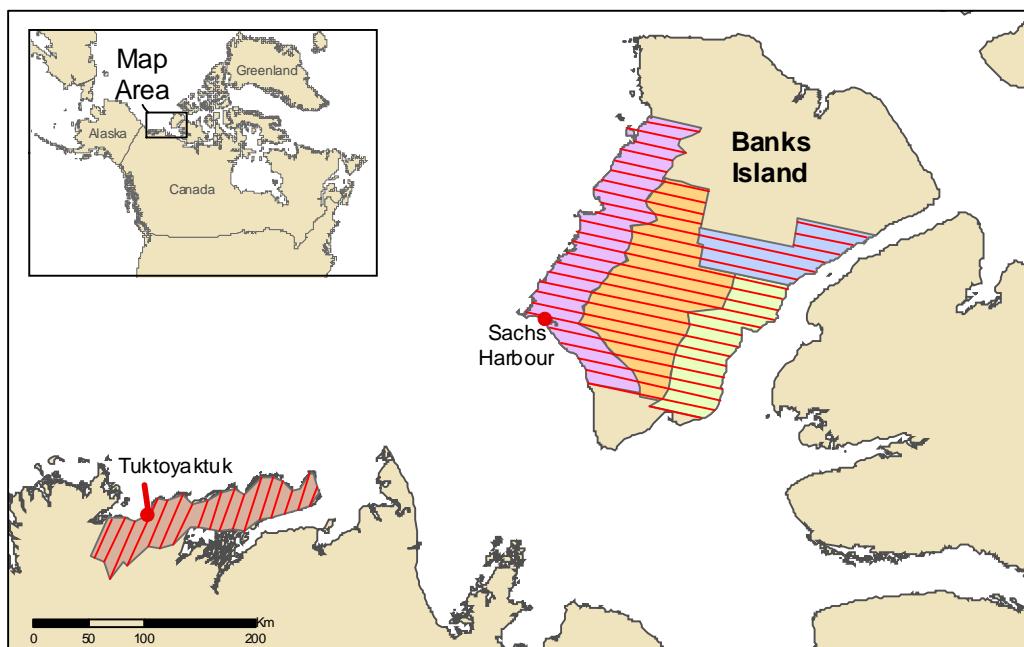


MIGRATORY BIRD SURVEY
IN THE WESTERN CANADIAN ARCTIC
2010



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U.S. Fish and Wildlife Service

April 2011

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ABSTRACT: We conducted a fixed-wing aerial survey of waterfowl and other migratory birds on Banks Island and the Tuktoyaktuk Peninsula, Northwest Territories, Canada during 20-29 June 2010. Most of the survey area boundaries and transects were established previously for helicopter surveys conducted by the Canadian Wildlife Service. The sample design consisted of 400-m-wide transects spaced systematically at 10-km intervals (approximately 4% sample). The survey results are presented by area. This year marks our sixth year conducting fixed-wing waterfowl surveys in the Canadian Arctic. We believe that fixed-wing aircraft offer a safe and cost-efficient alternative to the use of helicopters for conducting these surveys. We recommend the establishment of a long-term annual survey to monitor the status and trends of migratory birds nesting in the region.

Key words: aerial survey, Canadian Arctic, waterfowl, migratory birds, Canada goose, greater white-fronted goose, tundra swan, king eider, long-tailed duck, loons.

INTRODUCTION

Many important nesting areas of North American waterfowl lie outside the range of the existing Waterfowl Breeding Population and Habitat Survey (U.S. Fish and Wildlife Service 2010) and other cooperative waterfowl survey efforts. For example, portions of the central and western Canadian Arctic are recognized as important nesting areas of waterfowl and other migratory birds but due to their remoteness have been surveyed only periodically or not at all. Cooperating agencies of the Arctic Goose Joint Venture and Sea Duck Joint Venture recently initiated efforts to assess bird abundance and distribution in these areas to improve status information and harvest management for several species of sea ducks, geese, swans, and other migratory birds. As part of these efforts, the Canadian Wildlife Service (CWS) conducted systematic transect surveys by helicopter in 2002-2006 (Alisauskas 2003, Alisauskas 2005, Alisauskas 2006, Raven and Dickson 2006, Alisauskas unpubl. data). Also in 2005-2009, the Waterfowl Management Branch of the U.S. Fish and Wildlife Service (USFWS) flew transect surveys using a single-engine, turbine-powered, fixed-wing aircraft to gather additional data and to explore the logistic feasibility of using this more cost-effective survey aircraft for regular surveys in the region (Conant et al. 2006, Conant et al. 2007, Groves et al. 2009a, Groves et al. 2009b, Groves and Mallek 2011). In 2010 we conducted a fixed-wing aerial survey on Banks Island and the Tuktoyaktuk Peninsula. This report summarizes the results from our survey in 2010.

STUDY AREA AND METHODS

Survey Design

The survey in 2010 consisted of five strata on Banks Island and the Tuktoyaktuk Peninsula in the Northwest Territories, Canada (Figure 1, Table 1). The Banks Island West, Inland, and East strata and the Tuktoyaktuk Peninsula stratum were previously delineated by CWS for bird

surveys they conducted by helicopter in 1989-1994, based on geographic, physiographic, and habitat features (Cotter and Hines 2006, Hines et al. 2006). We explored one additional area that had not previously been surveyed (Banks Island Northeast). We also modified the eastern boundary of the Banks Island Inland stratum to abut the Banks Island East stratum. The total survey area in 2010 was 43,037 km² (Table 1).

We repeated transects previously established by CWS for the Banks Island West and East strata and the Tuktoyaktuk Peninsula (Cotter and Hines 2006, Hines et al. 2006). We reduced the sampling intensity of the Banks Island West stratum by half to allow us to cover all areas within our approximate two-week survey window. Because our fixed-wing aircraft had greater survey range than the helicopter used by CWS, we created new transects for the Banks Island Inland stratum that extended east/west across the entire stratum. The final survey design consisted of variable-length transects spaced systematically at 10-km intervals (Figure 1, Table 1). The width of each transect strip was 400 m (200 m on each side of the aircraft). Approximately 4% of the total survey area was sampled.

Data Collection and Analyses

We flew the 2010 survey on 20-29 June. The survey timing was intended to coincide with the mid-incubation period for geese, as well as the period when king eiders were paired (Cotter et al. 1997). We spent a total of 57.5 hours of flight time, including 48.2 hours surveying transects and flying to/from transects, and 9.3 hours ferrying the survey airplane from and to our home base in Alaska. We based out of the communities of Inuvik and Sachs Harbour. We used the specially modified de Havilland Turbine Beaver (N754) as our fixed-wing survey platform. This aircraft has been used for waterfowl surveys in Alaska since 1977 (Mallek and Groves 2011). Two observers participated in the survey, one left-seat pilot/observer and one right-seat observer (Ed Mallek and Deb Groves, respectively).

Survey procedures followed established USFWS and CWS protocol for aerial waterfowl breeding population surveys (USFWS and CWS 1987). The centerline of each transect strip was flown at a height of 30-45 m (100-150 feet) above ground level and at a ground speed of 145-170 km/hr (90-105 miles/hr). Aircraft navigation to transect “start” and “end” waypoints and along the transect centerline was maintained using the aircraft Global Positioning System (GPS). The pilot and right-seat observer each recorded observations by species (or species group) within 200 m of the flight path on their respective side of the aircraft. Marks on the windows and wing struts were used to delineate the outer edges of transects. All birds (except shorebirds and small passerines) and large mammals observed within the transect strip were recorded. Each observation was recorded vocally to a sound file (.wav format), linked with simultaneous GPS coordinates, and saved to separate on-board computers for each observer, via custom software developed by John I. Hodges (USFWS, Migratory Bird Management, Juneau, AK). After the flight, a transcription program, also developed by John Hodges, was used to replay the sound files and combine the transcribed observation data with the geographic coordinates to produce a text data file. The transcribed text file was then used for data analyses.

Observations of waterfowl were recorded and summarized according to established survey protocol (USFWS and CWS 1987). For duck species, observations were recorded by the

following categories: lone drakes, pairs, flocked drakes, and mixed-sex groups of five or more birds. Observations of one hen and two drakes were recorded as a pair and a lone drake. A hen and three drakes were recorded as a pair and two drakes. Observations of one to four hens were not recorded. Geese, swans, loons, and cranes were recorded as singles, pairs, or groups (flocks). The remaining bird and mammal species were recorded by number, and we differentiated between adults and calves for caribou and muskoxen.

The number of total indicated ducks was calculated for each species or species group by multiplying two times the sum of the number of lone drakes, drakes in flocks of two to four, and pairs, and adding this to the total number of grouped birds [i.e. $2*(\text{drakes } \leq 4 + \text{pairs}) + \text{grouped birds}$]. For Canada geese, white-fronted geese, and brant, the number of total indicated birds was calculated by multiplying the number of singles and pairs by two and adding the number of grouped birds. For the remaining bird species, the number of total indicated birds was simply the number of birds observed. Using the number of total indicated birds for each species or species group, densities, population indices, and variances were estimated with the ratio method (Cochran 1977, Smith 1995).

Population indices of most duck species were adjusted for incomplete detection using visibility correction factors (VCFs) that were developed for this survey aircraft (N754) in tundra habitats, derived from a 3-year helicopter/fixed-wing study on the Yukon-Kuskokwim Delta, Alaska in 1989-1991 (Conant et al. 1991, Smith 1995). These VCFs have been used in Alaska as constant adjustments to annually-obtained breeding population indices (Mallek and Groves 2011). King and common eider indices were not adjusted for incomplete detection because we do not have reliable VCFs for these species. The remaining bird and mammal indices were also not adjusted for incomplete detection.

RESULTS

Weather and Habitat Conditions

The western Canadian Arctic experienced above-average spring temperatures and an early snow melt in 2010 (Derkson et al. 2010). When we first arrived on the survey area on 20 June, no snow was present. Shallow lakes were completely thawed, while deeper lakes were mostly frozen with a narrow band of open water along their shorelines. By the end of our survey on 29 June, the deep lakes were within just a day or two of thawing completely.

Population Estimates

Population indices are presented by species and area in Tables 2 and 3. Species for which VCF estimates exist are presented both with and without the VCF applied. Population densities of total indicated birds (not adjusted for incomplete detection) are presented in Tables 4 and 5. Distributions of selected species within the survey area, displayed as locations of observations along the survey transects, are illustrated in Figures 2-18. Common and scientific names of all species are listed in Appendix 1.

Canada Geese

In some areas of the Canadian Arctic that we surveyed in recent years, notably the Queen Maud Gulf Migratory Bird Sanctuary, we observed two size classes of Canada geese: “small” Canada geese, which breed in the region, and “large” Canada geese, which are thought to use the area mainly or exclusively for molting (Latour et al. 2008). We retained the term “small” Canada geese in this report for purposes of consistency among years. We did not observe any large Canada geese on our survey area in 2010.

The total population index for small Canada geese was 14,103. We observed 18% as singles, 59% as paired, and 23% in flocks (≥ 3 unpaired birds). Assuming single birds represented pairs with undetected mates on nests, indicated pairs comprised 80% of the total indicated birds observed.

White-fronted Geese

The population index for greater white-fronted geese was 23,417. We observed 7% as singles, 16% as paired, and 77% in flocks (≥ 3 unpaired birds). Assuming single birds represented pairs with undetected mates on nests, indicated pairs comprised 28% of the total indicated birds observed.

Snow and Ross’s Geese

This survey was not expected to provide an accurate population estimate of snow and Ross’s geese, due to their clumped distribution. However, we recorded these species when encountered, because the data may be useful for documenting changes in the distribution of colonies. The distribution of our observations of snow and Ross’s geese in 2010 is illustrated in Figure 5.

King Eiders

The population index for king eiders was 23,554. We observed 12% as single drakes, 67% in pairs, 4% as flocked drakes, and 17% in mixed-sex groups of ≥ 5 birds. Assuming single drakes and flocked drakes in groups <5 represented pairs with undetected mates on nests, indicated pairs comprised 85% of the total indicated birds observed.

Long-tailed Ducks

The unadjusted population index for long-tailed ducks was 16,952, and the index adjusted with a VCF of 1.87 was 31,699.

Northern Pintails

The unadjusted population index for northern pintails was 14,822, and the index adjusted with a VCF of 3.05 was 45,207. Most of the pintails (98%) were observed on the Tuktoyaktuk Peninsula (Figure 9). Indicated breeding pairs comprised 41% of the total number of indicated birds observed.

Tundra Swans

The population index for tundra swans was 14,279. The index for tundra swan nests was 1,433.

Sandhill Cranes

The population index for sandhill cranes was 4,068.

Loons

Pacific, red-throated, yellow-billed, and common loons were present in the survey area. Yellow-billed loons were only observed on Banks Island, and common loons were only observed on the Tuktoyaktuk Peninsula (Figures 11-13). Population indices in 2010 were 4,047 Pacific loons, 2,050 red-throated loons, 931 yellow-billed loons, and 24 common loons.

RECOMMENDATIONS

We experienced two full and two partial days that we couldn't fly in 2010 due to inclement weather. Otherwise, the 2010 survey went smoothly in terms of logistics and safety. Overall, the terrain and flying-weather conditions we encountered during our fixed-wing surveys in 2005-2010 were manageable. The remoteness and high latitude of the region did provide certain logistic challenges, including:

- 1) Extreme distances between airports
- 2) Lack of suitable off-airport landing surfaces (i.e., lakes that were large and deep enough to land on and take off from with a float-equipped aircraft were almost entirely ice-covered during the survey period)
- 3) Extremely sparse weather reporting and forecasting for the survey area

Given these characteristics of the region, we recommend that pilots are highly experienced flying in remote and arctic environments. Single-engine fixed-wing aircraft surveying in this environment should be turbine powered, equipped with amphibious floats, have an automated flight following (AFF) system on board, and have an installed aircraft satellite phone. The turbine engine delivers a significant increase in engine reliability over a piston engine, and the amphibious floats deliver increased safety (to the aircraft and occupants) in the unlikely event of a forced landing due to mechanical problems or weather. The AFF system allows real-time tracking of the aircraft (via a satellite phone data system), providing the aircraft's geographic location at all times. The aircraft satellite phone enables the pilot to call flight service in remote areas, allowing the pilot to get updated weather and forecasts and to update (shorten, extend, and close) flight plans.

ACKNOWLEDGEMENTS

Tim Moser (USFWS - Division of Migratory Bird Management), with help from Lynne Dickson (CWS), has led the efforts to develop the Canadian Arctic Migratory Bird Survey and has been

largely responsible for obtaining needed support and funding. The survey in 2010 was accomplished with the support of the Tuktoyaktuk and Sachs Harbour Hunters and Trappers Committees, Northwest Territories Department of Environment and Natural Resources, USFWS, CWS, Arctic Goose Joint Venture, Sea Duck Joint Venture, Central Flyway Council, and Mississippi Flyway Council. The survey was conducted under NWT Wildlife Research Permit WL 007413.

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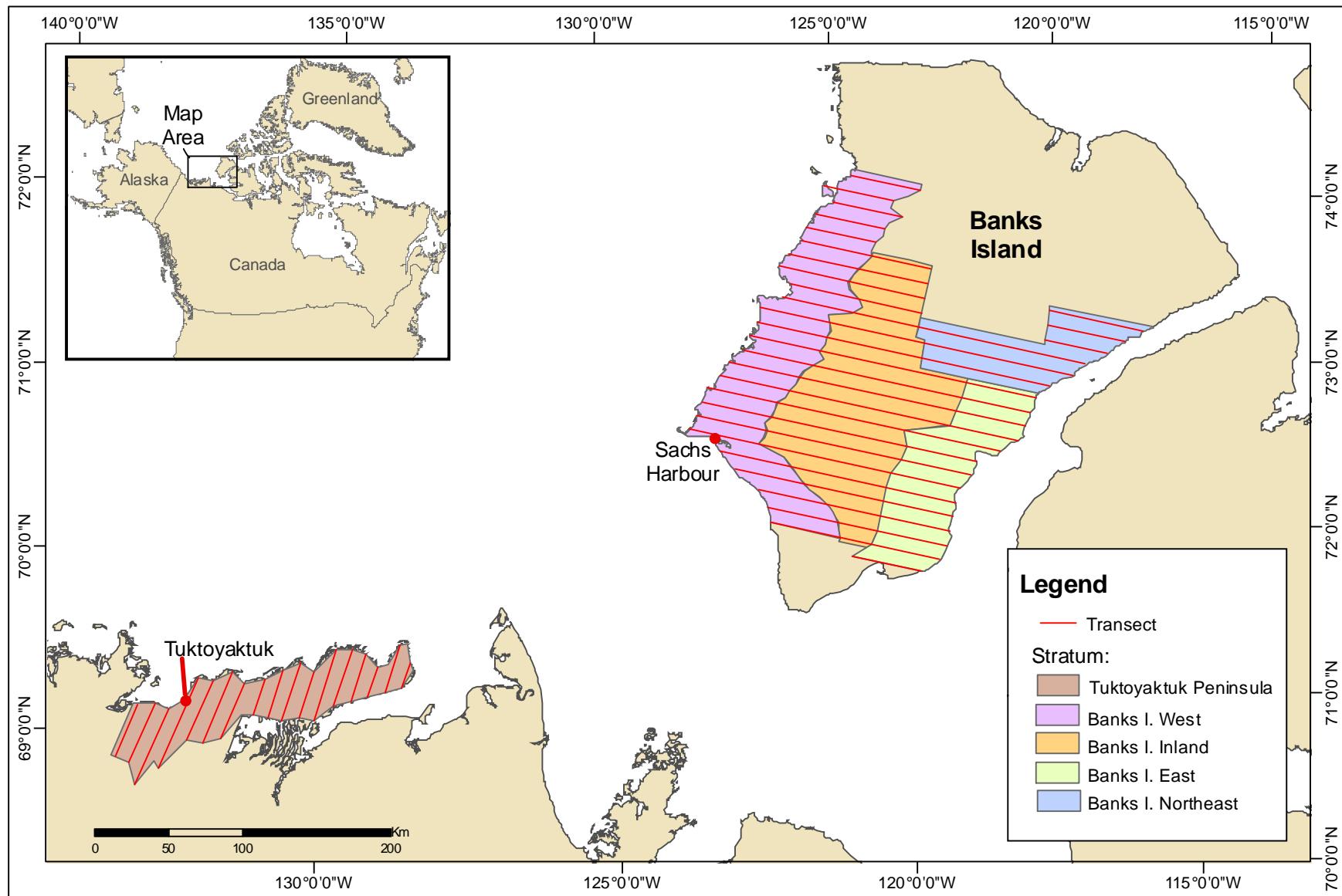


Figure 1. Transect lines within five strata surveyed for migratory birds and other wildlife by fixed-wing aircraft on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010.

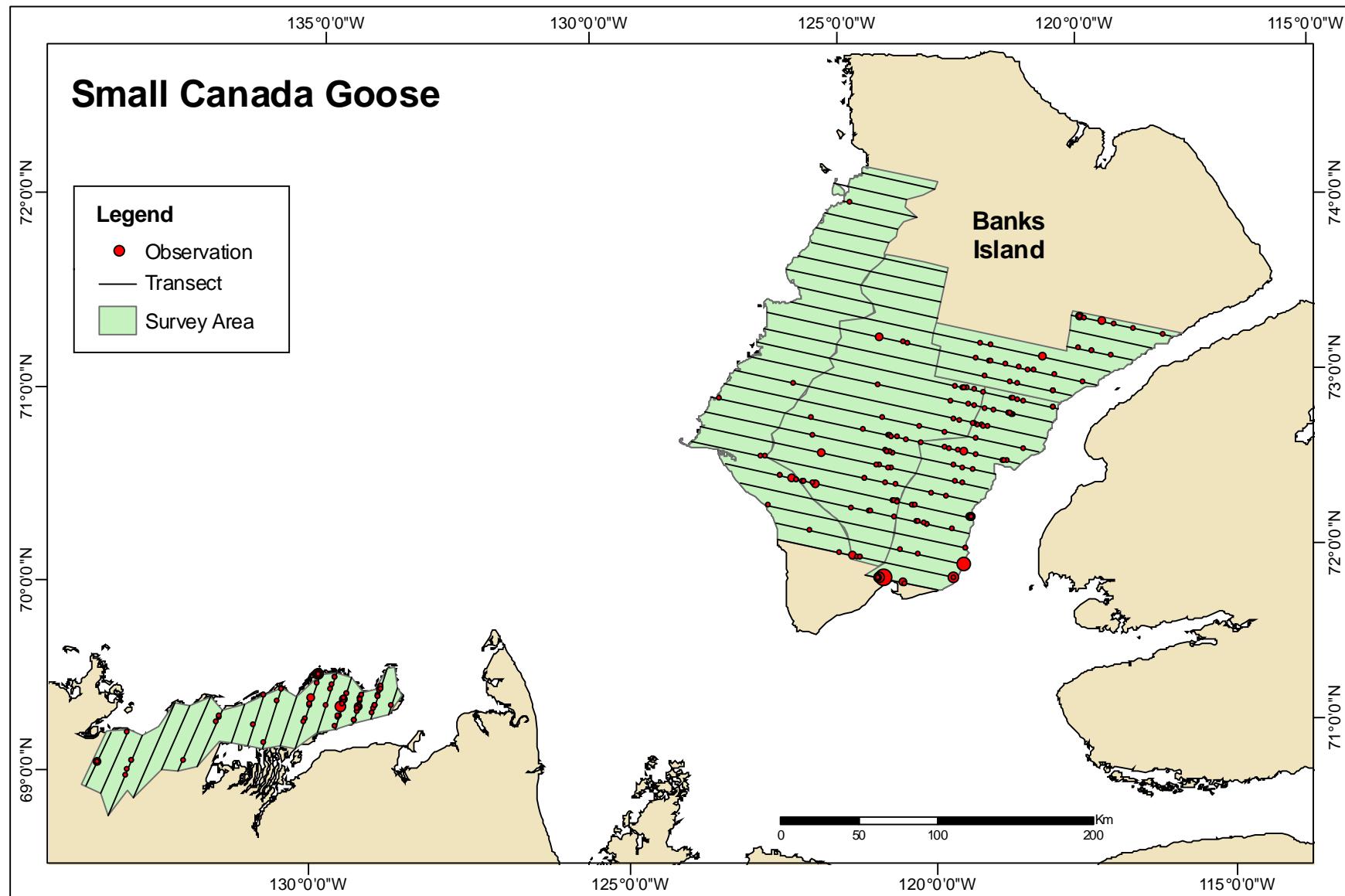


Figure 2. Locations of small Canada goose observations in 2010. Symbol size is proportional to the number of birds observed.

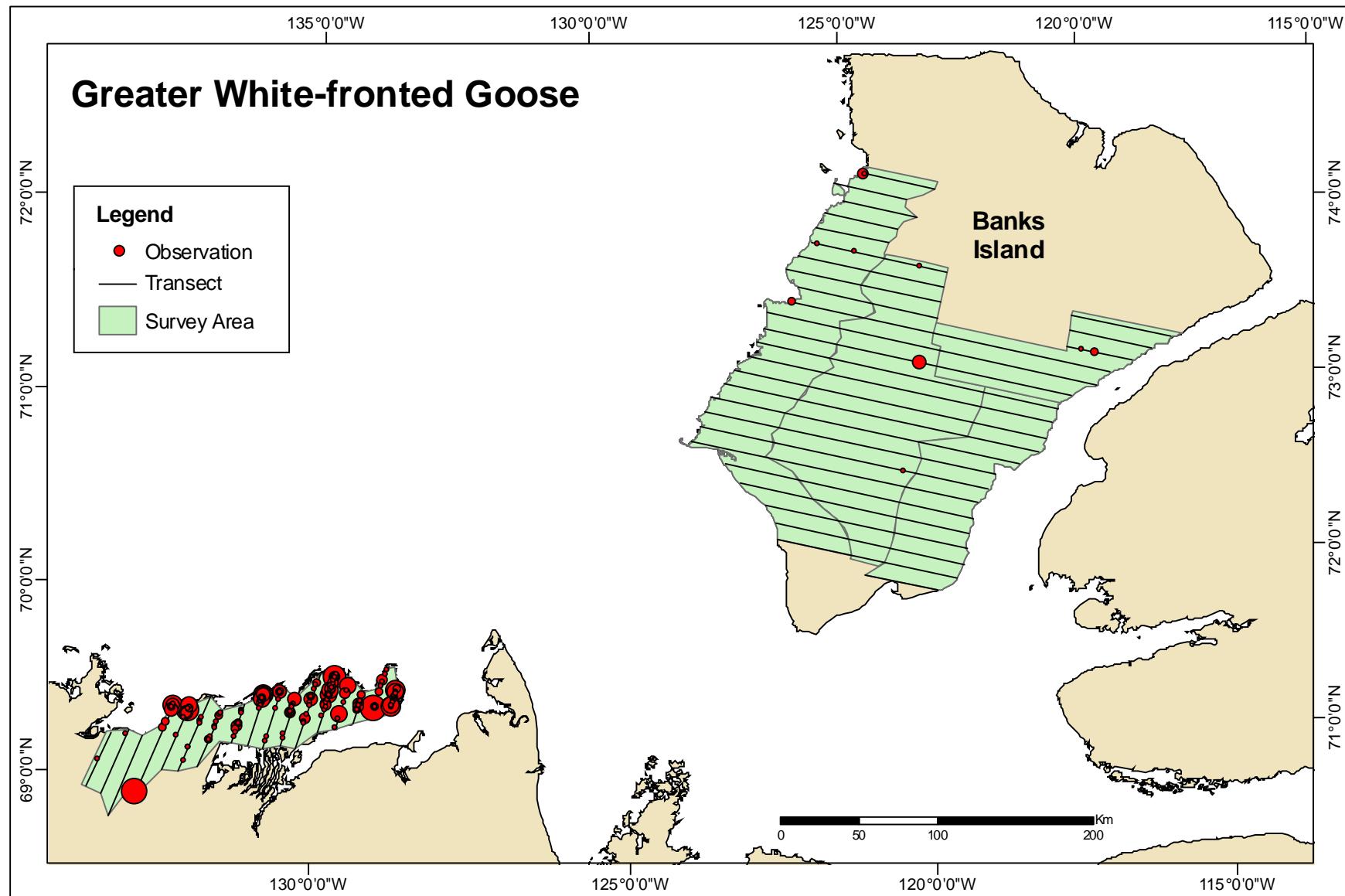


Figure 3. Locations of white-fronted goose observations in 2010. Symbol size is proportional to the number of birds observed.

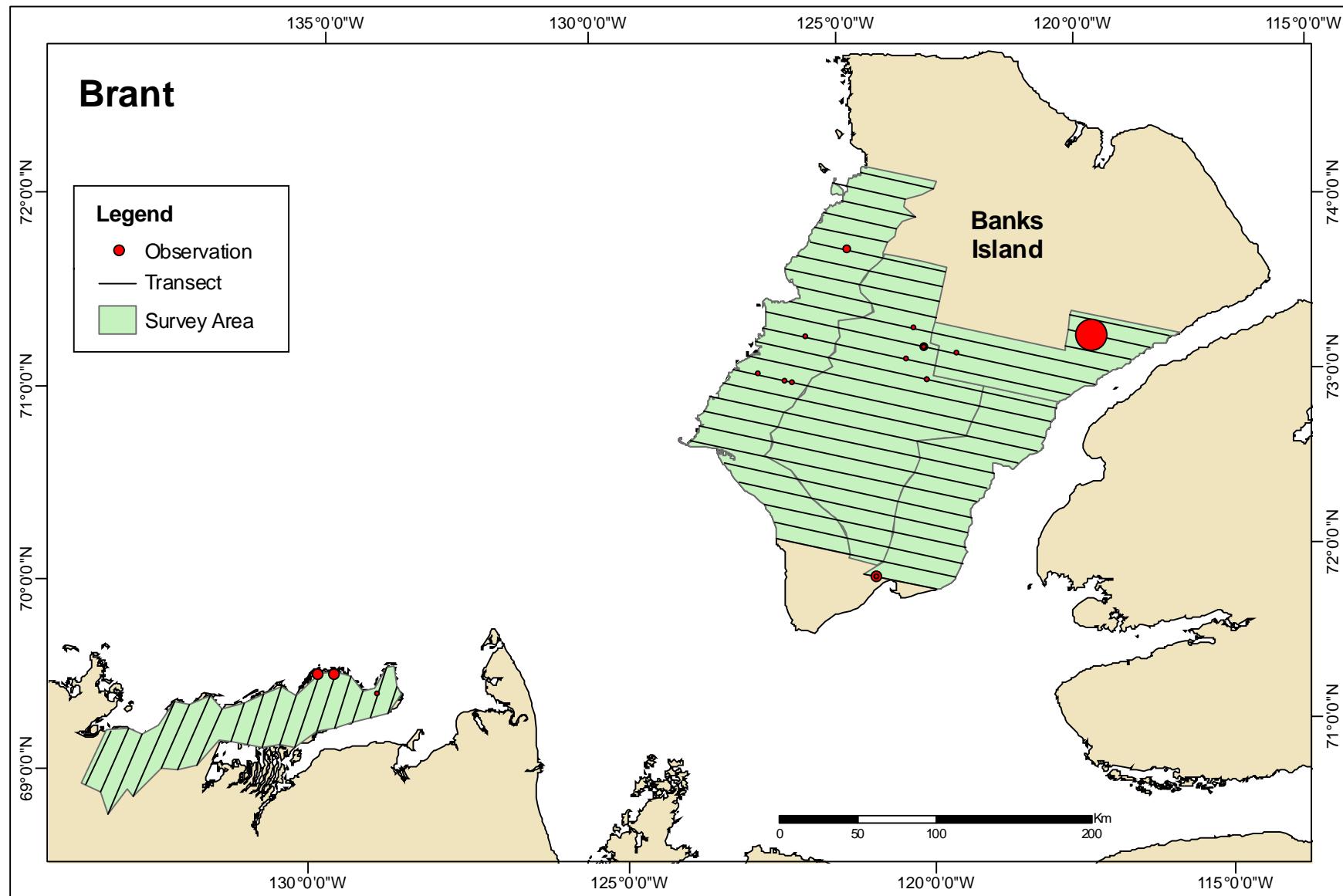


Figure 4. Locations of brant observations in 2010. Symbol size is proportional to the number of birds observed.

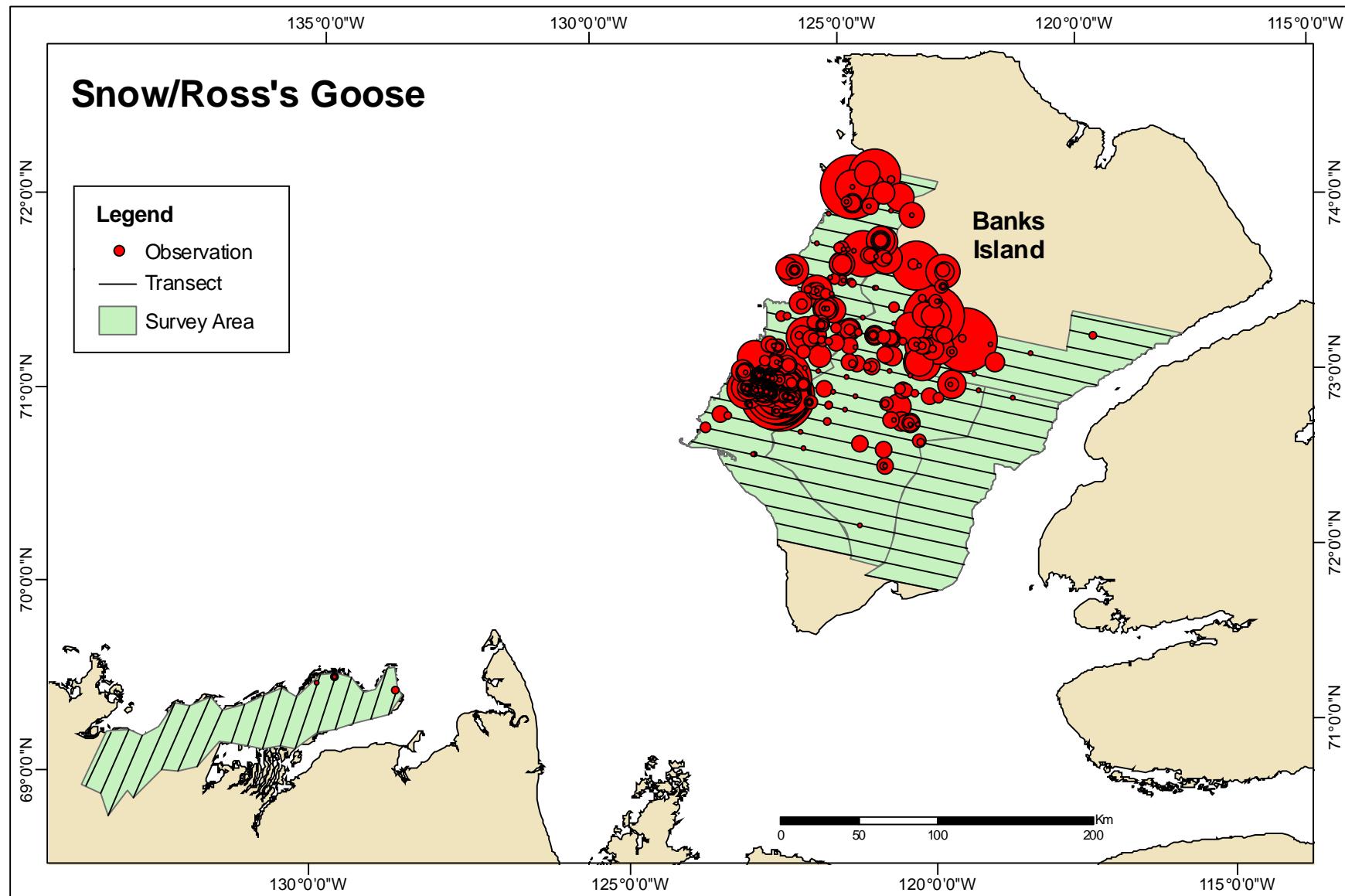


Figure 5. Locations of snow/Ross's goose observations in 2010. Symbol size is proportional to the number of birds observed.

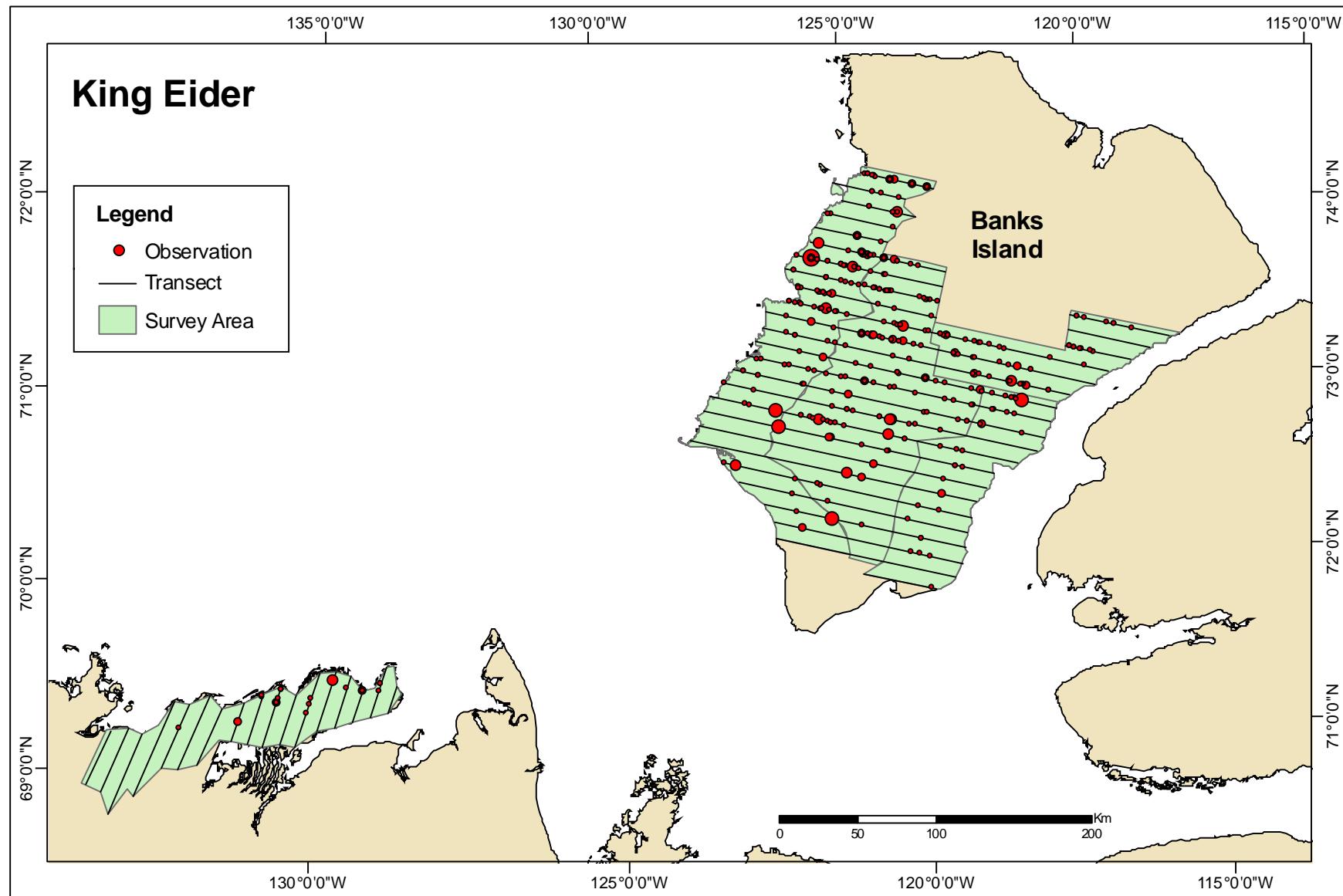


Figure 6. Locations of king eider observations in 2010. Symbol size is proportional to the number of birds observed.

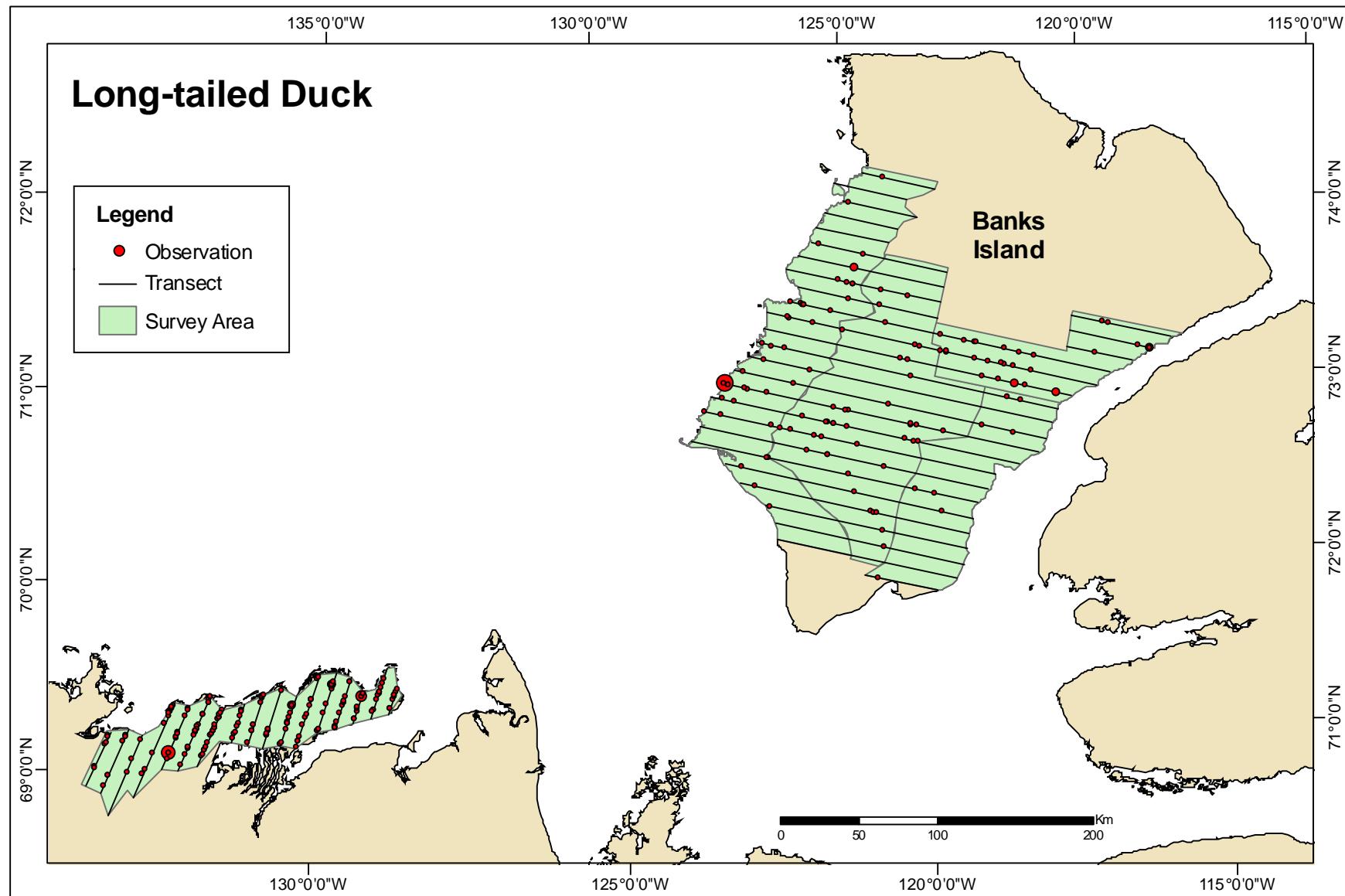


Figure 7. Locations of long-tailed duck observations in 2010. Symbol size is proportional to the number of birds observed.

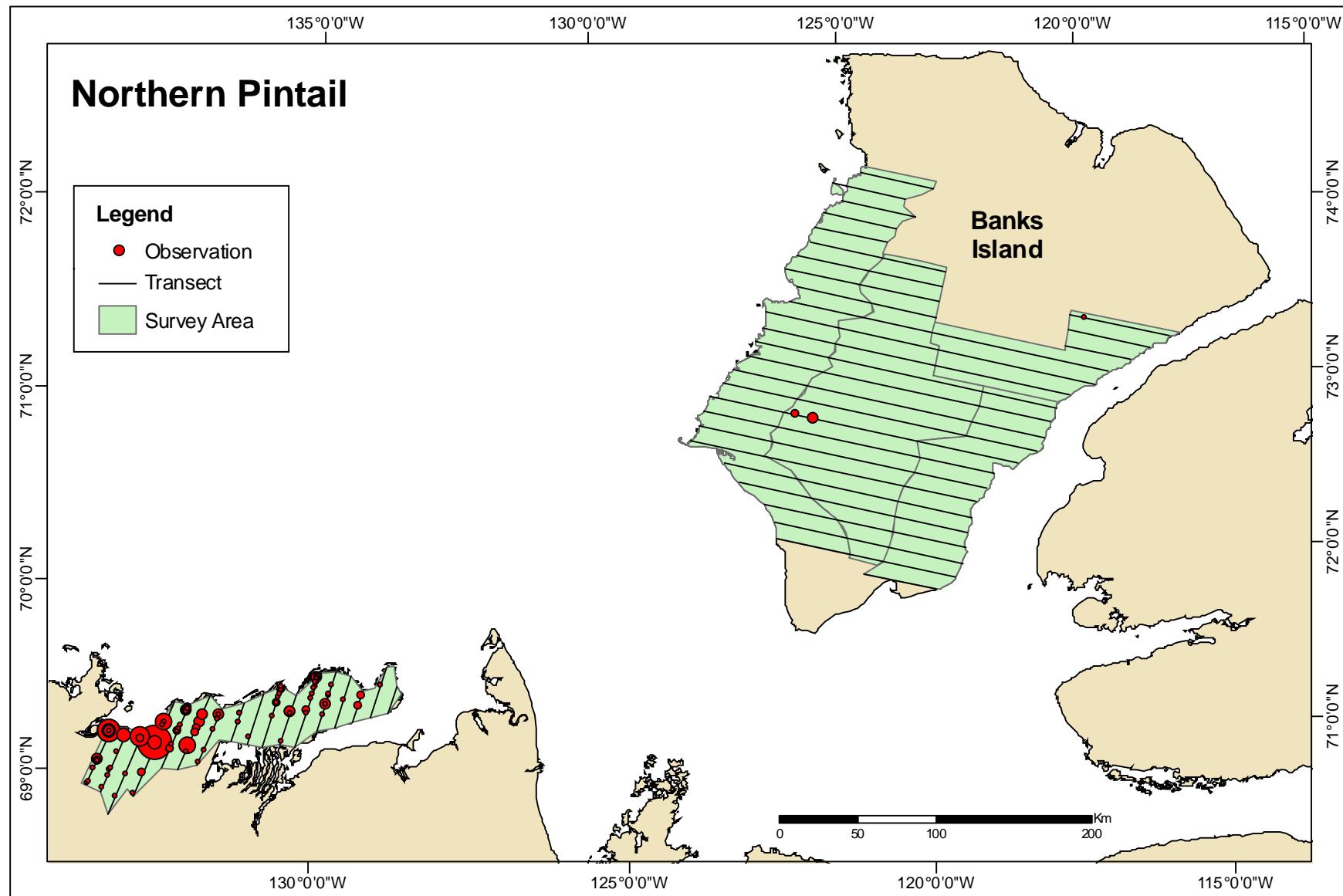


Figure 8. Locations of northern pintail observations in 2010. Symbol size is proportional to the number of birds observed.

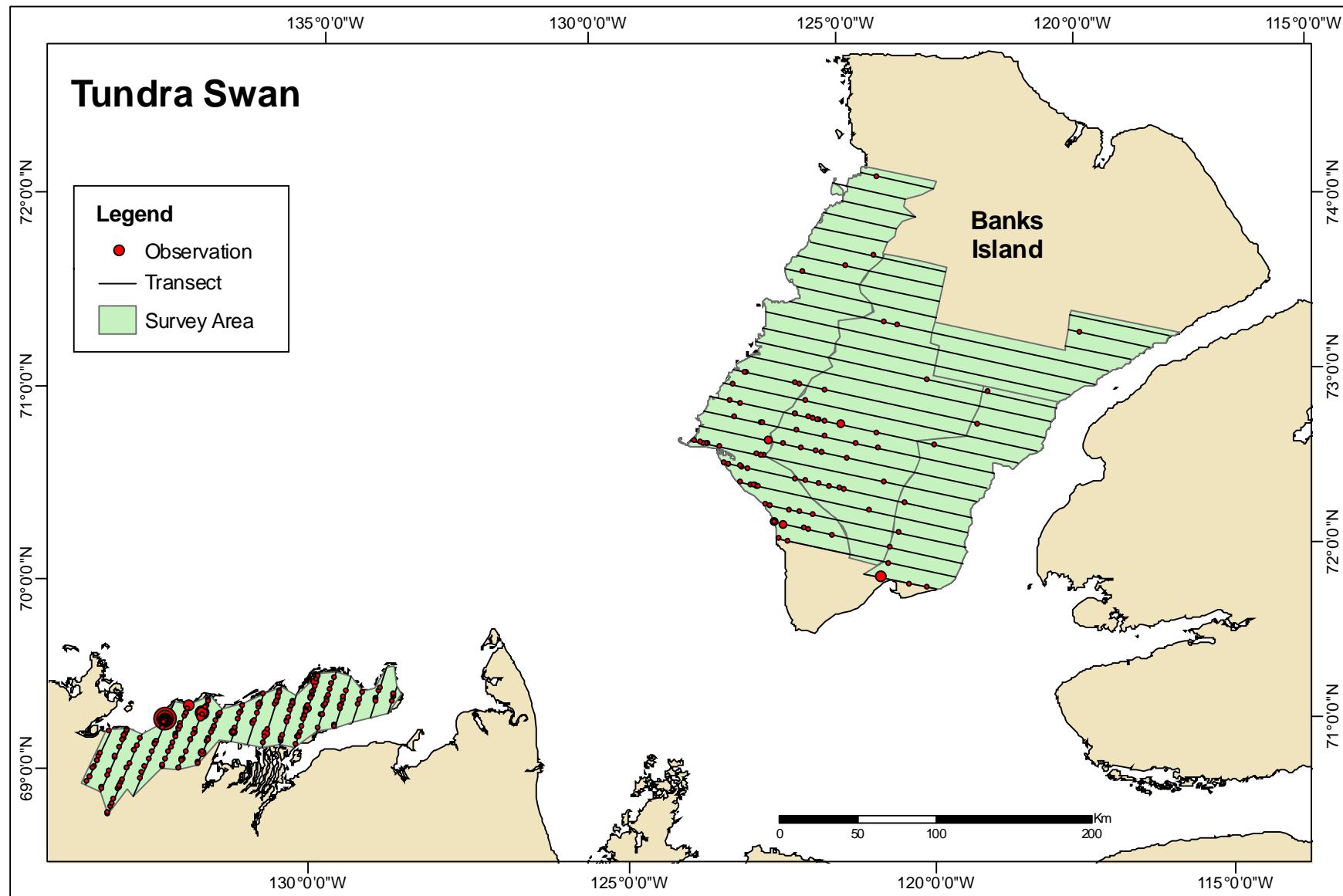


Figure 9. Locations of tundra swan observations in 2010. Symbol size is proportional to the number of birds observed.

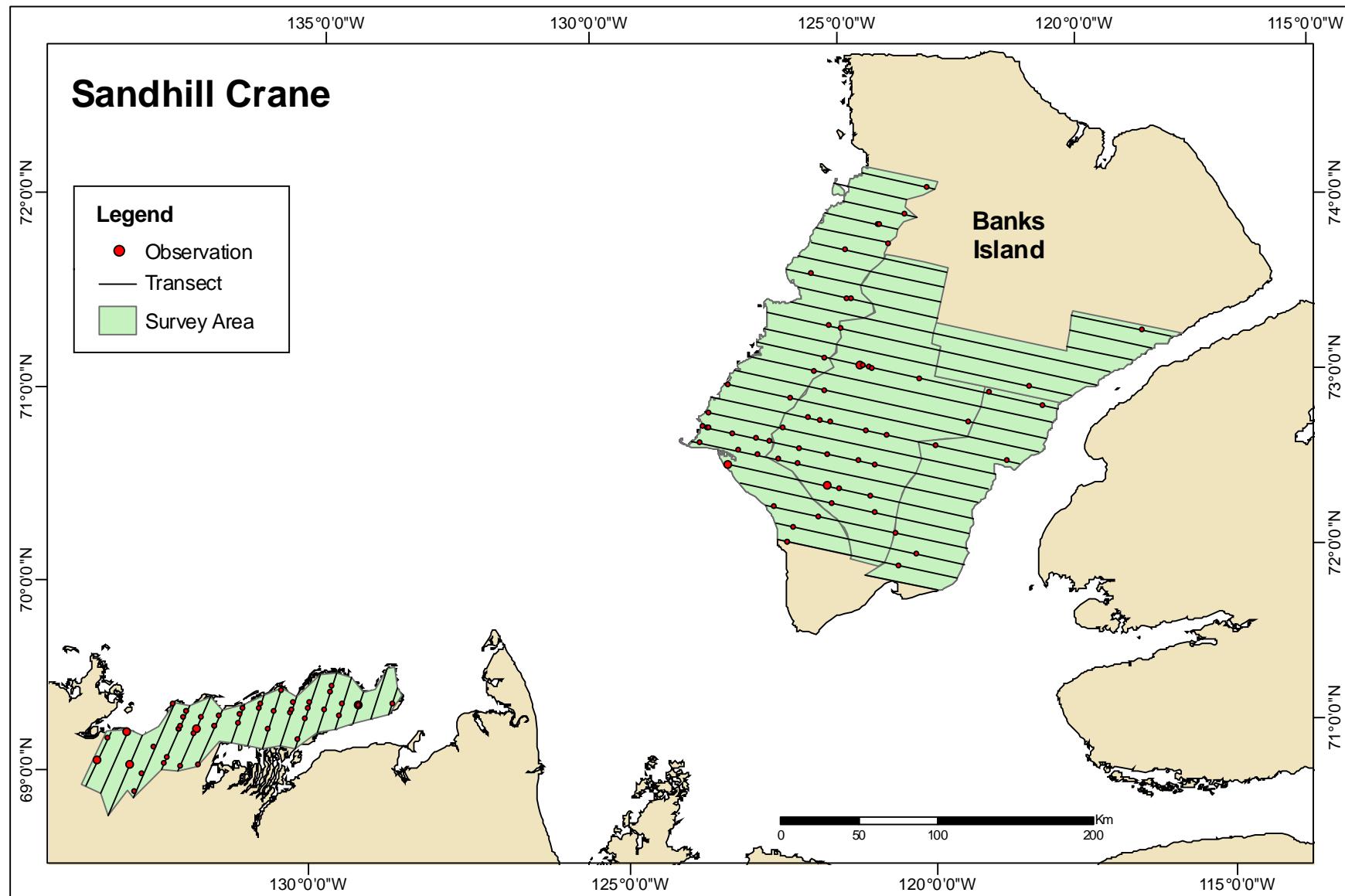


Figure 10. Locations of sandhill crane observations in 2010. Symbol size is proportional to the number of birds observed.

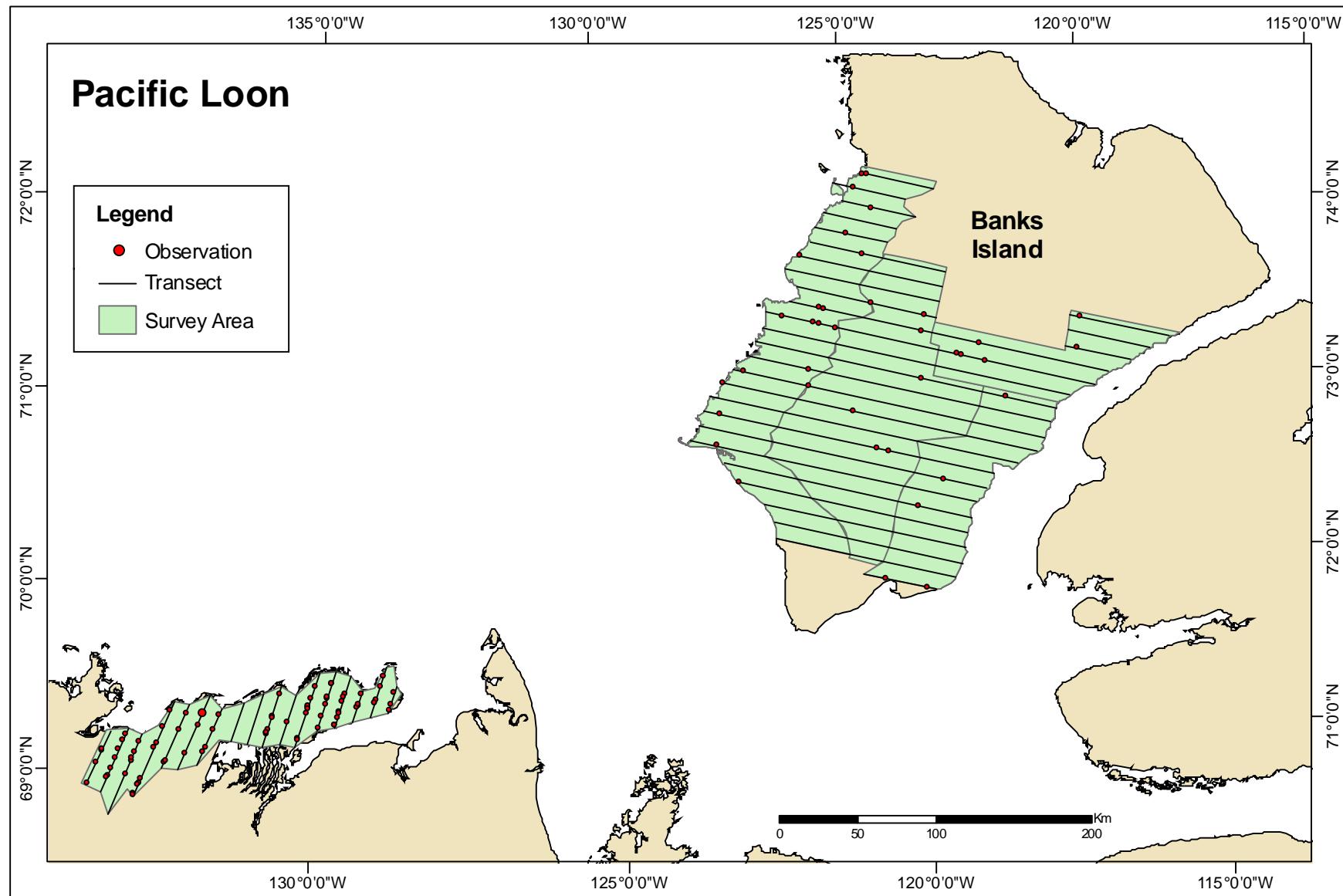


Figure 11. Locations of Pacific loon observations in 2010. Symbol size is proportional to the number of birds observed.

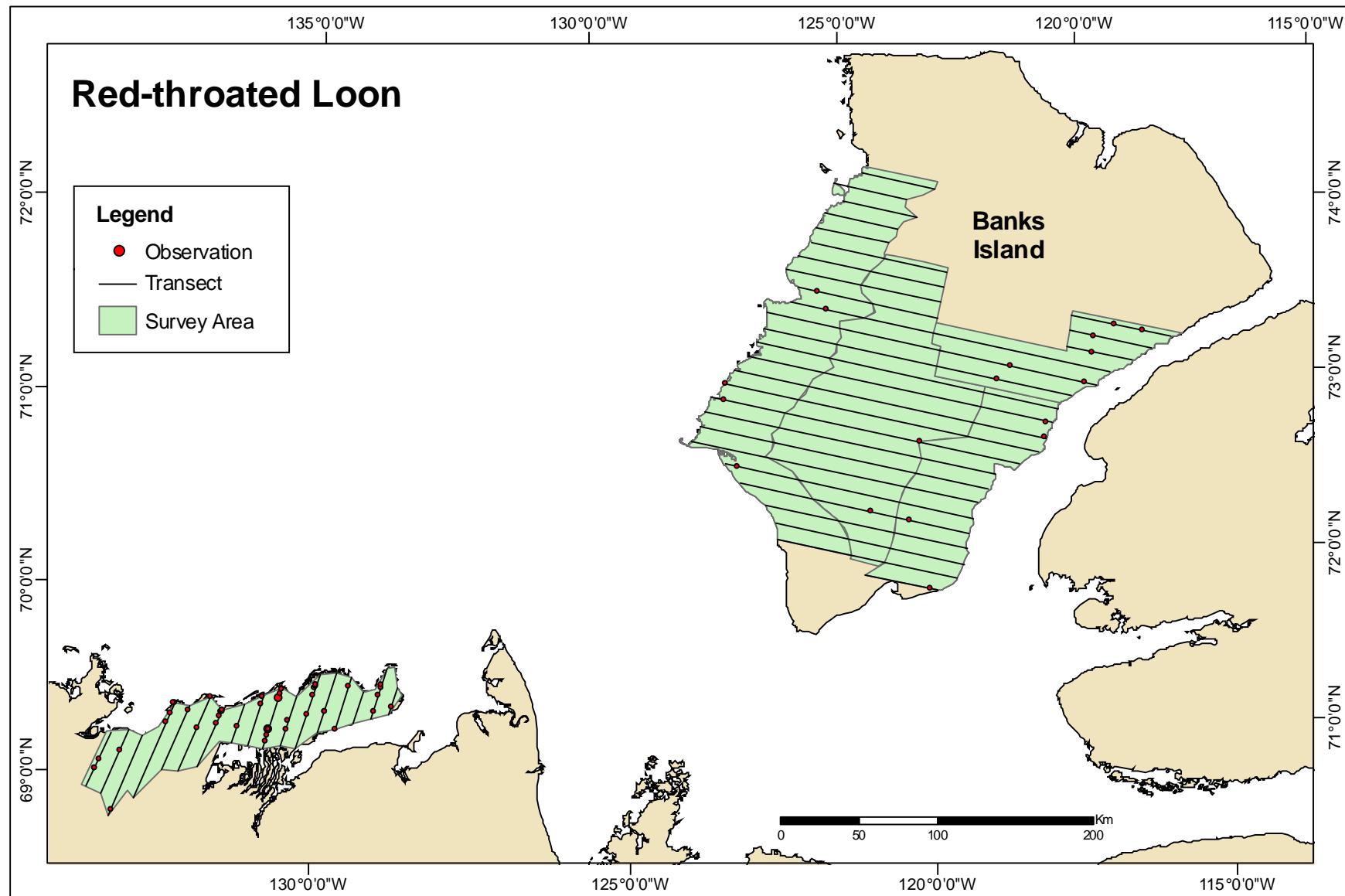


Figure 12. Locations of red-throated loon observations in 2010. Symbol size is proportional to the number of birds observed.

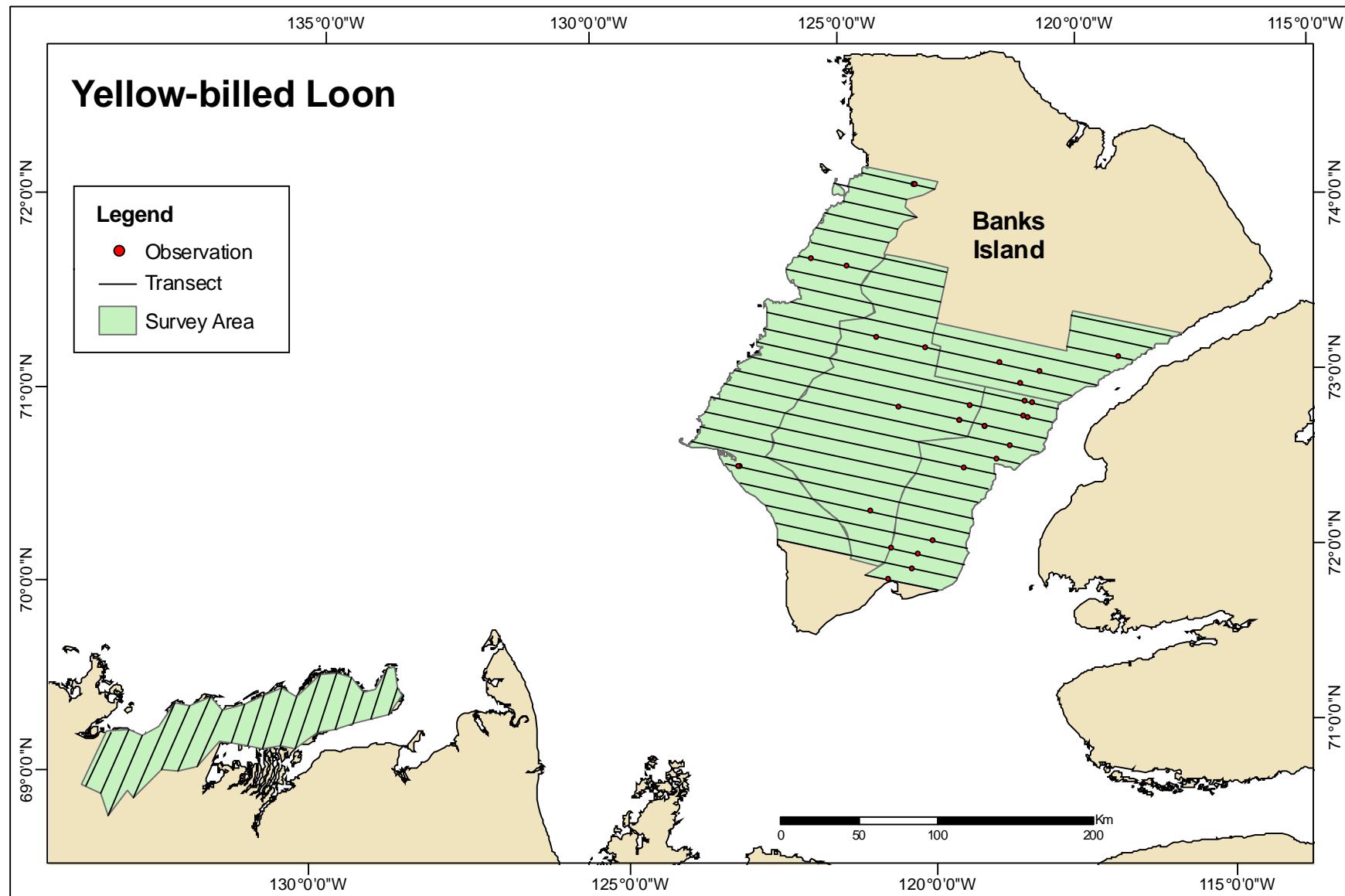


Figure 13. Locations of yellow-billed loon observations in 2010. Symbol size is proportional to the number of birds observed.

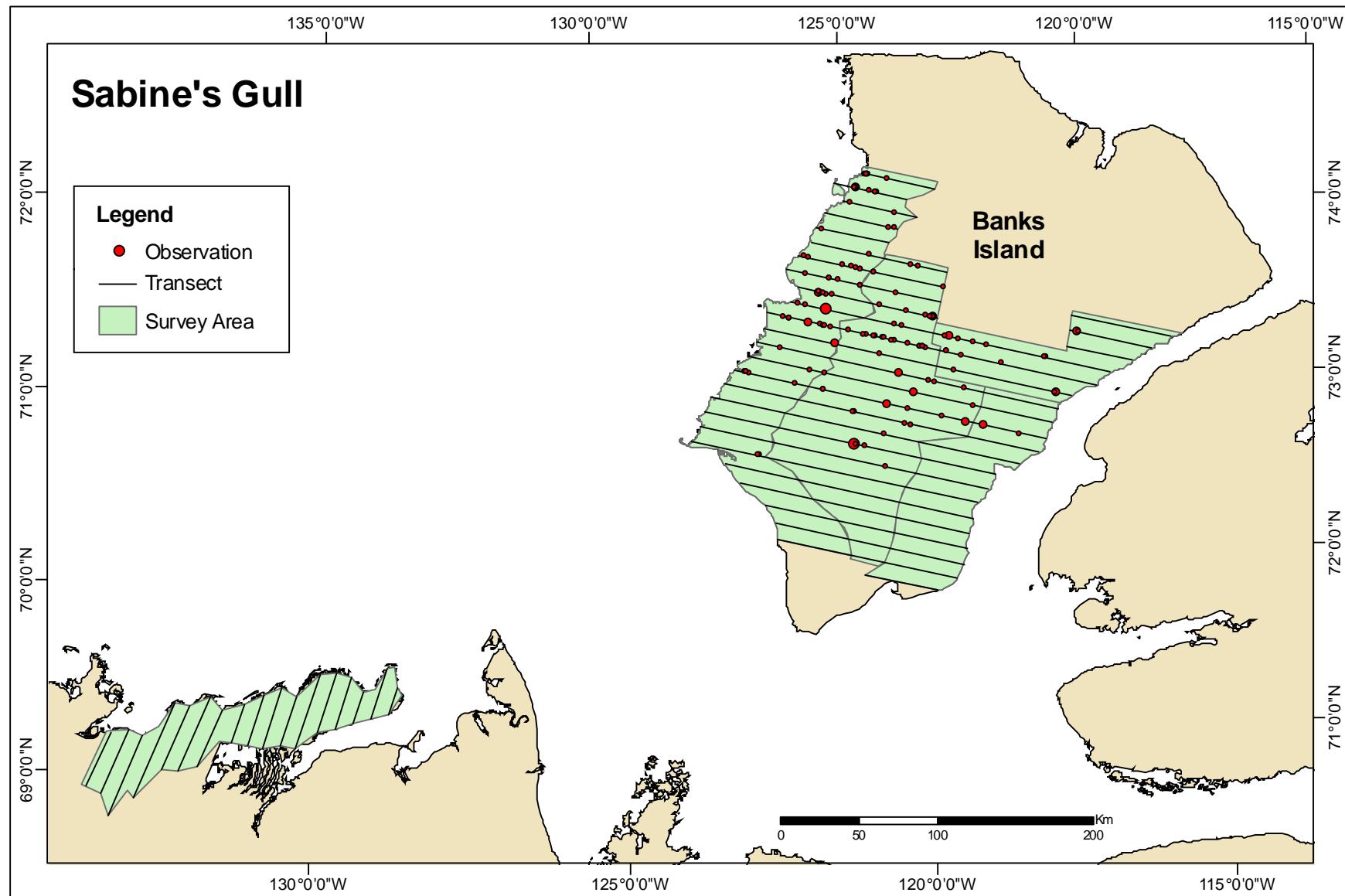


Figure 14. Locations of Sabine's gull observations in 2010. Symbol size is proportional to the number of birds observed.

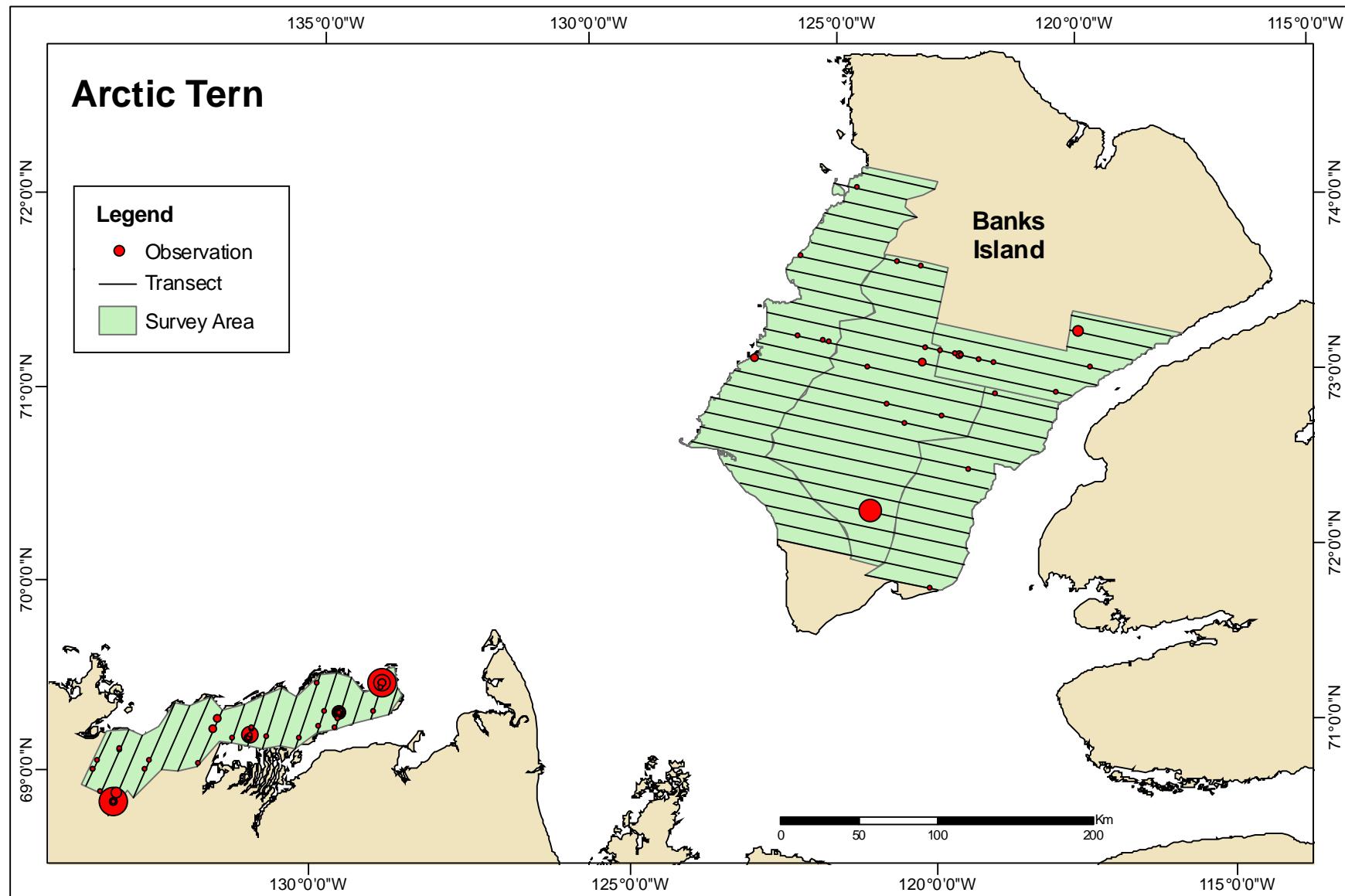


Figure 15. Locations of arctic tern observations in 2010. Symbol size is proportional to the number of birds observed.

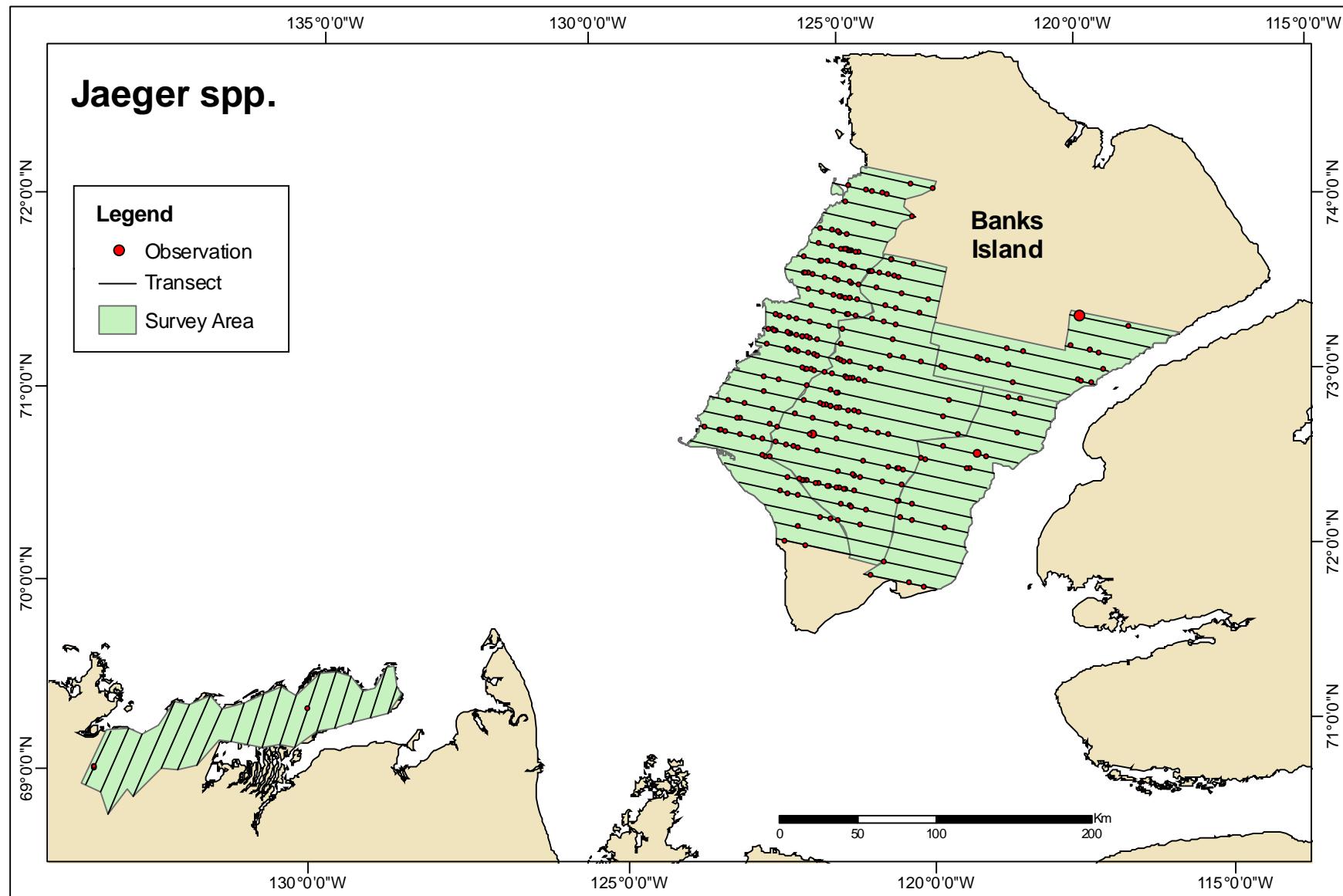


Figure 16. Locations of jaeger observations in 2010. Symbol size is proportional to the number of birds observed.

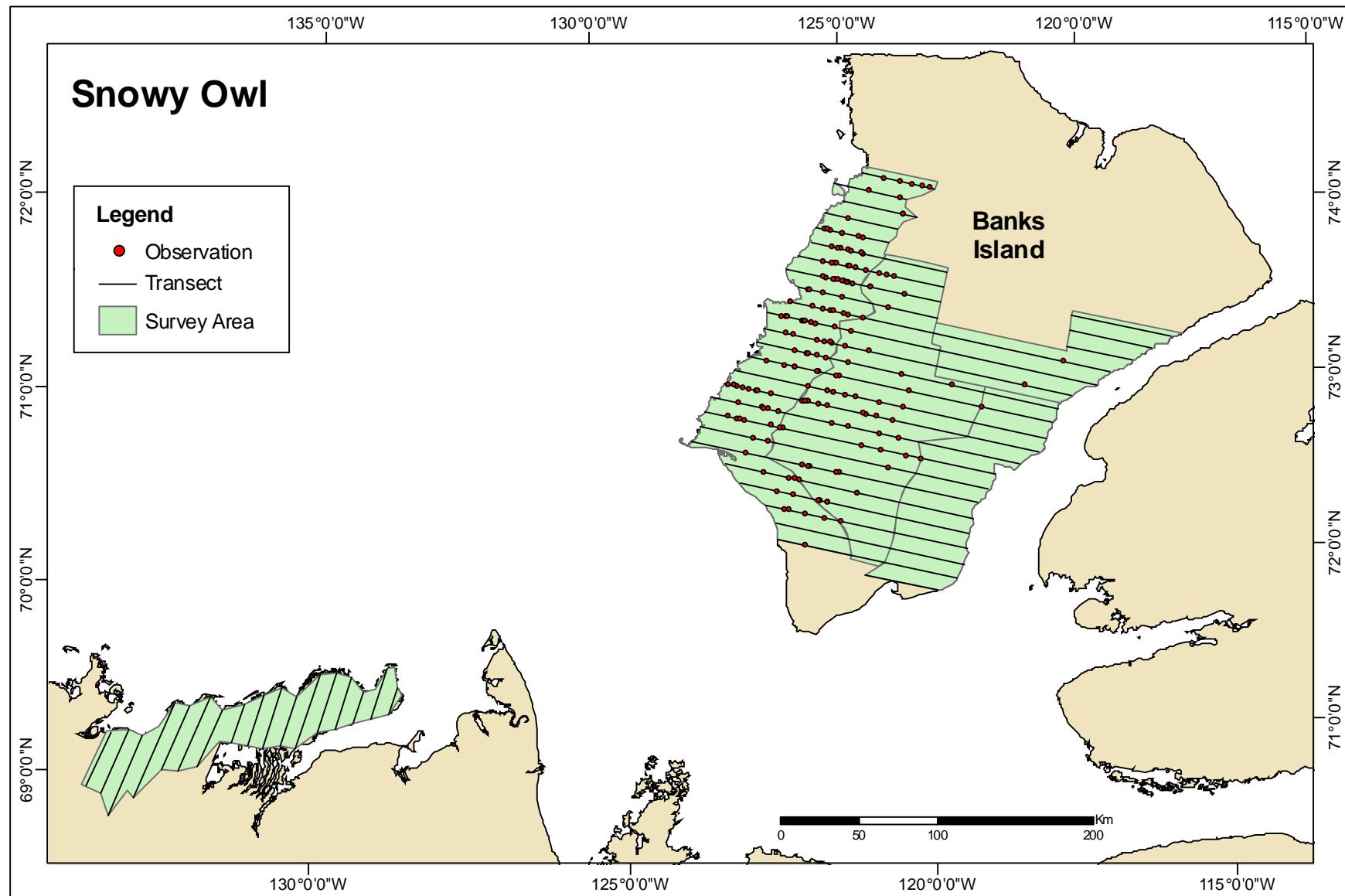


Figure 17. Locations of snowy owl observations in 2010. Symbol size is proportional to the number of birds observed.

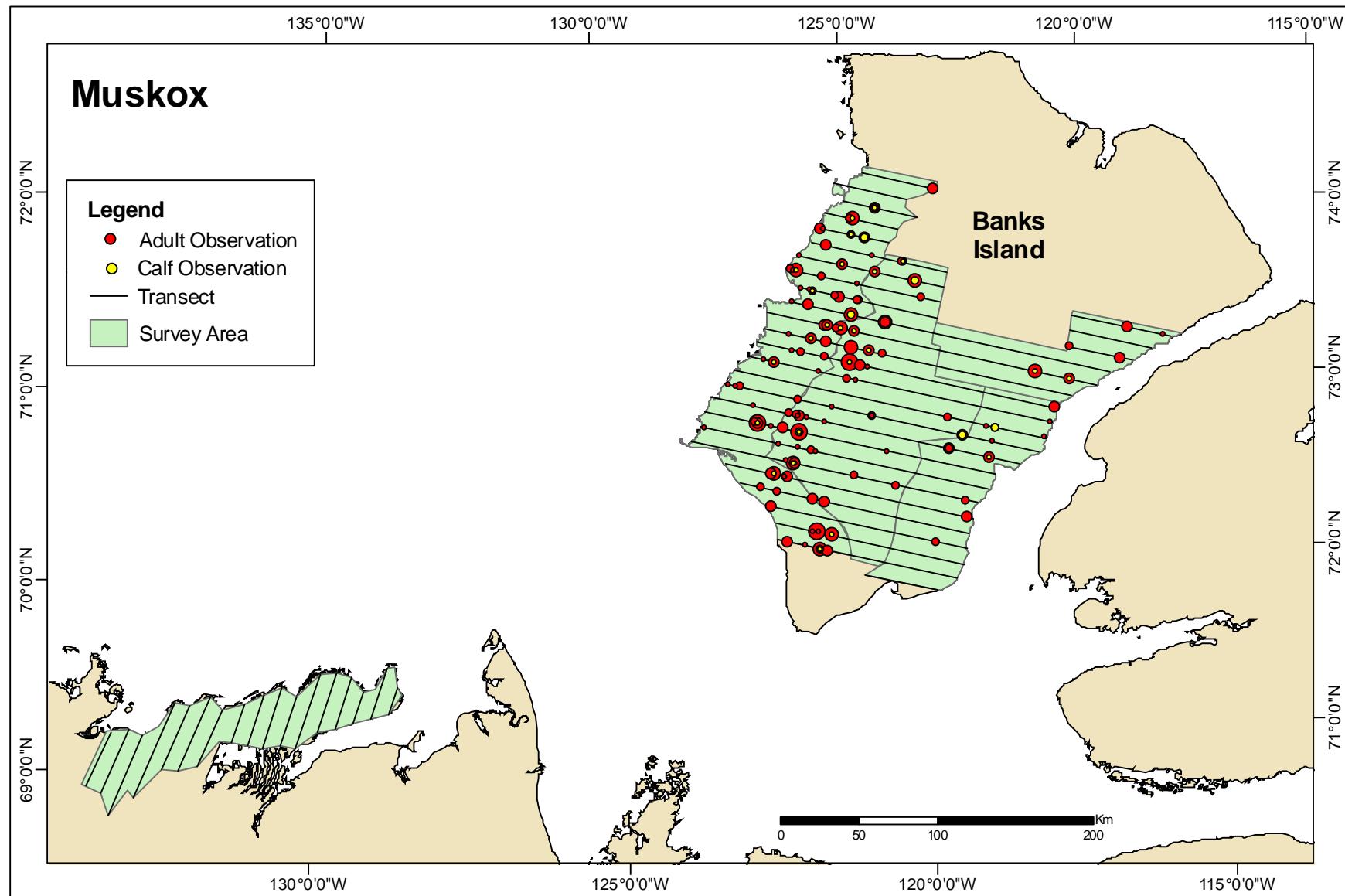


Figure 18. Locations of muskox observations in 2010. Symbol size is proportional to the number of birds observed.

Table 1. Survey design used for the fixed-wing aerial survey on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010.

	Banks I. West	Banks I. Inland	Banks I. East	Banks I. Northeast	Tuktoyaktuk Peninsula	All Areas
Stratum Area (km ²)	11,700	13,382	6,537	4,881	6,537	43,037
No. Transects	25	20	14	6	17	82
Total Transect Length (km)	1,199.3	1,361.2	683.0	465.7	674.1	4,383.3
Transect Coverage (km ²)	479.7	544.5	273.2	186.3	269.6	1,753.3
% Coverage of Stratum	4.1	4.1	4.2	3.8	4.1	4.1

Table 2. Population indices, by area, of waterfowl from the fixed-wing survey on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010. Single birds (except snow/Ross's Geese, scaup, and tundra swans) were doubled when calculating estimates. Indices of selected species are presented both with and without visibility correction factors (VCFs) applied to adjust for incomplete detection. VCFs are from 1989-1991 fixed-wing vs. helicopter comparison surveys in Alaska tundra habitats (Conant et al. 1991).

Species	VCF	Banks I.		Banks I.		Banks I.		Banks I.		Banks I.		Tuktoyaktuk			
		West	SE	Inland	SE	East	SE	Northeast	SE	Total	SE	Peninsula	SE	Total	SE
Small Canada Goose	---	683	308	3,146	630	4,403	918	1,677	393	9,909	1,220	4,195	1,333	14,103	1,807
White-fronted Goose	---	415	241	393	301	0	0	157	173	965	422	22,452	4,997	23,417	5,014
Brant	---	317	190	369	199	287	288	1,494	1,537	2,466	1,588	436	266	2,903	1,610
Snow/Ross's Goose	---	332,213	189,430	55,175	20,071	96	71	8,700	6,753	396,184	190,610	436	306	396,620	190,610
Mallard	---	0	0	0	0	0	0	0	0	0	0	727	501	727	501
Mallard	4.01	0	0	0	0	0	0	0	0	0	0	2,917	2,032	2,917	2,032
American Wigeon	---	0	0	0	0	0	0	0	0	0	0	339	233	339	233
American Wigeon	3.84	0	0	0	0	0	0	0	0	0	0	1,303	902	1,303	902
Green-winged Teal	---	0	0	0	0	0	0	0	0	0	0	1,091	474	1,091	474
Green-winged Teal	8.36	0	0	0	0	0	0	0	0	0	0	9,121	4,183	9,121	4,183
Northern Shoveler	---	0	0	0	0	0	0	0	0	0	0	436	303	436	303
Northern Shoveler	3.79	0	0	0	0	0	0	0	0	0	0	1,654	1,159	1,654	1,159
Northern Pintail	---	0	0	295	292	0	0	52	55	347	297	14,475	3,612	14,822	3,624
Northern Pintail	3.05	0	0	900	889	0	0	160	167	1,059	905	44,148	11,475	45,207	11,511
Canvasback	---	0	0	0	0	0	0	0	0	0	0	1,867	1,876	1,867	1,876
Canvasback	2.43	0	0	0	0	0	0	0	0	0	0	4,537	4,559	4,537	4,559
Scaup sp.	---	0	0	0	0	0	0	0	0	0	0	9,965	3,015	9,965	3,015
Scaup sp.	1.93	0	0	0	0	0	0	0	0	0	0	19,232	6,140	19,232	6,140
Black Scoter	---	0	0	0	0	0	0	0	0	0	0	727	365	727	365
Black Scoter	1.17	0	0	0	0	0	0	0	0	0	0	851	432	851	432
Surf Scoter	---	0	0	0	0	0	0	0	0	0	0	7,953	6,686	7,953	6,686
Surf Scoter	1.17	0	0	0	0	0	0	0	0	0	0	9,305	7,835	9,305	7,835
White-winged Scoter	---	0	0	0	0	0	0	0	0	0	0	10,959	2,911	10,959	2,911
White-winged Scoter	1.17	0	0	0	0	0	0	0	0	0	0	12,822	3,581	12,822	3,581
Unidentified Scoter	---	0	0	0	0	0	0	0	0	0	0	17,263	3,735	17,263	3,735
Unidentified Scoter	1.17	0	0	0	0	0	0	0	0	0	0	20,198	4,715	20,198	4,715
Common Eider	---	49	49	0	0	526	256	157	173	732	313	533	258	1,266	406
King Eider	---	8,780	1,823	8,430	1,361	1,866	519	3,145	544	22,220	2,396	1,334	479	23,554	2,443
Long-tailed Duck	---	2,561	842	2,310	471	431	183	1,782	265	7,084	1,017	9,868	1,157	16,952	1,541
Long-tailed Duck	1.87	4,789	1,706	4,320	1,075	805	358	3,332	689	13,246	2,161	18,453	3,434	31,699	4,057
Red-breasted Merganser	---	0	0	0	0	144	144	0	0	144	144	8,825	2,805	8,969	2,809
Red-breasted Merganser	1.27	0	0	0	0	182	183	0	0	182	183	11,208	4,580	11,391	4,584
Goldeneye sp.	---	0	0	0	0	0	0	0	0	0	0	145	147	145	147
Goldeneye sp.	3.61	0	0	0	0	0	0	0	0	0	0	525	531	525	531
Tundra Swan	---	2,000	569	1,081	380	550	301	52	56	3,684	749	10,595	2,164	14,279	2,290
Tundra Swan Nest	---	219	69	123	45	0	0	0	0	342	83	1,091	160	1,433	180

Table 3. Population indices, by area, of additional bird and mammal species from the fixed-wing survey on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010. Indices were not adjusted to account for incomplete detection.

Species	Banks I. West		Banks I. Inland		Banks I. East		Banks I. Northeast		Banks I. Total		Tuktoyaktuk Peninsula			
	West	SE	Inland	SE	East	SE	Northeast	SE	Total	SE	Peninsula	SE	Total	SE
Sandhill Crane	951	214	909	261	239	92	52	34	2,152	352	1,915	319	4,068	475
Pacific Loon	658	176	319	129	144	68	210	110	1,331	254	2,716	337	4,047	422
Red-throated Loon	171	75	49	34	144	68	183	61	547	123	1,503	319	2,050	342
Yellow-billed Loon	171	97	197	92	407	102	157	83	931	187	0	0	931	187
Common Loon	0	0	0	0	0	0	0	0	0	0	24	24	24	24
Glaucous Gull	146	73	123	69	574	476	0	0	843	486	24	24	868	487
Sabine's Gull	2,244	556	2,163	547	120	120	734	234	5,260	823	0	0	5,260	823
Unidentified Large Gull	2,195	444	1,253	199	383	112	341	84	4,172	506	7,662	2,150	11,834	2,208
Unidentified Small Gull	0	0	0	0	24	24	0	0	24	24	24	25	48	34
Arctic Tern	244	136	1,057	748	120	67	472	230	1,892	797	5,504	2,423	7,396	2,551
Jaeger sp.	3,219	512	2,949	312	670	195	839	209	7,677	664	73	53	7,750	666
Ptarmigan sp.	610	172	1,106	234	239	74	183	26	2,138	301	1,212	271	3,351	405
Common Raven	0	0	0	0	0	0	0	0	0	0	242	155	242	155
Rough-legged Hawk	341	117	369	94	72	37	0	0	782	155	315	133	1,097	204
Northern Harrier	0	0	0	0	0	0	0	0	0	0	145	63	145	63
Bald Eagle	0	0	0	0	0	0	0	0	0	0	145	68	145	68
Golden Eagle	0	0	0	0	0	0	0	0	0	0	24	25	24	25
Gyrfalcon	0	0	0	0	0	0	52	34	52	34	0	0	52	34
Snowy Owl	3,049	415	1,499	251	24	24	52	29	4,624	487	0	0	4,624	487
Muskox Adult	8,536	1,272	6,046	1,038	1,220	449	891	462	16,693	1,764	0	0	16,693	1,764
Muskox Calf	756	177	614	206	120	96	52	50	1,542	293	0	0	1,542	293
Caribou Adult	268	165	172	92	0	0	157	155	598	245	1,624	467	2,222	527
Caribou Calf	0	0	0	0	0	0	26	26	26	26	170	93	196	96
Arctic Fox	24	24	123	48	24	24	79	31	250	67	0	0	250	67
Wolf	49	34	25	24	0	0	0	0	73	41	0	0	73	41
Grizzly Bear	0	0	0	0	0	0	0	0	0	0	24	25	24	25

Table 4. Population densities (number per km²), by area, of waterfowl from the fixed-wing survey on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010. Densities were not adjusted to account for incomplete detection.

Species	Banks I.		Banks I.		Banks I.		Banks I.		Tuktoyaktuk	
	West	SE	Inland	SE	East	SE	Northeast	SE	Peninsula	SE
Small Canada Goose	0.058	0.026	0.235	0.047	0.674	0.140	0.344	0.080	0.642	0.204
White-fronted Goose	0.035	0.021	0.029	0.022	0.000	0.000	0.032	0.035	3.434	0.764
Brant	0.027	0.016	0.028	0.015	0.044	0.044	0.306	0.315	0.067	0.041
Snow/Ross's Goose	28.395	16.191	4.123	1.500	0.015	0.011	1.782	1.383	0.067	0.047
Mallard	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.077
American Wigeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.036
Green-winged Teal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.167	0.073
Northern Shoveler	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.067	0.046
Northern Pintail	0.000	0.000	0.022	0.022	0.000	0.000	0.011	0.011	2.214	0.553
Canvasback	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.286	0.287
Scaup sp.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.524	0.461
Black Scoter	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.056
Surf Scoter	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.217	1.023
White-winged Scoter	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.676	0.445
Unidentified Scoter	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.641	0.571
Common Eider	0.004	0.004	0.000	0.000	0.081	0.039	0.032	0.035	0.082	0.040
King Eider	0.750	0.156	0.630	0.102	0.286	0.079	0.644	0.111	0.204	0.073
Long-tailed Duck	0.219	0.072	0.173	0.035	0.066	0.028	0.365	0.054	1.510	0.177
Red-breasted Merganser	0.000	0.000	0.000	0.000	0.022	0.022	0.000	0.000	1.350	0.429
Goldeneye sp.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.023
Tundra Swan	0.171	0.049	0.081	0.028	0.084	0.046	0.011	0.012	1.621	0.331
Tundra Swan Nest	0.019	0.006	0.009	0.003	0.000	0.000	0.000	0.000	0.167	0.024

Table 5. Population densities (number per km²), by area, of additional bird and mammal species from the fixed-wing survey on Banks Island and Tuktoyaktuk Peninsula, Northwest Territories, Canada, 20-29 June 2010. Densities were not adjusted to account for incomplete detection.

Species	Banks I. West		Banks I. Inland		Banks I. East		Banks I. Northeast		Tuktoyaktuk Peninsula	
	West	SE	Inland	SE	East	SE	Northeast	SE	Peninsula	SE
Sandhill Crane	0.081	0.018	0.068	0.020	0.037	0.014	0.011	0.007	0.293	0.049
Pacific Loon	0.056	0.015	0.024	0.010	0.022	0.010	0.043	0.023	0.415	0.052
Red-throated Loon	0.015	0.006	0.004	0.003	0.022	0.010	0.038	0.013	0.230	0.049
Yellow-billed Loon	0.015	0.008	0.015	0.007	0.062	0.016	0.032	0.017	0.000	0.000
Common Loon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004
Glaucous Gull	0.013	0.006	0.009	0.005	0.088	0.073	0.000	0.000	0.004	0.004
Sabine's Gull	0.192	0.048	0.162	0.041	0.018	0.018	0.150	0.048	0.000	0.000
Unidentified Large Gull	0.188	0.038	0.094	0.015	0.059	0.017	0.070	0.017	1.172	0.329
Unidentified Small Gull	0.000	0.000	0.000	0.000	0.004	0.004	0.000	0.000	0.004	0.004
Arctic Tern	0.021	0.012	0.079	0.056	0.018	0.010	0.097	0.047	0.842	0.371
Jaeger spp.	0.275	0.044	0.220	0.023	0.102	0.030	0.172	0.043	0.011	0.008
Ptarmigan spp.	0.052	0.015	0.083	0.017	0.037	0.011	0.038	0.005	0.185	0.041
Common Raven	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.024
Rough-legged Hawk	0.029	0.010	0.028	0.007	0.011	0.006	0.000	0.000	0.048	0.020
Northern Harrier	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.010
Bald Eagle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.010
Golden Eagle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004
Gyrfalcon	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.007	0.000	0.000
Snowy Owl	0.261	0.035	0.112	0.019	0.004	0.004	0.011	0.006	0.000	0.000
Muskox Adult	0.730	0.109	0.452	0.078	0.187	0.069	0.183	0.095	0.000	0.000
Muskox Calf	0.065	0.015	0.046	0.015	0.018	0.015	0.011	0.010	0.000	0.000
Caribou Adult	0.023	0.014	0.013	0.007	0.000	0.000	0.032	0.032	0.248	0.071
Caribou Calf	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.005	0.026	0.014
Arctic Fox	0.002	0.002	0.009	0.004	0.004	0.004	0.016	0.006	0.000	0.000
Wolf	0.004	0.003	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Grizzly Bear	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004

APPENDIX 1. Common and scientific names of species included in this report.

<u>Common Name</u>	<u>Scientific Name</u>
Tundra swan	<i>Cygnus columbianus</i>
Greater white-fronted goose	<i>Anser albifrons</i>
Snow goose	<i>Chen caerulescens</i>
Ross's goose	<i>Chen rossii</i>
Canada goose	<i>Branta canadensis</i>
Brant	<i>Branta bernicla</i>
Mallard	<i>Anas platyrhynchos</i>
American wigeon	<i>Anas americana</i>
Green-winged teal	<i>Anas crecca</i>
Northern shoveler	<i>Anas clypeata</i>
Northern pintail	<i>Anas acuta</i>
Canvasback	<i>Aythya valisineria</i>
Scaup sp.	<i>Aythya marila, A. affinis</i>
Common eider	<i>Somateria mollissima</i>
King eider	<i>Somateria spectabilis</i>
Black scoter	<i>Melanitta nigra</i>
White-winged scoter	<i>Melanitta fusca</i>
Surf scoter	<i>Melanitta perspicillata</i>
Long-tailed duck	<i>Clangula hyemalis</i>
Goldeneye sp.	<i>Bucephala islandica, B. clangula</i>
Red-breasted merganser	<i>Mergus serrator</i>
Sandhill crane	<i>Grus canadensis</i>
Pacific loon	<i>Gavia pacifica</i>
Red-throated loon	<i>Gavia stellata</i>
Yellow-billed loon	<i>Gavia adamsii</i>
Common loon	<i>Gavia immer</i>
Glaucous gull	<i>Larus hyperboreus</i>
Sabine's gull	<i>Xema sabini</i>
Arctic tern	<i>Sterna paradisaea</i>
Jaeger sp.	<i>Stercorarius pomarinus, S. parasiticus, S. longicaudus</i>
Ptarmigan sp.	<i>Lagopus mutus, L. lagopus</i>
Common raven	<i>Corvus corax</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Northern harrier	<i>Circus cyaneus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Gyrfalcon	<i>Falco rusticolus</i>
Snowy owl	<i>Bubo scandiaca</i>
Muskox	<i>Ovibos moschatus</i>
Caribou	<i>Rangifer tarandus</i>
Arctic fox	<i>Vulpes lagopus</i>
Gray wolf	<i>Canis lupus</i>
Grizzly bear	<i>Ursus arctos</i>