MIGRATORY BIRD SURVEY
IN THE WESTERN CANADIAN ARCTIC
2010

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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*(drakes ≤4 + pairs) + 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 (Derksen 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.

LITERATURE CITED


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.

<table>
<thead>
<tr>
<th></th>
<th>Banks I. West</th>
<th>Banks I. Inland</th>
<th>Banks I. East</th>
<th>Banks I. Northeast</th>
<th>Tuktoyaktuk Peninsula</th>
<th>All Areas</th>
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<td>20</td>
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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).

<table>
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<th>SE</th>
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<td>23,554</td>
<td>4,057</td>
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<td>---</td>
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<td>1,823</td>
<td>8,430</td>
<td>1,361</td>
<td>1,866</td>
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<td>3,145</td>
<td>544</td>
<td>22,220</td>
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<td>23,554</td>
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<td>23,554</td>
<td>4,057</td>
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</table>
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.

<table>
<thead>
<tr>
<th>Species</th>
<th>Banks I. West</th>
<th>Banks I. Inland</th>
<th>Banks I. East</th>
<th>Banks I. Northeast</th>
<th>Banks I. Total</th>
<th>Tuktoyaktuk Peninsula</th>
<th>Total</th>
</tr>
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<td>144</td>
<td>183</td>
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<td>2,050</td>
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<td>24</td>
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Table 4. Population densities (number per km\(^2\)), 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.

<table>
<thead>
<tr>
<th>Species</th>
<th>Banks I. West</th>
<th>Banks I. Inland</th>
<th>Banks I. East</th>
<th>Banks I. Northeast</th>
<th>Tuktoyaktuk Peninsula</th>
</tr>
</thead>
<tbody>
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<td>Small Canada Goose</td>
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<td>0.642</td>
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<td>0.167</td>
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<td>0.067</td>
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<td>0.644</td>
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<td>0.009</td>
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</table>
Table 5. Population densities (number per km$^2$), 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.

<table>
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<th>Species</th>
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<th>Banks I. Inland</th>
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<th>Banks I. East</th>
<th>SE</th>
<th>Banks I. Northeast</th>
<th>SE</th>
<th>Tuktoyaktuk Peninsula</th>
<th>SE</th>
</tr>
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<td>Sandhill Crane</td>
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<td>0.011</td>
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<td>0.010</td>
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<td>0.023</td>
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<td>0.003</td>
<td>0.022</td>
<td>0.010</td>
<td>0.038</td>
<td>0.013</td>
<td>0.230</td>
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<td>0.007</td>
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<td>0.016</td>
<td>0.032</td>
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<td>0.000</td>
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<td>0.046</td>
<td>0.015</td>
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<td>0.015</td>
<td>0.011</td>
<td>0.010</td>
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APPENDIX 1. Common and scientific names of species included in this report.

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<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
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<tbody>
<tr>
<td>Tundra swan</td>
<td><em>Cygnus columbianus</em></td>
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<tr>
<td>Greater white-fronted goose</td>
<td><em>Anser albifrons</em></td>
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<tr>
<td>Snow goose</td>
<td><em>Chen caerulescens</em></td>
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<tr>
<td>Ross’s goose</td>
<td><em>Chen rossii</em></td>
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<tr>
<td>Canada goose</td>
<td><em>Branta canadensis</em></td>
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<td>Brant</td>
<td><em>Branta bernicla</em></td>
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<tr>
<td>Mallard</td>
<td><em>Anas platyrhynchos</em></td>
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<tr>
<td>American wigeon</td>
<td><em>Anas americana</em></td>
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<tr>
<td>Green-winged teal</td>
<td><em>Anas crecca</em></td>
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<tr>
<td>Northern shoveler</td>
<td><em>Anas clypeata</em></td>
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<td>Northern pintail</td>
<td><em>Anas acuta</em></td>
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<td>Canvasback</td>
<td><em>Aythya valisineria</em></td>
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<tr>
<td>Scaup sp.</td>
<td><em>Aythya marila, A. affinis</em></td>
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<td>Common eider</td>
<td><em>Somateria mollissima</em></td>
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<tr>
<td>King eider</td>
<td><em>Somateria spectabilis</em></td>
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<tr>
<td>White-winged scoter</td>
<td><em>Melanitta fusca</em></td>
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<tr>
<td>Surf scoter</td>
<td><em>Melanitta perspicillata</em></td>
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<td>Goldeneye sp.</td>
<td><em>Bucephala islandica, B. clangula</em></td>
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<td>Red-breasted merganser</td>
<td><em>Mergus serrator</em></td>
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<td>Sandhill crane</td>
<td><em>Grus canadensis</em></td>
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<td>Pacific loon</td>
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<td>Red-throated loon</td>
<td><em>Gavia stellata</em></td>
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<td>Yellow-billed loon</td>
<td><em>Gavia adamsii</em></td>
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<tr>
<td>Common loon</td>
<td><em>Gavia immer</em></td>
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<td>Glaucous gull</td>
<td><em>Larus hyperboreus</em></td>
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<td>Sabine’s gull</td>
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<td>Jaeger sp.</td>
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<td>Ptarmigan sp.</td>
<td><em>Lagopus mutus, L. lagopus</em></td>
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<td>Common raven</td>
<td><em>Corvus corax</em></td>
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<td>Rough-legged hawk</td>
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<td>Northern harrier</td>
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<td>Gyrfalcon</td>
<td><em>Falco rusticolus</em></td>
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<td><em>Ovibos moschatus</em></td>
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<td>Gray wolf</td>
<td><em>Canis lupus</em></td>
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<td>Grizzly bear</td>
<td><em>Ursus arctos</em></td>
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