



Monitoring Passerine Birds in the Central Alaska Network

2015 and 2016 Summary Report for the Central Alaska Network Inventory and Monitoring Program

Natural Resource Report Series NPS/CAKN/NRRS—2017/1478





ON THIS PAGE

Photograph of a researcher conducting a passerine survey at Mile 8, Denali National Park and Preserve.
Photograph courtesy of the National Park Service/Dave Merz

ON THE COVER

Photograph of researcher conducting passerine surveys in Denali National Park and Preserve.
Photograph courtesy of the National Park Service/George Gress

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Executive Summary

Passerine birds are one of the components of the National Park Service (NPS) Vital Signs Monitoring Program in the Central Alaska Network (CAKN) Inventory and Monitoring Program. Objectives of the CAKN passerine monitoring program include estimating the abundance of passerine birds, detecting trends in their abundance and occupancy over time, and identifying how different species are responding over time to a suite of environmental variables, including landcover and elevation.



Photo 1. Pine Siskin (*Carduelis pinus*)

Photograph by: Mark Paulson NPS.

We use repeated point-counts conducted along roadside survey routes to meet our monitoring objectives. The roadside bird survey routes are similar to those conducted for the North American Breeding Bird Survey (BBS). Each roadside route had 50 sampling points placed approximately 800 m apart. The surveys started within ½ hour of sunrise and took five to six hours to complete. At each roadside sampling point, we conducted a 3-minute point count and recorded all birds heard from the point and all birds seen within ~400m (¼ mile) of the point.

In 2015–2016, we continued with Stage I of the program by sampling on the six established roadside survey routes along the Denali Park Road in Denali National Park and Preserve (Denali), the McCarthy Road in Wrangell-St. Elias National Park and Preserve (Wrangell-St. Elias), and the Nabesna Road in Wrangell-St. Elias. We sampled the six roadside survey routes between 9 April and 30 June in 2015, and 12 April and 29 June in 2016. Species richness per route ranged from 43 to 60 species in 2015, and from 36 to 48 species in 2016. Most detections (~70%) were of members of three families, *Emberizidae* (Sparrows), *Fringillidae* (Finches), and *Parulidae* (Warblers), in order of prevalence. White-crowned Sparrow (*Zonotrichia leucophrys*) was the most commonly detected species on the point counts (n=2700, 17% of all detections).

In 2016, we also investigated a new technique for off-road surveys targeting montane-breeding birds in cooperation with the NPS Arctic Network (ARCN). In this pilot study, we established a series of fixed survey routes within a grid on Primrose Ridge in Denali. We conducted repeat surveys along the routes and recorded the locations of all birds detected within 400 m of the route. We sampled four off-road survey routes between 19 May and 30 June 2016. Species richness per route ranged from 8

to 22 species, with White-crowned Sparrow being the most commonly detected species (n=98, 19% of all detections). Several alpine species were detected on survey routes, including White-tailed Ptarmigan (n=1 detection), Surfbird (n=9 detections), Wandering Tattler (n=1 detection), American Pipit (n=57 detections), and Gray-crowned Rosy Finch (n=2 detections).

In 2017, we will continue to conduct roadside surveys in CAKN. We plan to modify sampling techniques for the off-road surveys and expand efforts to more sampling grids, in cooperation with the NPS Arctic Network (ARCN).

Acknowledgments

We thank the Central Alaska Monitoring Network (CAKN) for providing financial support for this project, particularly Maggie MacCluskie for her continued support of this project and our efforts at optimizing sampling and analytical methods. We thank the efforts of many field technicians who collected data for this project, including Dave Merz, Jason Reppert, Mark Paulson, and Avery Meeker. We also thank Nicholas Bywater (CAKN) for his continued help with our database.

Background and Introduction

Through the National Park Service (NPS) Inventory and Monitoring Program, the Central Alaska Network (CAKN) tracks the major physical drivers of ecosystem change and responses of the two major components of the biota: plants and animals (MacCluskie and Oakley 2005). CAKN identified the distribution and abundance of animals as a focus of the program and included passerine birds as a vital sign.

Over 75% of the terrestrial vertebrate species in CAKN are birds. Birds are an important component of ecosystems and their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems (Fancy and Sauer 2000, O'Connell et al. 2000, Peitz et al. 2002). More than 70% of the bird species in CAKN are landbirds. Landbird is a general term used for those species that live or nest primarily in terrestrial habitats.

The landbird monitoring effort in CAKN includes three network parks: Denali National Park and Preserve (Denali), Wrangell-St. Elias National Park and Preserve (Wrangell-St. Elias), and Yukon-Charley Rivers National Preserve (Yukon-Charley). The landbird monitoring effort focuses primarily on species in the order Passeriformes because: 1) many of them are common, 2) they often respond quickly to changes in the environment, 3) many are widely distributed, and 4) many species can be detected using a single survey method. Passerine birds have been the focus of avian monitoring efforts since 1992 and the inception of the NPS Inventory and Monitoring Program in 2001. From 1992 to 2008, different surveys and survey techniques were used to collect data on passerine birds in both on-road and off-road locations in Denali as efforts were directed at establishing the most appropriate field techniques to meet the objectives of the monitoring program (see Schmidt et al. 2013). We are also assessing the efficacy of current techniques to monitor trends in Willow Ptarmigan (*Lagopus lagopus*) using data collected along the roadside survey routes. A more detailed background on the sampling techniques and history of the Passerine Monitoring Program within CAKN can be found in the 2013–2014 CAKN Annual Report (McIntyre et al. 2015).

Current monitoring efforts

Our current monitoring efforts are focused on data collected on a series of roadside survey routes in Denali and Wrangell-St. Elias. We are also working cooperatively with the NPS Arctic Network (ARCN) to test new field and analytical techniques for improving the efficiency of sampling at off-road sites.

Our current sampling approach involves conducting a series of standardized bird surveys throughout the nesting season on roadside survey routes in CAKN using similar methods employed by BBS (Sauer et al. 2008). A recent analysis of data collected using a temporal repeat count approach during roadside bird surveys on the Denali Park Road from 1993 to 1998, 2006, and 2009 suggested that this survey technique will allow us to meet our monitoring objectives without violating assumptions of the data analyses (Schmidt et al. 2013). Binomial mixture models enable generation of detectability-corrected-abundance estimates from count data, and utilize data that are easier to collect than distance sampling or other methods of estimating detectability (Kery et al. 2005). The key

requirement of these models is the temporal replication of counts (or temporal repeat surveys) at a number of sample locations (Kery et al. 2005).

Repeated counts and recently developed hierarchical N-mixture models (Royle 2004) avoid many of the problems encountered with distance sampling and unadjusted point counts by separately estimating detection probability and abundance. These mixture models build on methods developed for occupancy estimation (Royle and Nichols 2003, MacKenzie et al. 2006) and separate the abundance process from the observation process. Further, this approach will allow us to detect changes in dates of first detection of each species and changes in the probability of detecting a species across the survey period as well as changes in detection across the survey day. These shifts in time are important for identifying potential impacts of a warming climate on changes in breeding season phenology for birds (Both and te Marvelde 2007).

In 2015 and 2016, we continued to implement passerine monitoring in two of the three CAKN parks and conducted a series of temporal repeat surveys along roadside routes in Denali and Wrangell-St. Elias. In 2016, we conducted a pilot season of off-road survey routes to target montane-breeding birds in Denali.

The purpose of this progress report is to describe the fieldwork conducted and to provide a brief summary of the data collected in 2015 and 2016.

Methods

Passerine Monitoring Objectives

Our primary objective is to detect changes in a series of metrics associated with the distribution, presence, abundance, and peak detection times of a suite of passerine birds over time. The following metrics are measured: 1) first, peak, and last annual detection dates, 2) peak detection times within daily and annual sampling periods, and 3) occupancy (presence).

We focused our fieldwork in 2015 and 2016 on:

1. Surveying three roadside bird survey routes in Denali along the Denali Park Road;
2. Surveying two roadside bird survey routes along the McCarthy Road and one roadside bird survey route along the Nabesna Road, both in Wrangell-St. Elias;
3. Surveying four off-road bird survey routes in Denali (2016 only).

The roads mentioned in this report are generally two-lane gravel roads with relatively low traffic volumes (less than one vehicle per survey hour) during the time surveys were conducted. The off-road routes were located on Primrose Ridge in Denali and experienced very low hiker volume during survey efforts (i.e., no hikers were encountered while conducting surveys, two individuals were sighted >2 km away).

Conducting the Surveys

Sampling methods for roadside surveys generally followed those developed for the BBS. The main differences between the BBS and CAKN roadside surveys are that the roadside CAKN surveys are conducted at least three times during the nesting season and included recording measurements of the time and type of detection as well as recording a suite of environmental variables at each sampling point.

We standardized surveys to reduce variation in detection probability by starting each survey within 0.5 hours of sunrise, finishing each survey within ~6 hours of the start, and surveying only one roadside route per day per person. We did not conduct surveys during periods of precipitation or when wind speed was >13 kph because rain and higher winds affected our ability to detect birds, both by influencing bird behavior and observer hearing.

At each roadside point along a survey route, we conducted a three-minute count and recorded all birds heard from the point and all birds seen within ~400m (¼ mile) of the point. For each detection, we identified the species, the type of detection (see below), and the time of detection within a minute interval (e.g, 1 min, 2 min, or 3 min). Because it is often very difficult to differentiate between Greater Scaup or Lesser Scaup and Common Redpoll and Hoary Redpoll without detailed observation of the bird, these were identified as Scaup species (spp.) and Redpoll species (spp.). All other detections were made to species. Type of detection included: singing, calling, visual, fly-over, drumming, winnowing, aerial display - aural, and aerial display - visual. In the case where a bird could not be identified, we recorded it as an unidentified bird.

At each survey point, we also recorded a series of environmental variables including wind speed and direction, temperature, cloud cover, precipitation, background noise, insect presence, and the number of motorized vehicles heard or seen during the count. Additionally, we recorded bird species detected between points and the number of adult Snowshoe Hare (*Lepus americanus*) detected between points (between point observation data not included in this report).

Our goal in 2015 and 2016 was to survey the eastern most Denali roadside route (route 1) at least once every ten days from mid- April through late June, the other two Denali routes (routes 2 and 3) at least three times between mid-May and late June, the two McCarthy routes at least once every two weeks between early May and late June, and the Nabesna route at least once every two weeks between mid-May through late June. We rotated observers across the routes and surveyed the routes in both directions (starting at the last point and ending at the first point) during the season.

In 2016, we tested the off-road sampling design on four 4 km-long routes within a grid on the Primrose Ridge in Denali. We began surveying within ½ hour of sunrise and took five to eight hours to complete each route. We surveyed a single route per day, and surveyed routes successively until all four routes were completed. We recorded all birds heard or seen within 400 m (1/4 mile) of the transect line, and recorded locations, distance (in meters) and bearing (in degrees) for each bird detected. We also recorded background noise levels and how each bird was detected (visually, aurally, etc.). Further detail on specific protocols for the 2016 off-road surveys can be found in Appendix A. Our goal was to survey the two lower elevation routes at least three times and the higher elevation routes at least two times between mid-May and late June.

Scientific names of bird species mentioned in this report are listed in Appendix D and not within the text of this report. Phylogenetic sequence, English and scientific names follow *The A.O.U. Check-list of North American Birds* (7th ed., American Ornithologists Union 1998) and supplements through 2016 (Chesser et al. 2016).

Results and Discussion

Survey Effort

The 2015 survey team consisted of Carol McIntyre (NPS), Mark Paulson (NPS), Jeremy Mizel (NPS), and Jason Reppert (NPS) with Laura Phillips (NPS) assisting as data recorder (Table 1). All sampling occurred from 09 April 2015 to 30 June 2015 (Table 2). McIntyre completed 432 counts, Paulson completed 993, Mizel completed 250, and Reppert completed 250, totaling 1,925 counts across all routes in 2015 (Table 1).

Table 1. Observer counts completed for the roadside bird survey routes, Central Alaska Monitoring Network passerine monitoring program, Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve, Alaska, 2015.

Observer	Routes surveyed	Counts completed
Carol McIntyre	All Routes	432
Jeremy Mizel	Denali Roadside 1 and 2	250
Mark Paulson	All Routes	993
Jason Reppert	All Routes	250

Table 2. Roadside repeat bird sampling routes, sampling dates, number of repeat surveys, and species per route for the Central Alaska Monitoring Network passerine monitoring program, Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve, Alaska, 2015.

Route name 2015	Sampling period	Points on route	# of repeat surveys	Number of species
Denali Roadside 1	9 April – 30 June	50	14	43
Denali Roadside 2	16 April – 29 June	50	11	46
Denali Roadside 3	12 May – 30 June	50	7	53
McCarthy Roadside 1	7 May – 13 June	50	6	59
McCarthy Roadside 2	6 May – 12 June	50	6	56
Nabesna Roadside 1	8 May – 16 June	50	6	60

The 2016 survey team consisted of Jamie Dawson (Wrangell Institute for Science and Education), Carol McIntyre (NPS), Avery Meeker (U. Washington), Dave Merz (NPS), Jeremy Mizel (NPS), Laura Phillips (NPS), Jason Reppert (NPS), and Emily Williams (NPS; Table 3). All sampling occurred from 12 April and 29 June 2016 (Table 4). Dawson completed 302 counts, McIntyre completed 302, Meeker completed 50, Merz completed 410, Mizel completed 218, Phillips

completed 61, Reppert completed 150, and Williams completed 211, totaling 1,494 counts across all routes in 2016 (Table 3).

Table 3. Observer counts completed for the roadside bird survey routes, Central Alaska Monitoring Network passerine monitoring program, Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve, Alaska, 2016.

Observer	Routes surveyed	Counts completed
Jamie Dawson	McCarthy Roadside Routes 1, 2, and Nabesna Route	302
Carol McIntyre	Denali Roadside Routes 1, 2, and 3	92
Avery Meeker	Denali Roadside 2	50
Dave Merz	Denali Roadside Routes 1, 2, and 3	410
Jeremy Mizel	Denali Roadside Routes 1, 2, and 3	218
Laura Phillips	Denali Roadside 1 and 2	61
Jason Reppert	McCarthy Roadside Routes 1, 2, and Nabesna Route	150
Emily Williams	Denali Roadside Routes 1, 2, and 3	211

Table 4. Roadside repeat bird sampling routes, sampling dates, number of repeat surveys, and species per route for the Central Alaska Monitoring Network passerine monitoring program, Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve, Alaska, 2016.

Route name 2016	Sampling period	Points on route	# of repeat surveys	Number of species
Denali Roadside 1	12 April – 27 June	50	9	39
Denali Roadside 2	26 April – 28 June	50	10	47
Denali Roadside 3	4 May – 29 June	50	5	36
McCarthy Roadside 1	26 May – 18 June	50	3	48
McCarthy Roadside 2	27 May – 19 June	50	3	41
Nabesna Roadside 1	25 May – 6 June	50	3	40

Species Diversity and Detections across Roadside Routes 2015

The number of species detected on each roadside route ranged from 43 to 60 in 2015 (Table 2), with some species being only detected on single routes. For example, Northern Pintail, Bonaparte's Gull, Red-throated Loon, American Kestrel, Hammond's Flycatcher, and Eastern Phoebe were only detected on the Nabesna route, whereas Yellow-bellied Sapsucker was only detected on the McCarthy Road route 2 (Appendix D).

Pooling across all survey routes, we detected 99 species, including 49 species in the Order Passeriformes in 2015 (Appendix B). Alder Flycatcher, Gray Jay, Common Raven, Boreal Chickadee, Ruby-crowned Kinglet, Swainson's Thrush, Hermit Thrush, American Robin, Varied Thrush, Redpoll Spp., Orange-crowned Warbler, Yellow-rumped Warbler, Wilson's Warbler, Savannah Sparrow, Lincoln's Sparrow, White-crowned Sparrow, and Dark-eyed Junco were detected on all routes in 2015 (Appendix B).

White-crowned Sparrow was the most commonly detected species (n=2,700 detections; 17% of all detections) and was the most commonly detected species for routes 1 and 3 of the Denali Park Road. American Tree Sparrow was the most commonly detected species for route 2 of the Denali Park Road. Swainson's Thrush was the most commonly detected species on both of the McCarthy Road routes. Dark-eyed Junco was the most commonly detected species on the Nabesna Road route.

A striking difference in species composition across routes is the high frequency of detections of Willow Ptarmigan on all three Denali routes, the conspicuous absence of them on both McCarthy routes, and very few (n=7 detections) of them on the Nabesna route (Appendix B). Willow Ptarmigan was the most frequently detected non-passerine species on all three Denali routes in 2015 (Appendix B).

Species Diversity and Detections across Roadside Routes 2016

The number of species detected on each roadside route ranged from 39 to 48 in 2016 (Table 4). Several species were only detected on single routes (Appendix C). For example, Greater White-fronted Goose, American Green-winged Teal, Bufflehead, Bonaparte's Gull, and Trumpeter Swan were only detected on the Nabesna route, whereas Red-tailed Hawk, Golden-crowned Kinglet, and Tree Swallow were only detected on the McCarthy Road route 2 (Appendix C).

Pooling across all survey routes, we detected 83 species, including 46 species in the Order Passeriformes in 2016 (Appendix C). Wilson's Snipe, Gray Jay, Boreal Chickadee, Swainson's Thrush, American Robin, Redpoll Spp., Orange-crowned Warbler, Yellow-rumped Warbler, Wilson's Warbler, Savannah Sparrow, Fox Sparrow, Lincoln's Sparrow, White-crowned Sparrow, and Dark-Eyed Junco were detected on all routes in 2016 (Appendix C).

White-crowned Sparrow was the most commonly detected species overall (n=1,964 detections; 19% of all detections) and was the most commonly detected species on all Denali routes and the Nabesna route. Similar to 2015, Swainson's Thrush was the most commonly detected species on both of the McCarthy Road routes in 2016 (Appendix C). Another prominent difference in species composition across routes is the high frequency of detections of American Tree Sparrow on all three Denali routes and the noticeable absence of them on all three Wrangell-St. Elias routes (Appendix C). This pattern was similar in 2015, but with the exception of 3 detections of American Tree Sparrow on the Nabesna route (Appendix B, C).

Similar to 2015, Willow Ptarmigan were present on all three Denali routes, but completely absent from all three Wrangell-St. Elias routes in 2016 (Appendix C). Both in 2015 and 2016, Black-billed

Magpies were present on all three Denali routes, but absent from all three Wrangell-St. Elias routes (Appendix B, C).

The differences in the presence of species among routes are most likely due to the differences in habitat and elevations along the routes. For example, the roadside routes along the McCarthy Road are dominated by mixed stands of coniferous and deciduous forests, but also include a diversity of wetland habitats. The Nabesna route includes mixed stands of coniferous and deciduous forests, a diversity of wetland habitats, and also some subalpine shrub habitats. In contrast, routes 1 and 2 in Denali occur mainly in subalpine habitats with very few wetlands or forested areas and route 3 in Denali occurs mainly in subalpine and wetland habitat.

Species Diversity and Detections across Off-road Routes 2016

The number of species detected on each off-road route ranged from 8 to 22, with American Golden Plover, Horned Lark, American Pipit, and Savannah Sparrows detected on all routes. White-crowned Sparrows were the most commonly detected species (n=98 detections; 19% of all detections), followed by Savannah Sparrows (n=60 detections, 12% of all detections). White-tailed Ptarmigan, Wandering Tattler, Hermit Thrush, and Lapland Longspur were each only detected once.

Detection Types and Times of Roadside Routes

Most detections were of vocalizing (singing or calling) birds in both years (92.3% in 2015, 93.8% in 2016; Table 5). Most detections (95.0% in 2015, 99% in 2016) were of individual birds rather than pairs or flocks, with a maximum flock size of 40 White-winged Crossbills. Most detections (60% in 2015, 63% in 2016) occurred within the first minute of the point counts.

Table 5. Percentage of detections by detection type for survey routes in the Central Alaska Monitoring Network, 2015-2016.

Type of detection	2015	2016
Singing	72.6	81.4
Calling	19.7	12.4
Visual	3.3	4.9
Fly-over	3.2	0.9
Drumming	0.3	0.1
Winnowing	0.2	0.1
Aerial display - aural	0.3	0.1
Aerial display - visual	0	0

Species of note

We detected singing male Tennessee Warblers along the McCarthy Road both in 2015 and 2016, including one male in 2015 in the same stand of shrub willows (*Salix* spp.) where we detected one in 2014. As of this writing, there are no confirmed breeding records of this species in Wrangell-St. Elias, but continued detections of singing males suggest that efforts should be made to find an occupied nest. Observers conducting the North American Breeding Bird Survey on the McCarthy Road also reported detecting several singing Tennessee Warblers (J.J. Frost, pers. comm). A dead female Tennessee Warbler was also found by Camp Denali staff in the Camp Denali driveway in early June 2015 (J. Hamm, pers. comm).

We also detected a singing male Eastern Phoebe near point 3 along the Nabesna Road, on the north side of the road just west of the Jack Creek Bridge, on 14 June 2015. The bird was also observed on 15 and 16 June 2015 at the same location. M. Paulson detected this singing male, photographed it, and completed a rare bird report (on file). C. McIntyre sent a copy of the rare bird report and photographs to Dan Gibson (UAF Museum Ornithological Curator) and Luke DeCicco (USFWS).

We also detected a singing Brown Creeper on McCarthy Road route 1 on 14 June 2016. The last detections of Brown Creeper were on 24 and 25 May 2012, on both McCarthy Road routes (NPS, unpublished data).

Public outreach

We continued to engage the public in science-based education activities in 2015 and 2016. Jason Reppert participated in the Wrangell-Institute for Science and Environment's annual Earth Discovery Days at the Copper River School in early May 2015 and a field trip for students from Effie Kokrine School (Fairbanks) in Denali in June 2015. Jason also took multiple groups of local students on short bird walking trips throughout the year. Jason also led the Birds of Denali field seminar for the Murie Science and Learning Center in Denali in June 2015. Laura Phillips led the Wonder Wings field seminar for the Murie Science and Learning Center in Denali in September 2015.

In early 2016, a paper was published in *Ecosphere* detailing distributional change in passerine species in connection with vegetation change in subarctic ecosystem, using data from ongoing CAKN passerine monitoring (Mizel et al. 2016). In May and June 2016, Laura Phillips, Carol McIntyre, and collaborators presented seminars during the "Denali Days" week at the Murie Science and Learning Center and at the Denali Education Center. In August, Laura Phillips presented a poster for the North American Ornithological Conference in Washington, D.C. Through August–December, several posts about Denali's avian ecology program were presented on social media outlets (Facebook, Twitter, etc.). In December, Emily Williams presented two posters at the Alaska Bird Conference in Cordova, AK.

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Appendix A. ARCN/CAKN Off-road Survey Protocol.

Conducting Surveys

1. Surveys are conducted between 0200 and 1000 in ARCN parks. In Denali, they are conducted between 30 minutes before sunrise to 1000.
2. Do not conduct surveys during dense fog, snow, heavy rain or when winds exceed 15 mph. If you experience poor survey weather after you start the survey, you should stop and wait for survey conditions to improve. Rangefinders perform poorly in fog.
3. Surveys are conducted by two-person teams comprised of an observer and recorder. The recorder does not cue the observer on birds the latter has missed. The recorder does not make any observations.
4. The observer navigates the route by moving the GPS cursor along the survey route and following the bearing given by the GPS using a field (handheld) compass (i.e., not the GPS one).
5. At the start of each survey, make sure your GPS is recording your tracks. Don't turn off track collection on GPS units even when off-survey. We will delete the off-survey sections of tracks in ArcGIS. If you turn tracks off at the end of a survey, you may forget to turn them on at the beginning of the next one.
6. Attempt to stay within 15 m of the route, but minimize the amount of time looking at the GPS screen. Don't zoom in tight to the line, but use the cursor-bearing method described above.
7. The time spent surveying each individual cell will vary from 30-75 minutes depending on bird density and route length. This variation is accommodated in the analysis. If you find yourself proceeding rapidly through a cell in which you are detecting few birds, slow down and stop and listen occasionally. Failing to stop and listen occasionally will have the largest effect on your detection of species with relatively quiet songs, Savannah Sparrow in particular.
8. Upon leaving a cell, record the end time for the survey and the average background noise level (0-3) you encountered while conducting the survey in that cell. Directions for the observation log are shown below. Because the observer will have the GPS unit, the observer needs to tell the recorder that they are leaving a plot and the cell ID of the plot they are entering. The centroids for each cell should be loaded and labeled on the GPS. The recorder needs to remind the observer to give them the background noise.
9. The cell column refers to the cell you are walking through not necessarily where the bird is located. See the example datasheet.
10. Take breaks between cells not in the middle of a cell.

Recording bird observations (see Table 1 of Appendix A for more detailed instructions)

1. Upon detecting a bird, the observer takes a waypoint and estimates a bearing and distance to the bird using a compass and a rangefinder. They communicate this information along with the species ID and detection type to the recorder.
2. If you detect multiple birds from the same waypoint, don't take additional waypoints for each of these detections. Record the different bearings and distances to these detections and indicate with a vertical line that these belong to the same waypoint.
3. Record the consecutive numbers assigned by the GPS. Do not rename the waypoints even if you cross out an observation.
4. Record all observations <400 m away including those of birds located outside of the cell you are walking through and located outside of the grid entirely. At the start of each route, record all birds including those located in the adjacent cell (i.e., the cell away from the direction of the route).
5. Record one observation per individual. Do not enter a second observation of a previously detected bird even if it moves to a different cell. However, if you detect a new bird in a cell that you have surveyed and exited (i.e., the one in your wake or 'behind' you), record that observation and waypoint.
6. Error on the conservative side to avoid double-counting birds. If you cannot tell if you have previously detected a bird, do not record this individual.
7. Do not guess at bird identification. If you are at all uncertain about an observation, attempt to verify the identification by spending a couple of additional minutes listening to the bird (approach if necessary) or using your iPod. Enter the species ID as unknown ("UNK"), if there is any uncertainty about its identity.
8. Record the location where the bird was first observed, not where you figured out what species it was.
9. If you detect a bird and believe your location could be >100 m off (i.e., the combined error of your bearing and distance estimate), record this location as 'uncertain'.
10. Occasionally, the survey route takes the observer closer to the bird after the initial detection. If upon closer observation, you find you can give a more precise location (and that bird hasn't moved), you may update the datasheet with the more precise location (new waypoint, bearing, and distance) of this individual by crossing out the original location, adding the new information. Do not change any locations if you suspect that the bird has moved – just record uncertain for the location.
11. You should only use one detection code for each observation (Appendix A, Table 2). The code should refer to your initial detection of the bird. For instance, if you heard a bird

singing and then saw it, your detection type would be “S” for singing. Similarly, if you first saw a bird and then heard it, your detection would be “V” (visual).

- a. In contrast to observations of aerial displays, fly-overs include birds that are simply flying over the area, but are not using the survey area. A good example of this might be a Common Raven that is flying high over the survey area, but obviously not using the area. Birds that you observe as they are flying, but staying in the area (such as a bird flying from perch to perch) should be recorded as visual observations unless they are doing an aerial display (see above). A bird that is obviously foraging on the wing (i.e. harriers, jaegers, etc.) is recorded as a visual detection because it is using the survey area grounds.
 - b. For flyovers, do not mark a waypoint or record a bearing or distance. Record flyover detections for one species in each plot in one row. That is, keep a running tally of flyovers for that species in the comments column.
12. In addition to recording the detection type (singing, calling, visual, etc.) that you used to first detect the bird, record the following:
 - a. If you first detect the bird visually or calling, but you hear it sing afterwards, record ‘SL’ in the ‘Sang later/mated pair/territorial’ column.
 - b. If you first detect the bird visually or calling, also note all territorial behavior, in particular if the detection is of a mated pair (add ‘P’). Typically, these types of detections will be of a pair in which both individuals are alarm calling or feeding nestlings (‘T’). Occasionally, you will note aggressive territorial behavior such as male-male fighting (also record ‘T’ for both males). For sexually dimorphic species (e.g., wheatears), note the sex of all individuals that you visually observe in the comments (‘M’ or ‘F’).
13. In some situations, recording every single calling bird you encounter will be overwhelming and will make it difficult to detect and keep track of the individuals which are of primary interest, singing males.
14. For observations of ≥ 2 individuals together (e.g. flocking species and mated pairs), record one observation and the number of individuals. For a detection of two males that are fighting in the same spot, record a separate observation for each male.
15. We do not include juveniles/young of the year in analysis. When you record these individuals, the detection type is J.

Appendix A, Table 1. Directions for filling out the datasheet.

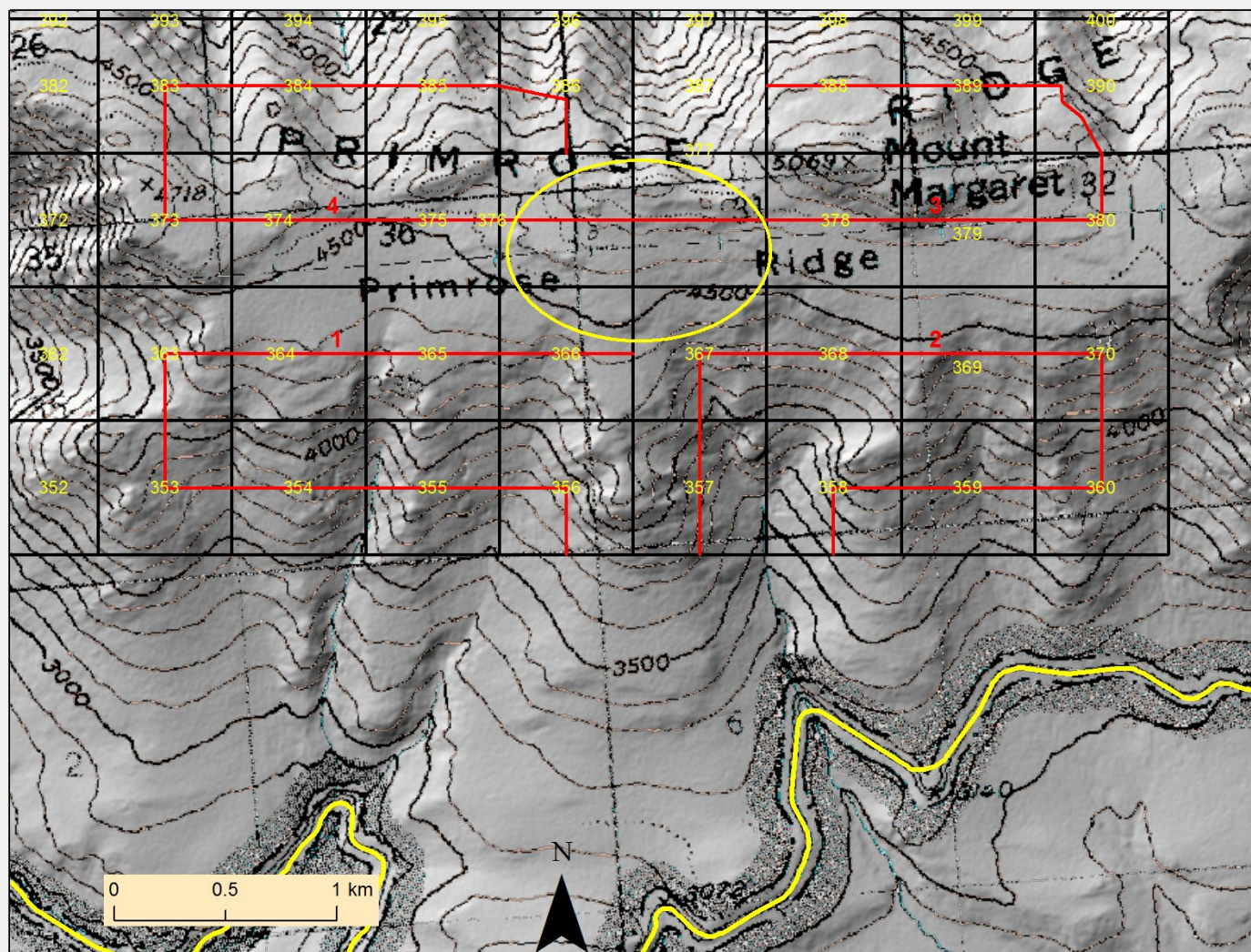
Parameter	Description
Study area	AKP (Anaktuvuk Pass), PRI (Primus Cr.), KBE (Kelly Bend), DEN (Denali)
Date	
Sheet	Each day start at 1. Each side of the page is a different sheet.
Observer	Initials plus birth year (e.g., JDM75)
GPS #	Each GPS will have an individual ID # to correspond downloaded survey tracks.
Cell ID	Record the cell you are walking through, not the cell the bird is located in.
Start	Time you entered the cell and began surveying.
End	Time you left the cell.
Noise	Background noise level: <ul style="list-style-type: none"> • 0 (none) • 1 (barely reduces hearing) • 2 (noticeable reduction in hearing) • 3 (prohibitive noise).
Waypt	Marked where you are standing. Record the consecutive number the GPS automatically names the waypoint. Do not change this.
Time	Enter the time of detection as HH:MM (e.g., 2:13).
Species	4-letter AOU code.
Distance (meters)	Use your range finder when at all possible.
Bearing (degrees)	Use your compass.
DT	Detection type when you first observed the bird.
Uncertain location?	If you are uncertain about your distance or bearing data (e.g., the actual location of the bird could be >100 m off), then put "Y" in this column. Otherwise, "N".
Sang later/mated pair/territorial?	SL = sang later P = mated pair; male and female T = territorial behavior (e.g., alarm calling, male fighting)
Comments	Record count of birds in multiple birds were detected (e.g., "2" for a male and female observed together). Tally flyovers in this column. Note the sex of birds.
Sheet	Each day start at 1. Each side of the page is a different sheet.

Appendix A, Table 2. Detection codes.

Detection Code	Description	Definition
S	Singing bird	First detection was an aural observation of a singing bird.
C	Calling bird	First detection was an aural observation of a calling bird.
V	Visual observation	First detection was a visual observation of a bird perched in the count area, but not flying over or doing an aerial display.
ADA	Aerial display- aural	First detection was an observation of a bird doing an aerial display. Birds that are commonly detected by aerial displays include Horned Lark, American Pipit, Redpolls, and Least and Baird's Sandpipers.
ADV	Aerial display-visual	First detection was a visual observation of a bird doing an aerial display.
FO	Fly over	First detection was a visual or aural observation of a bird flying over the area, but does not include birds that are displaying.
WI	Winnowing	First detection was of a bird that was winnowing. The only species commonly detected by winnowing is the Wilson's Snipe.
N	Nest	First detection was of a nest
J	Juvenile	Detection of a juvenile bird.

Appendix A, Table 3. Code suffixes.

Code suffix	Description	Definition
SL	Sang later	First detection was C or V, but afterwards, you heard him sing.
P	Mated pair	Observation of mated pair together recorded in combination w/C or V.
T	Territorial behavior	Alarm calling, fighting, feeding nestlings, etc. Recorded in combination w/C or V.



Appendix A, Figure 1. Primrose Ridge routes. The optimal basecamp location is indicated by the yellow circle.

Appendix B. Detections for each of the Roadside survey routes in the Central Alaska Monitoring Network, 2015.

Appendix B, Table 1. Detections (1=detected at least once, 0 = not detected during any repeated survey) of each species for each of the roadside survey routes. The route names are Denali Roadside 1 = DR1, Denali Roadside 2 = DR2, Denali Roadside 3 = DR3, McCarthy Roadside 1 = MR1, McCarthy Roadside 2 = MR2, and Nabesna Roadside 1 = NR1.

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Canada Goose	0	0	0	1	0	0
Trumpeter Swan	0	0	0	1	1	1
American Wigeon	0	0	1	1	1	1
Mallard	0	0	1	1	1	1
Blue-winged Teal	0	0	0	1	0	0
Northern Shoveler	0	0	1	0	1	1
Northern Pintail	0	0	0	0	0	1
American Green-winged Teal	0	0	1	1	1	1
Redhead	0	0	0	1	0	0
Ring-necked Duck	0	0	1	1	1	1
Scaup Sp.	0	0	1	1	0	1
White-winged Scoter	0	0	0	0	1	1
Bufflehead	0	1	1	1	0	1
Barrow's Goldeneye	0	0	1	1	1	1
Spruce Grouse	1	1	0	0	0	0
Willow Ptarmigan	1	1	1	0	0	1
Rock Ptarmigan	0	1	1	0	0	0
Red-necked Grebe	0	0	0	1	0	0
American Golden Plover	0	0	1	0	0	0
Whimbrel	1	1	1	0	0	0
Surfbird	0	0	1	0	0	0
Least Sandpiper	0	0	1	0	0	0
Wilson's Snipe	1	0	1	1	1	1
Spotted Sandpiper	1	0	0	0	1	1
Solitary Sandpiper	0	0	0	1	1	1
Wandering Tattler	0	0	1	0	0	0
Lesser Yellowlegs	0	0	1	1	1	1
Long-tailed Jaeger	0	1	0	0	0	0
Bonaparte's Gull	0	0	0	0	0	1
Mew Gull	1	1	1	1	0	1
Herring Gull	0	0	0	1	0	1
Red-throated Loon	0	0	0	0	0	1
Pacific Loon	0	0	0	0	1	0
Common Loon	0	0	0	1	1	1

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Bald Eagle	0	0	0	1	1	1
Northern Harrier	1	0	1	0	0	0
Red-tailed Hawk	1	0	0	1	1	0
Golden Eagle	1	1	1	0	0	0
Great Horned Owl	0	1	0	0	1	0
Northern Hawk Owl	0	1	0	0	0	0
Belted Kingfisher	0	0	0	0	1	0
Downy Woodpecker	1	0	0	0	0	0
Hairy Woodpecker	0	0	0	0	1	0
American Three-toed Woodpecker	0	1	0	0	0	1
Black-backed Woodpecker	0	0	0	1	0	0
Northern Flicker	1	0	0	1	1	1
American Kestrel	0	0	0	0	0	1
Merlin	1	1	1	1	0	1
Gyr Falcon	0	1	0	0	0	0
Olive-sided Flycatcher	1	0	0	1	1	1
Western Wood-pewee	0	0	0	1	1	1
Alder Flycatcher	1	1	1	1	1	1
Hammond's Flycatcher	0	0	0	0	0	1
Say's Phoebe	0	1	1	0	0	0
Northern Shrike	0	1	0	0	0	0
Gray Jay	1	1	1	1	1	1
Black-billed Magpie	1	1	1	0	0	0
Common Raven	1	1	1	1	1	1
Horned Lark	0	0	1	0	0	0
Tree Swallow	0	0	0	1	1	1
Violet-green Swallow	0	0	0	1	1	0
Bank Swallow	0	0	0	1	0	0
Cliff Swallow	0	0	1	0	0	0
Black-capped Chickadee	0	0	1	1	1	1
Boreal Chickadee	1	1	1	1	1	1
Golden-crowned Kinglet	0	0	0	1	1	0
Ruby-crowned Kinglet	1	1	1	1	1	1
Arctic Warbler	0	1	1	0	0	0
Townsend's Solitaire	0	1	0	0	0	0
Gray-cheeked Thrush	1	1	1	0	1	1
Swainson's Thrush	1	1	1	1	1	1
Hermit Thrush	1	1	1	1	1	1
American Robin	1	1	1	1	1	1
Varied Thrush	1	1	1	1	1	1
Bohemian Waxwing	1	0	0	1	1	1
American Pipit	0	1	1	0	0	0

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Pine Grosbeak	0	1	0	1	1	1
White-winged Crossbill	1	1	0	1	1	1
Redpoll Species	1	1	1	1	1	1
Pine Siskin	1	1	0	1	1	1
Lapland Longspur	0	0	1	0	0	0
Northern Waterthrush	1	0	1	1	1	0
Tennessee Warbler	0	0	0	1	1	0
Orange-crowned Warbler	1	1	1	1	1	1
Yellow Warbler	1	0	1	1	1	1
Blackpoll Warbler	1	1	0	1	1	1
Yellow-rumped Warbler (Myrtle Warbler)	1	1	1	1	1	1
Wilson's Warbler	1	1	1	1	1	1
American Tree Sparrow	1	1	1	0	0	1
Chipping Sparrow	0	0	0	1	1	0
Savannah Sparrow	1	1	1	1	1	1
Fox Sparrow	1	1	1	1	0	1
Lincoln's Sparrow	1	1	1	1	1	1
White-crowned Sparrow	1	1	1	1	1	1
Golden-crowned Sparrow	1	1	1	0	0	0
Dark-eyed Junco	1	1	1	1	1	1
Rusty Blackbird	1	0	0	1	1	1
Unidentified bird	1	1	1	1	1	1

Appendix C. Detections for each of the Roadside survey routes in the Central Alaska Monitoring Network, 2016.

Appendix C, Table 1. Detections (1=detected at least once, 0 = not detected during any repeated survey) of each species for each of the roadside survey routes. The route names are Denali Roadside 1 = DR1, Denali Roadside 2 = DR2, Denali Roadside 3 = DR3, McCarthy Roadside 1 = MR1, McCarthy Roadside 2 = MR2, and Nabesna Roadside 1 = NR1.

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Greater White-fronted Goose	0	0	0	0	0	1
Trumpeter Swan	0	0	0	0	0	1
American Wigeon	0	0	1	0	1	1
Northern Shoveler	0	1	0	1	0	0
American Green-winged Teal	0	0	0	0	0	1
Lesser Scaup	0	0	1	1	0	0
Scaup Sp.	0	0	0	1	1	1
Bufflehead	0	0	0	0	0	1
Barrow's Goldeneye	0	0	1	1	0	1
Ruffed Grouse	1	0	0	0	0	0
Spruce Grouse	1	1	0	1	1	0
Willow Ptarmigan	1	1	1	0	0	0
Rock Ptarmigan	0	1	1	0	0	0
White-tailed Ptarmigan	0	0	1	0	0	0
Whimbrel	1	1	0	0	0	0
Surfbird	0	1	0	0	0	0
Wilson's Snipe	1	1	1	1	1	1
Greater Yellowlegs	0	0	0	1	0	0
Lesser Yellowlegs	0	0	0	1	1	0
Bonaparte's Gull	0	0	0	0	0	1
Mew Gull	1	1	0	1	0	1
Herring Gull	1	0	0	1	0	0
Common Loon	0	0	0	1	0	0
Bald Eagle	0	0	0	1	0	0
Norther Harrier	1	1	1	0	0	0
Sharp-shinned Hawk	1	1	0	0	0	0
Red-tailed Hawk	0	0	0	0	1	0
Golden Eagle	1	1	0	0	0	0
Great Horned Owl	0	0	0	1	1	1
Short-eared Owl	0	0	1	0	0	0
Hairy Woodpecker	0	1	0	0	1	0
American Three-toed Woodpecker	1	1	0	0	0	0
Northern Flicker	0	1	0	1	1	1
American Kestrel	0	1	0	0	0	1
Merlin	0	1	1	0	0	1
Peregrine Falcon	0	1	0	0	0	0

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Olive-sided Flycatcher	1	0	0	1	1	1
Western wood-pewee	0	0	0	1	1	1
Alder Flycatcher	0	0	0	1	1	1
Say's Phoebe	0	1	0	0	0	0
Northern Shrike	0	1	0	0	0	0
Gray Jay	1	1	1	1	1	1
Black-billed Magpie	1	1	1	0	0	0
Common Raven	1	1	0	1	1	1
Horned Lark	0	0	1	0	0	0
Tree Swallow	0	0	0	0	1	0
Violet-green Swallow	0	0	0	1	1	0
Bank Swallow	0	0	1	0	0	0
Black-capped Chickadee	1	1	1	0	0	0
Boreal Chickadee	1	1	1	1	1	1
Brown Creeper	0	0	0	1	0	0
Golden-crowned Kinglet	0	0	0	0	1	0
Ruby-crowned Kinglet	1	1	0	1	1	1
Arctic Warbler	1	1	1	0	0	0
Townsend's Solitaire	0	1	0	1	0	0
Gray-cheeked Thrush	1	1	1	1	0	1
Swainson's Thrush	1	1	1	1	1	1
Hermit Thrush	1	1	1	1	0	0
American Robin	1	1	1	1	1	1
Varied Thrush	1	1	0	1	1	1
Bohemian Waxwing	0	0	0	1	1	1
American Pipit	0	1	1	0	0	0
Pine Grosbeak	0	0	0	1	1	0
White-winged Crossbill	1	1	0	1	1	0
Redpoll Species	1	1	1	1	1	1
Laplong Longspur	0	0	1	0	0	0
Northern Waterthrush	0	0	0	1	1	1
Tennessee Warbler	0	0	0	1	1	1
Orange-crowned Warbler	1	1	1	1	1	1
Yellow Warbler	1	0	0	1	1	1
Blackpoll Warbler	1	1	1	1	1	0
Yellow-rumped Warbler (Myrtle Warbler)	1	1	1	1	1	1
Wilson's Warbler	1	1	1	1	1	1
American Tree Sparrow	1	1	1	0	0	0
Chipping Sparrow	0	0	0	1	1	0
Savannah Sparrow	1	1	1	1	1	1
Fox Sparrow	1	1	1	1	1	1
Lincoln's Sparrow	1	1	1	1	1	1
White-crowned Sparrow	1	1	1	1	1	1

Common Name	DR1	DR2	DR3	MC1	MC2	NR1
Golden-crowned Sparrow	1	1	1	0	0	0
Dark-eyed Junco	1	1	1	1	1	1
Rusty Blackbird	0	0	0	1	1	1
Unidentified Bird	1	1	1	1	1	1

Appendix D. Scientific and common names of bird species mentioned in this report.

Scientific Name	Common Name
<i>Anser albifrons</i>	Greater White-fronted Goose
<i>Chen caerulescens</i>	Canada Goose
<i>Cygnus buccinator</i>	Trumpeter Swan
<i>Anas americana</i>	American Wigeon
<i>Anas platyrhynchos</i>	Mallard
<i>Anas discors</i>	Blue-winged Teal
<i>Anas clypeata</i>	Northern Shoveler
<i>Anas acuta</i>	Northern Pintail
<i>Anas c. carolinensis</i>	American Green-winged Teal
<i>Aythya americana</i>	Redhead
<i>Aythya collaris</i>	Ring-necked Duck
<i>Aythya affinis</i>	Lesser Scaup
<i>Aythya sp</i>	Scaup Sp.
<i>Melanitta fusca</i>	White-winged Scoter
<i>Bucephala albeola</i>	Bufflehead
<i>Bucephala islandica</i>	Barrow's Goldeneye
<i>Bonasa umbellus</i>	Ruffed Grouse
<i>Falci pennis canadensis</i>	Spruce Grouse
<i>Lagopus lagopus</i>	Willow Ptarmigan
<i>Lagopus muta</i>	Rock Ptarmigan
<i>Lagopus leucura</i>	White-tailed Ptarmigan
<i>Podiceps grisegena</i>	Red-necked Grebe
<i>Pluvialis dominica</i>	American Golden Plover
<i>Numenius phaeopus</i>	Whimbrel
<i>Calidris virgata</i>	Surfbird
<i>Calidris minutilla</i>	Least Sandpiper

Scientific Name	Common Name
<i>Gallinago delicata</i>	Wilson's Snipe
<i>Actitis macularius</i>	Spotted Sandpiper
<i>Tringa solitaria</i>	Solitary Sandpiper
<i>Tringa incana</i>	Wandering Tattler
<i>Tringa melanoleuca</i>	Greater Yellowlegs
<i>Tringa flavipes</i>	Lesser Yellowlegs
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger
<i>Chroicocephalus philadelphia</i>	Bonaparte's Gull
<i>Larus canus</i>	Mew Gull
<i>Larus argentatus</i>	Herring Gull
<i>Gavia stellata</i>	Red-throated Loon
<i>Gavia pacifica</i>	Pacific Loon
<i>Gavia immer</i>	Common Loon
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Circus cyaneus</i>	Northern Harrier
<i>Accipiter striatus</i>	Sharp-shinned Hawk
<i>Buteo jamaicensis</i>	Red-tailed Hawk
<i>Aquila chrysaetos</i>	Golden Eagle
<i>Bubo virginianus</i>	Great Horned Owl
<i>Surnia ulula</i>	Northern Hawk Owl
<i>Asio flammeus</i>	Short-eared Owl
<i>Megaceryle alcyon</i>	Belted Kingfisher
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker
<i>Picoides pubescens</i>	Downy Woodpecker
<i>Picoides villosus</i>	Hairy Woodpecker
<i>Picoides dorsalis</i>	American Three-toed Woodpecker
<i>Picoides arcticus</i>	Black-backed Woodpecker
<i>Colaptes auratus</i>	Northern Flicker

Scientific Name	Common Name
<i>Falco sparverius</i>	American Kestrel
<i>Falco columbarius</i>	Merlin
<i>Falco rusticolus</i>	Gyr Falcon
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Contopus cooper</i>	Olive-sided Flycatcher
<i>Contopus sordidulus</i>	Western Wood-pewee
<i>Empidonax alnorum</i>	Alder Flycatcher
<i>Empidonax hammondi</i>	Hammond's Flycatcher
<i>Sayornis phoebe</i>	Eastern Phoebe
<i>Sayornis saya</i>	Say's Phoebe
<i>Lanius excubitor</i>	Northern Shrike
<i>Perisoreus canadensis</i>	Gray Jay
<i>Pica hudsonia</i>	Black-billed Magpie
<i>Corvus corax</i>	Common Raven
<i>Eremophila alpestris</i>	Horned Lark
<i>Tachycineta bicolor</i>	Tree Swallow
<i>Tachycineta thalassina</i>	Violet-green Swallow
<i>Riparia riparia</i>	Bank Swallow
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Poecile atricapillus</i>	Black-capped Chickadee
<i>Poecile hudsonicus</i>	Boreal Chickadee
<i>Certhia americana</i>	Brown Creeper
<i>Regulus satrapa</i>	Golden-crowned Kinglet
<i>Regulus calendula</i>	Ruby-crowned Kinglet
<i>Phylloscopus borealis</i>	Arctic Warbler
<i>Myadestes townsendi</i>	Townsend's Solitaire
<i>Catharus minimus</i>	Gray-cheeked Thrush
<i>Catharus ustulatus</i>	Swainson's Thrush

Scientific Name	Common Name
<i>Catharus guttatus</i>	Hermit Thrush
<i>Turdus migratorius</i>	American Robin
<i>Ixoreus naevius</i>	Varied Thrush
<i>Bombycilla garrulus</i>	Bohemian Waxwing
<i>Anthus rubescens</i>	American Pipit
<i>Pinicola enucleator</i>	Pine Grosbeak
<i>Loxia leucoptera</i>	White-winged Crossbill
<i>Acanthis sp.</i>	Redpoll Species
<i>Spinus pinus</i>	Pine Siskin
<i>Calcarius lapponicus</i>	Lapland Longspur
<i>Parkesia noveboracensis</i>	Northern Waterthrush
<i>Oreothlypis peregrina</i>	Tennessee Warbler
<i>Oreothlypis celata</i>	Orange-crowned Warbler
<i>Setophaga petechia</i>	Yellow Warbler
<i>Setophaga striata</i>	Blackpoll Warbler
<i>Setophaga coronata</i>	Yellow-rumped Warbler (Myrtle Warbler)
<i>Cardellina pusilla</i>	Wilson's Warbler
<i>Spizelloides arborea</i>	American Tree Sparrow
<i>Spizella passerina</i>	Chipping Sparrow
<i>Passerculus sandwichensis</i>	Savannah Sparrow
<i>Passerella iliaca</i>	Fox Sparrow
<i>Melospiza lincolnii</i>	Lincoln's Sparrow
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow
<i>Zonotrichia atricapilla</i>	Golden-crowned Sparrow
<i>Junco hyemalis</i>	Dark-eyed Junco
<i>Euphagus carolinus</i>	Rusty Blackbird

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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