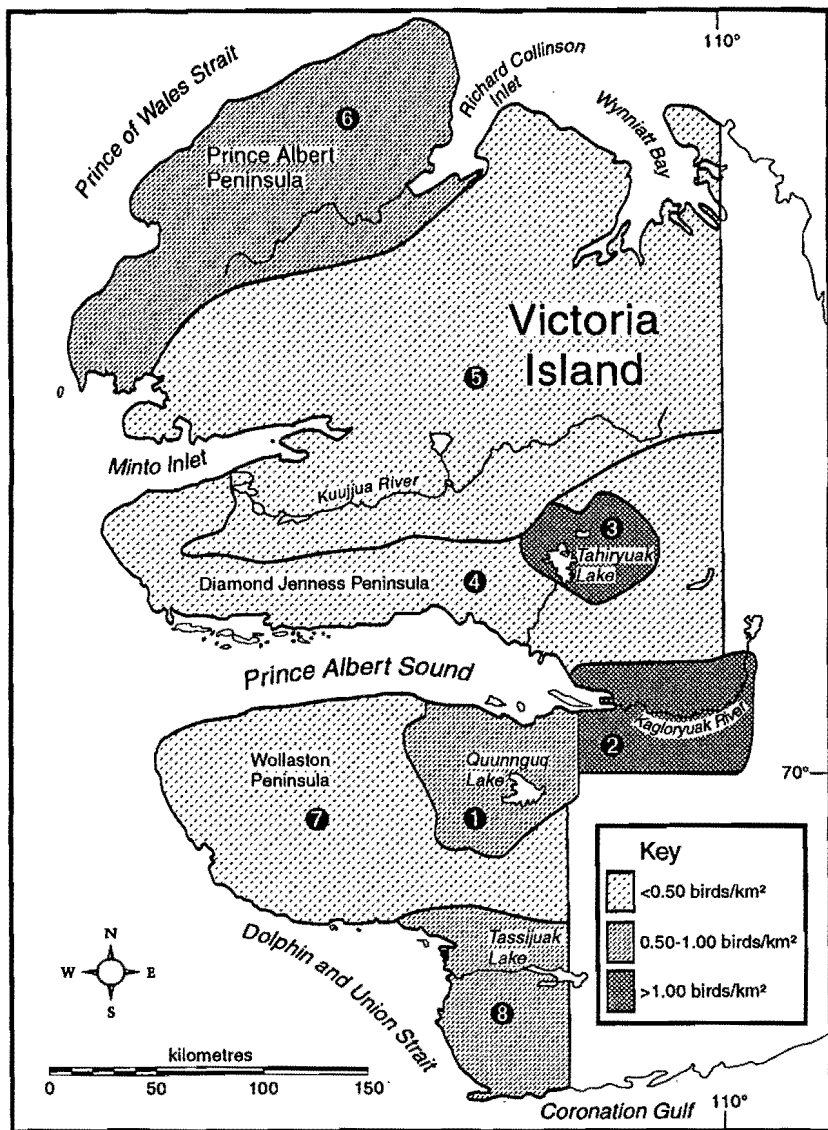


Figure 4. Average densities of King Eiders recorded during aerial surveys on western Victoria Island, 1992 to 1994.

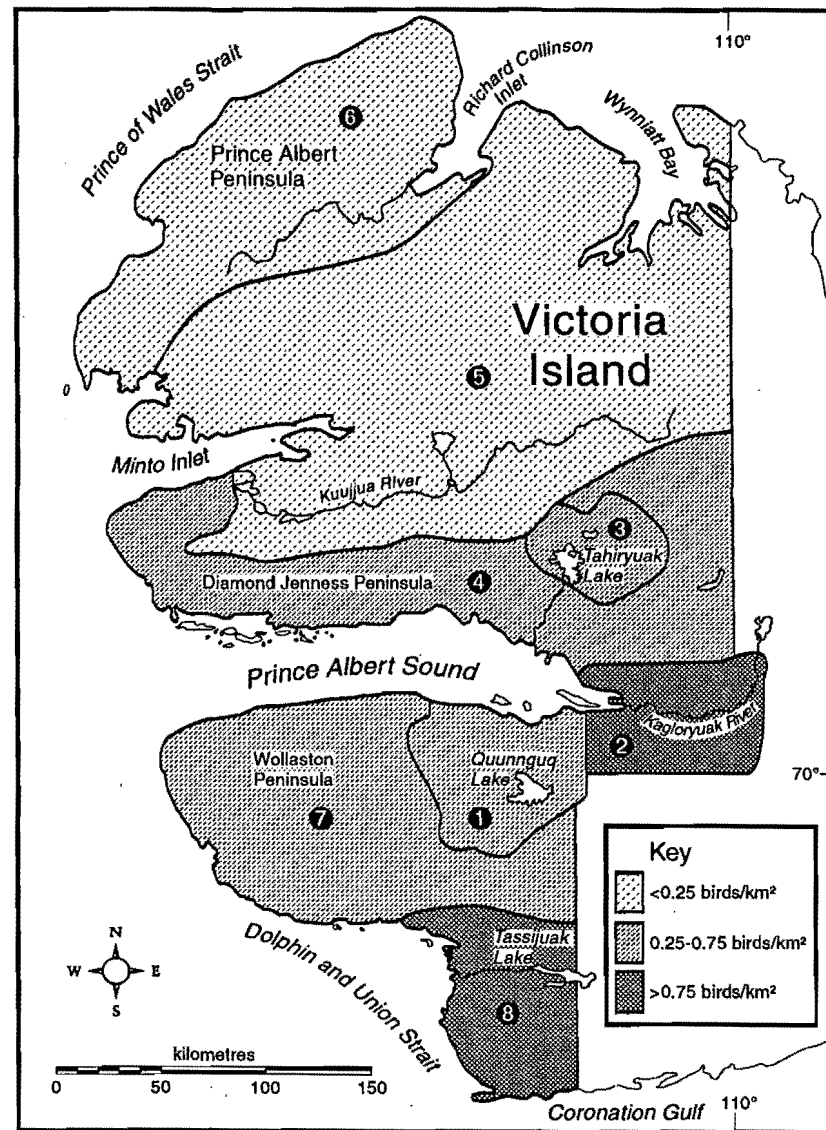


Figure 5. Average densities of Canada Geese recorded during aerial surveys on western Victoria Island, 1992 to 1994.

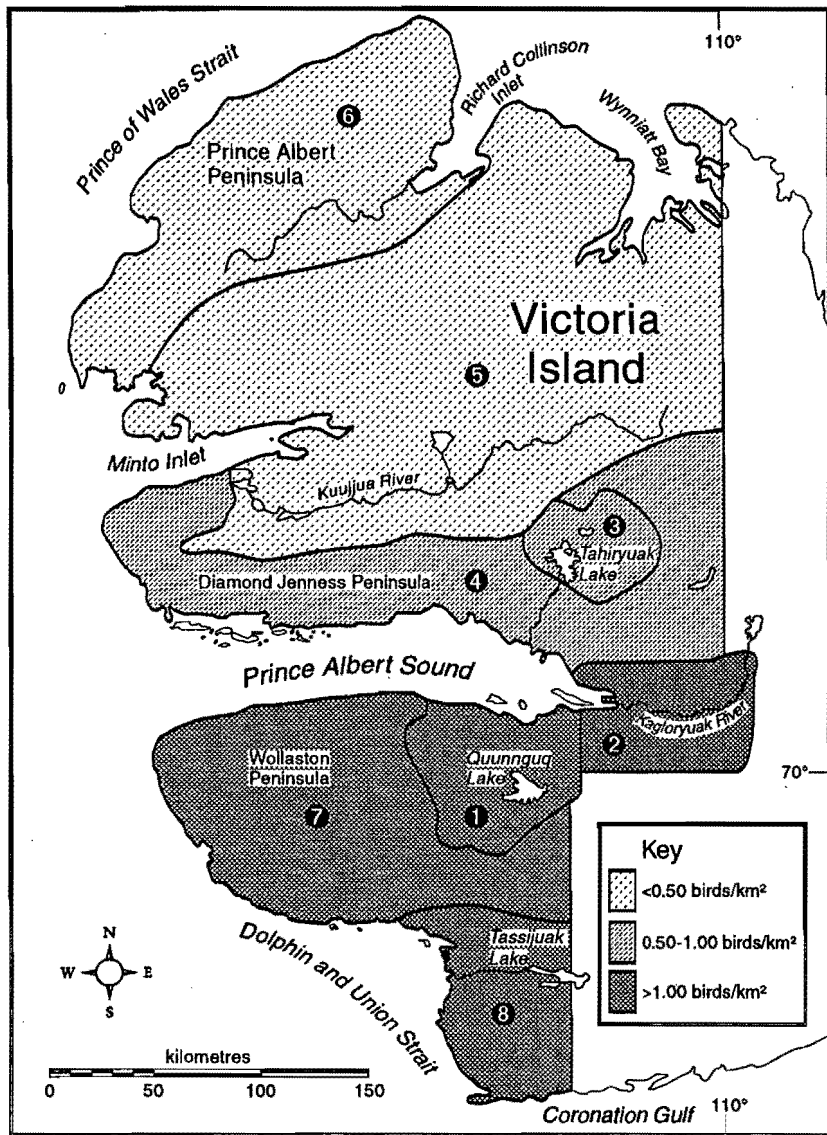


Figure 6. Average densities of Tundra Swans recorded during aerial surveys on western Victoria Island, 1992 to 1994.

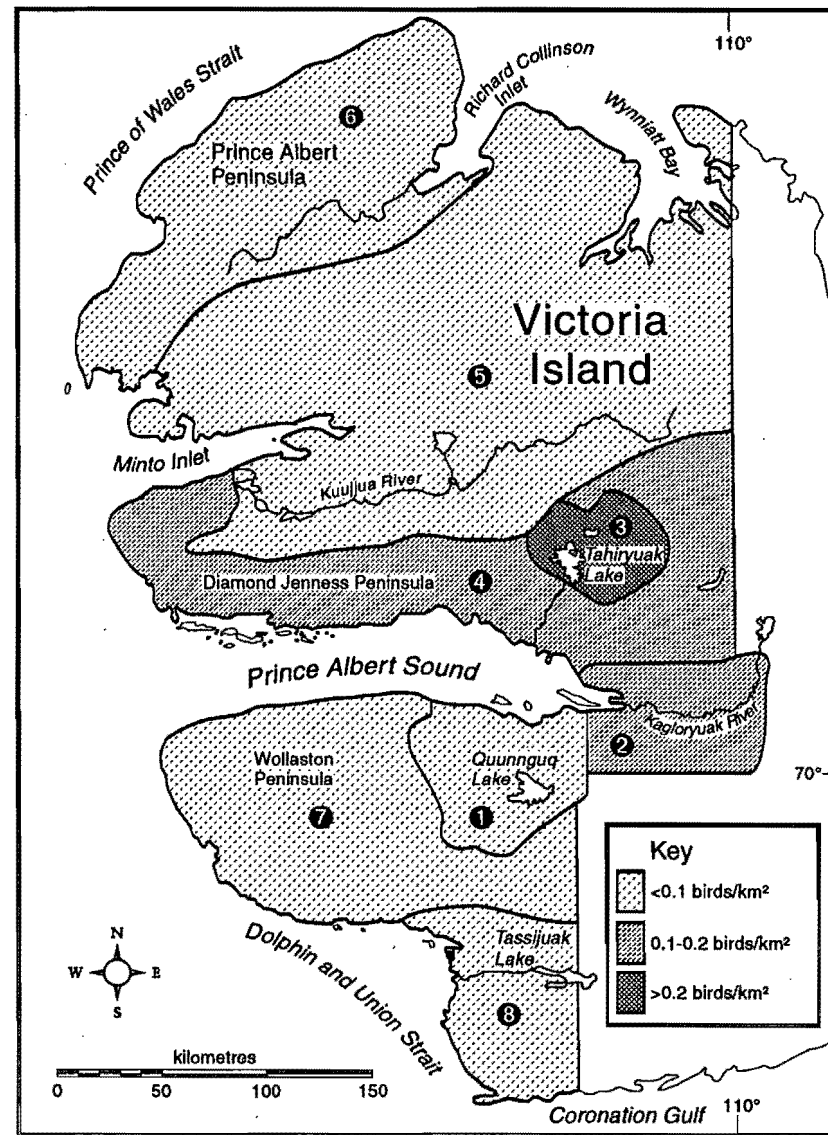


Figure 7. Average densities of Oldsquaw recorded during aerial surveys on western Victoria Island, 1992 to 1994.

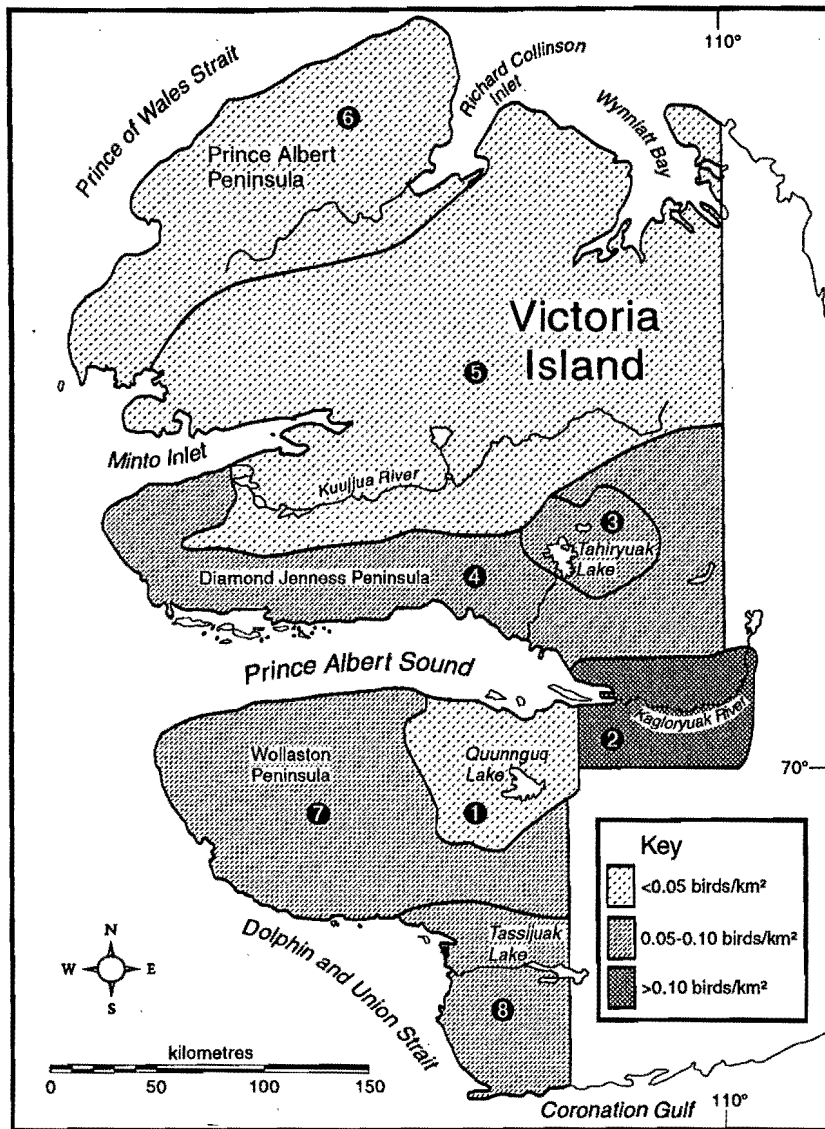


Figure 8. Average densities of Pacific Loons recorded during aerial surveys on western Victoria Island, 1992 to 1994.

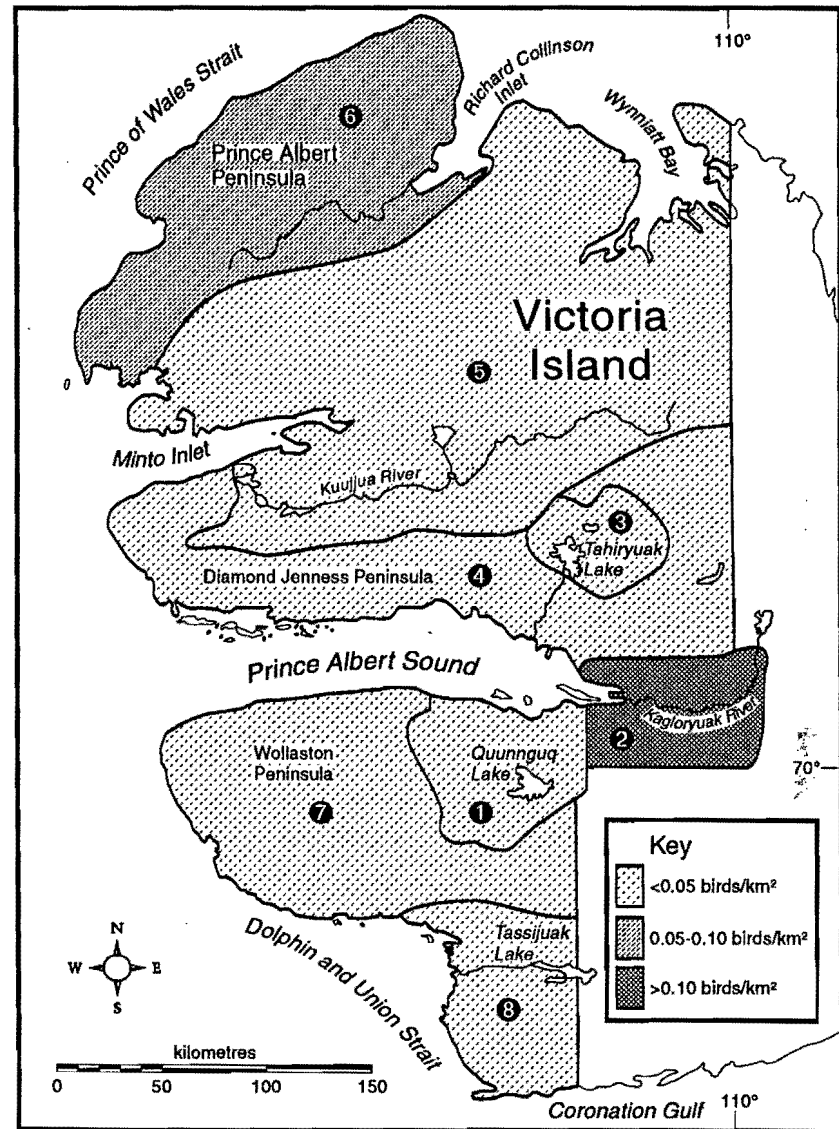


Figure 9. Average densities of Parasitic Jaegers recorded during aerial surveys on western Victoria Island, 1992 to 1994.

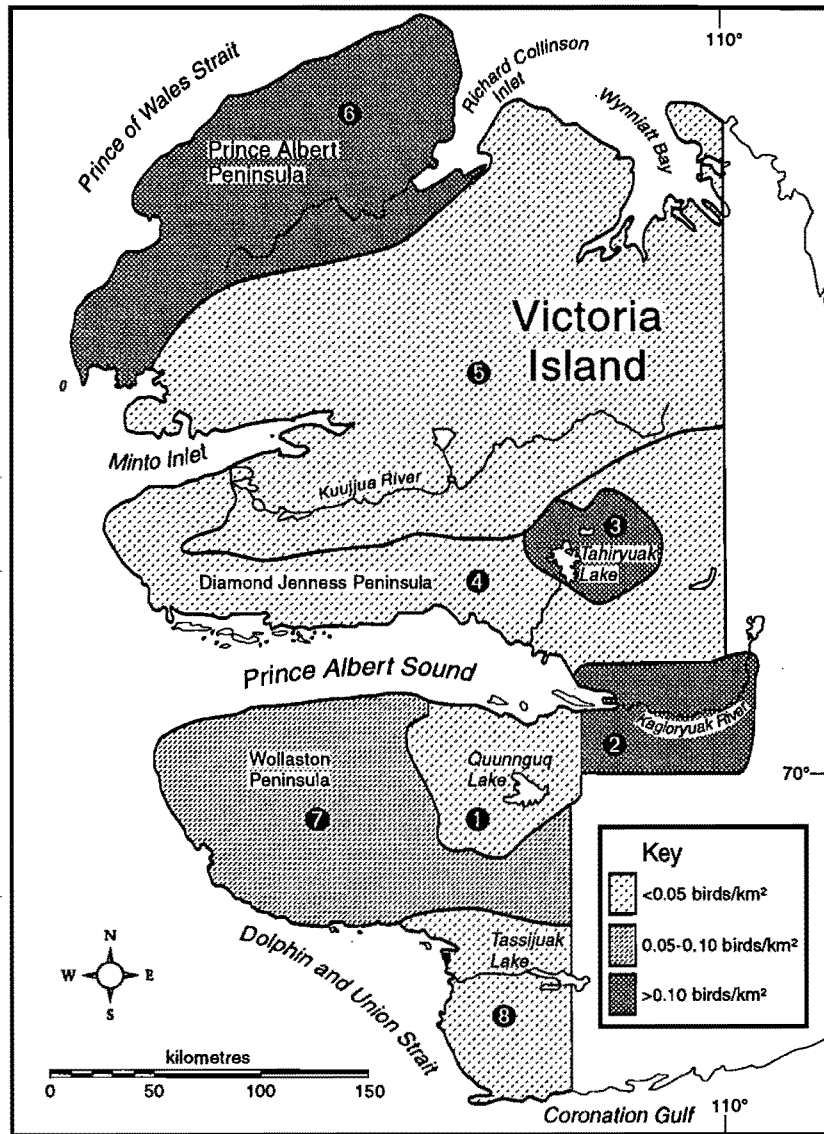


Figure 10. Average densities of Parasitic Jaegers recorded during aerial surveys on western Victoria Island, 1992 to 1994.

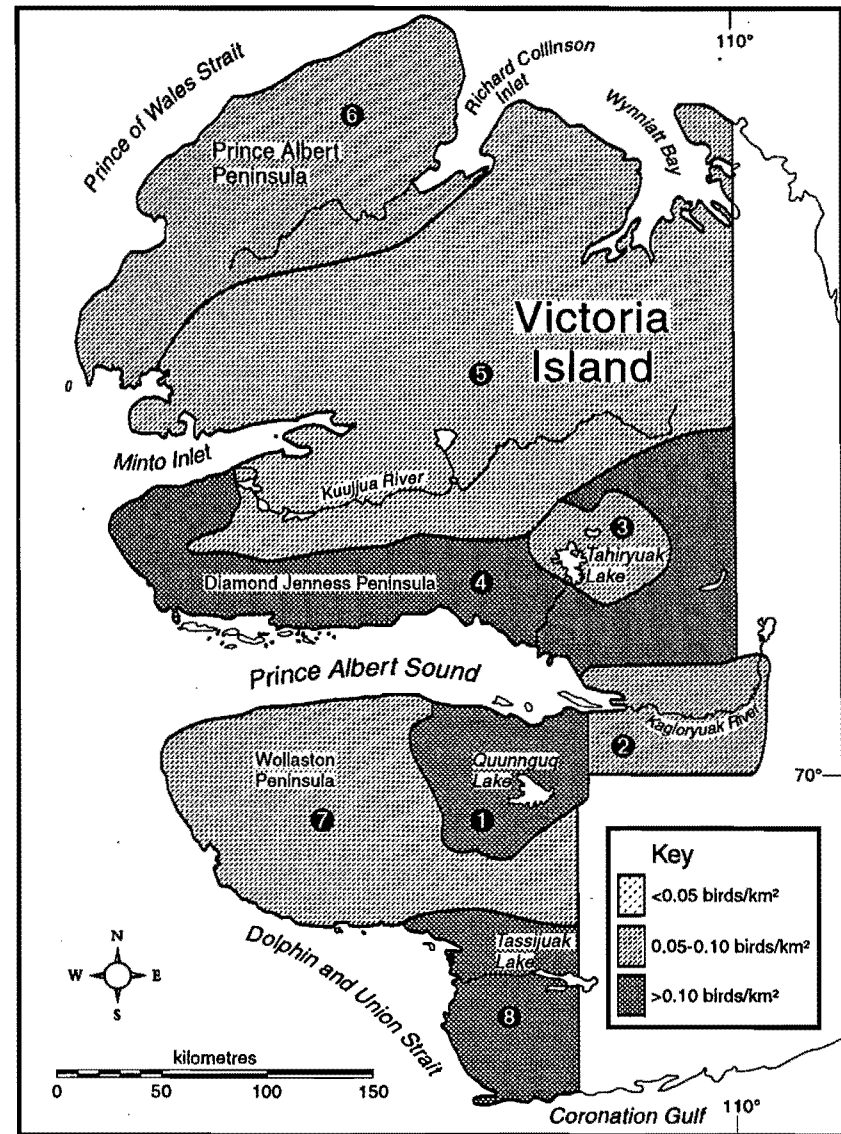


Figure 11. Average densities of Glaucous Gulls recorded during aerial surveys on western Victoria Island, 1992 to 1994.

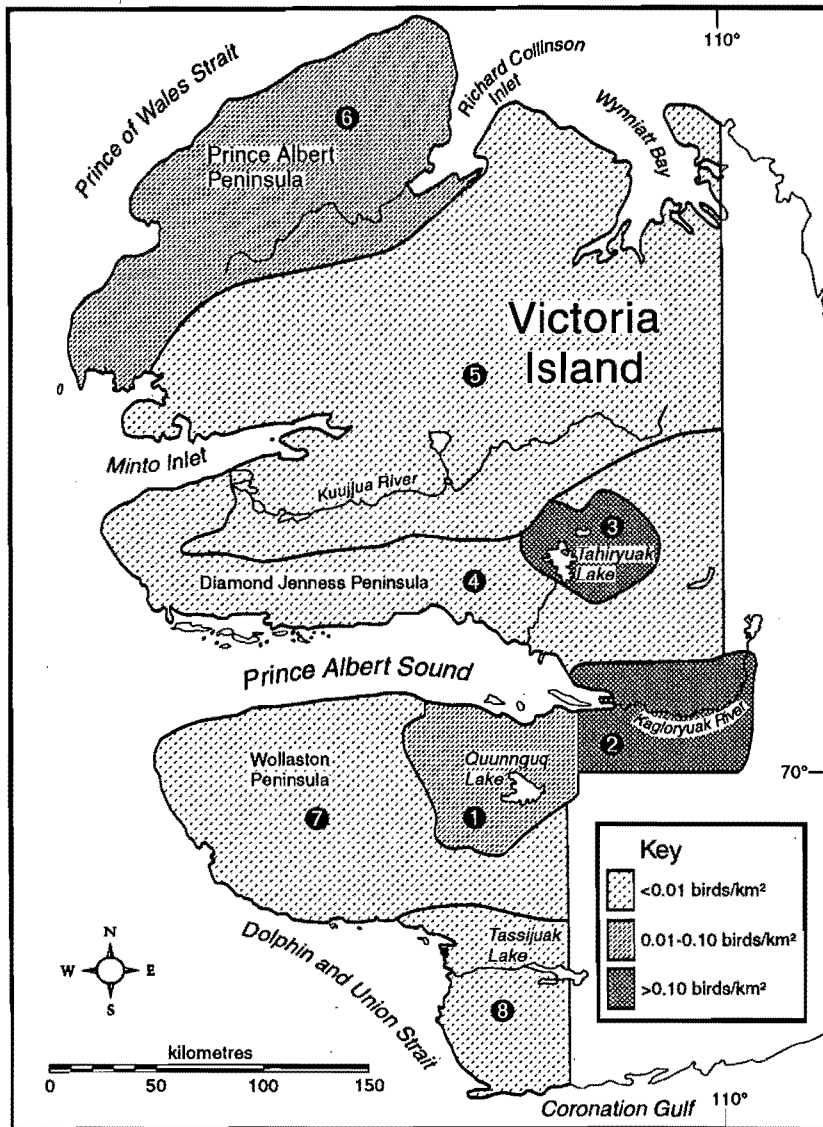


Figure 12. Average densities of Sabine's Gulls recorded during aerial surveys on western Victoria Island, 1992 to 1994.

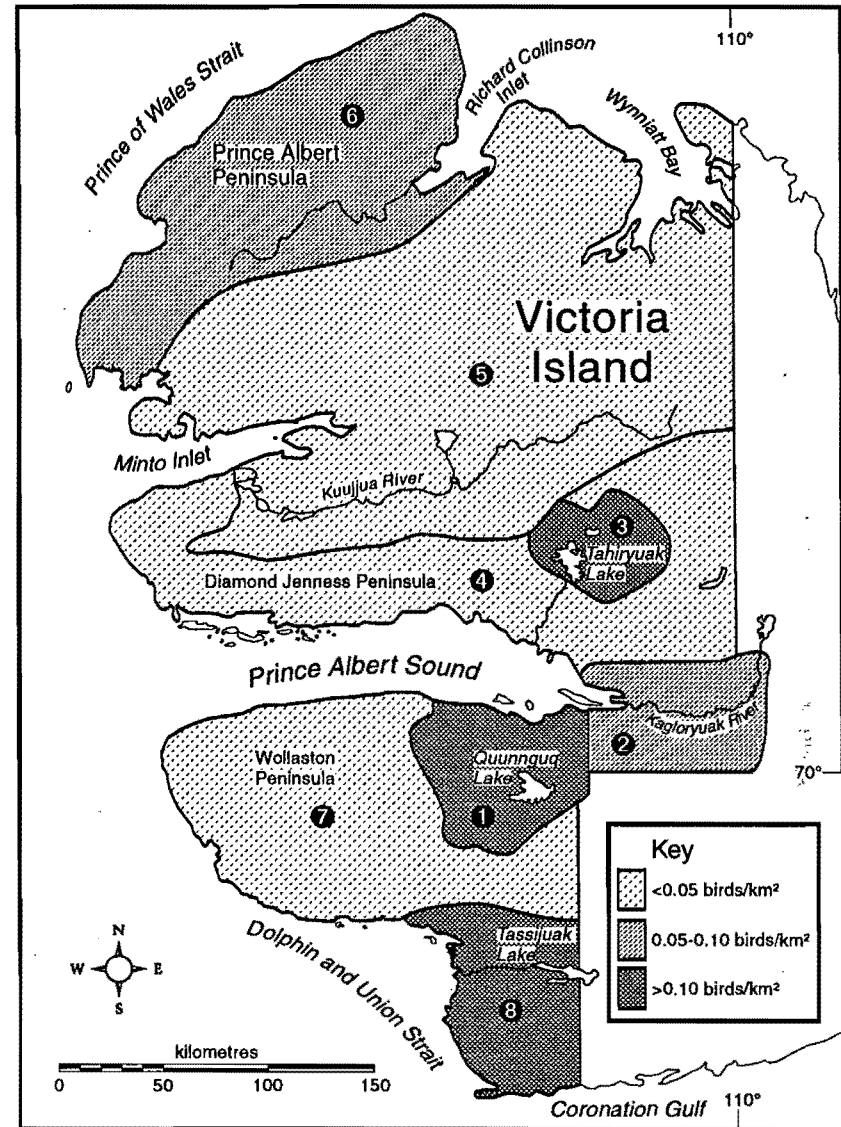


Figure 13. Average densities of Arctic Terns recorded during aerial surveys on western Victoria Island, 1992 to 1994.

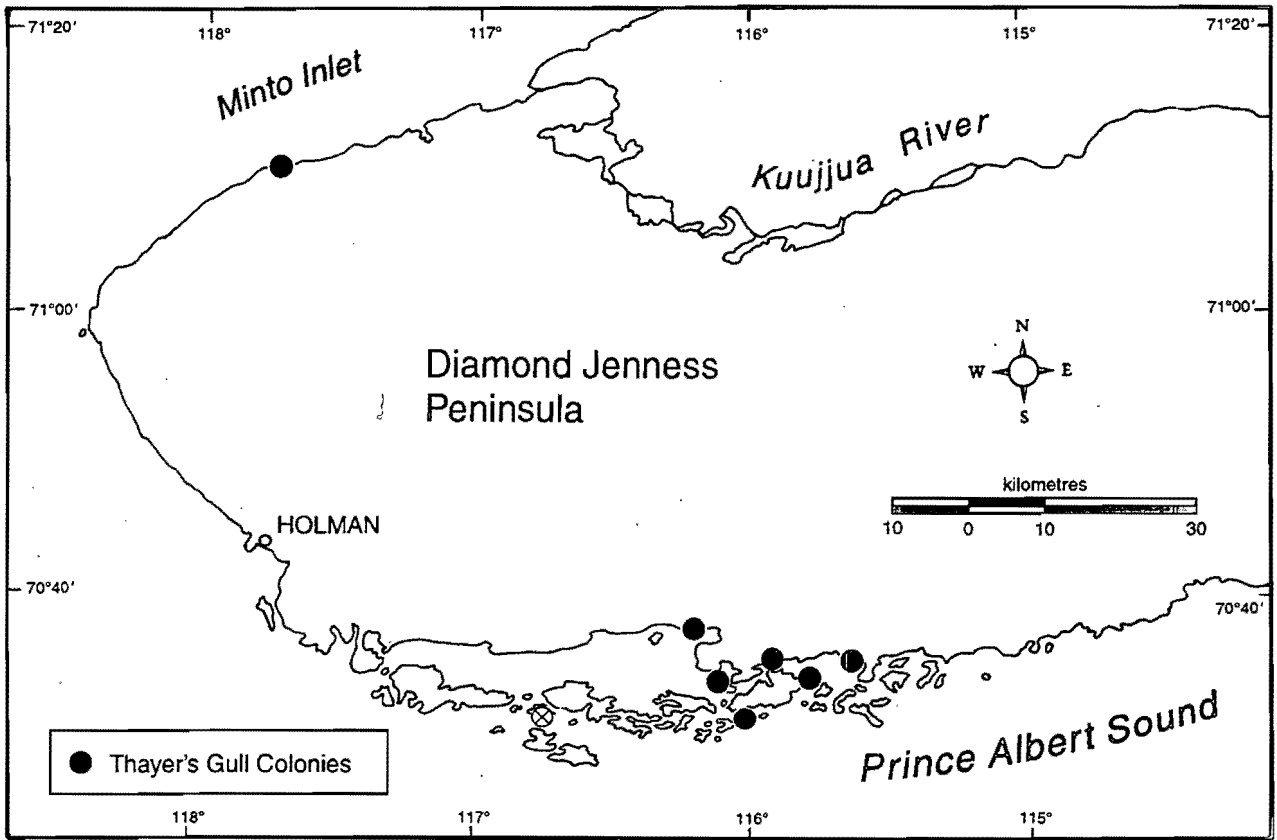


Figure 14. Location of Thayer's Gull nesting colonies.

APPENDIX A.

Calculations of total indicated King Eiders and Canada Geese observed during aerial surveys on western Victoria Island, 1992 to 1994.

Appendix A1. Number of indicated King Eiders on each transect, 1992 to 1994*.
a) 1992 aerial surveys

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 to 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24	1					1	1	2
1	2	26			2	2		6	4	8
1	3	24	3			2		5	5	10
1	4	22	1		6			13	7	14
1	5	18			1			2	1	2
1	6	24	1		1			3	2	4
1	7	34			5		6	16	5	16
2	8	80	8		8			24	16	32
2	9	80	13	1	20		10	64	33	76
2	10	80	14		13	2		42	29	58
2	11	80	7		9		5	30	16	37
2	12	80	5	1	5			16	10	20
2	13	68	4	1	10			25	14	28
2	14	80	13		7	5		32	25	50
2	15	60	4		3		15	25	7	29
3	17	40			1	7	7	16	8	23
3	18	44	3		2			7	5	10
3	19	44	3		16	2		37	21	42
3	20	48	3	1	5			14	8	16
3	21.5	46	2		13		5	33	15	35
3	22	14	1					1	1	2
3	23.5	20	2		3			8	5	10
3	24.5	26	1	1	9			20	10	20
4	19.5	36		1	1	2		5	3	6
4	21	36	1		1	2		5	4	8
4	23	36	2		2			6	4	8
4	24	44	1		3			7	4	8
4	25	36	1		6			13	7	14
4	26	32	1		3			7	4	8
4	27	34								
4	28	36			8			16	8	16
4	29	34	3		1			5	4	8
4	30	36	2		6			14	8	16
4	31	36			1			2	1	2
4	32	36			1			2	1	2
4	33	36	2		2			6	4	8
4	34	34								
4	35	34	1		2			5	3	6
4	36	18								
4	37	16								
4	38	24	1					1	1	2
4	41	6			3			6	3	6
4	42	31			1			2	1	2
4	43	40			1			2	1	2
4	44	44	1					1	1	2
4	40/45	54								
4	39/46	48	1		4			9	5	10

Appendix A1: 1992 surveys. Continued

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 to 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	47	40								
5	48	44								
5	49	36								
5	50	34								
5	51	70	1		1			3	2	4
5	52	54	1		1			3	2	4
5	53	54	1					1	1	2
5	54	60		1				1		
5	55	50			1			2	1	2
5	56	50								
5	57	50	3		1	2		7	6	12
5	58	52			1			2	1	2
5	59	34	1		1			3	2	4
5	60	24	1					1	1	2
5	61	28								
5	62	10								
6	63	12								
6	64	36	1		1			3	2	4
6	65	36	1		1			3	2	4
6	66	36	3		3			9	6	12
6	67	36								
6	68	36	1	1	2			6	3	6
6	69	30			1			2	1	2
6	70	34	1		1		5	8	2	9
6	71	50	1		2			5	3	6
6	72	24			2			4	2	4
6	73	60	4		2	1		9	7	14
6	74	54	3		4			11	7	14
6	75	38	4		1			6	5	10
6	76	36	1		2	2		7	5	10
6	77	34	5	1	6			18	11	22
6	78	32	1		4			9	5	10
6	79	24	5		2			9	7	14
6	80	30	5		3			11	8	16
6	81	30	2		6	2		16	10	20
6	82	32			1			2	1	2
6	83	16	2	1	1			5	3	6
6	84	14								
6	85/86	34	3		3			9	6	12
6	87/88	34	1		1		6	9	2	10
6	89	30	2		1	2		6	5	10
6	90	40	2		2	2		8	6	12
6	91	32	2		1			4	3	6
6	92	34								
6	93	30	1		1			3	2	4

*Lone females not included
Blanks denote no birds seen

Appendix A1. Number of indicated King Eiders on each transect, 1992 to 1994 *.
b) 1993 aerial surveys

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 - 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24	1		1			3	2	4
1	2/133	58	3		5			13	8	16
1	3/129	56	2	1				3	2	4
1	4/130	62	3		5	4		17	12	24
1	5/131	46	4		8	3		23	15	30
1	6/132	44	2		2		5	11	4	13
1	7	34	4		5			14	9	18
2	8	80	6		10		11	37	16	43
2	8.5	80	7		6			19	13	26
2	9	80	10	1	11		8	41	21	50
2	10	80	15	1	14	2		46	31	62
2	11	80	7		7	5	15	41	19	53
2	12	80	7		9		6	31	16	38
2	13	68	7	1	5	3		21	15	30
2	14	80	8		12		6	38	20	46
2	15	60			5			10	5	10
3	17	40	2	1	7		10	27	9	28
3	18	44	5	1	2			10	7	14
3	19	44	2		2			6	4	8
3	20	48	1	1	3		20	28	4	28
3	21.5	46	3		9			21	12	24
3	22	22	3		7		5	22	10	25
3	23.5	20	2		2			6	4	8
3	23.6	32	5		9			23	14	28
3	24.5	26	2		2			6	4	8
4	29	34			3		6	12	3	12
4	30	36	2		3			8	5	10
4	31	36	4		2			8	6	12
4	32	36	1		5	2		13	8	16
4	33	36	1		1		6	9	2	10
4	34	34	1		1			3	2	4
4	35	34			2			4	2	4
4	36	18								
4	37	16								
4	38	24								
4	39/46	48								
4	40/45	54	1			2		3	3	6
4	41	6		2				2		
4	42	31		1				1		
4	43	40	1		2			5	3	6
4	44	44			1			2	1	2
5	51	70	1					1	1	2
5	52	54	3		1			5	4	8

Appendix A1: 1993 surveys. Continued

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 - 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	53	54			3			6	3	6
5	54	60			1			2	1	2
5	54.5	50		1	1			3	1	2
5	55	50	1		1			3	2	4
6	63	12	1	1	1			4	2	4
6	64	36	1		2	3		8	6	12
6	65	36		1				1		
6	66	36		1	3			7	3	6
6	67	36	1		1			3	2	4
6	68	36	1				14	15	1	16
6	69	30								
6	70	34				4		4	4	8
6	71	50								
6	72	24	1					1	1	2
6	73	60	1		1			3	2	4
6	74	54	2		4			10	6	12
6	75	38	1		2			5	3	6
6	76	36	2	1				3	2	4
6	77	34	1		2			5	3	6
6	78	32								
6	79	24			1			2	1	2
6	80	30			1			2	1	2
6	81	30	2		3			8	5	10
6	82	32	5	1	2			10	7	14
6	85	22	1		4			9	5	10
6	88	34	2	1				3	2	4
6	89	40	1	1				2	1	2
6	90	42	3		6			15	9	18
6	91	38		1	1		9	12	1	11
6	92	38			1			2	1	2
7	122	101								
7	123	107	5		2			9	7	14
7	124	112	10			2		12	12	24
7	125	114	4		3			10	7	14
7	126	112	4		10		6	30	14	34
7	127	116	5		1	2		9	8	16
8	105	67	1		2			5	3	6
8	106	68	4		5			14	9	18
8	107	70	6	1	8			23	14	28
8	108	73	6		6	2		20	14	28
8	109	70	5		5	2		17	12	24
8	110	75	11	1	3	2		20	16	32
8	111	72	3		5			13	8	16
8	112	72	4	1	5			15	9	18
8	113	65			7	7	13	34	14	41
8	114	62	1		4	2		11	7	14
8	115	59	2	1	12	2		29	16	32
8	116	46	4		2		7	15	6	19

*Lone females not included
Blanks denote no birds seen

Appendix A1. Number of indicated King Eiders on each transect, 1992 to 1994*.
c) 1994 aerial surveys

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 - 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24			2			4	2	4
1	2/133	58	2		3			8	5	10
1	3/129	56	2		2			6	4	8
1	4/130	62	1		5		17	28	6	29
1	5/131	46	3	1	4			12	7	14
1	6/132	44	2		5	3		15	10	20
1	7	34		1	7	2		17	9	18
2	8	80	7		11			29	18	36
2	8.5	80	11	1	12	2		38	25	50
2	9	80	11		14		47	86	25	97
2	10	80	7		26		20	79	33	86
2	11	80	12		20		12	64	32	76
2	12	80	5		10		7	32	15	37
2	13	68	7		6	3		22	16	32
2	14	80	9	2	15		10	51	24	58
2	15	60	3		11	6		31	20	40
3	17	40	2		10			22	12	24
3	18	44	4		12			28	16	32
3	19	44	1		8		8	25	9	26
3	20	48	1		9			19	10	20
3	21.5	46		1	18		19	56	18	55
3	22	22			7			14	7	14
3	23.5	20			4		5	13	4	13
3	23.6	32	3		4			11	7	14
3	24.5	26	1		7			15	8	16
4	24	44			4			8	4	8
4	25	36			2		7	11	2	11
4	26	32	1		1			3	2	4
4	27	34			2			4	2	4
4	28	36						0	0	0
4	29	34			3			6	3	6
4	30	36	2		5			12	7	14
4	31	36			2		17	21	2	21
4	32	36			1			2	1	2
4	33	36	1		3			7	4	8
4	34	34						0	0	0
4	35	34	1					1	1	2
4	36	18						0	0	0
4	37	16						0	0	0
4	38	24	1					1	1	2
4	39/46	48	1		3		16	23	4	24
4	40/45	54			2			4	2	4
4	41	6						0	0	0
4	42	31			2			4	2	4
4	43	40			3			6	3	6
4	44	44	3	1	7			18	10	20

Appendix A1: 1994 surveys. Continued

Stratum	Transect	Km surveyed	Lone male	Lone female	Pair	2 - 4 males	Groups of >4	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	51	54			2			4	2	4
5	52	54	1		5		8	19	6	20
5	53	54			2			4	2	4
5	53.5	54	2		4			10	6	12
5	54	60			1			2	1	2
5	54.5	50	1		4			9	5	10
5	55	50	1		1		6	9	2	10
5	56	50			1			2	1	2
5	57	50	1		3			7	4	8
6	63	12	1		3			7	4	8
6	64	36	1		1			3	2	4
6	65	36	1				9	10	1	11
6	66	36			1			2	1	2
6	67	36	2		1		15	19	3	21
6	68	36	2					2	2	4
6	69	30	1		1			3	2	4
6	70	34			1			2	1	2
6	71	50	2		2		5	11	4	13
6	72	24	1		1			3	2	4
6	73	60	1		3			7	4	8
6	74	54	1	2	12			27	13	26
6	75	38	4		3		10	20	7	24
6	76	36	2		7			16	9	18
6	77	34		4	5		8	22	5	18
6	78	32	1		1			3	2	4
6	79	24			1		19	21	1	21
6	80	30	1	1	3		5	13	4	13
6	81	30	3		8			19	11	22
6	82	32			2		8	12	2	12
6	83	16			3		8	14	3	14
6	84	14			2			4	2	4
6	85	22	4		4			12	8	16
6	88	34						0	0	0
6	89	40	1					1	1	2
6	90	42						0	0	0
6	91	38	2		4			10	6	12
6	92	38					15	15	0	15
6	93	40	2				6	8	2	10

*Lone females not included
Blanks denote no birds seen

Appendix A2. Summary of calculations: total indicated King Eiders on each stratum, 1992 to 1994.

	Stratum							
	1	2	3	4	5	6	7	8
1992								
Lone males	6	60	15	17	8	51	nd*	nd
Lone females	0	3	2	1	1	3	nd	nd
Pairs	15	67	49	46	6	54	nd	nd
2-4 males	4	7	9	4	2	9	nd	nd
Groups of >4	6	30	12	0	0	11	nd	nd
Total indicated birds	56	298	158	134	32	239	nd	nd
Estimated population	3232	6205	3219	6506	3832	9880	nd	nd
Standard error	680	815	779	1218	2472	1504	nd	nd
1993								
Lone males	19	67	25	11	5	26	28	47
Lone females	1	3	3	3	1	8	0	4
Pairs	26	79	43	20	7	35	16	64
2-4 males	7	10	0	4	0	7	4	17
Groups of >4	5	46	35	12	0	23	6	20
Total indicated birds	109	358	171	82	24	159	102	276
Estimated population	3340	5948	3051	6172	7043	7766	6393	4757
Standard error	695	544	503	756	1986	3065	1593	580
1994								
Lone males	10	72	12	10	6	33	nd	nd
Lone females	2	3	1	1	0	7	nd	nd
Pairs	28	125	79	40	23	69	nd	nd
2-4 males	5	11	0	0	0	0	nd	nd
Groups of >4	17	96	32	40	14	108	nd	nd
Total indicated birds	103	512	214	140	72	312	nd	nd
Estimated population	3156	8507	3818	7832	15003	12243	nd	nd
Standard error	529	799	598	1607	4557	2935	nd	nd

* nd = not surveyed

Appendix A3. Number of indicated Canada Geese on each transect, 1992 to 1994*.

a) 1992 aerial surveys

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24		1		2	1	2
1	2	26						
1	3	24						
1	4	22		1		2	1	2
1	5	18						
1	6	24		2		4	2	4
1	7	34		1	6	8	1	8
2	8	80	2	6		14	8	16
2	9	80	8	16	9	49	24	57
2	10	80	9	17	3	46	26	55
2	11	80	7	13	21	54	20	61
2	12	80	10	7	53	77	17	87
2	13	68	11	5	8	29	16	40
2	14	80	4	9		22	13	26
2	15	60	8	5	5	23	13	31
3	17	40	4	2		8	6	12
3	18	44		3		6	3	6
3	19	44	3	1		5	4	8
3	20	48						
3	21.5	46		3	7	13	3	13
3	22	14						
3	23.5	20	2			2	2	4
3	24.5	26						
4	19.5	36	1	1		3	2	4
4	21	36	2			2	2	4
4	23	36	4	2		8	6	12
4	24	44	3	4		11	7	14
4	25	36	2	3		8	5	10
4	26	32	3	4		11	7	14
4	27	34		1	4	6	1	6
4	28	36		2	11	15	2	15
4	29	34	2			2	2	4
4	30	36	3	4		11	7	14
4	31	36	2	2		6	4	8
4	32	36	3	2	3	10	5	13
4	33	36	1	1	3	6	2	7
4	34	34	2	1		4	3	6
4	35	34	2		17	19	2	21
4	36	18		2		4	2	4
4	37	16	1	1	6	9	2	10
4	38	24		2		4	2	4
4	39/46	48	3	1		5	4	8
4	40/45	54	1	1		3	2	4
4	41	6	1			1	1	2
4	42	31	1			1	1	2
4	43	40	1			1	1	2
4	44	44	1			1	1	2

Appendix A3: 1992 surveys. Continued

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	47	40		2		4	2	4
5	48	44	2	1		4	3	6
5	49	36	3			3	3	6
5	50	34						
5	51	70						
5	52	54						
5	53	54						
5	54	60						
5	55	50						
5	56	50						
5	57	50						
5	58	52						
5	59	34		1		2	1	2
5	60	24		1		2	1	2
5	61	28						
5	62	10						
6	63	12	2			2	2	4
6	64	36	1			1	1	2
6	65	36						
6	66	36	1			1	1	2
6	67	36						
6	68	36	1	1		3	2	4
6	69	30	1		4	5	1	6
6	70	34	2	3	3	11	5	13
6	71	50	1	2		5	3	6
6	72	24						
6	73	60						
6	74	54		1		2	1	2
6	75	38	1			1	1	2
6	76	36						
6	77	34		1		2	1	2
6	78	32	1			1	1	2
6	79	24						
6	80	30						
6	81	30						
6	82	32						
6	83	16						
6	84	14						
6	85/86	34	1			1	1	2
6	87/88	34						
6	89	30						
6	90	40						
6	91	32			4	4		4
6	92	34						
6	93	30						

*Lone females not included
Blanks denote no birds seen

Appendix A3. Number of indicated Canada Geese on each transect, 1992 to 1994
 b) 1993 aerial surveys

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24	1	1	7	10	2	11
1	2/133	58	1	4	3	12	5	13
1	3/129	56	1	5		11	6	12
1	4/130	62	8	8	5	29	16	37
1	5/131	46	2	1	3	7	3	9
1	6/132	44	2	5	7	19	7	21
1	7	34	4	3	6	16	7	20
2	8	80	4	9		22	13	26
2	8.5	80	2	4	4	14	6	16
2	9	80	7	6	3	22	13	29
2	10	80	7	17	6	47	24	54
2	11	80	8	9	9	35	17	43
2	12	80	21	18	39	96	39	117
2	13	68	6	8		22	14	28
2	14	80	10	13	12	48	23	58
2	15	60	11	7	9	34	18	45
3	17	40	1	1		3	2	4
3	18	44	2	2		6	4	8
3	19	44	1	2		5	3	6
3	20	48	1	1		3	2	4
3	21.5	46		1		2	1	2
3	22	22	1	1		3	2	4
3	23.5	20	3			3	3	6
3	23.6	32		2		4	2	4
3	24.5	26						
4	29	34	1			1	1	2
4	30	36						
4	31	36	1	2		5	3	6
4	32	36	2	3		8	5	10
4	33	36	1		7	8	1	9
4	34	34		1		2	1	2
4	35	34						
4	36	18						
4	37	16		1		2	1	2
4	38	24		2		4	2	4
4	39/46	48		2		4	2	4
4	40/45	54						
4	41	6	1			1	1	2
4	42	31						
4	43	40						
4	44	44						
5	51	70						
5	52	54	1			1	1	2

Appendix A3: 1993 surveys. Continued

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	53	54						
5	54	60						
5	54.5	50						
5	55	50						
6	63	12		1		2	1	2
6	64	36						
6	65	36						
6	66	36	2	1		4	3	6
6	67	36						
6	68	36		1		2	1	2
6	69	30						
6	70	34	3	1		5	4	8
6	71	50		1		2	1	2
6	72	24	1			1	1	2
6	73	60		1		2	1	2
6	74	54	1	1		3	2	4
6	75	38						
6	76	36						
6	77	34	1			1	1	2
6	78	32						
6	79	24						
6	80	30						
6	81	30						
6	82	32						
6	85	22						
6	88	34						
6	89	40						
6	90	42						
6	91	38	1			1	1	2
6	92	38						
7	122	101	5	2	5	14	7	19
7	123	107	8	7		22	15	30
7	124	112	7	9		25	16	32
7	125	114	11	5	3	24	16	35
7	126	112	7	7		21	14	28
7	127	116	10	5		20	15	30
8	105	67	6	4	4	18	9	24
8	106	68	8	13	15	49	21	57
8	107	70	5	8	11	32	13	37
8	108	73	3	7		17	10	20
8	109	70	9	13	6	41	22	50
8	110	75	7	9	8	33	16	40
8	111	72	16	6		28	22	44
8	112	72	13	7	4	31	20	44
8	113	65	7	10	3	30	17	37
8	114	62	5	10	7	32	15	37
8	115	59	7	5	5	22	12	29
8	116	46	12	9	13	43	21	55

*Lone females not included
Blanks denote no birds seen

Appendix A3. Number of indicated Canada Geese on each transect, 1992 to 1994*.
c) 1994 aerial surveys

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
1	1	24		4	3	11	4	11
1	2/133	58	3	3	4	13	6	16
1	3/129	56	3	2		7	5	10
1	4/130	62	2	5	5	17	7	19
1	5/131	46		3	4	10	3	10
1	6/132	44		4	4	12	4	12
1	7	34	1	3		7	4	8
2	8	80	2	11	14	38	13	40
2	8.5	80	8	15	22	60	23	68
2	9	80	14	15	3	47	29	61
2	10	80	3	15	10	43	18	46
2	11	80	5	14	15	48	19	53
2	12	80	7	20	25	72	27	79
2	13	68	9	15	15	54	24	63
2	14	80	8	14	15	51	22	59
2	15	60	11	6	12	35	17	46
3	17	40		2		4	2	4
3	18	44	1	1		3	2	4
3	19	44		1	10	12	1	12
3	20	48		2	5	9	2	9
3	21.5	46	1		4	5	1	6
3	22	22		1		2	1	2
3	23.5	20		4		8	4	8
3	23.6	32	1	3	5	12	4	13
3	24.5	26		2		4	2	4
4	24	44		4		8	4	8
4	25	36	3		3	6	3	9
4	26	32				0	0	0
4	27	34	1			1	1	2
4	28	36	3			3	3	6
4	29	34		3		6	3	6
4	30	36	3	6		15	9	18
4	31	36		4		8	4	8
4	32	36		5	9	19	5	19
4	33	36	1	1		3	2	4
4	34	34				0	0	0
4	35	34	3	2		7	5	10
4	36	18		2		4	2	4
4	37	16				0	0	0
4	38	24		1		2	1	2
4	39/46	48	1	2		5	3	6
4	40/45	54				0	0	0
4	41	6			5	5	0	5
4	42	31			13	13	0	13
4	43	40		1		2	1	2
4	44	44		2	3	7	2	7

Appendix A3: 1994 surveys. Continued

Stratum	Transect	Km surveyed	Single	Pair	Group >2	Observed number of birds	Indicated breeding pairs	Total indicated birds
5	51	54	1			1	1	2
5	52	54	1			1	1	2
5	53	54				0	0	0
5	53.5	54				0	0	0
5	54	60				0	0	0
5	54.5	50		1	4	6	1	6
5	55	50	1			1	1	2
5	56	50		1		2	1	2
5	57	50				0	0	0
6	63	12			4	4	0	4
6	64	36	2	5		12	7	14
6	65	36	1		3	4	1	5
6	66	36	1	4		9	5	10
6	67	36	1			1	1	2
6	68	36		2		4	2	4
6	69	30				0	0	0
6	70	34	2	1	5	9	3	11
6	71	50		2		4	2	4
6	72	24		2		4	2	4
6	73	60	1	1		3	2	4
6	74	54		1		2	1	2
6	75	38				0	0	0
6	76	36				0	0	0
6	77	34		1		2	1	2
6	78	32				0	0	0
6	79	24				0	0	0
6	80	30				0	0	0
6	81	30	2			2	2	4
6	82	32				0	0	0
6	83	16				0	0	0
6	84	14				0	0	0
6	85	22				0	0	0
6	88	34		1		2	1	2
6	89	40		1		2	1	2
6	90	42		2		4	2	4
6	91	38				0	0	0
6	92	38				0	0	0
6	93	40				0	0	0

*Lone females not included
Blanks denote no birds seen

Appendix A4. Summary of calculations: total indicated Canada Geese on each stratum, 1992 to 1994.

	Stratum							
	1	2	3	4	5	6	7	8
1992								
Single	0	57	9	39	5	12	nd*	nd
Pair	5	72	9	34	5	8	nd	nd
Group>2	6	99	7	44	0	11	nd	nd
Indicated pairs	5	129	18	73	10	20	nd	nd
Total indicated birds	16	357	43	190	20	51	nd	nd
Estimated population	924	7013	876	9224	4329	1780	nd	nd
Standard error	250	941	296	1188	3124	723	nd	nd
1993								
Single	19	76	9	6	1	9	48	98
Pair	27	91	10	11	0	7	35	101
Group>2	31	82	0	7	0	0	8	76
Indicated pairs	46	167	19	17	1	16	83	199
Total indicated birds	123	416	38	41	2	32	174	474
Estimated population	3769	6912	678	3086	587	1068	10905	8170
Standard error	823	1399	112	740	647	619	559	796
1994								
Single	9	67	3	15	3	10	nd	nd
Pair	24	125	16	33	2	23	nd	nd
Group>2	20	131	24	33	4	12	nd	nd
Indicated pairs	33	192	19	48	5	33	nd	nd
Total indicated birds	86	515	62	129	14	78	nd	nd
Estimated population	2635	8557	1106	7217	2917	2622	nd	nd
Standard error	263	535	180	1396	1222	924	nd	nd

*nd = not surveyed



APPENDIX B.

Numbers of birds observed during aerial surveys on Victoria Island, 1992 to 1994.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 1

Species	Transect number							Total	No. per sq km
	1	2	3	4	5	6	7		
Pacific Loon	1						1	2	0.03
Red-throated Loon								0	0.00
Yellow-billed Loon								0	0.00
Loon sp.								0	0.00
Tundra Swan	4							4	0.06
Canada Goose	2			2		4	8	16	0.23
Brant								0	0.00
G. White-fronted Goose							1	1	0.01
Snow Goose								0	0.00
Dark goose								0	0.00
Northern Pintail								0	0.00
Common Eider					17		10	27	0.39
King Eider	1	6	5	13	2	3	16	46	0.67
Oldsquaw	2	2				2	1	7	0.10
Rough-legged Hawk					1			1	0.01
Ptarmigan sp.								0	0.00
Sandhill Crane								0	0.00
Shorebird	10	6	6	7	2	7	4	42	0.61
Pomarine Jaeger	1					2		3	0.04
Parasitic Jaeger			1			1	3	5	0.07
Long-tailed Jaeger	2							2	0.03
Jaeger sp.						1		1	0.01
Glaucous Gull		1	2	1		5	2	11	0.16
Thayer's Gull								0	0.00
Sabine's Gull					5			5	0.07
Arctic Tern	2						2	4	0.06
Snowy Owl		1						1	0.01
Common Raven								0	0.00
Passerine	1	4	1	2	2	1	3	14	0.20
Transect length (km)	24	26	24	22	18	24	34		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 2

Species	Transect number								Total	No. per sq km
	8	9	10	11	12	13	14	15		
Pacific Loon	4	1	5	1	1		7	3	22	0.09
Red-throated Loon		3				4		1	8	0.03
Yellow-billed Loon									0	0.00
Loon sp.		2		2		3	2	2	11	0.05
Tundra Swan	12	12	19	19	3	7	5	7	84	0.35
Canada Goose	14	49	46	54	77	29	22	23	314	1.29
Brant					11				11	0.05
G. White-fronted Goose									0	0.00
Snow Goose				2	1	1			4	0.02
Dark goose			1						1	0.00
Northern Pintail	3				1				4	0.02
Common Eider									0	0.00
King Eider	24	64	42	30	16	25	32	25	258	1.06
Oldsquaw	7	4		4	4	10	3	5	37	0.15
Rough-legged Hawk					2		1		3	0.01
Ptarmigan sp.				1	2	1	2		6	0.02
Sandhill Crane	2		2		1	1	3	3	12	0.05
Shorebird	35	60	29	21	35	18	18	5	221	0.91
Pomarine Jaeger	7	4	6	6	6	3	5	4	41	0.17
Parasitic Jaeger	7	9	9	9	9	12	6		61	0.25
Long-tailed Jaeger	3	3	3	1	2	2	1		15	0.06
Jaeger sp.	1	1	5	1	3	2	1		14	0.06
Glaucous Gull			2	1	1	3	1	2	10	0.04
Thayer's Gull									0	0.00
Sabine's Gull	21	2			3	2	3		31	0.13
Arctic Tern	6	5				1	3		15	0.06
Snowy Owl	2	2	4	8		3	4	2	25	0.10
Common Raven						1			1	0.00
Passerine	3	1	3	1	6	6		2	22	0.09
Transect length (km)	80	80	80	80	80	68	80	60		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 3

Species	Transect number								Total	No. per sq km
	17	18	19	20	21.5	22	23.5	24.5		
Pacific Loon		2	5				2		9	0.08
Red-throated Loon					1		1		2	0.02
Yellow-billed Loon								1	1	0.01
Loon sp.					2		1		3	0.03
Tundra Swan	1		5						6	0.05
Canada Goose	8	6	5		13		2		34	0.30
Brant									0	0.00
G. White-fronted Goose									0	0.00
Snow Goose									0	0.00
Dark goose									0	0.00
Northern Pintail									0	0.00
Common Eider									0	0.00
King Eider	16	7	37	14	33	1	8	20	136	1.21
Oldsquaw	28	2	9	4		6	7	3	59	0.52
Rough-legged Hawk									0	0.00
Ptarmigan sp.	1			1	2		1		5	0.04
Sandhill Crane									0	0.00
Shorebird	11	24	6	14	21	5	10	9	100	0.89
Pomarine Jaeger	1	2	5		1		1	2	12	0.11
Parasitic Jaeger			1	1			1	1	4	0.04
Long-tailed Jaeger				1					1	0.01
Jaeger sp.			1				1		2	0.02
Glaucous Gull	6	1	3	1		1	4		16	0.14
Thayer's Gull							1		1	0.01
Sabine's Gull	2				1		2		5	0.04
Arctic Tern	1	3		1				1	6	0.05
Snowy Owl									0	0.00
Common Raven									0	0.00
Passerine			2	2			3	2	9	0.08
Transect length (km)	40	44	44	48	46	14	20	26		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 4

Species	Transect number																				Total	No. per sq km					
	19.5	21	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	41	42			43	44	40/45	39/46	
Pacific Loon		1		1		1			3																6	0.02	
Red-throated Loon				1				1				1													3	0.01	
Yellow-billed Loon																						2			2	0.01	
Loon sp.																						2			2	0.01	
Tundra Swan	2	1		1		1	1		2	2	1			2	2		1					2			18	0.06	
Canada Goose	3	2	8	11	8	11	6	15	2	11	6	10	6	4	19	4	9	4	1	1	1	1	1	3	5	151	0.46
Brant																									0	0.00	
G.White-fronted Goose							4																		4	0.01	
Snow Goose											1														1	0.00	
Dark goose																									0	0.00	
Northern Pintail																									0	0.00	
Common Elder		4		2	3							60		2										37	108	0.33	
King Eider	5	5	6	7	13	7		16	5	14	2	2	6		5			1	6	2	2	1		9	114	0.35	
Oldsquaw				4	5					1		1	2	5	8						6	3	3	1	39	0.12	
Rough-legged Hawk			1														1								1	3	0.01
Ptarmigan sp.									1																1	1	0.00
Sandhill Crane		1																						1	2	0.01	
Shorebird	4	9	2	4	11	4	2	3		1	2	2	4		7	2	1	7	2	5	4	1	1	5	83	0.25	
Pomarine Jaeger	1																				2	3	1		7	0.02	
Parasitic Jaeger	1		1											2							4	4	1		2	15	0.05
Long-tailed Jaeger	1									1				1											3	0.01	
Jaeger sp.																							1		1	0.00	
Glaucous Gull			1				2	21			6	1		1	3	1		7		2	5	2		9	61	0.19	
Thayer's Gull											1				1	20				1		1	1		25	0.08	
Sabine's Gull		2																							2	0.01	
Arctic Tern	1							6		2	2		2												13	0.04	
Snowy Owl					1	1				1	2											2			7	0.02	
Common Raven								1																	1	0.00	
Passerine	1			4					1	5		3	3	5	4	6		3							35	0.11	
Transect length (km)	36	36	36	44	36	32	34	36	34	36	36	36	36	34	34	18	16	24	6	31	40	44	54	48			

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 5

Species	Transect number																Total	No. per sq km
	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
Pacific Loon					1	1	1						1				4	0.01
Red-throated Loon																	0	0.00
Yellow-billed Loon									1				1				2	0.01
Loon sp.												1					1	0.00
Tundra Swan				1										1			2	0.01
Canada Goose	4	4	3										2	2			15	0.05
Brant																	0	0.00
G. White-fronted Goose																	0	0.00
Snow Goose																	0	0.00
Dark goose																	0	0.00
Northern Pintail																	0	0.00
Common Eider			2											6	6		14	0.05
King Eider					3	3	1	1	2		7	2	3	1			23	0.08
Oldsquaw	3			2	3	9			1	1		2	2				23	0.08
Rough-legged Hawk		2	1										1	2			6	0.02
Peregrine Falcon				1													1	0.00
Falcon sp.			1														1	0.00
Ptarmigan sp.		2						1									3	0.01
Sandhill Crane	1	2	3		2										1	1	10	0.04
Shorebird	1	4	4	3	14	6	5	2	2	5	4	7	3		2	1	63	0.23
Pomarine Jaeger						1				1					1		3	0.01
Parasitic Jaeger												1	1				2	0.01
Long-tailed Jaeger						1	3					1	1			1	7	0.03
Jaeger sp.												1					1	0.00
Glaucous Gull	5	2	1	1	2		2		2	1	1	2	2	8	4	1	34	0.12
Thayer's Gull																	0	0.00
Sabine's Gull												1					1	0.00
Arctic Tern					1												1	0.00
Snowy Owl	1														1		2	0.01
Common Raven					1												1	0.00
Passerine	3	1		2	4	9	2		3	2		3	1		1		31	0.11
Transect length (km)	40	44	36	34	70	54	54	60	50	50	50	52	34	24	28	10		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from 19 June to 1 July, 1992.

Stratum 6

Species	Transect number																							Total	No. per sq km						
	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85/86			87/88	89	90	91	92	93
Pacific Loon	1					3		3		1	1	1			2							4	4							20	0.05
Red-throated Loon						3											2													5	0.01
Yellow-billed Loon				5								1						1				3			1				11	0.03	
Loon sp.												3																	3	0.01	
Tundra Swan	1	2	1											2												2			8	0.02	
Canada Goose	2	1		1		3	5	11	5			2	1		2	1						5		1			4		39	0.10	
Brant												1	2		2						5		6						16	0.04	
G. White-fronted Goose																													0	0.00	
Snow Goose										1								18											19	0.05	
Dark goose												1	1												1				3	0.01	
Northern Pintail																													0	0.00	
Common Eider						2					2	2		6				2	16										30	0.08	
King Elder		3	3	9		6	2	8	5	4	9	11	6	7	18	9	9	11	16	2	5		9	9	6	8	4		3	182	0.47
Oldsquaw							1	1		1	1				1			1					2					1		9	0.02
Gyrfalcon		1																											1	0.00	
Rough-legged Hawk		2		1				1		2		1								1		1				1			10	0.03	
Ptarmigan sp.	1						2			1	1				1	1					1					2			10	0.03	
Sandhill Crane		3		1				1				2															2		9	0.02	
Shorebird	2	1	8	4	2	6	3	5	6	7	10	14	15	3	5	7	7	12	8	8	12	5	17	7	25	10	13	8	10	240	0.62
Pomarine Jaeger	1	3	2					1	6		1	3	4	3		7	2	6	4	2			1		1	1	3		2	53	0.14
Parasitic Jaeger	2	4	8			1			2	1	2	5	7	7	7	3	3	1	2	1			2					1	1	60	0.16
Long-tailed Jaeger				1		1		1	1		6	3	1	2	1	2			1						1		1	2	2	26	0.07
Jaeger sp.		1	2											2	1	1		1	2	1			1			1	1	1	15	0.04	
Glaucous Gull		5		2	1	3	1	1	1	1	2		2	2	4	4							1			1			31	0.08	
Thayer's Gull				1	1																								2	0.01	
Sabine's Gull													1		5														6	0.02	
Arctic Tern		1							1	2	2				3	3						1	1	1	1	3	2		21	0.05	
Snowy Owl		1		2		1			1	1	3	3	5	3	1	2	2	3		2			1		1	3	2	1		38	0.10
Common Raven																									1				1	0.00	
Passerine			4	3	1	2	2	3	5			3	1	4		9	1	4		2	1		2	2	1	2	1	2	2	57	0.15
Transect Length (km)	12	36	36	36	36	36	30	34	50	24	60	54	38	36	34	32	24	30	30	32	16	14	34	34	30	40	32	34	30		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 1

Species	Transect number							Total	No. per sq km
	1	2/133	3/129	4/130	5/131	6/132	7		
Pacific Loon		5	2	5		2	1	15	0.12
Red-throated Loon									
Yellow-billed Loon									
Loon sp.				2				2	0.02
Tundra Swan	2	1				4	5	12	0.09
Canada Goose	10	12	11	29	7	19	16	104	0.80
Brant									
G. White-fronted Goose									
Snow Goose							4	4	0.03
Dark goose									
Northern Pintail									
Common Eider						8		8	0.06
King Eider	3	10	3	17	23	11	11	78	0.60
Oldsquaw	2				1	2	1	6	0.05
Falcon									
Rough-legged Hawk						1		1	0.01
Ptarmigan sp.									
Sandhill Crane									
Shorebird	2	1	4	3	2	2		14	0.11
Pomarine Jaeger			1	3			1	5	0.04
Parasitic Jaeger	1					1	1	3	0.02
Long-tailed Jaeger		1					1	2	0.02
Jaeger sp.									
Glaucous Gull	2	2		1	2	2		9	0.07
Thayer's Gull									
Sabine's Gull									
Arctic Tern		2	4	1		5		12	0.09
Snowy Owl									
Common Raven									
Passerine				2				2	0.02
Transect length (km)	24	58	56	62	46	44	34		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 2

Species	Transect number									Total	No. per sq km
	8	8.5	9	10	11	12	13	14	15		
Pacific Loon	7		4	5	1	5	3	1	1	27	0.10
Red-throated Loon						1			1	2	0.01
Yellow-billed Loon		1						5		6	0.02
Loon sp.		1	1	1				1		4	0.01
Tundra Swan	10	11	14	9	9	6	7	11	1	78	0.28
Canada Goose	22	14	22	47	35	96	22	48	34	340	1.24
Brant	2				2					4	0.01
G. White-fronted Goose											
Snow Goose						3				3	0.01
Dark goose											
Northern Pintail								2		2	0.01
Common Eider						4				4	0.01
King Eider	37	19	41	46	41	32	21	38	10	285	1.04
Oldsquaw	6	3	11	6	2	9	5	3	1	46	0.17
Falcon											
Rough-legged Hawk									1	1	0.00
Ptarmigan sp.	1	1	2		4	2	1			11	0.04
Sandhill Crane						1	1	3		5	0.02
Shorebird	8	9	14	10	6	7	13	4	8	79	0.29
Pomarine Jaeger	1	2	3	5	5	5	10	5	4	40	0.15
Parasitic Jaeger	3	2	2	2	4	1	1		1	16	0.06
Long-tailed Jaeger		1		2	2	1				6	0.02
Jaeger sp.	1			2						3	0.01
Glaucous Gull	6	1		1	4	6		9	1	28	0.10
Thayer's Gull											
Sabine's Gull	12	3			1	16		16		48	0.17
Arctic Tern	8	2	1		4			6		21	0.08
Snowy Owl	1			1	2			2	1	7	0.03
Common Raven											
Passerine											
Transect length (km)	80	80	80	80	80	80	68	80	60		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 3

Species	Transect number									Total	No. per sq km
	17	18	19	20	21.5	22	23.5	23.6	24.5		
Pacific Loon		7		1		1			2	11	0.09
Red-throated Loon											
Yellow-billed Loon									1	1	0.01
Loon sp.											
Tundra Swan		2	1	2	2	1			1	9	0.07
Canada Goose	3	6	5	3	2	3	3	4		29	0.23
Brant											
G. White-fronted Goose											
Snow Goose											
Dark goose											
Northern Pintail											
Common Eider											
King Eider	27	10	6	28	21	20	6	21	6	145	1.13
Oldsquaw		2			1		2	2		7	0.05
Falcon											
Rough-legged Hawk									1	1	0.01
Ptarmigan sp.					1					1	0.01
Sandhill Crane							1			1	0.01
Shorebird	10	2	6	2	7	5	1	6	4	43	0.33
Pomarine Jaeger	5	12	9	4	11	3	4	3	4	55	0.43
Parasitic Jaeger	1		1			2			1	5	0.04
Long-tailed Jaeger					3					3	0.02
Jaeger sp.							1			1	0.01
Glaucous Gull				2			2	1		5	0.04
Thayer's Gull											
Sabine's Gull	5				1	4	14	1	1	26	0.20
Arctic Tern	1	2	4		8		2	2		19	0.15
Snowy Owl		1			1	1	1			4	0.03
Common Raven											
Passerine					1					1	0.01
Transect length (km)	40	44	44	48	46	22	20	32	26		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 4

Species	Transect number																No. per	
	29	30	31	32	33	34	35	36	37	38	41	42	43	44	40/45	39/46	Total	sq km
Pacific Loon	1		2	1	1	2		2						1	1		11	0.05
Red-throated Loon																		
Yellow-billed Loon										1					1	1	3	0.01
Loon sp.							2			1						1	4	0.02
Tundra Swan	2	1	2				2				4	1			1	1	14	0.07
Canada Goose	1		5	8	8	2			2	4	1					4	35	0.17
Brant									4								4	0.02
G. White-fronted Goose																		
Snow Goose																		
Dark goose																		
Northern Pintail																		
Common Eider	1													1			2	0.01
King Eider	12	8	8	13	9	3	4			2	1	5	2	3			70	0.33
Oldsquaw		3	1	4		3	1	1		1				2			16	0.08
Peregrine Falcon													1			1	2	0.01
Rough-legged Hawk							2	1		1	1						5	0.02
Ptarmigan sp.															1		1	0.00
Sandhill Crane														1			1	0.00
Shorebird	2	3	3	3					2	1						2	16	0.08
Pomarine Jaeger	1				1			1									3	0.01
Parasitic Jaeger							1				1	1					3	0.01
Long-tailed Jaeger		1		1													2	0.01
Jaeger sp.																		
Glaucous Gull							3	1		4			2	7	5	2	24	0.11
Thayer's Gull							4	6					1				11	0.05
Sabine's Gull																		
Arctic Tern																		
Snowy Owl			1													1	2	0.01
Common Raven																		
Passerine	2		1												1	2	6	0.03
Transect length (km)	34	36	36	36	36	34	34	18	16	24	6	31	40	44	54	48		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 5

Species	Transect number						Total	No. per sq km
	51	52	53	54	54.5	55		
Pacific Loon	4						4	0.03
Red-throated Loon								
Yellow-billed Loon			1				1	0.01
Loon sp.			2				2	0.01
Tundra Swan								
Canada Goose		1					1	0.01
Brant								
G. White-fronted Goose								
Snow Goose								
Dark goose								
Northern Pintail								
Common Eider								
King Eider	1	5	6	2	3	3	20	0.15
Oldsquaw	8	6			1		15	0.11
Rough-legged Hawk								
Falcon								
Ptarmigan sp.								
Sandhill Crane	1						1	0.01
Shorebird	2	6	3	1	3	2	17	0.13
Pomarine Jaeger	1	3		3			7	0.05
Parasitic Jaeger		1	2				3	0.02
Long-tailed Jaeger								
Jaeger sp.		2					2	0.01
Glaucous Gull	4	2			1	4	11	0.08
Thayer's Gull								
Sabine's Gull								
Arctic Tern						1	1	0.01
Snowy Owl		4	1	4	1	1	11	0.08
Common Raven								
Passerine		2		1	1		4	0.03
Transect length (km)	70	54	54	60	50	50		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 6

Species	Transect number																				Total	No. per sq km							
	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82			85	88	89	90	91	92	
Pacific Loon				2		3			1			2		1	3	1		1	5		5				1		25	0.07	
Red-throated Loon	1	2																									5	0.01	
Yellow-billed Loon				1		3	1	2	1		4	1			1									1	1		16	0.04	
Loon sp.			1	2									1	1				1	1	1			1	3			12	0.03	
Tundra Swan	2			2	2				1																		7	0.02	
Canada Goose	2			4		2		5	2	1	2	3			1										1		23	0.06	
Brant		2																				2	2				7	0.02	
G. White-fronted Goose																													
Snow Goose											18				3												21	0.06	
Dark goose								2																			2	0.01	
Northern Pintail																													
Common Eider				1							1	2															4	0.01	
King Eider	4	8	1	7	3	15		4		1	3	10	5	3	5		2	2	8	10	9	3	2	15	12	2	134	0.37	
Oldsquaw	4												1					2		8	10	9	3	2	15	12	2	13	0.04
Falcon																													
Rough-legged Hawk		1	1	1	1		1			2			2									1					10	0.03	
Ptarmigan sp.				1			1	1		1			1	5	1	1											12	0.03	
Sandhill Crane		4	2			2	2				1																11	0.03	
Shorebird	2	1			3	1	1	4	2	2	4	4	4	2	1		1	2	1	2	8	4	1	4	7	3	64	0.18	
Pomarine Jaeger	2							1		1	2	3	3	1		2		2	3		6	4	10	2	3	3	48	0.13	
Parasitic Jaeger					2			1	3	1	3						2	1	1	1		3	1	3	2	1	25	0.07	
Long-tailed Jaeger	1	1					1	2		2	3					2		1					1		1		15	0.04	
Jaeger sp.		1					1					2		1					2				2			1	10	0.03	
Glaucous Gull		8	1		6		3	3	1		4	3	4	3	2						2	1	3	1			45	0.12	
Thayer's Gull														1													1	0.00	
Sabine's Gull															1									1			2	0.01	
Arctic Tern			2		2	1							3		2	1					1	3	2	1			18	0.05	
Snowy Owl					3	2	5	3	2	1	4			1			1	1				2	4	1	4	3	37	0.10	
Common Raven																													
Passerine		1	1	2				1	3		2	1						1			1		1	1	1	1	16	0.04	
Transect length (km)	12	36	36	36	36	36	30	34	50	24	60	54	38	36	34	32	24	30	30	32	22	34	40	42	38	38			

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 7

Species	Transect number						Total	No. per sq km
	122	123	124	125	126	127		
Pacific Loon			3	2	5	2	12	0.05
Red-throated Loon								
Yellow-billed Loon		1				1	2	0.01
Loon sp.								
Tundra Swan	7	6	11	1	8		33	0.12
Canada Goose	14	22	25	24	21	20	126	0.48
Brant	3						3	0.01
G. White-fronted Goose		1	4				5	0.02
Snow Goose								
Dark goose								
Northern Pintail	4						4	0.02
Common Eider								
King Eider		9	18	10	30	9	76	0.29
Oldsquaw	1	4	4	5	4	4	22	0.08
Peregrine Falcon				1			1	0.00
Rough-legged Hawk					1		1	0.00
Ptarmigan sp.			1		2		3	0.01
Sandhill Crane								
Shorebird	6	7	3	2	1	9	28	0.11
Pomarine Jaeger	3	3	4		1	4	15	0.06
Parasitic Jaeger			3	3	2	1	9	0.03
Long-tailed Jaeger		1	1			1	3	0.01
Jaeger sp.		2		1			3	0.01
Glaucous Gull	4	1	1	8	5		19	0.07
Thayer's Gull								
Sabine's Gull		2					2	0.01
Arctic Tern						4	4	0.02
Snowy Owl	2	1	1				4	0.02
Common Raven			1				1	0.00
Passerine	1	1		1		1	4	0.02
Transect length (km)	101	107	112	114	112	116		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island from June 18 to 29, 1993.

Stratum 8

Species	Transect number												Total	No. per sq km
	105	106	107	108	109	110	111	112	113	114	115	116		
Pacific Loon	2	6	2	1	4	2		4	2		4		27	0.08
Red-throated Loon							1	2					3	0.01
Yellow-billed Loon		1			1							2	4	0.01
Loon sp.	1		1	1			1						4	0.01
Tundra Swan	4	10	15	6	6	5	22	14	14	12	10	2	120	0.38
Canada Goose	18	49	32	17	41	33	28	31	30	32	22	43	376	1.18
Brant											1		1	0.00
G. White-fronted Goose			2	2		4	4	5		22	2		41	0.13
Snow Goose				2		2		1			11		16	0.05
Dark goose								2			2	2	6	0.02
Northern Pintail			1						4				5	0.02
Common Eider						1					1		2	0.01
King Eider	5	14	23	20	17	20	13	15	34	11	29	15	216	0.68
Oldsquaw	1	5		2		5	4	1	3	2			23	0.07
Peregrine Falcon						1							1	0.00
Rough-legged Hawk	1					1							2	0.01
Ptarmigan sp.				1		3	2	3	3	1	1	1	15	0.05
Sandhill Crane				4	1	2	2	1	4	2	1	1	18	0.06
Shorebird	11	11	3	13	12	5	19	13	11	8	20	8	134	0.42
Pomarine Jaeger	1	2	1	1	1		1	1	2	1	1	1	13	0.04
Parasitic Jaeger								1	1	2	1		5	0.02
Long-tailed Jaeger		1			1	1			1			1	5	0.02
Jaeger sp.				2					2	1	1		6	0.02
Glaucous Gull	4	3	3	14	5	6	1	4	7	7	7	2	56	0.18
Thayer's Gull														
Sabine's Gull					2								2	0.01
Arctic Tern	2	7	3	5		7	2	7	1		1	7	42	0.13
Snowy Owl								3		1		2	6	0.02
Common Raven										1			1	0.00
Passerine	5	1		1	1		8	1	2		1		20	0.06
Transect length (km)	67	68	70	73	70	75	72	72	65	62	59	46		

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island , 16-28 June 1994.

Stratum 1

Species	Transect number							Total	No. per sq km
	1/2133	3/129	4/130	5/131	6/132	7			
Pacific Loon		2				1		3	0.02
Red-throated Loon					2			2	0.02
Yellow-billed Loon		1	1					2	0.02
Loon sp.					1	3		4	0.03
Tundra Swan	1	6	2	4	3	2		18	0.14
Canada Goose	11	13	7	17	10	12	7	77	0.59
Brant							1	1	0.01
G. White-fronted Goose								0	0.00
Snow Goose				12				12	0.09
Dark goose								0	0.00
Northern Pintail								0	0.00
Common Eider						2		2	0.02
King Eider	4	8	6	28	12	15	17	90	0.69
Oldsquaw			6			1		7	0.05
Falcon								0	0.00
Rough-legged Hawk					1		1	2	0.02
Ptarmigan sp.						1		1	0.01
Sandhill Crane				5				5	0.04
Shorebird	1	1	1	4	7	4	5	23	0.18
Pomarine Jaeger								0	0.00
Parasitic Jaeger	2							2	0.02
Long-tailed Jaeger						3	1	4	0.03
Jaeger sp.								0	0.00
Glaucous Gull	1	2	1	2	2	3	2	13	0.10
Thayer's Gull								0	0.00
Sabine's Gull								0	0.00
Arctic Tern			3	10		8	1	22	0.17
Snowy Owl							1	1	0.01
Common Raven								0	0.00
Passerine			2	1		1		4	0.03
Transect length (km)	24	58	56	62	46	44	34	324	

Blanks denote no birds seen.

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island , 16-28 June 1994.

Stratum 2

Species	Transect number										Total	No. per sq km
	8	8.5	9	10	11	12	13	14	15			
Pacific Loon	8	4	6	4	3	9	3	8	3	48	0.17	
Red-throated Loon						4		3		7	0.03	
Yellow-billed Loon					1					1	0.00	
Loon sp.		1	1	3		4		2		11	0.04	
Tundra Swan	9	13	18	12	17	17	14	11	3	114	0.41	
Canada Goose	38	60	47	43	48	72	54	51	35	448	1.63	
Brant						25	6			31	0.11	
G. White-fronted Goose										0	0.00	
Snow Goose	25				5	25				55	0.20	
Dark goose										0	0.00	
Northern Pintail										0	0.00	
Common Eider						2				2	0.01	
King Eider	29	38	86	79	64	32	22	51	31	432	1.57	
Oldsquaw	2	5	6	4	2		7			26	0.09	
Falcon										0	0.00	
Rough-legged Hawk									1	1	0.00	
Ptarmigan sp.	1			1	2	1		2		7	0.03	
Sandhill Crane				2	2					4	0.01	
Shorebird	26	9	6	17	5	10	7	3	6	89	0.32	
Pomarine Jaeger	1		1		4		3	1	1	11	0.04	
Parasitic Jaeger	3					2	1			6	0.02	
Long-tailed Jaeger		2		1		1		1	2	7	0.03	
Jaeger sp.					1	1				2	0.01	
Glaucous Gull	6	8	5	3	1	9	3	3	2	40	0.15	
Thayer's Gull										0	0.00	
Sabine's Gull	7	2	5			3	8	26		51	0.19	
Arctic Tern	9	6				1		6		22	0.08	
Snowy Owl		1						1		2	0.01	
Short-eared Owl								1		1	0.00	
Common Raven										0	0.00	
Passerine		1	2		1	2		1	1	8	0.03	
Transect length (km)	80	80	80	80	80	80	68	80	60	688		

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island, 16-28 June 1994.

Stratum 3

Species	Transect number									Total	No. per sq km
	17	18	19	20	21.5	22	23.5	23.6	24.5		
Pacific Loon	7		1		2	2	2			14	0.11
Red-throated Loon										0	0.00
Yellow-billed Loon										0	0.00
Loon sp.					1					1	0.01
Tundra Swan			1	3			2			6	0.05
Canada Goose	4	3	12	9	5	2	8	12	4	59	0.46
Brant										0	0.00
G. White-fronted Goose										0	0.00
Snow Goose										0	0.00
Dark goose										0	0.00
Northern Pintail										0	0.00
Common Eider										0	0.00
King Eider	22	28	25	19	56	14	13	11	15	203	1.58
Oldsquaw	2	2	3	5				1		13	0.10
Falcon										0	0.00
Rough-legged Hawk				1		1				2	0.02
Ptarmigan sp.	2				2					4	0.03
Sandhill Crane				2						2	0.02
Shorebird	4	7	5	5	8	4		17	2	52	0.40
Pomarine Jaeger				1	2			3		6	0.05
Parasitic Jaeger			1			1			1	3	0.02
Long-tailed Jaeger		1			1			2		4	0.03
Jaeger sp.										0	0.00
Glaucous Gull		3		2				6		11	0.09
Thayer's Gull										0	0.00
Sabine's Gull	3			1	27					31	0.24
Arctic Tern	5				4		3	3		15	0.12
Snowy Owl						1		1		2	0.02
Short-eared Owl	1									1	0.01
Common Raven										0	0.00
Passerine	1			1	3					5	0.04
Transect length (km)	40	44	44	48	46	22	20	32	26	322	

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island, 16-28 June 1994.

Stratum 4

Species	Transect number																				Total	No. per sq km		
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	41	42	43	44	40/45			39/46	
Pacific Loon	1		2		1		1	4		2		1		4	3				4	7	5	35	0.12	
Red-throated Loon						4																4	0.01	
Yellow-billed Loon								2														2	0.01	
Loon sp.				2		1				2	1										1	1	8	0.03
Tundra Swan	2		2					3	2	1												5	15	0.05
Canada Goose	8	6		1	3	6	15	8	19	3		7	4		2	5	13	2	7		5	114	0.40	
Brant																						0	0.00	
G.White-fronted Goose																						0	0.00	
Snow Goose																						0	0.00	
Dark goose																						0	0.00	
Northern Pintail																						0	0.00	
Common Eider		6			3		4		8	2	1			3								2	29	0.10
King Eider	8	11	3	4		6	12	21	2	7		1			1		4	6	18	4	23	131	0.46	
Oldsquaw	4		1		2		3	1	11			4		1		4			3	3	2	39	0.14	
Peregrine Falcon															1							1	0.00	
Rough-legged Hawk																						0	0.00	
Ptarmigan sp.		1					1															2	0.01	
Sandhill Crane									2					1				2	1	2	1	9	0.03	
Shorebird	8	1		2	1	2	5		1	1	5	4	4		4		1	1			1	41	0.14	
Pomarine Jaeger																			1	1	3	5	0.02	
Parasitic Jaeger																						0	0.00	
Long-tailed Jaeger									1													1	0.00	
Jaeger sp.														1								1	0.00	
Glaucous Gull		2		4	6	3	3			2	1	1					2		5	4	2	35	0.12	
Thayer's Gull													13							2		15	0.05	
Sabine's Gull																						0	0.00	
Arctic Tern			2		2																	4	0.01	
Snowy Owl		1										1			1		1		1			5	0.02	
Common Raven																						0	0.00	
Passerine	2		1			1			3	2	1			1	2		5	5	4	5	1	33	0.12	
Transect length (km)	44	36	32	34	36	34	36	36	36	36	34	34	18	16	24	6	31	40	44	54	48			

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island, 16-28 June 1994.

Stratum 5

Species	Transect number										Total	No. per sq km
	51	52	53	53.5	54	54.5	55	56	57			
Pacific Loon	1		1			1			3		6	0.03
Red-throated Loon											0	0.00
Yellow-billed Loon			1								1	0.01
Loon sp.	1					1		2	1		5	0.03
Tundra Swan			2								2	0.01
Canada Goose	1	1				6	1	2			11	0.06
Brant											0	0.00
G. White-fronted Goose											0	0.00
Snow Goose											0	0.00
Dark goose											0	0.00
Northern Pintail											0	0.00
Common Eider											0	0.00
King Eider	4	19	4	10	2	9	9	2	7		66	0.35
Oldsquaw					3						3	0.02
Rough-legged Hawk		1							1		2	0.01
Falcon											0	0.00
Ptarmigan sp.				2	1						3	0.02
Sandhill Crane											0	0.00
Shorebird		2	3		1	4	2		2		14	0.07
Pomarine Jaeger											0	0.00
Parasitic Jaeger											0	0.00
Long-tailed Jaeger		2									2	0.01
Jaeger sp.											0	0.00
Glaucous Gull	1	2		1		2		1			7	0.04
Thayer's Gull											0	0.00
Sabine's Gull											0	0.00
Arctic Tern				2			3				5	0.03
Snowy Owl											0	0.00
Common Raven				1							1	0.01
Passerine	2	4		1	2	1	2				12	0.06
Transect length (km)	54	54	54	54	60	50	50	50	50		476	

Appendix B. Numbers of birds observed during aerial surveys on Victoria Island, 16-28 June 1994.

Stratum 6

Species	Transect number																											Total	No. per sq km			
	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	88	89	90	91			92	93	
Pacific Loon		4		1	2			2	4	2	3				2										1	1	3			25	0.06	
Red-throated Loon													1							1							1		3	0.01		
Yellow-billed Loon									1		1			1		1											2		6	0.02		
Loon sp.	1					1	1		1					1		3							1	1	2	2	2	3	2	21	0.05	
Tundra Swan	1																												1	0.00		
Canada Goose	4	12	4	9	1			9	4	4	3	2			2			2						2	2	4			64	0.16		
Brant																									6				6	0.02		
G. White-fronted Goose																													0	0.00		
Snow Goose														19														1	20	0.05		
Dark goose																													0	0.00		
Northern Pintail																													0	0.00		
Common Eider		4					10				4					2													20	0.05		
King Eider	7	3	10	2	19	2	3	2	11	3	7	27	20	16	22	3	21	13	19	12	14	4	12		1		6	15	8	282	0.72	
Oldsquaw			2			4	1			2			3		2												1		15	0.04		
Falcon																													0	0.00		
Rough-legged Hawk											2	1		2	2		1			1	1		1			2		2	15	0.04		
Ptarmigan sp.		1		2				1	1	2						3								3	1	2	2	1	19	0.05		
Sandhill Crane	3	1	3					2			2		2																13	0.03		
Shorebird	1	2	3		1	2	2	6	1	1	2	4	4	4	2	4		1	5	1			1	1	6	9	4	2	1	70	0.18	
Pomarine Jaeger											2	3	1		1	1								1	2	1	1	1	14	0.04		
Parasitic Jaeger											2	2	3	6		2	2		1									1	19	0.05		
Long-tailed Jaeger									2			1				1	1		2		1		1	2	1	3			15	0.04		
Jaeger sp.					1	1					2			2														1	7	0.02		
Glaucous Gull		1				1	2	2	3	1		1	1	4	2	1		1	1				2		1		2		2	28	0.07	
Thayer's Gull																													0	0.00		
Sabine's Gull												3					1										2		6	0.02		
Arctic Tern					1						1	2	2	2	7												10		25	0.06		
Snowy Owl								1				1	2	1				1		1	2					1			12	0.03		
Common Raven																1													1	0.00		
Passerine				4	1	1	4	2	1	1		2	1		1	1			1		1		1		4	3	5	2	1	36	0.09	
Transect																																
Length (km)	12	36	36	36	36	36	30	34	50	24	60	54	38	36	34	32	24	30	30	32	16	14	22	34	40	42	38	38	40	984		

Appendix C. Among year comparisons of numbers of several bird species observed on western Victoria Island from 1992 to 1994, based on 1994 study area.

Species	Estimated number			Comparison	F-value	p
	1992	1993	1994			
King Eider						
i) Total indicated birds	34176 ± 3470	33785 ± 3943	51831 ± 5789	Among all 3 years	10.13	<0.01**
				1992 vs 1993	2.93	≥0.10 ns
				1993 vs 1994	14.16	<0.05**
				1992 vs. 1994	7.90	<0.05**
ii) Indicated breeding pairs only	17287 ± 1810	15444 ± 2294	19691 ± 2282	Among all 3 years	2.29	≥0.10 ns
Canada Goose ^a	24518 ± 3576	18565 ± 2117	26115 ± 2179	Among all 3 years	0.45	≥0.10 ns
Oldsquaw	7925 ± 2297	7516 ± 1740	4734 ± 1069	Among all 3 years	1.24	≥0.10 ns
Tundra Swan	3668 ± 946	3826 ± 521	4060 ± 599	Among all 3 years	0.39	≥0.10 ns
Pacific Loon	2500 ± 998	4099 ± 1230	5329 ± 835	Among all 3 years	3.01	<0.10*
				1992 vs. 1993	20.86	<0.05**
				1993 vs. 1994	1.02	≥0.10 ns
				1992 vs. 1994	4.14	<0.10*

Appendix C. continued

Species	Estimated number			Comparison	F-value	p
	1992	1993	1994			
Pomarine Jaeger	3925 ± 899	7268 ± 1976	1236 ± 267	Among all 3 years	3.05	< 0.10*
				1992 vs. 1993	1.38	≥ 0.10 ns
				1993 vs. 1994	4.10	< 0.10*
				1992 vs. 1994	7.40	< 0.05**
Parasitic Jaeger	4755 ± 744	3098 ± 834	837 ± 334	Among all 3 years	3.87	< 0.10*
				1992 vs. 1993	2.27	≥ 0.10 ns
				1993 vs. 1994	18.82	< 0.05**
				1992 vs. 1994	4.66	< 0.10*
Long-tailed Jaeger	2624 ± 949	936 ± 450	1564 ± 612	Among all 3 years	2.57	≥ 0.10 ns
Glaucous Gull	11780 ± 4725	7773 ± 1212	5954 ± 917	Among all 3 years	1.14	≥ 0.10 ns
Sabine's Gull	1469 ± 700	1386 ± 1225	1661 ± 668	Among all 3 years	0.54	≥ 0.10 ns
Arctic Tern	2399 ± 532	2340 ± 830	3732 ± 1730	Among all 3 years	1.77	≥ 0.10 ns

* Significant difference, p < 0.10

** Significant difference, p < 0.05

ns Not significant

^a Based on indicated number