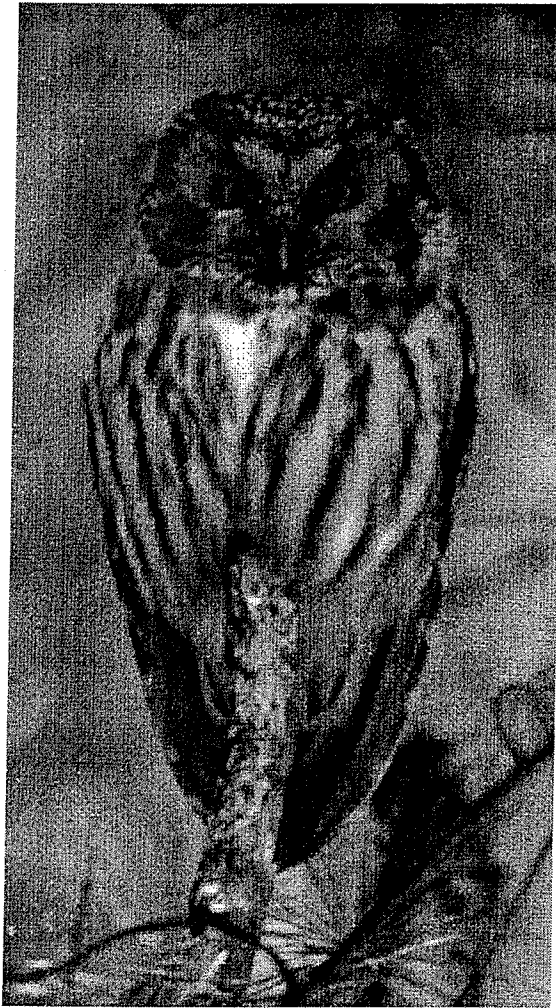


Owl and Wintering Bird Surveys,
Yukon-Charley Rivers
National Preserve

1999 Progress Report



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EXECUTIVE SUMMARY

Owls.--We conducted owl surveys in remote areas of Yukon-Charley Rivers National Preserve in March/April 1999. Owl presence, location, call activity, and environmental data were recorded during silent 8-minute count periods at stops 0.8 km apart along snowmobile transects. Transect lengths varied from 18.4 km (24 stops) to 12 km (16 stops). Surveys began at sunset and were completed within 4-5 hours. Distance estimates and direction were recorded for all owls detected in order to assign each bird to an ecological unit and to keep track of the distance over which individuals were heard.

We recorded 55 unique detections for boreal owls and 8 for great-horned owls over 180 stops. Detection rates for both species were high 1-4 hours after sunset, with boreal owl calls peaking 1-2 hours after sunset.

71% of 55 boreal owl detections and 63% of 8 great-horned owl detections occurred when the moon was visible to the observer; the moon was visible at 39% of 180 stops. However, neither boreal owl nor great-horned owl call rates (number of calls per 8-minute period) appeared to vary with moon visibility.

Count period data showed that 31% of all boreal owls and 38% of all great-horned owls were heard only in the last 3 minutes of the 8-minute count period. If we had stopped the count at 5 minutes, we would have missed nearly 1/3 of all detections.

Methods are being refined and a second field season is planned for March 2000.

Wintering Birds.--Concurrent with the owl surveys, we conducted diurnal point count surveys for wintering birds. All birds heard and seen during a 5-minute period were recorded along with a distance estimate from the observer to the bird. Point counts were conducted every 200 m in treed habitats and 300 m in open habitats along the transect; a transect consisted of 10-12 points. Earth cover classes were used to classify habitat within 50 m of the observer.

Fourteen species were detected during count periods on these surveys; two additional species were detected while traveling between points on the transects. American dippers were found in open water leads on the Charley and Nation Rivers while traveling by snowmobile between study areas, and snow buntings were identified on the Yukon River on March 25. Most commonly detected species included common redpolls, gray jays, white-winged crossbills, and boreal chickadees. Peak bird detection was between 2 and 4 hours after sunrise.

Seventy percent of the birds detected were within 60 m of the observer. Birds commonly heard at distances >70 m included common ravens and northern three-toed woodpeckers. The single northern goshawk and 1 of the 2 hairy woodpeckers detected were also >70 m from the observer.

Species richness was highest in the Yukon River Valley--Nation/Kandik/Bonanza Tributary Valleys ecounit (YV6). Bird abundance and species richness were low in the shrub categories and high in both the open needleleaf and open mixed needleleaf/deciduous land cover types.

A second field season is being planned for March 2000.

INTRODUCTION

Yukon-Charley Rivers National Preserve was established in 1980 by the Alaska National Interest Lands Conservation Act [Title II, Sec. (10)] to maintain the environmental integrity of the Charley River watershed and the populations of fish and wildlife within its borders. The complex geology, climatic conditions, natural fire regime and discontinuous permafrost soils have produced a diverse mosaic of taiga and tundra habitat types. The sedimentary rock record in the preserve is nearly complete, with layers dating from the Precambrian to the present. North of the Yukon River lies the oldest terrain in Alaska, which is likely part of the original continental margin (G. Mull, Alaska State Division of Geological and Geophysical Surveys, personal communication).

The diverse landscape within the preserve provides habitat for a vast array of bird species. The presence of 163 species (many of them Neotropical migrants) have been documented in the preserve (National Park Service NPSpecies database 1999). Aberrant species from more southern and eastern temperate regions are often found in the preserve because of its geographic location. The preserve is part of the Yukon River flyway, one of the natural corridors funneling migrating birds to and from Alaska during spring and fall (Skip Ambrose, U.S. Fish and Wildlife Service, personal communication).

Despite the apparent importance of the preserve to birds, information on species distribution and abundance is almost non-existent for most geographic areas and seasons. The most complete information exists for peregrine falcons (*Falco peregrinus*), whose nesting success and productivity have been studied along the Yukon and Charley Rivers since the early 1970's (Ambrose 1997). Yukon-Charley Rivers National Preserve supports the highest known density of the recently delisted American peregrine falcon (*F. p. anatum*) in North America.

For other species, information is limited to inventory lists compiled opportunistically by NPS since 1980 in a few areas of the preserve. In the mid-1980s, six line transects were established along the Yukon River to assess summer passerine abundance in riparian areas surrounding peregrine aeries (Hunter et al. 1988). Information on summer abundance was also obtained from two MAPS (Monitoring Avian Productivity and Survival) mistnetting stations at Coal Creek Camp in 1994 (Fox and App 1994). Finally, two off-road point count transects were established in 1997 as part of a long-term monitoring effort initiated by Boreal Partners in Flight (McKee 1999). These efforts are minuscule in comparison to the vast amount of land in the preserve.

In 1998, Yukon-Charley Rivers National Preserve was selected to receive funding from the National Park Service (NPS) Servicewide Inventory and Monitoring Program to conduct inventory work on birds. A study plan was submitted and approved in May 1998 (National Park Service 1998). The goals for the inventory project were to: 1) design and implement an avian inventory plan in Yukon-Charley Rivers National Preserve with methodology suitable for large parks and preserves that have minimal access and 2) develop a long-term monitoring protocol for birds in the preserve. To achieve these goals, the following objectives are being pursued:

1. Collect and summarize all existing information on the distribution and abundance of birds in Yukon-Charley Rivers National Preserve;

2. Obtain geographic data layers needed to characterize habitat (vegetation, hydrology, fire history, and ecological subsections);
3. Determine associations between bird abundance by species and habitat characteristics for at least 90% of the bird species estimated to exist in the preserve during the breeding season; extrapolate this information to obtain parkwide abundance and distribution estimates;
4. Examine distribution and relative abundance for wintering birds;
5. Document owl species presence/absence by ecological subsection; and
6. Design a bird monitoring program for the preserve.

This report presents preliminary data from owl and wintering bird surveys conducted in March/April 1999; these surveys were implemented to address objectives 4 and 5 above. A second field season is scheduled for March/April 2000.

John Burch, Chris McKee, and Steve Ulvi provided camaraderie and amusement (plus some useful field assistance). The authors are still trying to determine if they appreciated their contributions to the project.

STUDY AREA

Yukon-Charley Rivers National Preserve is a 2.5 million acre NPS unit located in eastern interior Alaska, just south of the Arctic Circle, and bordering Yukon Territory, Canada (Fig. 1). Elevation in the preserve rises from 220 m at the Yukon River to 2000 m in the mountains to the south. The semi-arid continental climate in the preserve area results in annual precipitation means of 30.2 cm in the eastern portion of the preserve and 20.9 cm in the western portion of the preserve [National Weather Service data for Circle, AK (1957–1997) and Eagle, AK, (1949–1997)]. Mean daily temperatures range between 15.6°C in July and –25°C in January.

The preserve is within the subarctic boreal forest zone and major tree species include: black spruce (*Picea mariana*), white spruce (*P. glauca*), aspen (*Populus tremuloides*), and balsam poplar (*Populus basamifera*). Willow (*Salix* spp.) and alder (*Alnus* spp.) are the most common shrub species. Major forest communities found in the preserve are spruce forest, mixed spruce–broadleaf forest, and broadleaf deciduous forest. Black spruce woodland, mixed spruce–broadleaf woodland, and broadleaf woodland are the major woodland communities. Wetland (bogs, marshes, and lake/open water areas) and alpine tundra communities are prominent in the preserve.

Surveys were conducted in 2 primary areas of Yukon-Charley Rivers National Preserve: Coal Creek/Charley River vicinity (March 14–20) and the Nation River/Yukon River area (March 21–25; Figs. 2 and 3). These areas were selected based on geographic location and ease of access. Ecological subsection units surveyed in the Coal Creek area were Biederman Hills, Thanksgiving Loess, Tintina Hills, Charley Foothills, Yukon River Valley units YV1, YV2, YV3, and YV5, and the Upper Charley Mountain Tundra units MT2 and MT3. Ecological subsection units surveyed in the Nation River area included the Hard Luck Lowland, Ogilvie Foothills, Tintina Hills, and Yukon River Valley Units (YV1, YV3, and YV5). Ecological subsection units used in this study are described in D. Swanson (1999).

METHODS

Owl Surveys

All owls detected and the number of calls they made during a silent (not using broadcast calls) 8-minute count period were recorded at stops 800 m (0.5 miles, straight-line distance) apart along snowmobile transects. Initial transect lengths were 18.4 km (12 miles; 24 stops) but they were shortened to 12 km (8 miles; 16 stops) due to time constraints and observer fatigue. The 8-minute count periods were broken into 0–3 minute, 3–5 minute, and 5–8 minute intervals to evaluate additional information gains as the survey period increased. The number of calls heard per individual bird was recorded for each interval.

Distances from observers to calling owls were estimated and compass bearings on call directions were recorded to examine species detection distances, to identify which ecological unit owls were calling from, and to minimize double counting of individual birds. The estimated distance to the owl, the compass direction of the call from the observer, and the observer's geographical location were plotted in ARCVIEW to determine owl locations. Moon visibility, wind speed, cloud cover, and precipitation conditions were recorded at each survey point as well as Global Positioning System (GPS) locations and the ecological unit at each point. Transects often passed through more than 1 ecounit. Owl surveys started at sunset and were completed within 4–5 hours. Sunset/sunrise times for the preserve were determined from military astrological charts generated for Eagle, AK and Circle, AK from website <http://tycho.usno.navy.mil/srss.html>.

To collect information on seasonal shifts in owl species and/or individuals calling, a second survey effort took place April 5–9, 1999. The three owl survey transects based out of Coal Creek Camp were repeated using the same stops and survey methods.

Tape playbacks were not used to elicit owl calls in this survey to avoid drawing owls into areas or habitats that may not have been part of their normal territory. Though taped playbacks are effective for determining owl species presence/absence data (Lundberg 1978), there are increased risks of predation on smaller owls by larger owls, disruption of foraging and courtship activities, and possible luring of the female from the nest (Smith 1987, Takats 1999).

Scientific names for owl species are given when first discussed in the text.

Wintering Bird Surveys

Wintering passerine birds, raptors, and diurnal owls were surveyed during daylight hours using off-road point count techniques. Snowshoes were used to travel along a transect running up or down elevation gradients or perpendicular to the river on flood plains. Point counts were conducted every 200 m in treed habitats and a minimum of 300 m in open habitats along the transect. Transects consisted of 10–12 point count stops. At each stop, all birds detected during a 5-minute period were recorded along with the estimated distance interval between the bird and the observer. Distance estimation intervals used were: 0–10 m, 11–20 m, 21–30 m, 31–40 m, 41–50 m, 51–60 m, 61–70 m, and >70 m. A GPS location and ecological unit descriptor was recorded for each point count stop. Earth cover classes (Ducks Unlimited 1998) were used to classify vegetation

at each point count stop. Bird species detected between stops that were not detected during a point count event were recorded. Surveys started within 1 hour after sunrise, which changed from 0641 h to 0611 h between March 16 and March 24.

In order to establish winter bird survey protocols, we ran surveys during both morning and afternoon periods. After completing a morning transect, we took a break and then ran the transect backwards in the afternoon, stopping at the same point count stations.

Scientific names for all bird species detected during point count periods on the winter bird surveys are listed in Table 3; scientific names for other species detected during the project or discussed in this report are given in the text when first discussed.

Statistics

Differences in mean calling rates for great-horned owls (*Bubo virginianus*) was tested using a one-tailed Student's t-test assuming equal variance.

RESULTS

Owl Surveys

Seven owl surveys were conducted in the preserve March 14–24, 1999 (Table 1; Figs. 2–3). Forty-nine boreal owls (*Aegolius funereus*) and 5 great-horned owls were detected during the March surveys for a detection rate of 1.9 boreal owls/survey hour (0.36 birds/point) and 0.16 great horned owls/survey hour (0.04 birds/point).

The 3 transects radiating from Coal Creek Camp were re-surveyed April 6–8, 1999 and produced 6 boreal owls and 3 great-horned owls (Table 1); 10 boreal owls and no great-horned owls had been recorded on these routes during the March surveys. April survey detection rates were 0.47 boreal owls/survey hour (0.12 birds/point) and 0.23 great-horned owls/survey hour (0.06 birds/point); comparatively, these same 3 routes produced 0.15 boreal owls/point and no great-horned owls in March.

Detectability.—Peak detection times during the sampling period (sunset to 5.5 hours after sunset) for both boreal and great-horned owls were 1–4.5 hours after sunset [Fig. 4(a)]; the corresponding number of point counts conducted by half-hour intervals is graphed in Fig. 4(b). Sunset times during the first field session changed from 1833 h on March 14 to 1856 h on March 20. The change to daylight-saving time occurred on April 4, so sunset times for the second field session increased from 2047 h on April 6 to 2057 h on April 8. Seventy-one percent of the boreal owl detections ($n=55$ detections) and 63% of the great-horned owl detections ($n=8$ detections) occurred when the moon was visible to the observer; the moon was visible at 39% of the stops during the study ($n=217$). Boreal owl call rates (number of calls per 8-minute period) did not appear to vary with moon visibility. The percentage of boreal owls producing >20 calls per 8-minute period was 25% when the moon was not visible ($n=16$ birds) and 23% when the moon was visible ($n=39$ birds). Great-horned owls produced a mean of 3 calls per 8-minute period when the moon was not visible ($n=3$ birds)

and 7 calls per 8-minute period when the moon was visible ($n = 5$ birds); these means are not significantly different (Student's T-Test; $P = 0.105$).

The number of boreal owls calling >20 times per 8-minute point count period increased from 20% for the March surveys ($n = 49$ birds) to 50% ($n = 6$ birds) for early April surveys. Great-horned owls decreased their call rates from 7 calls per 8-minute period in March ($n = 5$ birds) to 3 calls per 8-minute period in April ($n = 3$ birds); the moon was not visible when great-horned owls were detected during the April surveys.

The combined data from both survey periods showed that 17 boreal owls (31% of all boreal owls detected) and 3 great-horned owls (38% of all great-horned owls detected) were heard only during the last 3 minutes of the 8-minute count period. Had the survey count period stopped at 5 minutes, we would have missed nearly one third of the owls detected on the surveys.

Distance estimations.—Distance estimations for boreal owls ranged from 70 m to 1500 m, with 27% of the birds being >800 m from the observer. Great-horned owl distance estimates ranged from 30 m to 2500 m, with 56% of those detections being >800 m. Based on examination of owl locations when plotted in GIS, distances were greatly underestimated. In several instances, observers felt that owls were calling from cliffs or steep slopes on the river valley and distance estimates/azimuths gave locations in the river bottom.

Since the accuracy of the distance estimations prohibited placing the bird in a ecounit with any degree of confidence, habitat associations could not be examined. Revising our method of owl location determination should allow us to look at owl/ecounit associations from surveys run in 2000.

Wintering Bird Surveys

Species diversity.—Six off-road point count transects for wintering birds were run between March 16 and March 24, 1999 (Figs. 2 and 3; Table 2). Transects contained between 10 and 12 points each for a total of 68 sample points (Table 2). Species diversity was highest on the Nation River North route and lowest on the Nation River South route (Table 2). Fourteen species were detected during these surveys (Table 3). In addition to these 14 species, a downy woodpecker (*Picoides pubescens*) and a great-horned owl were identified while traveling between points on the transects and American dippers (*Cinclus mexicanus*) were found in open water leads on the Charley and Nation Rivers. Snow buntings (*Plectrophenax nivalis*) were observed on March 25 while traveling along the Yukon River. The most commonly detected species during the point count periods were common redpolls (frequently in flocks), gray jays, white-winged crossbills (usually in flocks), and boreal chickadees (Table 3).

Detectability.—The peak bird detection period was between 2 and 4 hours after sunrise [approximately 0800–1100 h; Fig. 5(a) and 5(b)]. Fifty-seven percent of the birds identified on the surveys were detected during this time period ($n = 306$ birds). The number of birds detected dropped rapidly after 1400 h.

Sixty-eight percent of the birds identified on the surveys were detected within the first 3 minutes of the five minute count period ($n = 306$ birds). Eleven species were detected during the 0–3 minute intervals of the point count periods; 3 additional species (boreal owl, northern hawk owl, and sharp-tailed grouse) were

detected only during the 3–5 minute intervals. If the point counts had been limited to 3-minute intervals, we would have missed detecting 107 individuals and 3 species.

Distance Estimation.—Seventy-seven percent of the birds detected (both visually and by call) were estimated to be within 60 m of the observer ($n = 306$ birds; Fig. 6). Species usually estimated to be within 60 m included white-winged crossbills and boreal chickadees; 98% of the white-winged crossbills and 93% of the boreal chickadees detected were estimated to be within 60 m of the observer ($n = 40$ and $n = 28$, respectively). Twenty-one percent of all birds were >70 m from the observer. Species commonly heard >70 m included common ravens (81% of raven detections, $n = 16$) and northern three-toed woodpeckers (70% of detections, $n = 10$); the single northern goshawk and 1 of the 2 hairy woodpeckers detected were also >70 m from the observer. Common redpolls and gray jays were the only species detected in all distance bands. Though we used unlimited distance estimation techniques, we were unable to obtain large enough sample sizes (>60 detections per species; Buckland et al. 1993) to examine species density estimates.

Habitat.—Eight ecounits were sampled during these surveys (Table 2). Species richness was highest in the Yukon River Valley--Nation/Kandik/Bonanza Tributary Valleys unit (YV6); 8 bird species were detected in this unit. Seven species were identified in the Biederman Hills (BH1) and Yukon River Valley--Active Floodplain (YV1) units. Species richness was lowest in the Yukon River Valley--Wet Terraces with Few Ponds (YV3) unit, where only 3 species were identified.

Multiple earth cover classes were located within each ecounit (Table 4). Species richness was highest in open needleleaf vegetation, but bird abundance was highest in open mixed needleleaf/deciduous (Table 5). Open needleleaf vegetation occurred in all ecounits except YV3 and Yukon River Valley--High Terraces, Undulating (YV5; Table 4); the YV3 and YV5 ecounits had the lowest species richness of the ecounits sampled. Bird abundance and species richness was low in the shrub categories sampled (Table 5) and consisted mostly of gray jays, ravens and white-winged crossbills flying overhead, and redpolls eating birch seeds.

White-winged crossbills, common redpolls, boreal chickadees and gray jays were most abundant in open needleleaf vegetation (Table 5). Woodpeckers were found in open needleleaf and woodland needleleaf vegetation. Sharp-tailed grouse and northern hawk owls were detected only in woodland needleleaf. Pine grosbeaks were equally abundant in woodland needleleaf and closed mixed deciduous vegetation. Gray jays and common redpolls were found in the greatest variety of habitats (Table 5).

DISCUSSION

Owls

Six species of owl potentially breed in the preserve. Only 2 species (boreal and great-horned owls) were detected during the March/April nocturnal surveys. In addition to boreal and great-horned owls (which we did detect), we had anticipated detecting great gray owls (*Strix nebulosa*) and potentially northern saw-whet owls (*Aegolius acadicus*) on these surveys. Great gray owls have been

observed and documented in the preserve and one of these owls (found dead in the preserve) was taken to the University of Alaska Museum for vouchering in 1999. Northern saw-whet owls have not yet been detected in the preserve, though they are relatively abundant in southern Alaska; northern saw-whet owl distribution in Alaska has not been well established. Northern hawk owls are diurnal and we did not expect to detect them during the nocturnal surveys. We did detect 3 northern hawk owls during the daylight wintering bird off-road point count transects in March. Snowy owls (*Nyctea scandiaca*) may exist in the preserve as occasional visitors during winter or spring but likely do not breed in the preserve. Short-eared owls (*Asio flammeus*) are migratory and were not expected to be present during the March survey time period, though they likely arrive in the preserve mid-late April.

Owl calling (and call detection) is affected by many variables including: weather (wind velocity, precipitation, temperature, cloud cover, lunar cycle, and barometric pressure); temporal factors (time of night, hours after sunset, hours before sunrise, and season); and behavioral/biological factors (sex, age, breeding status, breeding pairs in the area, prey availability, and other owl species present) [Fuller and Mosher 1981, Palmer 1987, Smith 1987, Clark and Anderson 1997]. Calling activity of boreal owls in Colorado was slightly influenced by wind, precipitation, and moon phase; cloud cover and temperature had no effect on calling activity (Palmer 1987). Clark and Anderson (1997) also found no correlation between cloud cover and boreal owl calling rate in Wyoming. We did not obtain sufficient data to examine correlations between owl calling and other weather variables, but wind and snow definitely inhibited our ability to hear owls at several points during the surveys.

Changing light intensity as a result of moonlight may affect owl calling (Palmer 1987, Clark and Anderson 1997). Boreal owls in Yellowstone National Park (Wyoming) are more vocal when moonlight is present so owl surveys are conducted on clear, moonlit nights (Katy Duffy, National Park Service, personal communication). However, boreal owls in Clark and Anderson's study (1997; also in Wyoming) did not appear to respond to lunar changes, though seasonal patterns showed biweekly peaks which coincided with a full moon phase. Palmer (1987) heard more boreal owls calling during a full moon than during any other moon phase. In our study, more boreal and great-horned owls appeared to be calling when the moon was visible, though there was a new moon during the March surveys; the moon was full during the 3 April surveys but few owls were heard on those routes. Call rate in this study did not appear to be influenced by moon visibility. During the March 2000 surveys the moon phase will range from full to last quarter, presenting an opportunity to further examine this question.

For the time period we surveyed (sunset to 5.5 hours after sunset), owl detectability stayed relatively high between 1 and 4.5 hours after sunset. Clark and Anderson (1997) found this same pattern for boreal owls in western Wyoming. Based on similar findings from the Canadian Provinces, the draft Owl Monitoring Protocol for Canada advocates owl surveys to be conducted from ½ hour after sunset until midnight (Takats et al. 1999).

The highest owl detection period in this study occurred between 1 and 2 hours after sunset. Boreal owls in Wyoming were more vocal in the first hour after sunset (Clark and Anderson 1997), but Musel and Stutz (1989) found the first 2-3 hours after dark to be the most vocal period for boreal owls in Idaho. Rohner and

Doyle (1992) reported that great-horned owls in southwest Yukon, Canada began hooting close to the nest 1 hour after sunset.

We will attempt to complete the 2000 owl surveys within 4 hours of sunset, though owls may be calling at other times of night as well. Bondrup-Nielsen (1978) found that boreal owls were sporadically active throughout the night with periods of activity lasting up to 4.5 hours; males may sing all night during the height of the breeding season. In northern Scandinavia, a bimodal pattern of activity was found with peak activity occurring just after sunset and just prior to sunrise (Korpimäki 1981). Boreal owl call rates in Alberta were found to be lowest between midnight and 0400 h (Takats 1998).

Optimal seasonal survey times for owl species in interior Alaska have not been determined. In one Alaskan study, boreal owl singing peaked between mid February and March (Meehan 1980). Boreal owls call most frequently before mating and based on a mean laying date of 13 April in Anchorage (Ted Swem, USFWS, unpublished data) this would occur between mid March and mid April. Boreal owls further north were expected to have later laying dates and consequently later peak detection periods (Ted Swem, USFWS, personal communication). Based on this and other boreal owl detection data from the Anchorage area (Brad Anderson, USFWS, personal communication), late March to mid- to late April was proposed as the peak detection time for boreal owls in interior Alaska (Colleen Handel, USGS-BRD, personal communication). Due to river and overflow conditions, we were advised that travel by snowmobile in the preserve should not occur beyond the second week of April, hence our study period was in mid-late March.

On the 3 routes that were rerun in April, slightly more owls were detected in March (0.15 birds/point) than in April (0.12 birds/point), suggesting that on a seasonal basis, peak calling/detection periods for boreal owls may occur in March in the preserve. These results are based on very small sample sizes (10 birds in March and 6 in April) and are also influenced by bad weather incurred during the Coal Creek Route in April; this route had 8 owl detections in March and only 1 in April. Snow during that survey likely negated owl detection during the first 5 points on that route. Conversely, owl detections on the Yukon River I-McGregor Bluff route increased from zero in March to 4 in April. Additional sampling is needed to accurately determine seasonal owl detection trends.

Though slightly more boreal owls were detected in March than in April, call rates were higher during the April surveys. We hypothesize that as owls obtained mates they were calling less, if at all (hence the fewer number of owls detected per point), but that call rates of unpaired owls increased as they attempted to obtain a mate late in the breeding season. Bondrup-Nielsen (1978) found that boreal owl calling intensity drops dramatically after a female is attracted and may cease altogether after a few days; calling intensity was found to intensify again just before unpaired males on territories stopped calling for good. Lundberg (1978) also proposed that the number of boreal owls singing was inversely related to breeding success. To maximize boreal owl detections (based on our current data), we should continue surveying prior to the first week in April, though prey abundance and varying environmental conditions likely will influence call rates on a year-to-year basis (Hayward 1994).

Beyond Audubon Christmas Bird Count information (which is not habitat linked), little information on wintering birds in interior Alaska is available. We hoped to obtain presence/absence and habitat use information for wintering birds through this portion of the inventory project. Though sample sizes for most species were small, we identified 18 of the 23 bird species we expected to find overwintering in the preserve. After examining the 1999 breeding bird data (Swanson and Nigro 1999) and the wintering bird data, we surmised that the March winter survey period may be an opportune time to survey for drumming woodpeckers (downy, hairy, northern three-toed, and black-backed woodpeckers occur in the preserve) and American dippers (feeding at open leads along major tributaries). Expected wintering bird species that we did not encounter may either occur in very low numbers in the preserve, be found at higher latitudes than inventoried, or occur in landcover units that we did not cover.

We were unsure about peak bird detection periods during winter daylight hours since little winter bird survey work has been completed in Alaska. Though midwinter daylight is limited to as little as 6 hours (including twilight hours) in Alaska, day length was up to 12 hours by the end of March. We hypothesized that birds might be active (primarily feeding) during most of the daylight hours and sampled birds from 0730 to 1800 h. Instead, bird detections declined markedly after 1300 h, indicating that birds apparently were able to satiate and become less active by early afternoon. Based on this premise, we will begin the 2000 wintering bird surveys shortly after sunrise and complete them by 1300 h.

With increased sample sizes from a second year of sampling, we hope to present a better picture of winter bird species distributions and habitat use. We intend to increase the count time interval to 8 minutes, which will also result in additional bird and/or species detections.

PROJECT RECOMMENDATIONS FOR 2000

Following are recommendations (based on 1999 data) for the winter portion of the Yukon-Charley Rivers National Preserve Bird Inventory Project. These recommendations will be used to improve data collection and minimize safety and health risks for field staff in 2000.

Owl Surveys

- Map owl locations on 1:63,500 scale topographic maps to facilitate distance estimations and obtain more accurate positions. Continue recording distance estimates and azimuths for each owl detected.
- Practice distance estimation and location mapping with field crews prior to surveys. Standardize estimations and techniques between crew members.
- Emphasize the need to give actual counts of calls in each time interval to more accurately examine calling rates by time of night and season; listing owls as "constantly calling" or "incessant" does not provide enough information for determining call rates.
- Record temperature, wind conditions, sky cover, and precipitation at each point. Start and finish weather data was insufficient to describe calling conditions along the routes.

- Shorten protocol to 8-mile transects of 16 points due to travel times of >15 minutes per point and the need to complete surveys within 4–5 hours of sunset.
- Use 800 m straight-line distances between points on the transects using a GPS unit. Recording distances using snowmobile odometers does not account for meandering or braided riverbeds and trails.
- Purchase Luxmeters (light meters) to measure light intensity at each survey point in addition to recording moon visibility. Though the moon may not be visible to the observer, it may be to the calling owl. Measuring light intensity may provide better correlation data with calling owls than whether or not the moon is visible to the observer.
- Attempt to survey at higher elevations. Continue maximizing ecounit coverage.
- Increase the field crew to 6 to allow 2 people to trail break/set trail during the day, 2 to conduct owl surveys at night, and 2 to conduct wintering bird transects during the day. This will reduce fatigue and increase survey safety and efficiency.
- Double survey some routes using staggered starting times on the same evening to look at temporal detection changes.
- If time permits, rerun several routes in April to again examine seasonal trends in species detection and call rates.
- Continue wearing ear protection while running snowmobiles. Allow ears to readjust to quiet after running snowmobiles between points.
- Continue with winter backcountry training for field staff prior to conducting surveys.
- Maintain regular communications via the park radio system.

Wintering Bird Surveys

- Complete surveys by 1300 h; very few birds detected after this time.
- Attempt to survey 10 points (>300 m apart) in open habitat areas and 12 points (>200 m) in treed habitat areas. Terrain and snow depths can greatly increase between point travel time.
- Begin conducting 8-minute point counts, maintaining 0–3, 3–5, and 5–8 minute recording intervals.
- Carry recording microphones for documenting and/or verifying unidentified or unusual calls.

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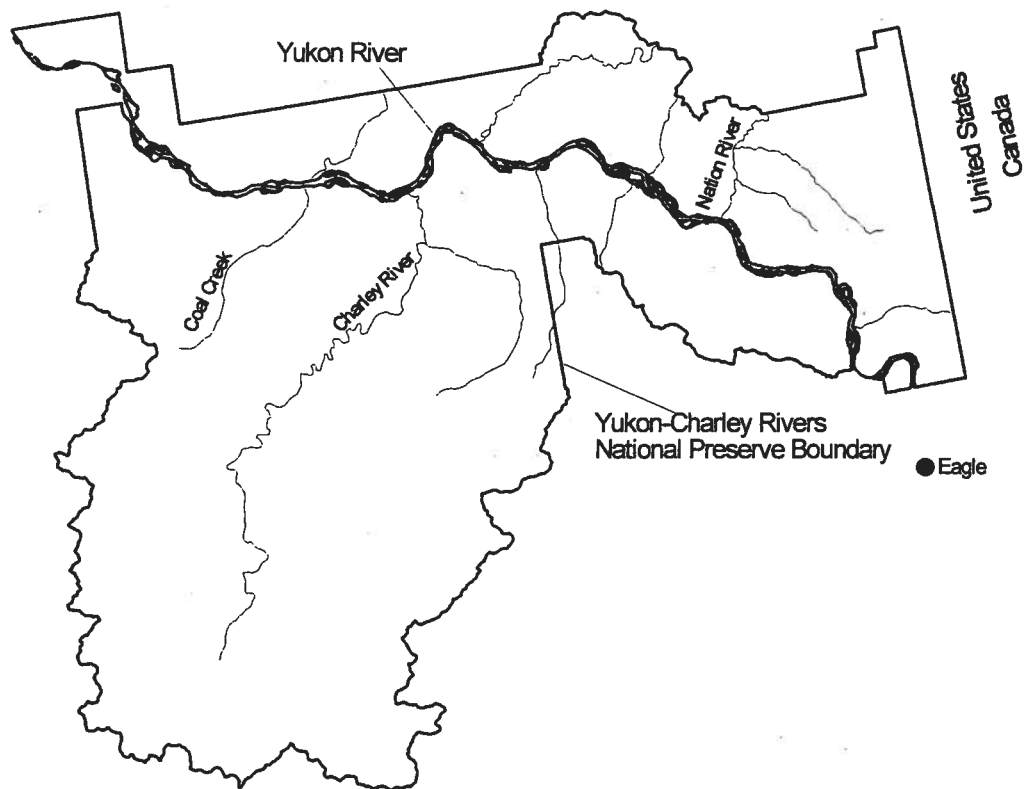


Fig. 1. Yukon-Charley Rivers National Preserve, AK.

Map Location



National Park Service
Yukon-Charley Rivers National Preserve
Biological Resources

0 10 20 30 Kilometers



1 : 984,250 1 inch = 25.00 kilometers



**Fig. 2. Western Area
1999 Winter I&M
Bird Surveys**

— Winter Owl Routes Winter Resident Bird Routes  Land within the Preserve	Yukon-Charley Rivers National Preserve 	Yukon-Charley Rivers National Preserve Within Alaska 	National Park Service Yukon-Charley Rivers National Preserve Biological Resources 0 1 2 3 4 5 Kilometers 1: 238,220 1 inch = 6.00 kilometers 
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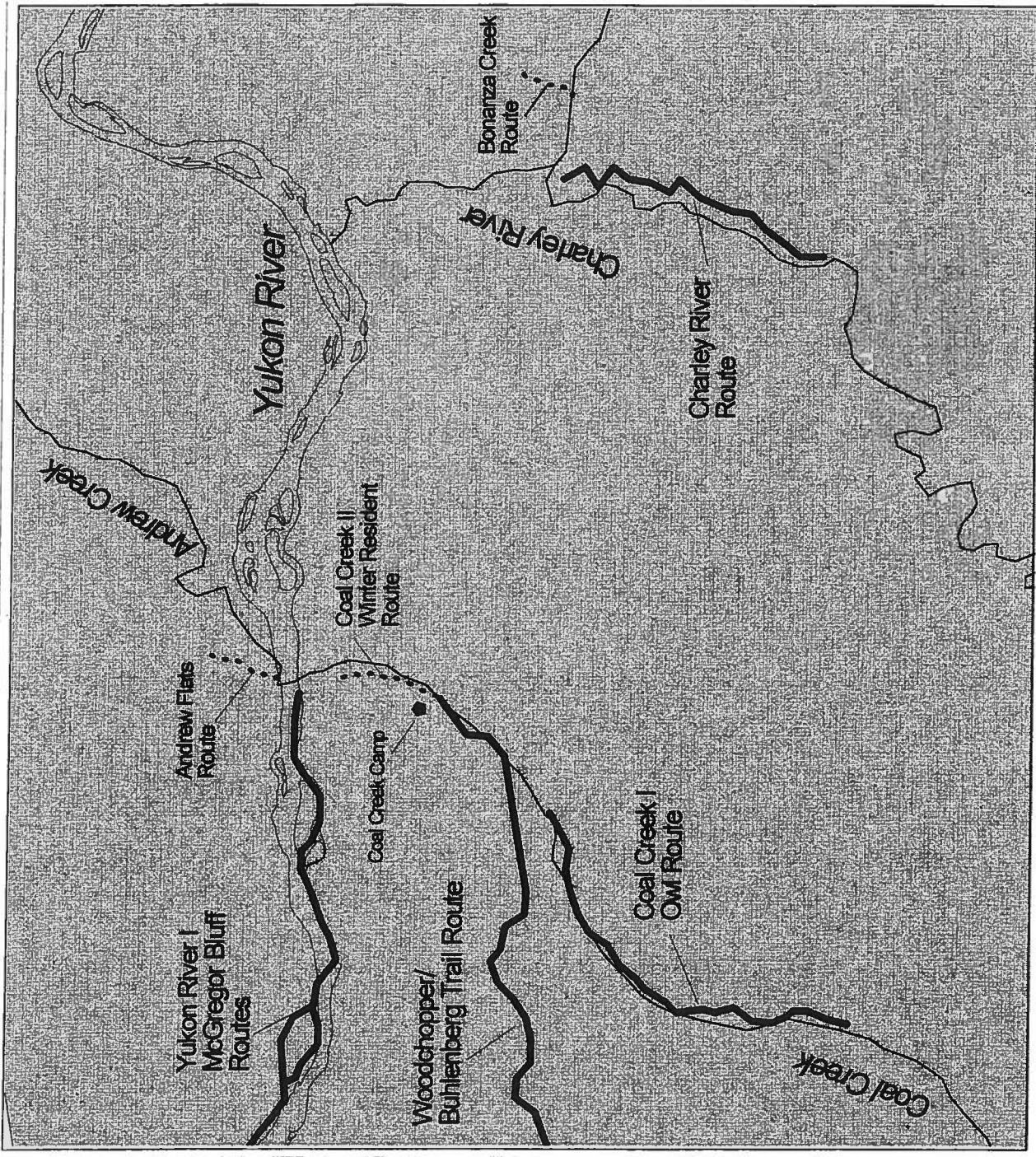


**Fig. 3. Eastern Area
1999 Winter I&M
Bird Surveys**

— Winter Owl
Routes

.... Winter Resident
Bird Routes

▨ Land within
Preserve

Yukon-Charley Rivers
National Preserve

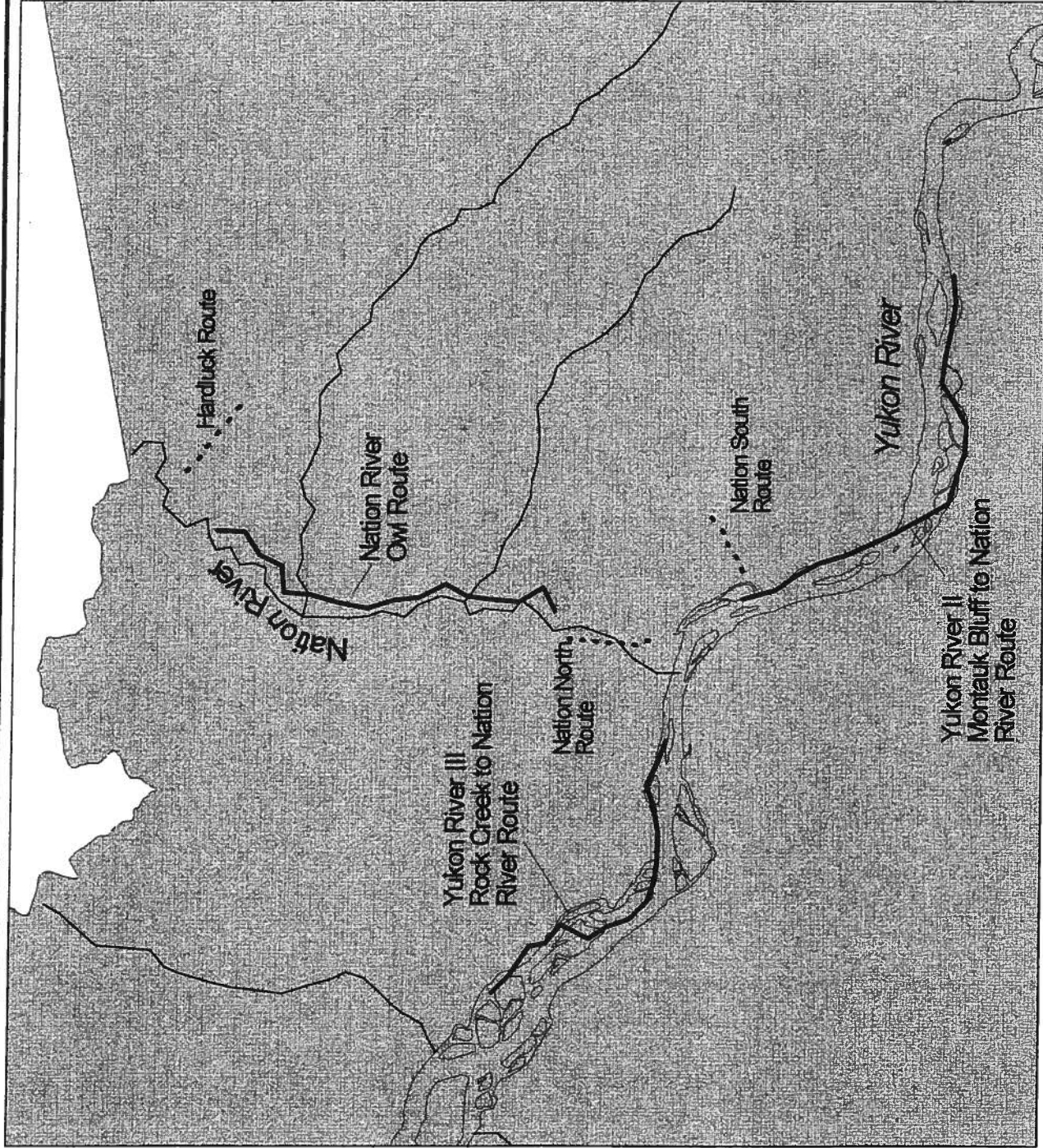


Yukon-Charley Rivers
National Preserve Within
Alaska



National Park Service
Yukon-Charley Rivers
National Preserve
Biological Resources

0 1 2 3 4 Kilometers
1 : 100,000 1 inch = 5.00 kilometers



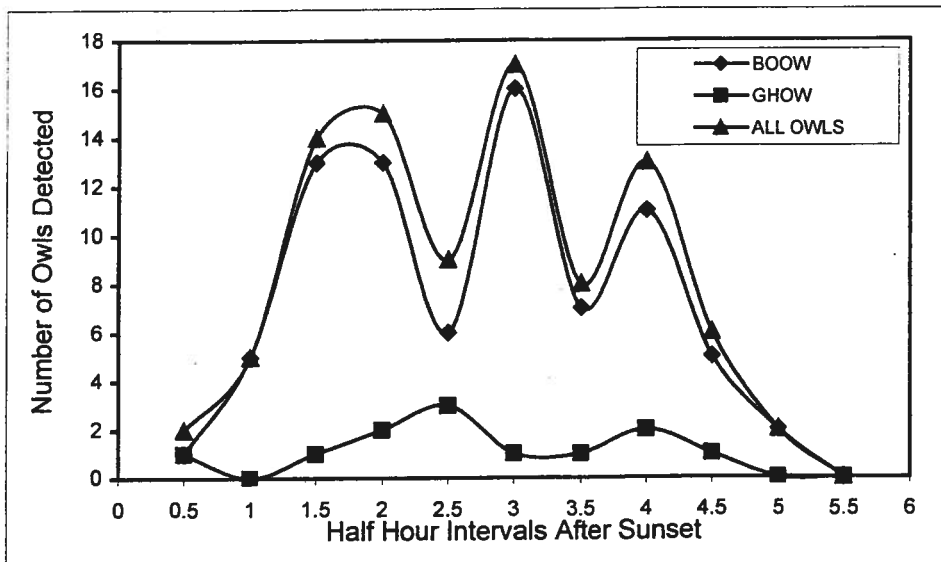


Fig. 4(a). Number of boreal (BOOW) and great-horned (GHOW) owls detected by half hour intervals after sunset during owl surveys in Yukon-Charley Rivers National Preserve, AK, March and April 1999. Owls were assigned to half hour intervals reflecting when after sunset they were detected. Time intervals are as follows: 0 - 30 mins. after sunset = 0.5, 31 - 60 = 1, 61 - 90 = 1.5, 91 - 120 = 2, 121 - 150 = 2.5, 151 - 180 = 3, 181 - 210 = 3.5, 211 - 240 = 4, 241 - 270 = 4.5, 271 - 300 = 5, 301 - 330 = 5.5.

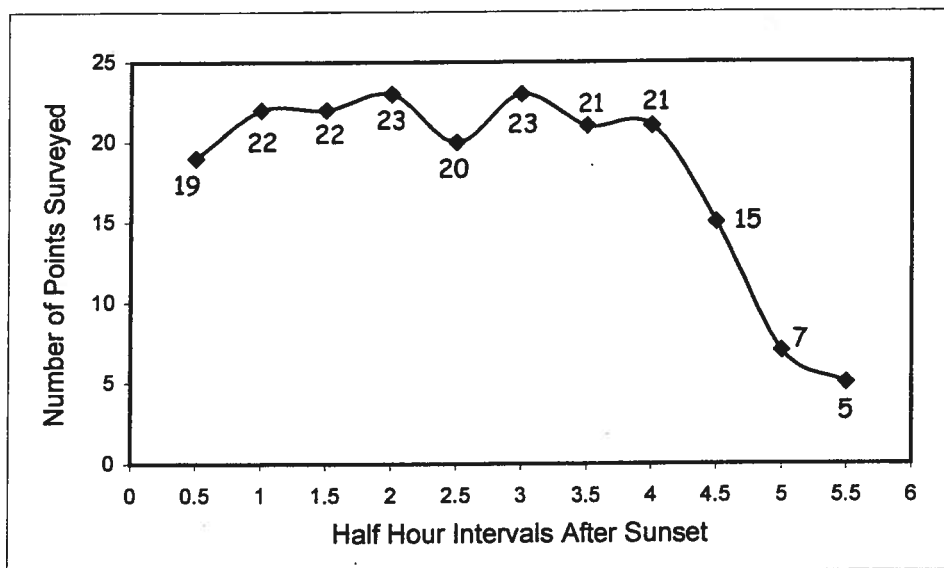


Fig. 4(b). Number of points surveyed by half hour time intervals during owl surveys in Yukon-Charley Rivers National Preserve, AK, March and April 1999. Half hour intervals are the same as in Fig. 4(a).

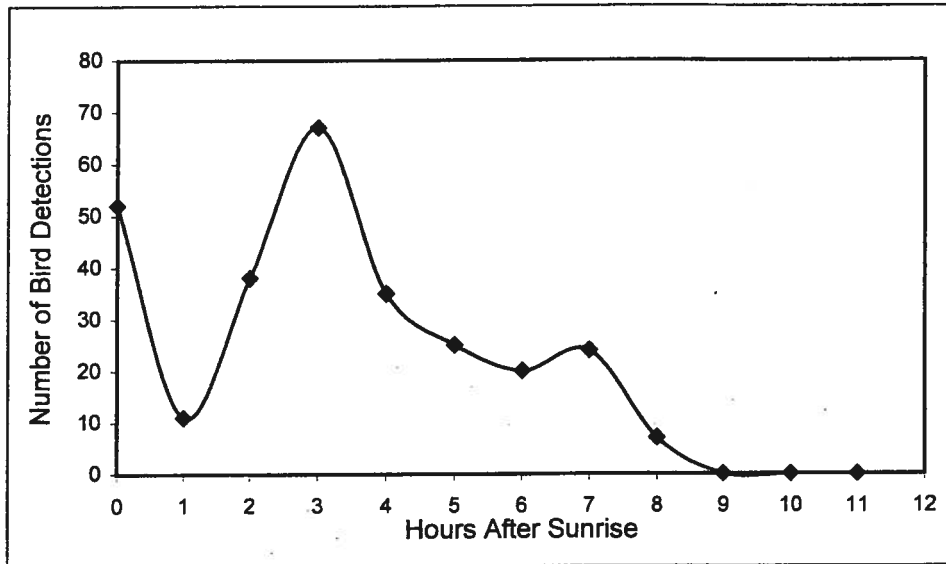


Fig. 5(a).

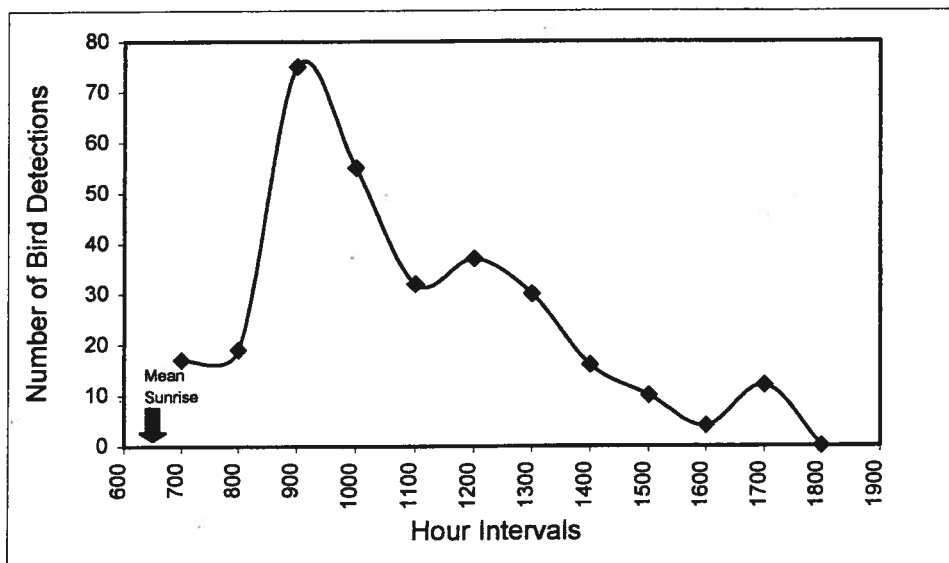


Fig. 5(b).

Fig. 5(a-b). Numbers of birds detected by hour intervals relative to sunrise (5a) and to time of day (5b) during off-road point count surveys in Yukon-Charley Rivers National Preserve, AK, March 1999. Hour intervals were calculated as follows: 0700 h - 0759 h = 700, 0800 h - 0859 h = 800, 0900 h - 0959 h = 900, etc.

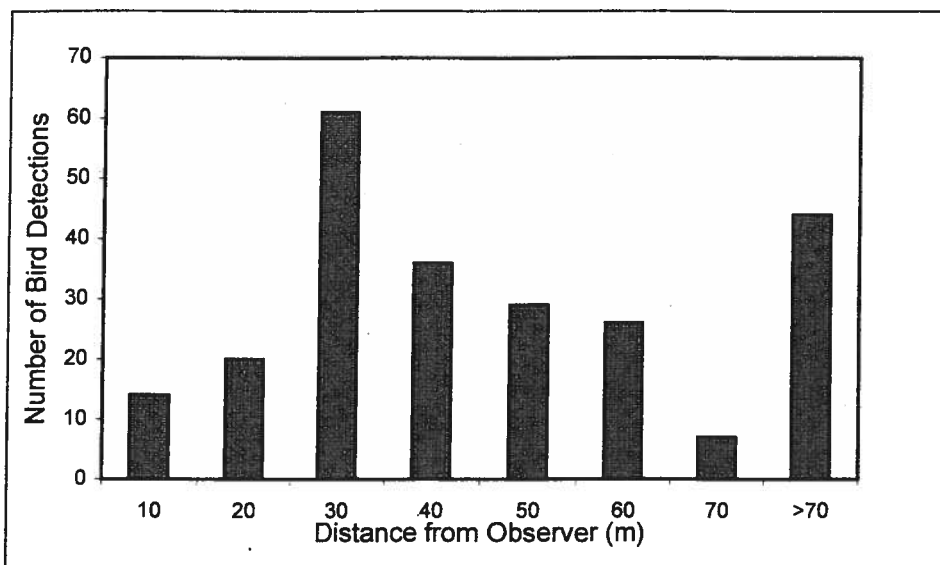


Fig. 6. Number of bird detections by distance from observer during off-road point count surveys in Yukon-Charley Rivers National Preserve, AK, March 1999.

Table 1. Continued.

Route Name	Survey Date	Ecountits Traversed	Sample Points (<i>n</i>)	Boreal Owls Detected per Point	Great- horned Owls Detected per Point
Nation River	21 March 1999	<u>OF1</u> —Ogilvie Foothills <u>HL</u> —Hard Luck Lowland <u>YV6</u> —Yukon River, Nation/Kandik/Bonanza Valleys	16	0.63 (<i>n</i> = 10 owls)	0.06 (<i>n</i> = 1)
Yukon River II—Montauk Bluff to Nation River	22 March 1999	<u>OF1</u> —Ogilvie Foothills <u>YV1</u> —Yukon River, Active Floodplain <u>YV3</u> —Yukon River, Wet Terraces with Few Ponds <u>YV5</u> —Yukon River, High Terraces, Undulating	18	0.67 (<i>n</i> = 12)	0.11 (<i>n</i> = 2)
Yukon River III—Rock Creek to Nation River	24 March 1999	<u>OF1</u> —Ogilvie Foothills <u>OF2</u> —Ogilvie Foothills Bluffs <u>YV1</u> —Yukon River, Active Floodplain <u>YV3</u> —Yukon River, Wet Terraces with Few Ponds <u>YV5</u> —Yukon River, High Terraces, Undulating	16	0.69 (<i>n</i> = 11)	0.06 (<i>n</i> = 1)
Coal Creek	6 April 1999	<u>TH</u> —Tintina Hills <u>CF</u> —Charley Foothills	16	0.06 (<i>n</i> = 1)	0
Woodchopper/Buhlenberg Trail	7 April 1999	<u>BH1</u> —Biederman Hills <u>TH</u> —Tintina Hills <u>TL</u> —Thanksgiving Loess	19	0.05 (<i>n</i> = 1)	0.05 (<i>n</i> = 1)

Table 1. Winter owl survey routes, ecounits sampled, number of points sampled, and number of owls per point by route in Yukon-Charley Rivers National Preserve, AK, March 16-24, 1999. Ecounits are defined when they first appear on the table; abbreviations are used thereafter.

Route Name	Survey Date	Ecounits Sampled	Sample Points (n)	Boreal Owls Detected per Point	Great-horned Owls Detected per Point
Coal Creek	17 March 1999	<u>TH</u> —Tintina Hills <u>CF</u> —Charley Foothills	23	0.35 (n = 8 owls)	0
Yukon River I—McGregor Bluff	18 March 1999	<u>BH1</u> —Biederman Hills <u>BH2</u> —Biederman Hills Bluffs <u>YV1</u> —Yukon River, Active Floodplain <u>YV3</u> —Yukon River, Wet Terraces with Few Ponds <u>YV5</u> —Yukon River, High Terraces, Undulating	24	0	0
Woodchopper/Buhlenberg Trail	18 March 1999	<u>BH1</u> —Biederman Hills <u>TH</u> —Tintina Hills <u>TL</u> —Thanksgiving loess	22	0.09 (n = 2)	0
Charley River	19 March 1999	<u>CF</u> —Charley Foothills <u>TH</u> —Tintina Hills <u>YV6</u> —Yukon River, Nation/Kandik/Bonanza Valleys	16	0.38 (n = 6)	0.06 (n = 1)

Table 1. Continued.

Route Name	Survey Date	Ecounits Traversed	Sample Points (<i>n</i>)	Boreal Owls Detected per Point	Great-horned Owls Detected per Point
Yukon River I-McGregor Bluff	8 April 1999	<u>BH1</u> —Biederman Hills <u>BH2</u> —Biederman Hills Bluffs <u>YV1</u> —Yukon River, Active Floodplain <u>YV3</u> —Yukon River, Wet Terraces with Few Ponds <u>YV5</u> —Yukon River, High Terraces, Undulating	16	0.25 (<i>n</i> = 4)	0.13 (<i>n</i> = 2)

Table 2. Winter off-road point count transect routes, ecounits traversed, and number of bird species detected by route in Yukon-Charley Rivers National Preserve, AK, March 16-24, 1999.

Route Name	Ecounits Traversed	Number of Points Sampled by Ecounit	Number of Bird Species Detected by Route
Andrew Flats	<u>YV1</u> —Yukon River Valley, Active Flood Plain	7	6
	<u>YV2</u> —Yukon River Valley, Wet terraces with Oxbows	5	
Bonanza Creek	<u>YV6</u> —Yukon River Valley, Nation/Kandik/Bonanza Tributary Valleys	1	6
	<u>TH</u> —Tintina Hills	11	
Coal Creek II	<u>BH1</u> —Biederman Hills	12	7
Hard Luck	<u>HL</u> —Hard Luck Lowland	10	6
Nation River North	<u>YV6</u> —Yukon River Valley, Nation/Kandik/Bonanza Tributary Valleys	12	8
Nation River South	<u>YV3</u> —Yukon River Valley, Wet Terraces with few Ponds	5	5
	<u>YV5</u> —Yukon River Valley, High Terraces, Undulating	5	

Table 3. Relative abundance estimates for bird species detected on winter off-road point count routes in Yukon-Charley Rivers National Preserve, AK, March 16-24, 1999.

Species	Relative Abundance (<i>n</i> = 306 birds)
Northern Goshawk (<i>Accipiter gentilis</i>)	.003
Ruffed Grouse (<i>Bonasa umbellus</i>)	.003
Sharp-tailed Grouse (<i>Tympanuchus phasianellus</i>)	.007
Boreal Owl (<i>Aegolius funereus</i>)	.003
Northern Hawk Owl (<i>Surnia ulula</i>)	.003
Hairy Woodpecker (<i>Picoides villosus</i>)	.007
Three-toed Woodpecker (<i>Picoides tridactylus</i>)	.033
Gray Jay (<i>Perisoreus canadensis</i>)	.200
Common Raven (<i>Corvus corax</i>)	.052
Black-capped Chickadee (<i>Parus atricapillus</i>)	.007
Boreal Chickadee (<i>Parus hudsonicus</i>)	.092
Pine Grosbeak (<i>Pinicola enucleator</i>)	.016
White-winged Crossbill (<i>Loxia leucoptera</i>)	.131
Common Redpoll (<i>Carduelis flammea</i>)	.441

Table 4. Ecounits and earth cover classes sampled during winter off-road point count surveys in Yukon-Charley Rivers National Preserve, AK, March 16-24, 1999.

Ecounit	Earth Cover Vegetation Class
Biederman Hills (BH1)	Open Needleleaf
	Closed Mixed Deciduous
	Open Mixed Deciduous
	Open Mixed Needleleaf/Deciduous
Hard Luck Lowland (HL)	Open Needleleaf
	Woodland Needleleaf
	Tall Shrub
Tintina Hills (TH)	Open Needleleaf
	Woodland Needleleaf
	Open Mixed Deciduous
Yukon River Valley—Active Flood Plain (YV1)	Open Needleleaf
	Tall Shrub
Yukon River Valley—Wet Terraces with Oxbows (YV2)	Open Needleleaf
	Woodland Needleleaf
Yukon River Valley—Wet Terraces with Few Ponds (YV3)	Woodland Needleleaf
	Tall Shrub
	Low Shrub/Tussock Tundra
Yukon River Valley—High Terraces, Undulating (YV5)	Woodland Needleleaf
	Open Mixed Needleleaf/Deciduous
Yukon River Valley—Nation/Kandik/Bonanza Valleys (YV6)	Open Needleleaf
	Closed Mixed Deciduous
	Closed Needleleaf

Table 5. Species detection frequency for wintering birds in each earth cover vegetation class sampled during off-road point count transects in Yukon-Charley Rivers National Preserve, March 16-24, 1999.

Species	Closed Needleleaf	Open Needleleaf	Woodland Needleleaf	Closed Mixed Deciduous	Open Mixed Deciduous	Open Mixed Needleleaf/ Deciduous	Tall Shrub	Low Shrub/ Tussock Tundra	Number of Birds Detected
Northern Goshawk		1.00							1
Ruffed Grouse		1.00							1
Sharp-tailed Grouse			1.00						2
Boreal Owl								1.00	1
Northern Hawk Owl			1.00						1
Hairy Woodpecker		1.00							2
Three-toed Woodpecker		.50	.50						10
Gray Jay	.02	.54	.25	.02	.08	.05	.02	.03	61
Common Raven		.19	.56	.06			.06	.13	16
Black-capped Chickadee		1.0							2
Boreal Chickadee	.11	.71	.07	.07		.04			28
Pine Grosbeak		.20	.40	.40					5
White-winged Crossbill	.03	.65				.28	.03	.03	34
Common Redpoll		.40	.35	.05	.01	.16	.02	.01	135
Number of sample points in each earth cover class	n = 1	n = 32	n = 23	n = 2	n = 2	n = 4	n = 2	n = 2	
Number of birds per point	5.0	4.7	3.6	6.5	3.0	9.3	3.0	3.5	

Appendix 1. (Continued).

REGION	NEST	DRAINAGE	94	95-1*	95-2	96-1	96-2	97-1	97-2	98-1	98-2	99-1	99-2	00-1	00-2	LAT	LONG
YUK 1	1079	Chena	ns	unocc.	unocc.	ns	ns	unocc.	unocc.	ns	ns	pr(inc)	single	pr(inc)	unocc.	64.9823	145.6923
YUK 1	1080	Charley	ns	ns	ns	ns	ns	unocc.	unocc.	ns	ns	pr	pr	pr(inc)	pr	64.9260	143.5567
YUK 1	1081	Charley	ns	ns	ns	ns	ns	unocc.	unocc.	ns	ns	pr(inc)	unocc.	pr(inc)	2 eggs	64.8363	143.2405
YUK 1	1082	Charley	ns	ns	ns	ns	ns	unocc.	unocc.	ns	ns	pr(inc)	2 yg	pr(inc)	single	64.8573	143.4005
YUK 9	1083	Chena	ns	unocc.	unocc.	ns	ns	unocc.	unocc.	ns	ns	single	2 yg	pr(inc)	2 yg	64.8000	147.1052
YUK 1	1084	Charley												single	unocc.	64.9672	143.7090
YUK 1	1085	Charley												2 eggs	single	64.8567	143.3363
YUK 1	1086	Goodpaster												unocc.	3 eggs	64.3423	145.0500
YUK 1	1087	Chena												pr(inc)	unocc.	64.9375	145.4833
YUK 1	1088	Salcha												pr(inc)	unocc.	64.7602	144.4772
YUK 1	1089	Salcha												pr(inc)	unocc.	64.6807	144.8767
YUK 1	1090	Salcha												pr(inc)	4 yg	64.6430	145.4870
YUK 9	1091	Salcha												pr(inc)	2 yg	64.4713	146.8238
YUK 2	2001	Birch Ck	1 yg	pr(inc)	4 yg	pr	4 yg	pr(inc)	2 yg	pr(inc)	3 yg	pr(inc)	3 yg	pr(inc)	2 yg	65.8202	144.2918
YUK 2	2002	Birch Ck	3 yg	ad(inc)	3 yg	pr(inc)	4 yg	unocc.	unocc.	pr(inc)	4 yg	pr(inc)	3 yg	pr(inc)	unocc.	65.7540	144.3570
YUK 2	2003	Birch Ck	single ad	ad(inc)	3 yg	pr	0	single ad	unocc.	pr(inc)	3 yg	pr(inc)	2 yg	pr(inc)	2 yg	65.3627	144.2847
YUK 2	2004	Birch Ck	1 yg	pr(inc)	3 yg	pr(inc)	2 yg	3 adults	2 yg	pr(inc)	1 yg	pr(inc)	single	pr(inc)	unocc.	65.3207	144.4118
YUK 2	2005	Birch Ck	pair	pr(inc)	2 yg	pr(inc)	0	pr(inc)	3 yg	unocc.	unocc.	pr(inc)	2 yg	pr(inc)	3 yg	65.3477	144.8412
YUK 2	2006	Birch Ck	single ad	unocc.	unocc.	ad+egg	0	single ad	unocc.	unocc.	unocc.	pr(inc)	pr	unocc.	unocc.	65.3073	144.4652
YUK 2	2007	Birch Ck	single ad	pr(inc)	ad+eggs	pr(inc)	ad+eggs	pair	1 yg	pr(inc)	pr(inc)	pr(inc)	pr	pr(inc)	1 egg	65.3293	144.5317
YUK 2	2008	Birch Ck	unocc.	unocc.	single ad	0	single ad	single ad	unocc.	pr(inc)	single ad	pr(inc)	3 yg	pr(inc)	1 egg	65.2230	144.2740
YUK 2	2009	Birch Ck	unocc.	unocc.	single ad	pr(inc)	1 yg	single ad	2 yg	pr(inc)	3 yg	unocc.	4 yg	pr(inc)	unocc.	65.2558	144.3583
YUK 2	2010	Black R	2 yg	ns	ns	ns	2 yg	ns	ns	ns	ns	nc	nc	nc	nc	65.6900	143.0507
YUK 2	2015	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	pr(inc)	3 eggs	unocc.	unocc.	unocc.	unocc.	unocc.	single	65.2250	144.3292
YUK 2	2016	Birch Ck	unocc.	pr(inc)	2 yg	pr(inc)	dead yg	pair	2 yg	pr(inc)	2 yg	single	single	pr(inc)	3 yg	65.3037	145.0283
YUK 2	2023	Birch Ck	ns	ns	ns	pr(inc)	3 yg	pr(inc)	2 yg	pr	2 yg	pr(inc)	unocc.	pr	2 eggs	65.7175	144.7135
YUK 2	2024	Birch Ck	ns	ns	ns	pr(inc)	3 yg	single ad	unocc.	pr(inc)	3 yg	pr	1 yg	pr	1 yg	65.7155	144.7895
YUK 2	2025	Birch Ck	ns	ns	ns	ad(inc)	3 yg	pr(inc)	2 yg	pr(inc)	3 yg	pr(inc)	4 yg	pr(inc)	1 egg	65.8015	144.8070
YUK 2	2026	Birch Ck	ns	ns	ns	pr	unocc.	single ad	unocc.	pr(inc)	1 yg	pr(inc)	unocc.	pr(inc)	single	65.7765	145.4067
YUK 2	2027	Birch Ck	ns	ns	ns	single ad	single ad	pr(inc)	3 yg	pr	2 yg	pr(inc)	single	pr(inc)	unocc.	65.6968	145.1207
YUK 2	2028	Birch Ck	ns	ns	ns	pr(inc)	2 yg	pr(inc)	3 yg	pr	2 yg	pr(inc)	2 yg	pr(inc)	pr + egg	65.6922	145.0565
YUK 2	2029	Birch Ck	ns	unocc.	unocc.	pr	2 yg	pr(inc)	pair	pr	unocc.	single	2 yg	pr(inc)	single	65.1453	145.4850
YUK 2	2030	Birch Ck	unocc.	unocc.	unocc.	pr	unocc.	pr(inc)	3 yg	pr	unocc.	pair	2 yg	pr(inc)	single	65.3585	144.6950
YUK 2	2032	SF Birch Ck	unocc.	unocc.	unocc.	pr(inc)	2 yg	pr(inc)	2 yg	unocc.	unocc.	pr(inc)	3 yg	pr(inc)	single	65.2953	144.4213
YUK 2	2033	SF Birch Ck	unocc.	unocc.	unocc.	single ad	unocc.	unocc.	unocc.	unocc.	unknown	unocc.	unknown	unocc.	unocc.	65.2045	144.0837
YUK 2	2038	Black	ns	ns	ns	ns	3 yg	ns	ns	ns	ns	nc	nc	nc	nc	65.6058	143.1277
YUK 2	2040	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	pr(inc)	3 yg	pr(inc)	3 yg	pr(inc)	2 yg	pr(inc)	1 egg	65.3427	144.6242
YUK 2	2041	Birch Ck	ns	ns	ns	ns	ns	unocc.	unocc.	pr	1 yg	unocc.	unocc.	pr(inc)	3 yg	65.3030	144.4300

Appendix 1. (Continued).

REGION NEST DRAINAGE		94	95-1*	95-2	96-1	96-2	97-1	97-2	98-1	98-2	99-1	99-2	00-1	00-2	LAT	LONG
YUK 2	2042	Yukon R	ns	ns	ns	ns	ns	ns	pr(inc)	unocc.	unocc.	unocc.	unocc.	unocc.	65.7497	144.0800
YUK 2	2043	Coal Ck	ns	ns	ns	ns	ns	ns	pr(inc)	unocc.	pr(inc)	unocc.	unocc.	unocc.	65.2847	143.2123
YUK 2	2045	Woodchopp	ns	ns	ns	ns	ns	ns	pr(inc)	1 yg	pr(inc)	3 yg	pr (inc)	2 yg	65.3268	143.3348
YUK 2	2047	Yukon R	ns	ns	ns	ns	ns	ns	single ad	unocc.	pr(inc)	unocc.	pr (inc)	1 yg	65.7300	144.1207
YUK 2	2048	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	single	unocc.	unocc.	unocc.	65.3450	144.3022
YUK 2	2049	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	single	unocc.	unocc.	unocc.	65.8267	145.2210
YUK 2	2050	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	pr(inc)	4 yg	pr (inc)	unocc.	65.2110	144.1108
YUK 2	2051	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	pr(inc)	3 yg	pr (inc)	3 yg	65.2268	144.5413
YUK 2	2052	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	pr(inc)	single	pr (inc)	pr (inc)	65.1657	144.2772
YUK 2	2053	Birch Ck	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	pr (inc)	2 yg	65.2235	144.1620
YUK 1	2054	Chena	single ad	unocc.	unocc.	unocc.	pr(inc)	3 yg	ns	ns	ns	ns	single	unocc.	65.0412	145.1817
YUK 3	3001	70 Mile	2 yg	pair(inc?)	single ad	unocc.	ns	single ad	ns	ns	ns	ns	nc	nc	64.9000	141.3083
YUK 3	3002	70 Mile	1 yg	single ad	3 yg	unocc.	1+yg	unocc.	ns	ns	ns	ns	nc	nc	64.9030	141.6148
YUK 3	3003	70 Mile	1 yg	pr (inc)	3 yg	ad(inc)	single ad	unocc.	ns	ns	ns	ns	nc	nc	64.9303	141.7340
YUK 3	3004	70 Mile	pair	single ad	unocc.	pr(inc)	4 yg	unocc.	ns	ns	ns	ns	nc	nc	64.9862	142.2008
YUK 3	3005	70 Mile	pair	unocc.	3 yg	unocc.	2 yg	single ad	ns	ns	ns	ns	nc	nc	64.9963	142.3173
YUK 3	3006	70 Mile	pair	pr (inc)	ad + egg	single ad	3 yg	pr(inc)	ns	ns	ns	ns	nc	nc	64.8913	142.2802
YUK 3	3007	40 Mile	3 yg	single ad	unocc.	unocc.	2 yg	unocc.	ns	ns	ns	ns	nc	nc	64.4345	143.2422
YUK 3	3008	40 Mile	pair	pr (inc)	2 yg	pr(inc)	2 yg(egg)	2 yg	ns	ns	ns	ns	nc	nc	64.6158	142.2008
YUK 3	3009	40 Mile	1 yg	pr (inc)	3 yg	single ad	2 yg	unocc.	ns	ns	ns	ns	nc	nc	64.0710	142.0167
YUK 3	3010	70 Mile	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	ns	ns	ns	ns	nc	nc	64.7072	141.5402
YUK 3	3015	40 Mile	unocc.	pr (inc)	3 yg	ad(inc)	2 yg	pr(inc)	ns	ns	ns	ns	nc	nc	64.6118	142.2007
YUK 3	3022	70 Mile	unocc.	pr(subad)	unocc.	unocc.	unocc.	unocc.	ns	ns	ns	ns	nc	nc	64.9317	141.8268
YUK 3	3023	70 Mile	ns	pair	single ad	ad(inc)	2 yg	pr(inc)	ns	ns	ns	ns	nc	nc	64.9790	141.9902
YUK 3	3024	70 Mile	ns	pr (inc)	2 yg	pr(inc)	2 yg	pr(inc)	ns	ns	ns	ns	nc	nc	64.8483	141.8393
YUK 3	3025	70 Mile	ns	single ad	ns	pr(inc)	2 yg	single ad	ns	ns	ns	ns	nc	nc	64.8867	141.5568
YUK 3	3027	40 Mile	ns	pr(subad)	ns	pr(inc)	2 yg	pr(inc)	ns	ns	ns	ns	nc	nc	64.4698	142.2568
YUK 3	3028	40 Mile	ns	pair	ns	unocc.	unocc.	1 egg	ns	ns	ns	ns	nc	nc	64.4690	142.5268
YUK 3	3029	40 Mile	ns	pr (inc)	2 yg	pr(inc)	unocc.	1 yg	ns	ns	ns	ns	nc	nc	64.4592	142.6365
YUK 3	3030	40 Mile	ns	pair	ns	pr(inc)	2 yg	unocc.	ns	ns	ns	ns	nc	nc	64.4572	142.6678
YUK 3	3031	40 Mile	ns	pr (inc)	ns	unocc.	pr(inc)	1 yg	ns	ns	ns	ns	nc	nc	64.4018	142.8158
YUK 3	3032	40 Mile	unocc.	unocc.	ad+dead yg	pr(inc)	unocc.	2 yg	ns	ns	ns	ns	nc	nc	64.3862	142.8862
YUK 3	3033	70 Mile	unocc.	unocc.	unocc.	pr(inc)	pr(inc)	1 yg	ns	ns	ns	ns	nc	nc	64.9700	142.0793
YUK 3	3045	70 Mile	unocc.	unocc.	unocc.	single ad	unocc.	unocc.	ns	ns	ns	ns	nc	nc	64.9568	141.9765
YUK 3	3046	70 Mile	unocc.	unocc.	unocc.	pr(inc)	unocc.	3 yg	ns	ns	ns	ns	nc	nc	64.7902	141.4812
YUK 3	3049	40 Mile	ns	unocc.	unocc.	pr(inc)	pr(inc)	3 yg	ns	ns	ns	ns	nc	nc	64.4700	142.2042
YUK 3	3050	40 Mile	unocc.	unocc.	unocc.	single ad	unocc.	unocc.	ns	ns	ns	ns	nc	nc	64.5537	142.0367
YUK 3	3051	40 Mile	unocc.	unocc.	unocc.	unocc.	unocc.	unocc.	ns	ns	ns	ns	nc	nc	64.5890	142.1648

Appendix 1. (Continued).

REGION	NEST	DRAINAGE	94	95-1*	95-2	96-1	96-2	97-1	97-2	98-1	98-2	99-1	99-2	00-1	00-2	LAT	LONG
YUK 3	3052	40 Mile	unocc.	unocc.	unocc.	pr(inc)	2 yg	single ad	2 yg	ns	ns	nc	nc	nc	nc	64.6210	142.2573
YUK 3	3054	40 Mile	unocc.	unocc.	unocc.	pr(inc)	3 yg	pr(inc)	1 yg	ns	ns	nc	nc	nc	nc	64.4757	142.3275
YUK 3	3058	40 Mile	ns	ns	ns	ns	2 yg	pair	unocc.	ns	ns	nc	nc	nc	nc	64.6773	142.0782
YUK 3	3059	40 Mile	unocc.	unocc.	unocc.	ns	2 yg	unocc.	unocc.	ns	ns	nc	nc	nc	nc	64.4763	142.4807
YUK 3	3060	70 Mile	unocc.	unocc.	unocc.	unocc.	2 yg	single ad	1 yg	ns	ns	nc	nc	nc	nc	64.9695	142.1342
YUK 3	3063	40 Mile	ns	ns	ns	ns	ns	3 adults	single ad	ns	ns	nc	nc	nc	nc	64.4545	142.2050
YUK 3	3066	40 Mile	ns	ns	ns	ns	ns	pr(inc)	single ad	ns	ns	nc	nc	nc	nc	64.4415	142.0958
YUK 3	3067	40 Mile	ns	ns	ns	ns	ns	pr(inc)	2 yg	ns	ns	nc	nc	nc	nc	64.3833	142.0250
YUK 3	3069	40 Mile	ns	ns	ns	ns	ns	pr(inc)	1 yg	ns	ns	nc	nc	nc	nc	64.3468	142.0070
YUK 3	3070	40 Mile	ns	ns	ns	ns	ns	pr(inc)	2 yg	ns	ns	nc	nc	nc	nc	64.3403	141.9910
YUK 3	3071	40 Mile	ns	ns	ns	ns	ns	pr(inc)	unocc.	ns	ns	nc	nc	nc	nc	64.3032	141.9627
YUK 3	3072	40 Mile	ns	ns	ns	ns	ns	unocc.	3 yg	ns	ns	nc	nc	nc	nc	64.4772	142.2167
YUK 3	3073	40 Mile	ns	ns	ns	ns	ns	ns	1 yg	ns	ns	nc	nc	nc	nc	64.3723	143.1590
YUK 3	3074	40 Mile	ns	ns	ns	ns	ns	ns	2 yg	ns	ns	nc	nc	nc	nc	64.0097	141.9797
YUK 3	3075	40 Mile	ns	ns	ns	ns	ns	ns	3 yg	ns	ns	nc	nc	nc	nc	64.0985	141.7572
YUK 3	3076	40 Mile	ns	ns	ns	ns	ns	ns	pair	ns	ns	nc	nc	nc	nc	64.1331	141.7790
YUK 3	3077	40 Mile	ns	ns	ns	ns	ns	ns	pair	ns	ns	nc	nc	nc	nc	64.1737	141.7459
YUK 3	3078	40 Mile	ns	ns	ns	ns	ns	ns	2 yg	ns	ns	nc	nc	nc	nc	64.2014	141.7405
YUK 3	3079	40 Mile	ns	ns	ns	ns	ns	ns	single ad	ns	ns	nc	nc	nc	nc	64.2118	141.7685
YUK 3	3080	40 Mile	ns	ns	ns	ns	ns	ns	pair	ns	ns	nc	nc	nc	nc	64.2282	141.7864
YUK 3	3081	40 Mile	ns	ns	ns	ns	ns	ns	pair	ns	ns	nc	nc	nc	nc	64.2718	141.6959
YUK 3	3082	40 Mile	ns	ns	ns	ns	ns	ns	3 yg	ns	ns	nc	nc	nc	nc	64.2943	141.6260
YUK 3	3083	40 Mile	ns	ns	ns	ns	ns	ns	3 yg	ns	ns	nc	nc	nc	nc	64.3004	141.4912
YUK 3	3084	40 Mile	ns	ns	ns	ns	ns	ns	pair	ns	ns	nc	nc	nc	nc	64.2707	141.8238
YUK 3	3085	70 Mile	ns	ns	ns	ns	ns	ns	single ad	ns	ns	nc	nc	pr (inc)	2 eggs	64.9730	142.8102
YUK 3	3086	70 Mile	ns	ns	ns	ns	ns	ns	3 yg	ns	ns	nc	nc	pr (inc)	unocc.	64.9970	142.5691
YUK 3	3087	70 Mile	ns	ns	ns	ns	ns	ns	3 yg	ns	ns	nc	nc	pr (inc)	1 egg	64.9605	142.7540
YUK 4	4001	Nation	ns	single ad	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	65.5133	141.0258
YUK 4	4002	Nation	ns	pr (inc)	2 yg	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	65.4202	141.3855
YUK 4	4003	Kandik	ns	single ad	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	65.5227	141.7100
YUK 4	4004	Kandik	ns	pr (inc)	3 yg	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	65.5562	141.5535
YUK 4	4005	Nation	unocc.	single ad	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	65.5847	141.5075
YUK 4	4006	Black	2 yg	ns	ns	ns	4 yg	ns	ns	ns	ns	nc	nc	nc	nc	66.1878	142.1862
YUK 4	4010	Black	ns	ns	ns	ns	2 yg	ns	ns	ns	ns	nc	nc	nc	nc	66.1718	141.3962
YUK 4	4011	Black	unocc.	ns	ns	ns	1 yg	ns	ns	ns	ns	nc	nc	nc	nc	65.7072	142.0388
YUK 4	4012	Charley	ns	ns	ns	ns	ns	ns	ns	ns	ns	pr(inc)	unocc.	unocc.	unocc.	65.2943	142.7090
YUK 4	4013	Charley	ns	ns	ns	ns	ns	ns	ns	ns	ns	single	unocc.	pr (inc)	pr	65.1108	142.7067
YUK 5	5001	Black	1 yg	ns	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	66.6772	142.1707

Appendix 1. (Continued).

REGION	NEST	DRAINAGE	94	95-1*	95-2	96-1	96-2	97-1	97-2	98-1	98-2	99-1	99-2	00-1	00-2	LAT	LONG
YUK 5	5002	Black	single ad	ns	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	66.4958	142.4033
YUK 5	5003	Black	3 yg	ns	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	66.6053	142.8273
YUK 5	5004	Black	2 yg	ns	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	66.7058	143.0845
YUK 5	5005	Black	3 yg	ns	ns	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	66.6843	143.5055
YUK 5	5042	Black	unocc.	ns	ns	ns	1 yg	ns	ns	ns	ns	nc	nc	nc	nc	66.4772	141.4087

* e.g., 95-1 = Year and visit number (1 = May-June [i.e., occupancy], 2 = July [i.e., productivity]).