

**Monitoring Passerine Birds in
Denali National Park and Preserve, Alaska:**

2006 Progress Report

Central Alaska Network, Vital Signs Monitoring Program



Mount McKinley and Wonder Lake at start of the survey day from Upper Moose Creek minigrid, 5 June 2006.

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SUMMARY

Ten-minute point transect surveys were conducted in Denali National Park and Preserve, Alaska, as part of the Central Alaska Network's Vital Signs monitoring program.

Surveys were conducted between 1 and 21 June between 0300 and 0900 hours. All birds detected (seen or heard) at each sampling point were recorded during a 10-minute sampling period in one of four time intervals (0 to 3 min, $>3 \leq 5$ min, $>5 \leq 8$ min, and $>8 \leq 10$ min) and one of 13 distance intervals (10-m intervals up to 100 m, 25-m intervals to 150 m, and >150 -m). The survey crew sampled 194 points on 8 minigrids in 2006 and detected 1859 birds at 1782 detection events, including 167 to 300 birds per minigrid and 6.7 to 12.0 birds per point. Species richness ranged from 14 to 25 species per minigrid and 3.8 to 6.7 species per point. Seventy-two species were detected on minigrids (54 species during the 10-minute counts and 18 species on the minigrids but not during the 10-minute counts). Most detections (75%) were of members of three families, *Emberizidae* (Sparrows), *Turdidae* (Thrushes), and *Parulidea* (Warblers). White-crowned Sparrow (*Zonotrichia leucophrys*) was the most commonly detected species on the 10-minute counts ($n = 413$ detections, 22.2% of all detections).

INTRODUCTION

The Central Alaska Network (CAKN) adopted a holistic view of network ecosystems and through the Vital Signs monitoring program, 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 *Fauna Distribution and Abundance* as one of its top three Vital Signs. Overall, CAKN wants to describe the distribution of fauna across the park's landscapes and track changes in both their distribution and abundance.

The *Fauna Distribution and Abundance* Vital Sign includes monitoring efforts for a suite of vertebrate species including birds. Birds make up >75% of the terrestrial vertebrates in CAKN and exhibit numerous characteristics that suggest their potential as ecological indicators at large scales (O'Connell et al. 2000) including high body temperature, rapid metabolism, and high ecological position in most food webs (Fancy and Sauer 2000, Peitz et al. 2002). Landbirds make up >70% of the bird species in CAKN. Of all the landbirds that occur in CAKN, *Passeriformes* (or passerines) are relatively easy and economical to detect and a single survey can cover many common species. The order *Passeriformes* includes well-known songbirds such as kinglets, flycatchers, thrushes, warblers, and sparrows. Two goals of the CAKN integrated monitoring program are to quantify the relationships between environment, vegetation, and songbird distributions across Denali's landscape and to detect changes in these distributions in response to ecological changes over time.

We developed a sampling design for CAKN where repeated measurements of the physical environment, vegetation and birds are made at randomly selected points (Roland et al. 2003). This design allows for detection of changes in the ecosystem at a landscape scale over time. The sampling design is comprised of five rows of five points, all 547 yards (500 m) apart, arranged in a grid pattern at each study site. These “minigrids” are arranged on a macro-grid with 10 or 20 km spacing (Figure 1). By utilizing a randomized site selection procedure, the program provides unbiased data about the status and trend of park resources over large spatial scales.

Passerine monitoring objectives. The passerine bird monitoring component of the CAKN Vital Signs monitoring program has three primary objectives:

1. Calculate densities of common passerines, assess variation in annual estimates of density, and detect trends in the density of as many passerines as possible during the breeding season.
2. Track changes in the breeding season composition and distribution of passerines.
3. Assess responses of passerine communities (composition, abundance, distribution) to changes in vegetation structure and composition.

The purpose of this annual report is to describe fieldwork conducted in 2006, provide a summary of the data collected in 2006, make recommendations for future work, and describe work to be completed in 2007.

METHODS

The sampling frame for the CAKN passerine monitoring in Denali consists of 24 minigrids located between the Parks Highway (eastern boundary) and the Kantishna area (western boundary) on the north side of the Alaska Range (Figure 1). These minigrids are accessible by foot travel from the Denali park road. During the first three year period, 2006 to 2008, we will sample 24 minigrids located along the Denali park road (Figure 1) by sampling points on 8 unique minigrids each year. The second sampling rotation is expected to begin in 2009.

The 2006 survey team consisted of Jeff Wells (National Park Service), Mike Knoche (National Park Service), Kate Simon (Alaska Bird Observatory), and Anna Jensen (Alaska Bird Observatory). All team members completed an intensive two-week distance sampling and bird identification training program from 15 to 26 May 2006. The first week of the training was held in Fairbanks and the second week of the training was held in Denali. I was the training program instructor.

Survey methods. Two 2-person field crews to complete the surveys in 2006. Each two-person field crew consisted of one observer, who conducted the survey, and one recorder, who recorded the detections of the observer and other environmental data on standardized data sheets. Surveys were conducted only under conditions of good visibility, little or no precipitation, and light winds. Surveys were completed between 0300 and 0900 from 1 and 21 June and corresponded with peak singing times for most species of passerines in interior Alaska.

We used point transect sampling (Buckland et al. 2001) for all surveys. At each sampling point, the observer estimated the horizontal distance between them and the detection using a laser rangefinder and identified the bird to species during a 10-minute sampling period. All birds seen or heard at each sampling point were recorded during in one of four time intervals (0 to 3 min, $3 \leq 5$ min, $5 \leq 8$ min, and $8 \leq 10$ min) and one of 13 distance intervals (10 m intervals from 0 to 100-m, 25 m intervals from 100 to 150-m, and >150 m). Additionally, the type of detection (e.g., singing, calling, visual) was recorded. For most species, each individual bird was recorded as a separate observation. For species that occurred in clusters or flocks, the observer estimated the distance to the cluster or flock, not the individual bird.

During the 10-minute surveys, we attempted to get an “instantaneous count” of the birds present. Our survey method took into account the fact that birds closer to the observer had a higher probability of detection (if they were not flushed) than birds farther from the observer and that different species had different detection functions (i.e., the probability of detecting a bird at different distances from the observer).

After completing each 10-minute survey, the observers navigated to the next sample point using a map, compass, and hand-held Global Positioning System (GPS). Crew members recorded all species observed between points on standardized data sheets.

Scientific names of species mentioned in this report are listed in Appendix A and not within the text of this report. This list incorporates changes made in the 42nd, 43rd, 44th, 45th, 46th, and 47th Supplements to the Check-list, as published in *The Auk* 117: 847-858 (2000); 119:897-906 (2002); 120:923-932 (2003); 121:985-995 (2004); 122:1026-1031 (2005); 123:926-936 (2006).

RESULTS AND DISCUSSION

This was the first year of the three year sampling rotation for this project. Our sampling target for 2006 was 8 minigrids ($n = 200$ points). We sampled 194 points on 8 minigrids ($>97\%$ sampling success in 2006) but could not sample 6 points because of unstable terrain or river-crossings (Table 1). All sampling occurred from 1 to 21 June 2006 between the hours of 0300 and 0915. Most of the minigrids required two days to sample all accessible points; however, two minigrids required only one day and one minigrid required three days because of weather delays. At most minigrids, the team sampled more points on the first day of sampling than on the second day of sampling (Table 1). Trip reports and photographs of the grids are in Appendices B and C.

The surveyors detected 1859 birds at 1782 detection events on 8 minigrids in 2006 (Table 2). Species richness ranged from 14 to 25 species per minigrid and 3.8 to 6.7 species per point (Table 2). Most detections were of individual birds (99.3%); surfbird and White-winged Crossbill were the only species detected in flocks. Over 50% of all detections occurred within the first three minutes of the 10-minute count (Figure 2). Detection types included singing (78.5%), flying (11.3%), calling (5.1%), and visual (5.3%). Less than 1% of all detections were made in the ≤ 10 meter distance interval (Figure 3). Approximately 52% of all detections were made ≤ 100 meters from the observer and 15% of detections were made > 150 meters from the observer (Figure 3).

Seventy-two species were detected on minigrids in 2006, including 54 species on the 10-minute point counts and 18 species on the minigrids but not on the 10-minute counts (Table 3). Eight species (Table 3) were detected on all grids.

Members of three families, *Emberizidae* (Sparrows), *Turdidae* (Thrushes), and *Parulidea* (Warblers) made up approximately 75% of all detections (Table 3). As in all other years, White-crowned Sparrow was the most commonly detected species on the 10-minute counts (Table 3).

RECOMMENDATIONS FOR FUTURE YEARS

1. Training. I made several changes to the pre-field season training program in 2006 including serving as the training program instructor, holding the 2nd week of training in Denali, and limiting participants to the Denali field crew. In past years, the training was conducted by the Alaska Bird Observatory in the Fairbanks area and the class often contained personnel working on various projects in Alaska. I felt that the training program benefited this year because I was able to focus my attention to those directly involved in this study and I was able to assess the strengths and limitations of each crew member. The crew members also benefited from this model since they gained valuable experience about working in Denali during the training period. I suggest that the principal investigator continues to be the instructor for this training, that the training is limited to those working in Denali, and that all of the training is held in Denali.

2. Optimizing sampling. The 2006 survey crew detected about 25% fewer species between points than crews in most other years. For the first time since the project began in 2001, the survey crew completed sampling of all points on a single minigrid in one day (Table 1); therefore, the decrease in the number of species detected between points may have resulted from the crew members missing species as they raced between sampling

points. This result suggests that we should standardized travel time between points to allow comparisons of species detected between points across years to develop more complete species lists for each minigrid. As such, I am recommending that each crew completes no more than eight points per grid per day and that they attempt to walk between points at a speed conducive to looking for birds, rather trying to get to a point as fast as possible.

In 2006, the crew used the two NPS cabins near Wonder Lake for housing during the early part of June. Although this provided the crew with some comfortable conditions, it minimized the amount of time that they made observation of birds on these grids. As such, I recommend that the crew establishes spike camps and camps on each minigrid rather than staying in cabins. This should result in the crew spending more time on each grid and should provide opportunities for developing more complete species lists for each grid. Because getting to the sampling areas takes much of our time, this would be a good way to optimize our sampling on each minigrid.

3. *Survey conditions.* We did not loose any sampling days due to inclement or poor survey weather; however, it appeared that unseasonably cold temperatures during early June influenced the singing frequency of birds. In the future, I recommend that no surveys are conducted if the temperature is $<0^{\circ}\text{C}$.

4. *Work schedule.* We experimented with a 10-day on and 4-day off schedule in 2006 because three of the four crew members were local folks who wanted to spend some time at home during June. This resulted in crew members making multiple trips back and

forth to Denali from Fairbanks and Palmer, which often left them tired during the first couple of days of surveying after their time off. Because crew members are working from about 1:00 am to 11:00 am daily during the survey period, it is difficult for them to adjust their schedules to a more normal day on their days off. As such, they end up being tired on their first few survey days after their days off. Given this, I do not recommend using a 10-day on and 4-day off work schedule for this project in the future. Because our sampling opportunities already are limited to 6 hours per day for a 30 day period (or 180 hours per year), I recommend that we work most days in June (with the appropriate over time and comp. time applied) and use weather days as our rest days. Once we complete sampling on all eight grids each year, then we can take a few days off before starting any other field work.

5. *Species not covered by this sampling design.* Although this sampling design is robust for sampling approximately 16 species of common passerines, there are 36 species of passerines and 5 species of woodpeckers that are not adequately sampled by this project. These include common resident species such as Gray Jay, Black-capped Chickadee, and Boreal Chickadee who may start nesting earlier than other passerines, species such as Say's Phoebe and Northern Wheatear that occur at low densities, or species such as Cliff Swallow and Black-billed Magpie that occur in clumped distributions. To meet the objectives of the CAKN monitoring program, I recommend that we begin to explore ways to sample some of these other species, particularly resident species and those identified as species of conservation concern (e.g., Olive-sided Flycatcher, Blackpoll Warbler, and Rusty Blackbird). This may include conducting targeted sampling in

specific habitats and conducting multiple surveys across the nesting season to include early nesting species.

Fieldwork in 2007. The 2007 survey team will consist of one NPS biological technician, one Alaska Bird Observatory field biologist, and two Alaska Bird Observatory interns. The distance sampling and bird identification training will occur from 14 May to 25 May 2007 in Denali and I will be the instructor. Surveys will occur in Denali between 1 and 30 June 2007. We will survey 8 unique minigrids in 2007 and will sample in specific habitats for species of concern after we complete the minigrids.

ACKNOWLEDGMENTS

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TABLE 1. Sampling schedule for Central Alaska Network passerine monitoring project, Denali National Park and Preserve, Alaska, 2006.

Minigrid name	Access type	Sample dates	# points sampled		
			Day 1	Day 2	Day 3
Wonder Lake	Foot travel	1 to 2 June	18	2	0
Lower Thorofare	Foot travel	2 to 5 June	10	14	1
Upper Moose Creek	Foot travel	5 to 6 June	12	13	0
Lower Muldrow	Foot travel	7 June	24	0	0
Primrose	Foot travel	14 to 15 June	18	7	0
Polychrome	Foot travel	16 to 17 June	18	7	0
Upper Stony	Foot travel	18 to 19 June	15	10	0
Middle Teklanika	Foot travel	21 June	25	0	0

TABLE 2. Summary statistics for birds detected on 10-minute point transect surveys by minigrid, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

Minigrid name	Points surveyed	# birds	# species	Mean	Mean
				number of birds per point	number of species per point
Wonder Lake	20	202	24	9.3	5.5
Lower Thorofare	25	233	24	12.0	6.1
Upper Moose Creek	25	259	25	7.3	4.3
Lower Muldrow	24	169	16	9.4	5.2
Primrose	25	167	22	6.7	3.8
Polychrome	25	235	14	10.4	6.7
Upper Stony	25	294	17	11.8	6.2
Middle Teklanika	25	300	22	10.1	5.9

TABLE 3. Species detected on 10-minute counts on 8 minigrids, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

Common name	Detections		Minigrids		Points	
	n	%	n	%	n	%
American Wigeon	4	0.22	1	12.5	1	0.48
Northern Pintail	1	0.05	1	12.5	1	0.48
Willow Ptarmigan	38	2.04	5	62.5	29	13.81
Rock Ptarmigan	3	0.16	2	25.0	3	1.43
Common Loon	1	0.05	1	12.5	1	0.48
Horned Grebe	2	0.11	1	12.5	1	0.48
Northern Harrier	6	0.32	3	37.5	4	1.90
Sharp-shinned Hawk	1	0.05	1	12.5	1	0.48
Merlin	2	0.11	1	12.5	1	0.48
Peregrine Falcon	1	0.05	1	12.5	1	0.48
American Golden Plover	10	0.54	1	12.5	6	2.86
Spotted Sandpiper	1	0.05	1	12.5	1	0.48
Wandering Tattler	1	0.05	1	12.5	1	0.48
Lesser Yellowlegs	9	0.48	1	12.5	5	2.38
Upland Sandpiper	2	0.11	2	25.0	2	0.95
Surfbird	16	0.86	1	12.5	6	2.86
Least Sandpiper	6	0.32	2	25.0	3	1.43
Wilson's Snipe	4	0.22	3	37.5	4	1.90
Mew Gull	7	0.38	3	37.5	6	2.86
Northern Hawk Owl	1	0.05	1	12.5	1	0.48
Short-eared Owl	11	0.59	6	75.0	10	4.76
Olive-sided Flycatcher	5	0.27	2	25.0	5	2.38
Alder Flycatcher	3	0.16	1	12.5	2	0.95
Gray Jay	14	0.75	4	50.0	12	5.71
Black-billed Magpie	7	0.38	2	25.0	4	1.90
Common Raven	1	0.05	1	12.5	1	0.48
Horned Lark	23	1.24	2	25.0	13	6.19
Black-capped Chickadee	1	0.05	1	12.5	1	0.48
Boreal Chickadee	4	0.22	2	25.0	4	1.90
Ruby-crowned Kinglet	33	1.78	3	37.5	22	10.48
Arctic Warbler	43	2.31	2	25.0	24	11.43
Northern Wheatear	3	0.16	1	12.5	1	0.48
Gray-cheeked Thrush	21	1.13	3	37.5	19	9.05

TABLE 3 (cont'd). Summary of species detected on the 10-minute counts on 8 minigrids, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

Common name	Detections		Minigrids		Points	
	n	%	n	%	n	%
Swainson's Thrush	41	2.21	4	50.0	29	13.81
Hermit Thrush	25	1.34	8	100.0	19	9.05
American Robin	42	2.26	8	100.0	38	18.10
Varied Thrush	40	2.15	3	37.5	30	14.29
American Pipit	28	1.51	3	37.5	16	7.62
Orange-crowned Warbler	74	3.98	8	100.0	61	29.05
Yellow Warbler	1	0.05	1	12.5	1	0.48
Yellow-rumped Warbler	32	1.72	4	50.0	23	10.95
Blackpoll Warbler	1	0.05	1	12.5	1	0.48
Wilson's Warbler	151	8.12	8	100.0	88	41.90
American Tree Sparrow	188	10.11	8	100.0	98	46.67
Savannah Sparrow	128	6.89	8	100.0	85	40.48
Fox Sparrow	159	8.55	7	87.5	91	43.33
Lincoln's Sparrow	1	0.05	1	12.5	1	0.48
White-crowned Sparrow	413	22.22	8	100.0	162	77.14
Golden-crowned Sparrow	4	0.22	3	37.5	5	2.38
Dark-eyed Junco	67	3.60	5	62.5	40	19.05
Lapland Longspur	3	0.16	1	12.5	2	0.95
Snow Bunting	2	0.11	1	12.5	2	0.95
White-winged Crossbill	76	4.09	2	25.0	9	4.29
Redpoll sp. ^a	98	5.27	8	100.0	61	29.05

^a All redpolls are recorded as unknown redpoll species since we cannot determine if the detection is a Common Redpoll or a Hoary Redpoll.

TABLE 4. Species detected on minigrids, but not on the 10-minute point counts, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

Common name	Minigrids
Northern Shoveler	2
Green-winged Teal	1
Scaup sp.	1
Harlequin Duck	1
Common Merganser	1
Spruce Grouse	1
Red-tailed Hawk	1
Golden Eagle	2
Semipalmated Plover	1
Solitary Sandpiper	1
Long-tailed Jaeger	1
Northern Shrike	3
Violet-green Swallow	1
Northern Waterthrush	1

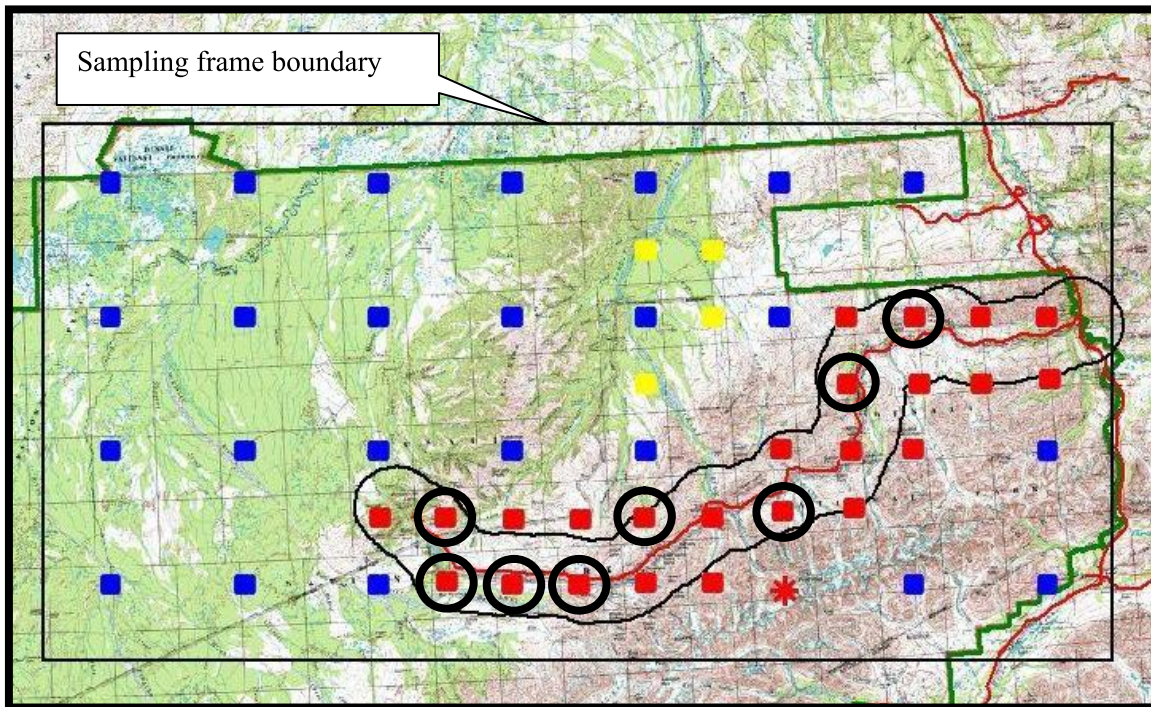


FIGURE 1. Sampling frame for vegetation and passerine monitoring projects in the Central Alaska Network on the north side of the Alaska Range in Denali National Park and Preserve, Alaska. The blue grids and most of the red grids will be sampled by the vegetation monitoring program. The red grids will be sampled by the passerine monitoring project. The red grids are based on a 10-km base grid within the Denali park road corridor, an area of high management concern. The yellow grids were sampled as part of the Toklat Basin study. The eight minigrids sampled in 2006 are circled in black and are front east to west: Primrose, Middle Teklanika, Polychrome, Upper Stony, Lower Muldrow Glacier, Lower Thorofare, Wonder Lake and Upper Moose Creek (north of Wonder Lake).

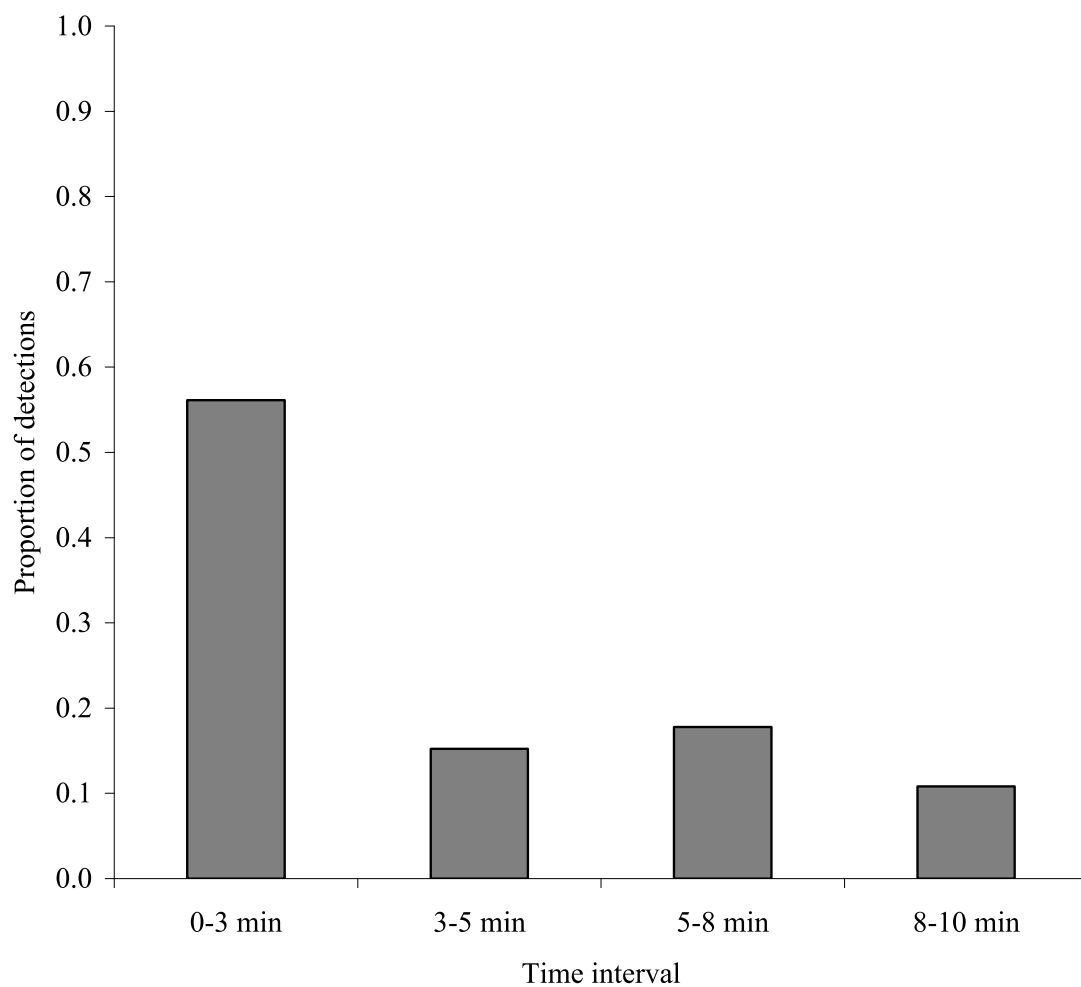


FIGURE 2. Distribution of detections of birds by time interval, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

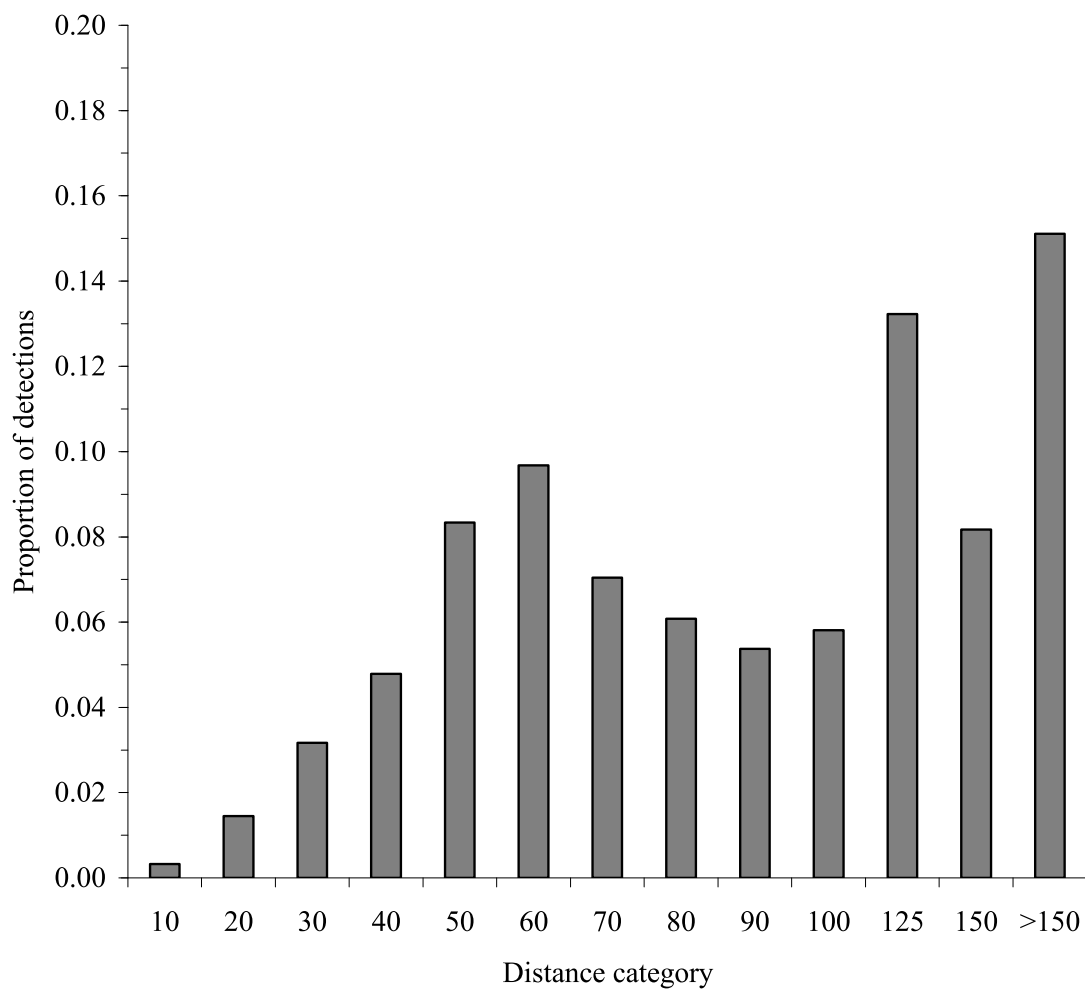


FIGURE 3. Distribution of detections of birds by distance intervals, Central Alaska Network passerine monitoring program, Denali National Park and Preserve, Alaska, 2006.

APPENDIX A. Common and scientific names of species mentioned in this report.

Common name	Genus species
American Wigeon	<i>Anas americana</i>
Northern Shoveler	<i>Anas clypeata</i>
Northern Pintail	<i>Anas acuta</i>
Green-winged Teal	<i>Anas crecca</i>
Scaup sp.	<i>Aythya sp.</i>
Harlequin Duck	<i>Histrionicus histrionicus</i>
Common Merganser	<i>Mergus merganser</i>
Spruce Grouse	<i>Falcapennis canadensis</i>
Willow Ptarmigan	<i>Lagopus lagopus</i>
Rock Ptarmigan	<i>Lagopus muta</i>
Common Loon	<i>Gavia immer</i>
Horned Grebe	<i>Podiceps auritus</i>
Northern Harrier	<i>Circus cyaneus</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Merlin	<i>Falco columbarius</i>
Peregrine Falcon	<i>Falco peregrinus</i>
American Golden-Plover	<i>Pluvialis dominica</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>
Spotted Sandpiper	<i>Actitis macularius</i>
Solitary Sandpiper	<i>Tringa solitaria</i>
Wandering Tattler	<i>Tringa incana</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Surfbird	<i>Aphriza virgata</i>
Least Sandpiper	<i>Calidris minutilla</i>
Wilson's Snipe	<i>Gallinago delicata</i>
Mew Gull	<i>Larus canus</i>
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>
Northern Hawk Owl	<i>Surnia uhula</i>
Short-eared Owl	<i>Asio flammeus</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Alder Flycatcher	<i>Empidonax alnorum</i>
Northern Shrike	<i>Lanius excubitor</i>
Gray Jay	<i>Perisoreus canadensis</i>
Black-billed Magpie	<i>Pica hudsonia</i>
Common Raven	<i>Corvus corax</i>

APPENDIX A (cont'd). Common and scientific names of species mentioned in this report.

Common name	Genus species
Horned Lark	<i>Eremophila alpestris</i>
Violet-green Swallow	<i>Tachycineta thalassina</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Boreal Chickadee	<i>Poecile hudsonica</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Arctic Warbler	<i>Phylloscopus borealis</i>
Northern Wheatear	<i>Oenanthe oenanthe</i>
Gray-cheeked Thrush	<i>Catharus minimus</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
American Robin	<i>Turdus migratorius</i>
Varied Thrush	<i>Ixoreus naevius</i>
American Pipit	<i>Anthus rubescens</i>
Orange-crowned Warbler	<i>Dendroica celata</i>
Yellow Warbler	<i>Dendroica petechia</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>
American Tree Sparrow	<i>Spizella arborea</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Fox Sparrow	<i>Passerella iliaca</i>
Lincoln's Sparrow	<i>Melospiza lincolnii</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Lapland Longspur	<i>Calcarius lapponicus</i>
Snow Bunting	<i>Plectrophenax nivalis</i>
Rusty Blackbird	<i>Euphagus carolinus</i>
White-winged Crossbill	<i>Loxia leucoptera</i>
Redpoll sp.	<i>Carduelis sp.</i>

APPENDIX B. Trip Reports for Central Alaska Network, Long-term Passerine Monitoring Program, 2006 Season Summary

Summary by Jeff Wells

Wonder Lake. The Wonder Lake minigrid is south of Wonder Lake; the southernmost points of the grid border the McKinley River. We based out the cabins locally known as “Dalle-MolleVille” along the park road. To gain access to the grid, we drove to the McKinley Bar Trail, which runs along the eastern edge of the grid. The drive took approximately 10 minutes and it took about 45 minutes of easy hiking to reach the nearest points on the grid. The grid was surveyed on June 1 and 2; as a result of a relatively late spring and early sampling dates, many snowfields persisted along the McKinley Bar Trail. We sampled the points in an east-west transect; however, it would be advisable to survey the furthest points first as to leave any remaining points nearer to the parking location. Points 1-4 and 6 were located either in or across the McKinley River and were not accessible. Point 5 required the fording of several smaller streams on the McKinley Bar and was located on the river bar over 150 meters from the nearest vegetation. All but two of the points were completed on the first day of sampling; thus, on the second sampling day Mike Knoche and Kate Simons completed the final two points while Jeff Wells and Anne Jensen began sampling the next grid. The two points that remained were located near the McKinley River and took the entire morning to complete.

Lower Thorofare. The Lower Thorofare minigrid is located adjacent to the park road approximately 10 miles east of Wonder Lake. We based out of the “Dalle-MolleVille” cabins and drove daily to the grid. The drive took roughly 20 minutes and the nearest points to the road (northernmost points) were $< \frac{1}{2}$ km off of the park road. The grid was sampled on June 2, 4, and 5 and all 25 points were completed. The points were surveyed in a north-south transect, walking from the road down to the McKinley River and back. The southernmost points are located on a gravel bar along a branch of the McKinley River. The grid was dominated by dwarf birch and willows along with a stand of cottonwoods on the southern edge near the McKinley River. Several small ponds dot the landscape as well. Walking between points is relatively easy because of the low vegetation and little elevation gain or loss. For our sampling period, the weather was unseasonably cold, which in conjunction with wind, fog, and snow caused a weather day on June 3. One point remained to be surveyed on June 5; thus, Mike Knoche and Anna Jensen finished this point and Kate Simons and Jeff Wells began the next grid.

Upper Moose Creek. The Upper Moose Creek minigrid is northeast of Camp Denali on the south facing slope; the southernmost points are situated along Moose Creek while the northernmost points are above tree line near the top of the ridge. For this grid, we based out of the “Dalle-MolleVille” cabins and drove daily to the grid (about 15 minute drive). We parked in the lower parking lot of the North Face Lodge. All 25 points on the grid were completed on June 5 and 6. Jeff Wells and Kate Simons surveyed the higher points (northern points) while Mike Knoche and Anna Jensen surveyed the lower points (southern points). For both teams, the points were surveyed in an east-west transect so as

to minimize elevation gain/loss. Mike Knoche and Anna Jensen accessed the lowest points on the grid by driving east along the gravel road that leaves the North Face Lodge parking lot. In this way, they were able to drive close to the points, drastically decreasing travel time. Eventually, a beaver dam prevents further travel on the road unless one wishes to navigate 2-3 ft water. Points 1-4 are all located south of Moose Creek. The creek is easy to cross and can be traversed with rubber boots without getting wet feet; however, the crossing location must be chosen carefully. The higher points on the grid are most easily accessed via Camp Denali's "Cranberry Ridge" trail. (A Camp Denali trail map is located in the minigrid map file and should be consulted before hiking begins. From Camp Denali, a hike of about one hour is required to reach to the westernmost points. To save time, it is recommended to drop the team that is headed to the upper points off at Camp Denali before parking in the lower parking lot. Jeff Wells and Kate Simon took wrong trails on both sampling days, significantly increasing the travel time to the first point. Overall, the grid is very steep and brushy. Alder, willow, and dwarf birch thickets dominate all but the upper points of the grid, making travel time between points relatively long.

Lower Muldrow Glacier. The Lower Muldrow Glacier minigrid is along the park road about 15 miles east of Wonder Lake. The southern points are situated on the Muldrow Glacier while the northern points are located near or on the road. We based out of the "Dalle-MolleVille" cabins and drove daily to the grid. The drive took about 45 minutes and we parked on the shoulder of the road. We surveyed 24 of the 25 points on June 7. Point 5 was located on the Muldrow Glacier in a hole on an overhanging leading edge and was unsafe to visit. The points were surveyed in a south-north transect, and there was very little elevation gain/loss throughout the grid. Roughly 10 points were positioned on the glacier, and travel between these points was slowed by the rough terrain of the glacier. To get to the points on the glacier, we crossed a small stream. The grid was dominated by low shrubs and fairly level terrain, both of which allowed quick travel between points. Several points are located north of the road, and travel between these points is most easily achieved by walking on the road. Point 24 was situated in the middle of the road, but the survey was completed from the side of the road.

Primrose Ridge. The Primrose Ridge minigrid is on the top of Primrose Ridge. We parked the truck on the shoulder of the park road near the rest stop located about 2 miles west of Savage River. There is a well-worn trail that begins from the north side of the park road across from the large rest stop. The trail leads to the top of the ridge; it took us about 2 hours to reach the top. We set up camp about 500 meters east of point 11. Water was scarce, but we found some large puddles that met our water needs. All 25 points were surveyed on June 14 and 15. The points were surveyed in an east-west transect to minimize elevation gain/loss; however, there was significant elevation changes as a result of gorges between points on the northern side of the ridge top. Furthermore, substantial altitude is lost when walking to the northern points. The grid as a whole is very open and there is little brush to contend with. The top of the ridge is fairly level, which allows for easy travel between points. Multiple large snowfields existed throughout the grid, especially on the northern side of the ridge. Wind was not much of an issue for us, but heavy smoke on the morning of June 15 did cause some delay.

Polychrome Glacier. The Polychrome Glacier minigrid is located on the north slopes of the mountains near the Polychrome Glaciers south of the Polychrome rest stop on the park road. We parked the truck at a small pullout situated next to a creek about 1 mile west of the Polychrome rest stop. We hiked down the creek bed and across the flats to the grid; with camping gear the hike took between approximately 1 ½ hours. We camped approximately 1.4 km west of point 23 near the westernmost glaciated creek coming out of the mountains. We hid our tents in tall willows so we were out of sight of the road, but in the future a camping spot closer to the grid should be found. Anna Jensen found a potential camping spot between points 24, 25, 19, and 20. All 25 points were surveyed on June 16 and 17. The grid was a mix of tall shrub (predominantly willow) and low open shrub. The southern points are slightly higher up in the hills at the edge of the mountains, but other than this, there is little elevation gain or loss. Our survey route was a mix of south-north and east-west directional travel as elevation gain/loss was not a major issue to content with. Travel between points was relatively quick as a result.

Upper Stony Creek. The Upper Stony minigrid is about 2 miles north of the park road along Stony Creek. We parked the truck in the pullout next to the bridge over Stony Creek and walked up the creek side to reach the grid. With camping gear, this took about 2 hours, but it was a very easy, level walk. We camped on Stony Creek between points 3 and 4 on the southern edge of the grid. This worked well and the close proximity to the grid allowed for short travel time to the first points. We sampled all 25 points on June 18 and 19. On the first morning we tackled the higher elevation points located on the western edge of the grid on the west side of Stony Creek. There are 10 points on this mountainside. Many of these points were on steep talus slopes and as such, significant travel time between points was needed. These points were characterized by high shrubs (largely willows). The rest of the points are east of Stony Creek and are on relatively flat, low shrub habitat. Stony Creek was easily crossed with rubber boots.

Middle Teklanika River. The Middle Teklanika minigrid is across the Teklanika River from the Teklanika campground. Instead of parking the truck at the Teklanika Bridge and hiking up the riverbed to the grid, we parked on the shoulder of the park road approximately 1 mile east of the Teklanika campground, crossed the Teklanika River and hiked in to the grid. Although this saved us several miles of walking, this route is only useful when water level in the Teklanika is low enough to allow for safe river crossings. Attempts to cross the Teklanika River during higher water could be very dangerous. For instance, our on trip into the grid, the river was about mid-thigh; however, on our trip back to the road, the river was considerably higher (waist). We camped near the middle of the grid in a mature spruce forest on a small creek running through the middle of the grid. This worked exceptionally well, as we were able to get all 25 points surveyed on June 21. Mike Knoche and Anna Jensen began at point 5 and Kate Simon and Jeff Wells began at point 21. Each team worked in a north-south direction and met up in the middle of the grid at the end of the morning. There are some steep ridges on the southern edge of the grid, but as a whole the grid is fairly level and easy to navigate. The grid is a mix of spruce forest, high shrubs (alder and willow), and low open shrub.

APPENDIX C. Photographs of some of the minigrids sampled for the Central Alaska Network passerine monitoring project, Denali National Park and Preserve, Alaska, 2006.



Figure A-1. Spring conditions during training week on Primrose Ridge, 23 May, 2006. NPS photograph by Jeff Wells.



Figure A-2. View to south from Primrose Ridge, 23 May, 2006. NPS photograph by Jeff Wells.



Figure A-3. Anna Jensen prepares for a survey along the McKinley River on the Wonder Lake minigrid, 1 June 2006. NPS photograph by Jeff Wells.



Figure A-4. Jeff Wells enjoys the view from the top of Upper Moose Creek minigrid, 2 June 2006. NPS photograph by Jeff Wells.



Figure A-5. A cool morning (note thin layer of ice on the puddle) on the Upper Moose Creek minigrid, 5 June 2006. NPS photograph by Jeff Wells.



Figure A-6. Muldrow glacier and a windy Mt. McKinley from the Muldrow Lower minigrid, 7 June 2006. NPS photograph by Jeff Wells.



Figure A-7. Looking north to a smoky sunrise, Primrose Ridge minigrid, 14 June 2006. NPS photograph by Jeff Wells.



Figure A-8. Kate Simons takes a break at the end of the sampling day, Polychrome Glacier minigrid, 17 June 2006. NPS photograph by Jeff Wells.



Figure A-9. Mike Knoche ponders his route along Stony Creek, 18 June 2006. NPS photograph by Jeff Wells.



Figure A-10. Home-sweet-home; spike camp on Stony Upper minigrid, 18 June 2006. NPS photograph by Jeff Wells.