Terrestrial Wildlife Study
Cooper Lake Project (FERC No. 2170)

Final Report

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June 2004

CLPP Relicensing Document Issuance #9O

TABLE OF CONTENTS

List of Tables

ATTACHMENTS

APPENDICES

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Final Report: Terrestrial Wildlife Study Cooper Lake Project (FERC No. 2170)

INTRODUCTION AND BACKGROUND

Study Purpose

The Cooper Lake Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) Project No. 2170, is owned and operated by Chugach Electric Association, Inc. (Chugach). The Project was originally licensed by FERC in May 1957, and the current license term expires at the end of April 2007. To retain its status as owner and operator of the Project, Chugach must file a final license application with FERC no later than April 30, 2005. As part of the process of developing an application to relicense the Project, Chugach has undertaken a program of studies designed to determine the ongoing and potential future effects of the Project on environmental resources.

This document reports the results from the Terrestrial Wildlife Study. The primary objective of the study was to conduct an inventory regarding the current status of terrestrial wildlife resources within the Project area. The baseline data collected for this study is used to describe the current terrestrial wildlife density, distribution, and habitat types in the Cooper Lake and Cooper Creek watershed area, the powerline right-of-way (ROW), as well as access routes into the powerline ROW. Data collected can be used to determine the possible effects of ongoing operation and maintenance activities on terrestrial wildlife within the Project area.

The research and fieldwork for this study were conducted by biologists from HDR Alaska, Inc. (HDR) during 2003 and included winter, spring, summer and fall surveys, although the majority of the fieldwork occurred from May to July. A biologist with the U.S. Fish and Wildlife Service (USFWS) assisted with the bald eagle survey component of the study. The study was conducted according to the approach described in the Terrestrial Wildlife Final 2003 Study Plan (HDR 2003), which was developed in consultation with resource agencies and other relicensing participants. Slight modifications were made to the Cooper Creek survey methodology described in the final study plan; these are described in the review of methodology in the Methods section of this report.

Description of the Project

Location and Project Lands

The Project dam and powerhouse are located within the Kenai Peninsula Borough, southcentral (southcoastal) Alaska, approximately 55 miles south of Anchorage. The closest community to the Project dam and powerhouse is Cooper Landing, approximately 4 miles north of Cooper Lake. Project facilities are located on Cooper Creek, Cooper Lake, and Kenai Lake. In addition, the 90-mile-long Project powerline between the Quartz Creek Substation (near Cooper Landing) and Anchorage crosses land located in both the Kenai Peninsula and Anchorage boroughs.

Lands occupied by the Project are owned and/or managed by the USDA Forest Service (USFS), Alaska Department of Natural Resources, and private landowners. The Project area, licensed Project boundary, and ownership/management of Project-area lands are shown in Figures 1 and 2.

Project Components

Cooper Lake Dam was constructed in 1957–1959 on Cooper Creek, approximately 4.8 river miles from the mouth of the creek at the outlet of Cooper Lake. The dam raised the elevation of Cooper Lake to provide increased storage capacity for hydroelectric generation. Storage below the base of the dam (at elevation 1, 168 feet above mean sea level [MSL]) is provided by the natural lake; storage above that level to the top of the Cooper Lake Dam spillway (elevation 1,210 feet MSL) is created by the dam. At its licensed normal maximum operating level of 1,210 feet MSL, Cooper Lake covers approximately 3,100 acres and has a mean depth of 187 feet.

The Project diverts water at the intake on Cooper Lake through the tunnel/penstock to the powerhouse on Kenai Lake. The Project powerhouse is located on the southwest shore of Kenai Lake, approximately 7 miles from the outlet of the lake. Cooper Creek and Kenai Lake both flow into the Kenai River.

The primary components of the Project are as follows:

- Cooper Lake Dam, a rock-and-fill structure across Cooper Creek at the outlet of Cooper Lake.
- Cooper Lake, a natural lake that has been increased in area to a maximum of approximately 3,100 acres by the dam (*Note*: the surface area of the reservoir at its current maximum operating level of 1,194 ft MSL is approximately 2,600 acres).
- An intake structure, located approximately 5 miles southeast of the dam on Cooper Lake. Elevation of the invert (base) of the opening to the tunnel/penstock is at 1,151 feet MSL (43 feet below the water surface at the normal maximum operating elevation of 1,194 feet MSL).
- A tunnel, conduit, and penstock extending 10,300 feet east from the intake structure on Cooper Lake to the Cooper Lake Powerhouse on Kenai Lake.
- Cooper Lake Powerhouse, containing two turbine/generator units, each rated at 9.69 MW (upgraded from 7.5 MW in 2000).
- A 6.3-mile-long 69-kV powerline from the Cooper Lake Powerhouse to the Quartz Creek Substation in Cooper Landing.
- A single-phase 4.16-kV distribution line from the powerhouse to the intake structure.
- 69/115-kV step-up transformer and appurtenant facilities at the Quartz Creek Substation.
- A 90.4-mile-long 115-kV powerline from the Quartz Creek Substation to the Anchorage Substation.

Project-related roads and access routes, as shown on Figure 1 are:

- Snug Harbor Road, an improved USFS easement across State-owned lands, extending from Cooper Landing to the vicinity of the Project powerhouse. This road was established to allow construction of the Project, but is open to the public and is now used

for multiple purposes (including access to private homes along Kenai Lake and nearby recreation areas). Snug Harbor Road and spurs off this road provide access to the Project powerhouse and intake structure. The following spur roads off Snug Harbor Road are used primarily or solely for Project operations and maintenance, and are proposed for inclusion in the Project boundary under the new license:
    - Spur to the Project powerhouse
    - Spur from the Russian Lakes Trailhead to the intake structure on Cooper Lake
    - Spur road to the surge tank on the penstock.
    - Spur road to the lower portal of the tunnel.
    - Spur road to the Quartz Creek Substation.
    - Spur road to an old logging area (FDR 1030300)
    - Six access routes to the powerline between the powerhouse and the Quartz Creek Substation.
- Cooper Lake Dam access road, an unimproved road from Cooper Landing up the Cooper Creek canyon. Most of this road is located on USFS land. This gated road is officially used solely for access to Cooper Lake Dam for the purpose of operations and maintenance related activities; however, it is also informally used by the public for hiking, off-road vehicle use, horseback riding, mountain biking, and snowmachine use. This road is proposed for inclusion in the Project boundary.
- Developed and undeveloped access routes to the 90-mile-long Quartz Creek to Anchorage powerline (Figure 3). These routes are located on USFS and State-managed lands. All existing and potential future access routes that have been identified by Chugach for possible Project-related use during the next license term are proposed for inclusion in the Project boundary.

Overview of Project Operations

The Project stores all inflow to Cooper Lake and diverts the entire outflow from the reservoir through the tunnel/penstock to the powerhouse, which discharges into Kenai Lake. For the period 1985–2002, the diverted natural flow ranged on average from around 20 cfs during late winter / early spring to about 260 cfs during early summer snowmelt, based on calculated inflows to Cooper Lake. Average annual inflow to / discharge from the reservoir for the same period was approximately 74,000 acre-feet (Chugach 2002).

The licensed maximum normal operating elevation of Cooper Lake is 1,210 feet MSL. However, since the mid-1980s, the reservoir has been operated at a normal maximum level of 1,194 feet MSL; the upper 16 feet of licensed reservoir storage is reserved for flood surcharge to ensure that the theoretical probable maximum flood (PMF) can be passed through the spillway without overtopping the dam. The reservoir typically is drawn down during late fall – early spring, experiences its most rapid refilling during the period of late spring – summer snowmelt runoff, and continues to fill through early fall. Within any given year, the reservoir typically fluctuates (on average) within a zone of about 15 feet (Chugach 2002).

The absolute range of reservoir operations varies from year to year, but generally remains within a relatively consistent band. The extreme high reservoir level (i.e., in a wet year) is approximately 7 or 8 feet above the annual high-water level experienced in an average year.

Similarly, the extreme low reservoir level (i.e., in a dry year) is about 7 or 8 feet below the lowest level experienced in an average year (Chugach 2002).

Electricity generated at the powerhouse (which averages approximately 50,500 megawatt-hours [MWh] per year) is transmitted to the Quartz Creek Substation, where it is transferred to the 90-mile-long Project powerline to the Anchorage Substation and the non-Project powerline to the Kasilof Substation. Electricity is also distributed to local communities located along the powerline route.

Project-Related Resource Issues Addressed by this Study

Terrestrial wildlife habitat in the Project area has been affected by continuing maintenance and operation of the Project, including reservoir operations and routine vegetation clearing. To assess ongoing impacts on terrestrial wildlife species due to the Project, we collected baseline data that describe the current terrestrial wildlife population and species composition along with habitat associations of individual species.

The study was also designed to provide information that can be used to evaluate the effects on terrestrial resources that could occur as a result of potential future changes in Project operations. At the time the 2003 study plans were developed, Chugach was considering proposing modifications to the dam spillway that would allow the reservoir to be operated safely at an increased maximum normal level of 1,206 feet MSL. The study plan for the Terrestrial Wildlife Study was designed to address this scenario. However, Chugach no longer plans to propose any changes in reservoir operations in the relicensing proposal. Therefore, the potential effects of a future change in operating regime are not evaluated in this report.

STUDY AREA

The study area is intended to cover all areas where terrestrial wildlife could be affected by Project operation and maintenance activities. The study area is defined as follows:

1. ***Cooper Lake.*** Terrestrial wildlife species were surveyed along the Cooper Lake shoreline using intensive area searches and line-transect surveys. The survey coverage included a minimum of 50 linear feet beyond the licensed normal maximum reservoir elevation of 1,210 feet MSL around Cooper Lake.
2. ***Snug Harbor Road.*** Terrestrial wildlife surveys were conducted along the full length of the road, including the area 50 feet either side of road centerline.
3. ***Cooper Creek.*** Terrestrial wildlife surveys were conducted along portions of Cooper Creek from the dam to the Kenai River. The study originally had intended to survey the entire corridor twice using a combination of point counts and line-transects. However, due to the high ambient noise caused by streamflow in the creek, and the resulting inability to detect birds by their singing, the study approach was modified such that the creek was surveyed as an entire transect, with species recorded as encountered.
4. ***Cooper Lake Dam Access Road.*** Terrestrial wildlife surveys were conducted on a 100-foot-wide swath (defined as 50 feet either side of road centerline) along the full length of the road.

5. ***Transmission Line Corridors.*** Point counts for terrestrial wildlife species were conducted along portions of the two Project transmission lines (the 6.3-mile-long line from the powerhouse to the Quartz Creek Substation, and the 90-mile-long line from the Quartz Creek Substation to Anchorage) plus the parallel zone extending 50 feet to either side beyond clearing limits.
6. ***Powerline Access Routes.*** Terrestrial wildlife surveys were conducted on a 100-foot-wide swath along the full length of selected access routes.

METHODS

The methodologies described below were employed to inventory and characterize the terrestrial avian and mammal species associated with the Project area.

Task 1 – Compile Literature Review Based on Existing Information

There was little existing Project-specific information concerning wildlife species available for review. Existing information that was available for the Project area was used to develop a thorough discussion of avian and mammal species life histories. In addition, the literature reviewed includes information regarding impacts of human activity and development on wildlife, roads and wildlife, snowmobiles and wildlife, and rights-of-way utilization and wildlife use. Existing information that was used for the literature review includes field guides, regional bird lists, Alaska breeding bird survey data, and other existing studies. Refer to Appendix C for the Terrestrial Wildlife Literature Review. Additional information was gained through discussions with agency biologists.

Task 2 – Inventory and Characterize the Terrestrial Wildlife Community

Surveys were conducted primarily during the 2003 calendar year and included a spring, summer, fall and winter (2004) survey component. The 2003 spring survey consisted of an aerial survey of the powerline ROWs, Cooper Lake and Cooper Creek to document mammal species by their tracks in the snow, signs of bears emerging from dens, and other wildlife observations (this survey is separate from the spring bald eagle survey). The summer surveys started the last week of May and continued through the end of July. The surveys during the month of June identified important nesting and rearing periods for a variety of bird species, while the surveys in July focused on mammals but included a continuation of the bird survey. A fall aerial survey in October was conducted to search for large mammals, and a winter survey in January 2004 was conducted to search for tracks in snow around Cooper Lake. These surveys, along with the Literature Review, have allowed us to describe wildlife use and wildlife habitat in the Project area, and to identify Project effects on these resources.

Surveys were conducted by a team of two biologists with experience studying Alaskan wildlife species. High-quality binoculars were used to locate and identify terrestrial wildlife species within the study area using the methods described below. We used a combination of intense area searches, point counts and line-transects to identify wildlife in the study area. The survey effort entailed observers quietly walking the transect or point count location, stopping at predetermined distance intervals and recording observations of any birds, mammals, tracks and scat, or other indicators of mammal activity (e.g., hair, digging activity, etc.) along the transect or at the point count location. These methods are described below under Cooper Lake and Powerline Survey Methodology**.** The methods used varied for different sections of the study area depending on factors such as terrain, configuration of shoreline, and diversity and abundance of species in the study area. Data were collected using separate standardized data sheets for terrestrial mammals, birds, and nest observations. (See Appendix B for data sheets used in the field). The data sheets for bird observations included the following variables:

- **Date, observer, site, transect or point count number**
- **Time:** Start and end time.
- **Precipitation**: Note amount as "none," or approximate amount per hour.
- **Air temperature**: Using portable thermometer.
- **Cloud Cover**: High/low, 0= no clouds, 1=less than 50%, 2=50%, 3=more than 50%, 4=100%.
- **Wind**: 0=calm, 1=light breeze, 2=moderate breeze, 3=strong breeze, 4=too windy for survey.
- **Observer location**: Location of observer from the start of the transect line.
- **Species Observed:** Using standard 4-letter species code for birds (American Ornithologists' Union [AOU]) (See attached species code list in Appendix B).
- **Habitat Description:** Determinations of the indicator species (e.g., alder thicket, cottonwood-willow) were made using *Plant Community Types of the Chugach National Forest: Southcentral Alaska* (Ralph et al. 1993). Other variables such as slope, percent canopy cover and density were also noted.
- **Distance from Water:** Recorded approximate distance of each observed bird from the water body edge; or noted if the bird was in water.
- **Number of Individuals:** The number of birds observed in a particular data location. The size of large flocks were estimated.
- **Detection status:** Record the first means of detection for an observation: singing (S), calling (C), or visual (V). Other observations, such as upland bird hatching and fledgling success, were recorded as opportunistic observations while re-checking nests that were found early on in the field season.
- **Flyover Status:** F= Flying over or through site, FA=Flew away, FI=flew in, FS=soaring.
- **Comments:** Included information when possible, such as sex, adults with food, approximate age, mobbing behavior, nest building activity, feeding, resting, and all other activities not noted above.
- **GPS Coordinates:** Recorded for locating transects, observation points, nests and other important resources.

Bird nests encountered were identified and permanently marked so that they could be monitored throughout the survey season. Subsequent field visits recorded distance from ground nests to water edge, habitat type, number of eggs (if applicable), suspected predation, and fledging success. Some nests were never relocated because they were obscured by tall vegetation. Fledgling success was not a specific component of this study but was recorded as opportunistic observations.

A winter survey was conducted in January 2004 to search for tracks in snow around Cooper Lake. These surveys, along with the Literature Review, have allowed us to describe wildlife use and wildlife habitat in the Project area, and to identify Project effects on these resources.

The data collected for terrestrial mammals varied slightly from data on the bird observation data sheets (see Appendix B). The nocturnal and elusive nature of many terrestrial mammal species made it necessary to study indirect signs of their presence by monitoring tracks, feces, burrows, feeding and resting areas, etc. This was done at each point count or line transect and opportunistically where appropriate. When an area of soft mud or sand near a water body was encountered, we would check for tracks, because many mammals prefer to travel along waterbodies.

Cooper Lake Survey Methodology

Surveys for terrestrial wildlife at Cooper Lake were conducted through the use of line transects. Line transects were identified in the office using aerial photography showing vegetation type boundaries. Vegetation characteristics such as canopy height, community composition, and density were identified from aerial photography and were the basis for delineating vegetation type boundaries. The project scientists identified areas by major habitat types and then randomly established plots for line transects. The locations of the transects coincided with the locations to be surveyed for the Terrestrial Vegetation study, which allowed us to make species-specific habitat correlations. We had originally planned to describe the study area by using a stratified-random methodology for all survey points. This method provides a standard sampling strategy that focuses on equalizing sampling effort between the various habitat types (or vegetation types) (Handel 2003). However, because of very dense vegetation, steep slopes, and dangerous terrain in some parts of the Project area, some locations that were identified from aerial photography vegetation boundaries had to be modified in the field because of accessibility and safety concerns.

We conducted intensive area surveys of the entire Cooper Lake shoreline while setting up transects during the last week of May and the first week of June. During this time we recorded wildlife observations and described the habitat characteristics of the transect locations. The first set of surveys was completed in June and the second set was completed in July. Transects were surveyed at varying times of the day including morning, afternoon, and evening transects in order to observe different species at the times they are most active. Surveys began between 3:00 A.M. and 5:00 A.M. and were completed by 10:00 A.M. This morning time period was selected based on peak passerine singing and activity. After 10:00 A.M. birds are generally less active and singing is much reduced.

Most wildlife species prefer to travel near stream or lake banks. Line transects are ideal for conducting surveys along lakeshores and streams because they allow sampling across environmental gradients (Sutherland 1996). The study area around Cooper Lake did not include the slopes of the adjacent mountains above the reservoir. However, we recorded any wildlife species that were observed as incidental observations and recorded the approximate locations. Each transect was selected so that all observed and anticipated species and habitat types would be included. Some locations (e.g., irregular topographic areas such as islands or outcroppings) were not feasible for a transect. In these locations we conducted intensive area surveys to locate potential nest sites and/or mammal denning, foraging, or migration routes.

We surveyed a total of 25 line-transects around Cooper Lake. The line transects were spaced at a minimum of 200 meters (approximately 650 feet) apart and in some areas were as much as 3,000 meters (approximately 9,800 feet) apart because of difficult terrain or similar vegetation community structure. At each transect location, the observers would start at a predetermined start point and azimuth. One team member would use a hand-held compass to navigate toward landmarks that lay on the transect line, while the other team member recorded wildlife sightings. The observers would walk at a rate of 0.5 – 2 kilometers/hour (0.3 – 1.2 mile/hour), stopping to record all birds or mammals encountered and any mammal signs along the 100-meter long transect. The transect line would often need to be modified to avoid wetlands, thick vegetation or other obstructions. For each bird detection we would record the distance traversed along the transect. All mammal activity including tracks, feces, burrows, traces of feeding, etc. was recorded. The location of each line transect was recorded using GPS and flagged with laths and flagging tape to be easily found for the second survey. All wildlife observations that occurred between transects were recorded as incidental observations. Figure 4 shows the transect locations around Cooper Lake.

Cooper Creek Survey Methodology

We conducted intensive area surveys of Cooper Creek during the last week of May and the first week of June. During these surveys we recorded any wildlife observations and described the habitat where wildlife was observed. The Final 2003 Study Plan for the Terrestrial Wildlife Study described the surveys for terrestrial wildlife species in Cooper Creek as consisting of a combination of line transects and point counts. However, during the first intensive area survey of the creek, in which the entire length of the creek was surveyed, we determined that it would not be beneficial to conduct point counts or transects on the creek. The reasoning behind this decision was based on the loud, ever-present ambient noise from the creek (equivalent to a strong breeze or higher). The reason for conducting point counts is to record species seen and heard, and for this reason, many of the bird species that were recorded during the surveys were singing males. However, the ambient noise of the creek was loud enough that no singing birds could be detected. The only birds that were detected were ones that we happened to flush out of the vegetation or that happened to fly over the creek. Therefore, we decided to survey the creek corridor as a single transect and record wildlife as encountered. We also relied on other study team participants to record their incidental wildlife sightings when they were working in the creek.

Snug Harbor and Dam Access Roads Survey Methodology

Snug Harbor Road and the Cooper Lake Dam access road (“Dam Access Road”) were each surveyed as single transects twice during the summer field season. The survey of each road consisted of walking the road and looking for wildlife 50 feet from the centerline on either side of the road. Every species encountered along the way was recorded, and we would periodically stop and record all birds singing in the area. (Refer to Figure 1 for Dam Access and Snug Harbor Road Locations.)

Powerline Corridor and Powerline Access Routes Survey Methodology

Terrestrial resources along the 6.3-mile-long transmission line from the Project powerhouse to the Quartz Creek Substation and the 90-mile long Project transmission line from the Quartz Creek Substation to Anchorage were surveyed to determine existing conditions and evaluate the possible ongoing effects on terrestrial wildlife from continued vegetation management along the powerline ROW. In addition, we assessed wildlife along the access routes to these powerlines.

We visited 26 point-count stations along the powerline corridor from Anchorage to the Project powerhouse (Figure 5). Selection of point-count locations along the corridor was based on vegetation communities that were delineated on acetate overlays and transferred by digitizing to the Project's GIS database. Vegetation characteristics such as canopy height, community composition, and density were identified from aerial photography and were the basis for delineating vegetation communities. The Project scientists chose point-count locations that would provide representative samples of habitat types along the powerline corridor, but also factored site accessibility into the site selection process. Chugach is not planning to implement any major structural changes to the powerlines or access routes, and plans to continue existing vegetation management practices. Therefore, spacing of sample sites along the powerline corridor was greater than in other portions of the study area, which was determined to be appropriate for the purposes of providing qualitative data sufficient to describe the baseline conditions, rather than statistically defensible quantitative data.

Surveys began between 3:00 A.M. and 5:00 A.M. and were completed by 10:00 A.M. The observers would locate the predetermined point-count location using aerial photography and GPS. After arriving at the point-count location, observers would wait one minute before starting the count. The observer would then count all birds and mammal signs within a 10-minute count period. Each individual species was recorded along with the detection method and distance and direction from the observer to the species. For presence/absence data we counted all birds regardless of distance at which they were detected. Once the 10-minute count for birds was over the observer would walk a 50-meter (164-foot) radius around the point-count location to search for signs of mammal activity, including tracks, feces, burrows, traces of feeding, etc.

In addition to surveying the powerline corridor, we conducted surveys of the powerline access routes (Figure 3). This entailed driving/walking along the route and recording wildlife seen or heard and habitat characteristics of the edge of the road and 50 feet from the centerline on either side of the road.

Bald Eagle Survey Methodology

Bald eagles are not listed as threatened or endangered in the State of Alaska; however, bald and golden eagles throughout the United States, including Alaska, are protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712). The Bald and Golden Eagle Protection Act restricts activities that may adversely affect eagles or their nests. Knowledge of where eagle nests occur in the Project area will help resource managers and Chugach Electric avoid impacts to bald eagles and their nests. Bald eagle nesting sites are fairly predictable in Alaska. Bald eagles tend to nest in old cottonwood trees along major waterways in southcoastal and interior Alaska. The high probability areas were identified from aerial photographs for particular attention while surveying.

The survey was conducted in a Bell 206 JetRanger Helicopter with seating for four passengers. The survey was completed on April 29, 2003, by Era Aviation, HDR, and a USFWS Biologist. We chose this survey date because egg laying had begun but the trees had not leafed out yet, making nests easy to spot. Prior to the helicopter survey, primary resource managers with jurisdiction over properties within the study area were contacted to obtain existing nest information for verification in the field. The USFWS had information regarding several nests along the powerline corridor that were active in previous years (Joe Conner, USFWS, Pers. Comm. to HDR, 2003).

A 660-foot buffer around bald eagle nests is recommended to minimize the chances that eagles might abandon an active nest (USFWS, Bald Eagle Basics brochure). Therefore, the aerial survey entailed searching for bald eagle nests 0.5 mile from the shoreline of Cooper Lake and 0.5 mile on either side of Cooper Creek. In addition, the two Project transmission lines were surveyed for active eagle nests by having observers watch each side of the powerline up to 0.5 mile away from the centerline.

For each identified nest, the team circumnavigated the nest to record coordinates, tree species in which the nest was located, activity of the nest (active or inactive), and general comments about the location of the nest. A nest was considered active if it was being newly built, or an established pair was observed incubating or with young. The nest location was recorded on the quadrangle map and was mapped using GIS.

Fall Migration Raptor Survey Methodology

Portage Valley serves as a migratory corridor for geese, swans, cranes, and raptors, and the USFWS has expressed concern about the potential for bird collisions with powerlines in this area. We consulted with the Alaska Department of Fish and Game (ADFG) regarding other possible migratory pathways in the Project area, and it was determined that Portage Valley was the best location for surveys. In order to determine the potential for bird collisions in the Portage Valley we conducted surveys to determine the species of birds migrating through the valley and other variables described below.

In addition to conducting surveys for raptors and other birds along the powerlines we consulted with the USFWS Law Enforcement Office and Chugach Electric Operations and Maintenance Office to determine if any raptor electrocutions or collisions had occurred along the Project powerlines.

The point count surveys for raptors and other large birds were conducted on September 17 and 22, 2003, in Portage Valley at the Portage Valley Visitor Center Pullout. This pullout area allows viewing of the powerline, a large portion of the Valley and the Cook Inlet Tidal Flats. The surveyors used high-quality 10x binoculars to assist in spotting and identifying birds. The surveyors recorded the following data on standardized forms used for migration counts:

1. Species and color morph (if appropriate) of each migrant bird species

2. Time of passage for each migrant
3. The flight direction and altitude
4. Wind speed, air temperature, percent cloud cover, precipitation, and observation of raptors or other birds using thermal lifts
5. Distance from the bird to the nearest portion of powerline

Winter Survey for Mammal Tracks

Snow track surveys were performed along Snug Harbor Road and the south end of Cooper Lake on January 14, 2004, by a team of biologists familiar with mammal winter tracking. These surveys involved using a snowmachine to cover large tracts of land and stopping whenever tracks were encountered. Different species may have tracks that look similar; therefore, in order to ensure correct species identification, several measurements were used to determine species identification, including gait patterns (the sequence of foot movements), stride, straddle and actual track measurements. Occasionally several measurements were required to determine species. We referred to a tracking field guide to identify tracks (Rezendes 1992). When a track was encountered that could not be immediately identified, we would photograph the track, and follow the track to see if it led to a burrow, den, feeding area, or resting spot that would help identify the species. For all species but wolves, all tracks encountered within 0.3 mile of each other were recorded as one animal.

Aerial Surveys for Mammals

Two aerial surveys were conducted to document large mammal use of the Project area during different seasons. The surveys were conducted in a Bell 206 JetRanger helicopter with seating for four passengers. The spring survey was conducted on April 2, 2003, and the fall survey was completed on October 2, 2003. Both surveys were conducted by Era Aviation and HDR. These surveys started in Anchorage, followed the powerline route from Anchorage to Cooper Lake, and then circumnavigated Cooper Lake looking for wildlife signs or tracks. The spring survey was completed several days after a snowfall, and wildlife tracks in the fresh snow were easily spotted from the helicopter. One observer would look for tracks or wildlife to the right of the powerline center and the other would concentrate on the other side. At the end of the survey, the two surveyors' notes were compared to make sure no tracks were double-counted and that each observer recorded the same species identification. The fall survey was conducted along the same route, but snow was present only in the higher pass areas along the powerline corridor. We recorded migrating birds such as tundra swans and waterfowl as opportunistic observations.

Brown Bears

Brown bears on the Kenai Peninsula are listed by the State of Alaska as a Population of Special Concern. This listing was made because the population is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbances (ADFG 2000). The Forest Service identified brown bears as a Management Indicator Species (MIS) for the Chugach Forest (USFS 2002a). One of the goals of the Chugach National Forest Land and Resource Management Plan is to maintain brown bears on the Kenai Peninsula portion of the Chugach National Forest (USDA Forest Service 2002b). Therefore, as part of the terrestrial mammal study component, we evaluated the possible impacts of Project-related human disturbances on brown bears in the study area. Observations of brown bears or brown bear signs were recorded during the study and reported to ADFG. In addition, we analyzed all defense of life and property (DLP) records for the Project area and adjacent areas.

RESULTS

The survey results provide a qualitative description of the existing terrestrial wildlife communities and their habitat preferences in the Project area and provide a baseline against which to measure any future changes.

A total of 85 terrestrial wildlife species were represented in the 2,804 detections made during point-count, line-transect, aerial, winter, and incidental observations of the 2003 and 2004 survey period. Of the 85 species observed, 63 species were bird detections and 22 species were mammal detections. One amphibian was recorded at Cooper Lake. Of the 63 birds species that were identified within the Project area during the study, 54 species were identified at a sampling point (i.e., point-count and line-transect locations). The 9 additional species were recorded as incidental observations or during the Fall Raptor Survey. Four of the species (one mammal and three bird species) observed are listed as Species of Special Concern by ADFG (ADFG 2003). All 22 mammal species were identified at a minimum of one sampling point.

Each sampling point was surveyed twice during the survey season. The first survey period was from May 21 through June 26 and the second from June 27 through July 30, 2003. There were 134 hours of observation over 32 days from May 21 through July 30, 2003. Additional time was spent conducting aerial surveys and winter surveys.

Habitat Descriptions

Six habitat types were identified in the Project area, encompassing a total area of 8,075.5 acres (4,952.9 acres of vegetated areas): 1) Needleleaf Forest; 2) Broadleaf Forest; 3) Broadleaf / Mixed Needleleaf/Broadleaf Forest; 4) Scrub Community; 5) Herbaceous (Forb and Graminoid) Cover; and 6) Disturbed/Unvegetated Areas. General descriptions and acreages mapped of each habitat type are provided below. For detailed descriptions of vegetation communities occurring in the study area refer to the Terrestrial Vegetation Study Report (HDR 2004).

Needleleaf Forest Type *— 1,823.8 acres (23 % of Study Area, 36.8 % of vegetated area)*

Three types of needle-leaved forest communities occur in the study area. These types include spruce, hemlock, and spruce-hemlock forest. Needleleaf forests are common to southcoastal Alaska and generally occur throughout the study area from Anchorage to Cooper Lake. Variations in percent cover, understory composition, and tree size occur throughout the geographic region.

Broadleaf Forest *— 253.8 acres (3 % of Study Area, 5.1 % of vegetated area)*

Two types of broadleaf forest communities occur in the study area. These types include birch and cottonwood cover types. Mature paper birch trees dominate the forest overstory, with a variety of species growing throughout the understory. Communities dominated by an overstory of black cottonwood are common along stream floodplains, adjacent to riparian corridors, and encompassing raised elevated areas in the wetland flats of the Twenty Mile/Portage/Placer River valleys.

Broadleaf/Mixed Forest *— 419.2 acres (5 % of Study Area, 8.5 % of vegetated area)*
Three types of mixed forest communities are present in the Project area: spruce-birch, spruce-cottonwood, and spruce-aspen. Spruce-birch forests are the most common mixed forest cover type mapped in the study area. This cover type has an overstory of Sitka, white, and/or Lutz spruce and paper birch. Few spruce-cottonwood forests were mapped in the study area. This cover type has an overstory of Sitka, white, and/or Lutz spruce and black cottonwood. Spruce-aspen forests were moderately abundant in the mapped study area. This cover type has an overstory of Sitka, white, and/or Lutz spruce and quaking aspen.

Scrub Community *— 1,562.5 acres (19 % of Study Area, 31.5% of vegetated area)*
Four types of scrub communities occur in the study area. These types include alder scrub thicket, willow, tall scrub, low scrub, and dwarf scrub. Alder scrub thickets are one of the most common cover types within the cleared powerline rights-of-way (ROWs) between Anchorage and Cooper Lake. Tall scrub willow thickets are also common between Anchorage and Cooper Lake. This cover type is one of the dominant cover types that exist along the cleared powerline corridor. Low scrub plant communities were abundant throughout much of the cleared powerline corridor from Powerline Pass south to Cooper Lake and at the southern flats of Cooper Lake.

Forb and Graminoid (Herbaceous) *- 893.6 acres (11 % of Study Area, 18.0% of vegetated area)*
Three types of forb and graminoid communities occur in the study area including graminoid cover, forb cover, and mixed forb/graminoid cover. Throughout the study area, two types of graminoid (grass-like) communities are dominant: bluejoint grass meadows and sedge meadows. Forb meadows are common along much of the powerline corridor, often occurring in areas where forested communities were cleared to allow construction of the powerline. They are also common in undisturbed areas, where they are intermixed with scrub and forest communities. The most common forb meadow seen in the study area is dominated by tall fireweed. The mixed forb/graminoid cover type is a mix of grasses and forbs. Much of the cleared powerline corridor has this cover type. Common plant species include fireweed, bluejoint grass, cow parsnip, Merten’s sedge, salmonberry, tall blueberry, rush, willow, calthaleaf avens, dandelion, and rattlebox.

Disturbed Areas/Unvegetated *— 3,122.6 acres (39 % of Study Area)*
This cover type identifies areas that are sparsely vegetated or unvegetated. Many of these areas are frequently disturbed by either natural or human-induced impacts. Species common to these areas tend to be weedy species, both exotic and native. Plant species seen in these areas include fireweed, rattlebox, common mustard, yarrow, Jacob’s ladder, white clover, Pacific silverweed, mountain timothy, bluejoint grass, and Merten’s sedge.

Terrestrial Birds

A total of 63 bird species were detected during the study period, of which 54 species were detected at a sampling point, and 9 species were detected during the fall migration surveys or as an incidental observation. There were 2,487 bird detections recorded at sampling points. Detailed life history information for many of the species detected during the surveys is included in Appendix C.

Table 1 shows all bird species detected, along with their abundance and distribution for southcoastal Alaska.

Table 1
Bird Species Sighted During 2003 Field Season and Abundance and Distribution

Common Name[1]	Latin Name	Abundance and Distribution[2]			
		SP	S	F	W
Alder flycatcher	*Empidonax alnorum*	U	U	U	-
American dipper	*Cinclus mexicanus*	C	C	C	C
American pipit	*Anthus rubescens*	C	C	C	+
American Robin	*Turdus migratorius*	C	C	C	R
Bald eagle	*Haliaeetus leucocephalus*	C	C	C	C
Bank swallow	*Riparia riparia*	U	U	U	-
Belted kingfisher	*Ceryle alcyon*	U	U	U	U
Black-billed magpie	*Pica pica*	C	C	C	C
Black-capped chickadee	*Poecile atricapillus*	U	U	U	U
Blackpoll warbler	*Dendroica striata*	R	R	R	-
Boreal chickadee	*Poecile hudsonicus*	R	R	R	R
Brown creeper	*Certhia americana*	U	U	U	U
Canada goose	*Branta canadensis*	C	C	C	U
Cliff swallow	*Petrochelidon pyrrhonota*	U	U	U	-
Common raven	*Corvus corax*	C	C	C	C
Common redpoll	*Carduelis flammea*	C	U	C	C
Dark-eyed junco	*Junco hyemalis*	C	C	C	U
Downy woodpecker	*Picoides pubescens*	U	U	U	U
Fox sparrow	*Passerella iliaca*	C	C	C	R
Golden eagle*	*Aquila chrysaetos*	R	R	R	R
Golden-crowned kinglet	*Regulus satrapa*	U	U	U	U
Golden-crowned sparrow	*Zonotrichia atricapilla*	C	C	C	R
Gray jay	*Perisoreus canadensis*	R	R	R	R
Great-horned owl*	*Bubo virginianus*	C	C	C	C
Hairy woodpecker	*Picoides villosus*	U	U	U	U
Harlan's Red-tailed hawk**	*Buteo jamaicensis harlani*	U	R	U	+
Hermit thrush	*Catharus guttatus*	C	C	C	-
Lincoln's sparrow	*Melospiza lincolnii*	C	C	C	+
Merlin	*Falco columbarius*	U	R	U	R
Northern flicker	*Colaptes auratus*	U	U	U	+
Northern goshawk	*Accipiter gentilis*	U	U	U	U
Northern waterthrush	*Seiurus noveboracensis*	U	U	U	-
Northern harrier**	*Circus cyaneus*	C	U	C	R
Northern shrike*	*Lanius excubitor*	U	U	U	U

Common Name[1]	Latin Name	Abundance and Distribution[2]			
		SP	S	F	W
Northern wheatear*	*Oenanthe oenanthe*	R	R	R	-
Olive-sided flycatcher	*Contopus cooperi*	R	R	R	-
Orange crowned warbler	*Vermivora celata*	C	C	C	+
Pine grosbeak	*Pinicola enucleator*	U	U	U	U
Pine siskin	*Carduelis pinus*	C	C	C	U
Red crossbill	*Loxia curvirostra*	R	R	R	R
Red-breasted nuthatch	*Sitta canadensis*	R	R	U	R
Rock ptarmigan	*Lagopus mutus*	C	C	C	C
Rough-legged hawk**	*Buteo lagopus*	R	+	R	+
Ruby-crowned kinglet	*Regulus calendula*	C	C	C	+
Savannah sparrow	*Passerculus sandwichensis*	C	C	C	+
Say's phoebe*	*Empidonax difficilis*	-	+	-	-
Sharp-shinned hawk	*Accipiter striatus*	C	U	C	U
Spruce grouse	*Falcipennis canadensis*	U	U	U	U
Steller's jay	*Cyanocitta stelleri*	C	C	C	C
Swainson's thrush	*Catharus ustulatus*	U	U	U	-
Townsend's warbler	*Dendroica townsendi*	U	U	U	+
Tree swallow	*Tachycineta bicolor*	C	C	C	-
Tundra swan	*Cygnus columbianus*	C	R	C	R
Varied thrush	*Ixoreus naevius*	C	C	C	R
Violet-green swallow	*Tachycineta thalassina*	C	C	C	-
Western wood-pewee	*Contopus sordidulus*	U	U	U	-
White-crowned sparrow	*Zonotrichia leucophrys*	U	R	U	R
White-winged crossbill	*Loxia leucoptera*	U	U	U	U
Wilson's warbler	*Wilsonia pusilla*	C	C	C	+
Wilson's snipe	*Gallinago gallinago*	C	C	C	R
Winter wren*	*Troglodytes troglodytes*	U	U	U	U
Yellow warbler	*Dendroica petechia*	U	U	U	-
Yellow-rumped warbler	*Dendroica coronata*	U	U	U	+

C = Common
U = Uncommon
R = Rare
+' = Casual or accidental
-' = Not known to occur
Sp = March through May
S = June and July
F = August through November
W = December through February
* birds that were incidental observations and not included in the actual point count or transect data
** raptors encountered during Fall Migration Survey only
1 Common Name, Latin Name and Abundance and Distribution Data Source: Armstrong 1995
[2] Abundance and distribution is for Southcoastal Alaska only (Armstrong 1995)

The five most common birds detected were pine siskin (24%), dark-eyed junco (7%), hermit thrush (7%), ruby-crowned kinglet (5%), and black-capped chickadee (5%). The highest densities of songbirds were detected during the first survey period (May 21 - June 26), when 61% of the 2,487 bird detections were recorded. Of the 54 species detected within a sampling point, the highest diversity of species, 85%, was documented along the cleared powerline ROWs. Among the various parts of the study area, Cooper Lake had the highest density of birds recorded during the survey season (see Appendix E for survey results from each project component).

Out of the 2,487 bird detections, 63% of the birds recorded were detected visually, 31% were detected by singing, 6% were detected by calling, and less than 0.01% were detected by drumming (woodpeckers only). During the first survey period, we detected 1,532 species, and during the second survey period we detected 955 species. During the first survey period, 40% of the birds detected were singing birds. That number dropped to 16% during the second survey period. Visual observations increased to 75% of the detections during the second survey period, although several large flocks of swallows and pipits probably skewed the visual observations during this period.

Not all bird species were detected during both survey periods. Species that were counted in the first survey period but that were not included in any subsequent survey period counts include: belted kingfisher, black-poll warbler, Canada goose, red crossbill, sharp-shinned hawk, tundra swan, western-wood pewee, and white-winged crossbill. Species that were counted in the second survey but not present during the first survey include: northern flicker, northern goshawk, and northern waterthrush.

The broadleaf/mixed forest and forb and graminoid habitat types had the highest density and diversity of bird species. Sampling point results show that 16 species occurred in all community types. Table 2 details the species numbers and percentages found in each habitat type.

Table 2
Habitat Preferences of Surveyed Birds

Common Name	Broad-Leaf Forest	Broadleaf Forest/ Mixed Forest	Disturbed Areas/Un-Vegetated	Forb & Graminoid	Needle-Leaf Forest	Scrub Community	Total
Alder flycatcher		4	1	18	2	4	29
American dipper		15		1			16
American pipit		1	13			17	31
American Robin	2	18	4	17	6	8	55
Bald eagle	1	6		3	1	3	14
Bank swallow				100			100
Belted kingfisher		1					1
Black-billed magpie			7	7	3	7	24
Black-capped chickadee	5	57	18	29	6	6	121
Blackpoll warbler	2	3	2				7
Boreal chickadee	1	13	1	3	5		23
Brown creeper		12	3	1			16
Canada goose				1			1
Cliff swallow		1		42	1		44
Common raven		8		7	2		17
Common redpoll	2	48		12	17	4	83
Dark-eyed junco	4	84	2	29	16	34	169
Downy woodpecker		3	1	3			7
Fox sparrow		7			3		10
Golden-crowned kinglet		10					10
Golden-crowned sparrow	2	8	2	40	18	14	84
Gray jay	1	16		10	1	6	34
Hairy woodpecker		2		3		2	7
Hermit thrush	13	47	4	62	24	17	167
Lincoln's sparrow	1	17	3	24	9	3	57
Merlin				1	1		2
Northern flicker		1					1
Northern goshawk		2					2
Northern waterthrush		1					1

Common Name	Broad-Leaf Forest	Broadleaf Forest/ Mixed Forest	Disturbed Areas/Un-Vegetated	Forb & Graminoid	Needle-Leaf Forest	Scrub Community	Total
Olive-sided flycatcher		16	1	5	1	1	24
Orange crowned warbler	4	27	3	32	7	5	78
Pine grosbeak		7	2				9
Pine siskin	31	157	31	183	94	107	603
Red crossbill	3	11	2				16
Red-breasted nuthatch		7	2	2		1	12
Rock ptarmigan			5				5
Ruby-crowned kinglet	10	48	5	39	15	15	132
Savannah sparrow	7	3	1	17	5	10	43
Sharp-shinned hawk		1					1
Spruce grouse		12		5	1		18
Steller's jay		6		4		2	12
Swainson's thrush		5	1	2	1		9
Townsend's warbler	2	20	4	5	9		40
Tree swallow	3			1	5	9	18
Tundra swan				6			6
Varied thrush	5	37	6	3	6	4	61
Violet-green swallow		5	11	6		8	30
Western wood-pewee		1		1			2
White-crowned sparrow	1			2	1		4
White-winged crossbill		2		7			9
Wilson's warbler	7	25	4	32	21	14	103
Wilson's snipe		3		13	3	3	22
Yellow warbler	5	23	2	26	3	1	60
Yellow-rumped warbler	2	19	3	8	2	3	37
Total	**114**	**820**	**144**	**812**	**289**	**308**	**2487**
Percent	**4.6**	**33.0**	**5.8**	**32.6**	**11.6**	**12.4**	**100.0**

Confirmed Nests

A total of eleven nests, representing seven species of terrestrial birds (excluding bald eagles) were found during the 2003 field season. The nests were located at Cooper Lake, Cooper Creek, and Snug Harbor Road. No nests were documented on the powerline ROWs or Dam Access Road. However, parental behavior, pair interactions, and fledglings were present at all Project components. Many times we observed and recorded nesting behavior but could not locate the nest. Many forest nesting species place their nests high in dense foliage and are difficult to locate. The American dipper nests were fairly easy to locate, which may explain why their nests were the most abundant of the nests documented. For each nest found, Table 3 describes the location within the study area, the detection method used to find the nest, nest location (e.g., ground or tree), distance from edge of water (if applicable), and nest fate. Refer to Figure 7 for nest locations on Cooper Lake, Figure 8 for nest locations on Snug Harbor Road, and Figure 9 for nests located along Cooper Creek.

Table 3
Nest Observation Data

Species	Date Discovered	Location	Detection Method	Nest location	Distance from edge of water (if applicable)	Nest Fate (if known)
American dipper	5/22/2003	Cooper Creek	Parental behavior	Rock outcropping above creek	0.5 meters	Unknown
American dipper	5/22/2003	Cooper Creek	Nest building	Rock outcropping adjacent to creek	0.2 meters	Unknown
American dipper	5/22/2003	Cooper Creek	Parental Behavior/Nest building	Tucked in rock crevice	0.5 meters	Unknown
American dipper	6/25/2003	Cooper Creek	Nestlings observed with parent	Unknown	N/A	2 Fledglings
Black-billed magpie	6/19/2003	Cooper Lake	Nestlings/parent behavior	Alder thicket	30 meters	Unknown
Boreal chickadee	6/11/2003	Snug Harbor Road	Nestlings/parent behavior	Hemlock tree	N/A	2 nestlings on 6/11/03
Golden-crowned sparrow	6/4/2003	Cooper Lake	Parental behavior	Ground	150 meters	5 eggs on 6/4/03, fledglings heard in area on 7/9/03 survey
Ruby-crowned kinglet	6/11/2003	Snug Harbor Road	Nest building/parental behavior	Spruce tree	N/A	Unknown
Savanna sparrow	7/9/2003	Cooper Lake	Parental behavior	Ground	100 meters	3 nestlings near nest, parents agitated
Savanna sparrow	6/17/2003	Cooper Lake	Flushed parent off nest	Ground	50 meters	4 eggs in nest
Varied thrush	6/13/2003	Snug Harbor Road	Parent bringing food to nestlings, nestlings calling	Spruce tree	N/A	Unknown

Raptors

We recorded 48 sightings of raptors during the course of spring, summer, and fall surveys. Nine species of raptors make up the 48 sightings that occurred in the Project area. These species include: bald eagle (28 individuals), merlin (3 individuals), northern goshawk (4 individuals), sharp-shinned hawk (1 individual), northern harrier (4 individuals), rough-legged hawk (3 individuals), great-horned owl (2 individuals), golden eagle (1 individual), and red-tailed hawk (2 individuals). Only four raptor species, the bald eagle, merlin, northern goshawk, and sharp-shinned hawk, were observed at a sampling point. The other species were observed during the fall migration survey or as incidental observations while traveling between sampling points. Also included in the fall migration survey were 6 sandhill cranes and 15 Canada geese. One flock of approximately 100 small birds was observed, but they were flying at a high altitude and could not be identified. Of the 48 sightings, over half occurred in the Portage Valley area. The most common raptor observed was the bald eagle. The single golden eagle observed was observed on August 1, 2003, flying through Portage Valley toward Portage Glacier. Golden eagles are considered a rare sighting in southcoastal Alaska. Both of the red-tailed hawk sightings were dark-morphed Harlan's race and the rough-legged hawk sighting was of a light-morphed adult. The fall migration survey results are listed below in Table 4.

Table 4
Fall Migration Survey Results

SURVEY DATE: 9/17/03 LOCATION: PORTAGE VALLEY, VISITOR CENTER PARKING LOT			
Survey Time Start: 0900 am Survey Time End: 1500 pm			
Species	**Number**	**Flying Altitude**	**Distance from Powerline**
Bald eagle	1	N/A-perched	200 meters
Bald eagle	1	50 meters	300 meters
Bald eagle	1	N/A - perched	30 meters
Red-tailed hawk	1	50 meters	20 meters
Northern harrier	1	20 meters	>500 meters
Bald eagle	1	60 meters	150 meters
Rough-legged hawk	1	30 meters	300 meters
Rough-legged hawk	1	80 meters	400 meters
Sandhill crane	6	250 meters	500 meters
SURVEY DATE: 9/22/03 LOCATION: PORTAGE VALLEY, VISITOR CENTER PARKING LOT			
Survey Time Start: 1300 pm Survey Time End: 1700 pm			
Species	**Number**	**Flying Altitude**	**Distance from Powerline**
Bald eagle	1	40 meters	200 meters
Red-tailed hawk	1	N/A - perched	125 meters
Canada goose	15	Approx. 600 meters	Approx. 600 meters
Northern harrier	1	20 meters	50 meters
Bald eagle	1	N/A - perched	150 meters
Merlin	1	30 meters	250 meters

Bald Eagle Nesting Surveys

A total of 10 nests were found during the aerial survey conducted on April 29, 2003. The survey effort recorded 6 active nests and 4 nests that were unoccupied/not active at the time of survey (Figure 6). All nests were found in black cottonwood trees.

The highest concentration of eagle nests was along Quartz Creek between the Quartz Creek substation and Kenai Lake. Table 5 identifies the nests by nest number corresponding to the location on Figure 6. The outcome for Nest 2 was observed during a flight to Powerline Pass on June 17, 2003, when two eagle chicks were observed from the helicopter. The other nests were not surveyed again and the outcome is unknown. Nest 9 was easily monitored from Snug Harbor Road during the summer survey period, and this nest was observed to fledge two bald eagles.

Table 5
Spring 2003 Aerial Bald Eagle Nesting Survey

Nest No.	General Location	Status	Outcome	Distance From the Powerline or Project Component
1	Bird Point	Incubating adult	2 eaglets observed 6/17/03	Nest located 388 meters from powerline
2	Lyon Creek	Incubating adult (per Joe Conner, USFWS)	Unknown	Nest located 213 meters from powerline
3	Quartz Creek	Unoccupied Nest - not active	N/A	Nest located 477 meters from powerline
4	Quartz Creek	Incubating adult	Unknown	Nest located 625 meters from powerline
5	Quartz Creek	Unoccupied Nest - not active	N/A	Nest located 100 meters from powerline
6	Quartz Creek	Incubating adult	Unknown	Nest located 412 meters from powerline
7	Quartz Creek	1 egg present in nest, male and female present	Unknown	Nest located 300 meters from powerline
8	Quartz Creek	Unoccupied Nest - not active	N/A	Nest located 250 meters from powerline
9	Snug Harbor Rd.	Incubating adult	2 eaglets fledged	Nest tree is located adjacent to Snug Harbor Rd
10	Cooper Lake	Unoccupied Nest - not active	N/A	Located approx. 365 meters from south Cooper Lake shore

Terrestrial Mammals

A total of 22 mammal species were detected during the study period, and a total of 323 mammal detections were recorded at sampling points. All species detected during the survey period were detected at a sampling point. The most common mammals encountered during the survey season were moose (32%) and red squirrel (22%). The highest densities of mammal species were recorded on the powerline corridor (37%). The highest diversity and density of mammals occurred in the broadleaf/mixed forest (44%) and the forb and graminoid (28%) habitat type. Detailed life history descriptions for mammals found in the study area are included in Appendix C. Table 6 shows the number of mammal detections for each survey location. This table does not include aerial survey or incidental wildlife observations. Table 7 shows the habitat preferences of surveyed individuals.

Table 6
Terrestrial Mammal Survey Results

Species	Scientific Name	Cooper Creek	Cooper Lake	Powerline	Dam Access Rd.	Snug Harbor Rd.	Total Detections
Arctic ground squirrel	*Spermophilus parryii*			2			**2**
Beaver	*Castor canadensis*	2	8				**10**
Black bear	*Ursus americanus*	9	7	6	3	9	**34**
Brown bear	*Ursus arctos*			1		1	**2**
Collared pika	*Ochotona collaris*	1					**1**
Coyote	*Canis latrans*		3	8	1	2	**14**
Dall sheep	*Ovis dalli*			17			**17**
Gray Wolf	*Canis lupus*			2	1		**3**
Hoary marmot	*Marmota caligata*	1		1			**2**
Least weasel	*Mustela rixosa*		2				**2**
Lynx	*Felis lynx*		1	2		1	**4**
Mink	*Mustela vison*		1				**1**
Moose	*Alces alces*	6	39	45	3	12	**105**
Mountain goat	*Oreamnos americanus*		1			14	**15**
Muskrat	*Ondatra zibethicus*		1				**1**
Northern red-backed vole	*Clethrionomys rutilus*	1	1	5		1	**8**
Northern river otter	*Lutra canadensis*		1	1			**2**
Porcupine	*Erethizon dorsatum*	3	2		1	6	**12**
Red fox	*Vulpes vulpes*		1	4	1	1	**7**
Red squirrel	*Tamiasciurus hudsonicus*	2	8	23	5	32	**70**
Shrew sp.	*Sorex spp.*			2			**2**
Snowshoe hare	*Lepus americanus*	1	3	1		4	**9**
Total		**26**	**79**	**120**	**15**	**83**	**323**

Table 7
Terrestrial Mammal Species and Habitat Preferences

Species	Broadleaf Forest	Broadleaf Forest/ Mixed Forest	Disturbed Areas/ Unvegetated	Forb & Graminoid	Needleleaf Forest	Scrub Community	Total Detections
Arctic ground squirrel			1			1	2
Beaver	1	2		5	1	1	10
Black bear	2	22		9	1		34
Brown bear		1		1			2
Collared pika		1					1
Coyote	1	4	1	5	2	1	14
Dall sheep		7	7	3			17
Hoary marmot			1			1	2
Lynx		1	1	2			4
Mink				1			1
Moose	4	26	4	46	15	10	105
Mountain goat		14				1	15
Muskrat				1			1
Porcupine	1	10			1		12
Red fox		2	2	2		1	7
Red squirrel	1	43	5	10	4	7	70
Red-backed vole		2	4			1	8
River otter				2			2
Shrew sp.					2		2
Snowshoe hare		5		2		2	9
Least weasel				1			1
Wolf		1		1	1		3
Total # of Species	**10**	**141**	**26**	**90**	**26**	**26**	**322**
Percents	**3%**	**44%**	**8%**	**28%**	**8%**	**8%**	**100.0%**

The most common detection method for observed mammal species was through visual observation (39%). Tracks were recorded as the detection method 26% of the time followed by scat/droppings (18%), auditory (12%), and browse (4%) (Table 8).

Table 8
Mammal Totals by Detection Method

Common Name	Visual	Tracks	Auditory	Scat/ Droppings	Browse	Middens	Total
Arctic ground squirrel	1		1				2
Beaver	7	3					10
Black bear	11	9		14			34
Brown bear	1	1					2
Collared pika	1						1
Coyote		2		12			14
Dall sheep	16	1					17
Hoary marmot			1	1			2
Least weasel		2					2
Lynx		2		2			4
Mink		1					1
Moose	22	56	1	15	11		105
Mountain goat	15						15
Muskrat				1			1
Porcupine	10	2					12
Red fox		1		6			7
Red squirrel	29	1	37	1	1	1	70
Red-backed vole	8						8
River otter	1	1					2
Shrew sp.	2						2
Snowshoe hare	3	2		4			9
Wolf				3			3
Total	**127**	**84**	**40**	**59**	**12**	**1**	**323**
Percent	**39%**	**26%**	**12%**	**18%**	**4%**	**0%**	**100%**

Winter Survey for Mammal Tracks

We conducted a winter survey along portions of Snug Harbor Road and the south end of Cooper Lake on January 14, 2004. The survey was conducted approximately one week after a snowfall so that the accumulated snow had compacted and it was easier to read tracks. Each track crossing was recorded as a single event. In some cases the same individual animal made multiple trails, and those were only counted as one event. Snowshoe hare tracks were the most commonly observed, with red squirrel tracks being the second most common. Tracks of snowshoe hare and coyote tended to be more numerous adjacent to Snug Harbor Road, where the habitat was young broadleaf/mixed forest. The moose tracks were observed in the scrub community type. The mink track was counted adjacent to a mature needleleaf forest type, and many of the squirrel tracks were recorded in conifer habitats. We did not record any tracks in the forb and graminoid habitat type. Table 9 summarizes the number of tracks, by species that were recorded on Snug Harbor Road and the south end of Cooper Lake.

Table 9
Track Crossings Recorded During Survey

Species	Tracks
Snowshoe hare	17
Red squirrel	14
Coyote	6
Red fox	2
Vole spp.	2
Moose	6
Mink	1
Total	48

Aerial Survey for Mammals

Aerial surveys for large mammals in the Project area were conducted on April 2, 2003, and October 2, 2003. During the fall survey we identified most of the observed species by visual observation of animals on or adjacent to the powerline ROWs and Cooper Lake. The spring survey recorded tracks on the ROWs and adjacent to the reservoir. Most of the mammal observations were sightings of moose and Dall sheep. During the fall and spring aerial surveys we searched appropriate habitat in the Project area for bear dens or early spring signs of bears emerging from dens. We found one possible bear den during our surveys, but it was located outside of the study area on Cooper Mountain, southwest of Stetson Creek. Bear tracks were noted entering and leaving the den. We recorded 176 tundra swans migrating through the Powerline Pass and Portage Valley area. The spreadsheet showing the results of these surveys including location, species, number of individuals, evidence (i.e. tracks, visual), and comments are located in Appendix E.

Brown Bears

During the 2003 terrestrial wildlife study period, only two brown bear detections were recorded. The first occurred as an incidental observation in mid-July on Snug Harbor Road. That bear was associated with a needleleaf forest cover type. The second bear detection was recorded on powerline sampling point 15 (Figure 5) at the end of July. We observed tracks that were associated with a forb and graminoid cover type.

Incidental Wildlife Observations

Incidental wildlife observations were recorded as observers traveled to and from and in-between sampling points. We also collected incidental observations from other study participants who observed wildlife during the course of their field studies. Appendix E contains a table with all of the Incidental Wildlife Observations recorded. Several species were recorded as incidental observations that were not recorded on any of the sampling points. One Say's phoebe was recorded at Cooper Lake Dam on July 30, 2003; this was the only observation of Say's phoebe during the entire study. A northern wheatear was recorded on top of Powerline Pass as the surveyors were walking in-between sampling points. This was the only observation of this species. Other species recorded incidentally were black bear, hoary marmot, coyote, moose, Dall sheep, spruce grouse, collared pika, belted kingfisher, winter wren, northern harrier, great-horned owl, and river otter.

ANALYSIS AND DISCUSSION

Cooper Lake has been surveyed for water birds and large mammals as part of the Cooper Creek Watershed Analysis (USDA 2002). The 2003 HDR Terrestrial Wildlife Study is the first to describe wildlife communities within the entire study area for the Cooper Lake Project relicensing, including the powerlines, Dam Access Road, Snug Harbor Road, and Cooper Creek. With the inventory design for this study, we were able to document 70% of the 86 terrestrial bird species and 73% of the 30 mammal species expected to occur in the Project area. Species richness in the study area (85 recorded species total) is average when compared with findings from other studies that documented terrestrial wildlife species on the Kenai Peninsula and southcoastal Alaska (Boggs et al. 1997).

Because the study focused on a wide range of species with differing activity periods, nesting phenologies and habitat affinities, it is unlikely that we found all species present. There were several instances when species that usually do not occur in southcoastal Alaska were documented and several cases where we did not document species that we expected would be encountered. It is unlikely that we found even a majority of the nests that were present because of factors such as nest failures before our survey, renesting after our survey, and nests that simply were missed. Observation time was limited at each sampling point because of geographical extent of the study area. The majority of the wildlife species observed were located in the habitat types with which they were expected to be associated, based on the literature review.

The survey results we present are unbiased with respect to the quality of coverage across the study area and, therefore, are useful for evaluating relative abundance and distribution of terrestrial birds and mammals throughout the study area.

Terrestrial Birds Species

Birds are relatively easy to census because they reveal their presence vocally and are rather conspicuous during certain times of the year. During the first survey period birds were both vocal and conspicuous while setting up breeding territories and attracting mates. The majority of the birds recorded during the surveys were recorded during the first survey period. Many birds cease to sing as soon as they have attracted a mate or have begun nesting, and this may account for the lower number of observations made during the July survey period.

Three species that were identified during surveys are listed as Species of Special Concern by ADFG. These species include the Townsend's warbler, blackpoll warbler, and olive-sided flycatcher. No USFWS federally listed species or listed species from any other agency were documented in the study area.

The Townsend's warbler species richness was 1.6% and was widely distributed across all surveyed locations. Singing males were easily detected in the month of June; however, in the month of July detection rates decreased because birds generally sing less once nesting has commenced. We detected Townsend's warblers exhibiting breeding behavior in broadleaf/mixed forest types and needleleaf forest types. Matsuoka (1996) describes Townsend's warblers as nesting in spruce-hemlock forests. Other observations of Townsend's warblers were made in broadleaf forest, disturbed areas, and forb and graminoid habitat community types. Detections in these habitat types suggest that they may provide feeding habitat or secondary nesting habitat. Detection in disturbed areas were early in the breeding season, when the birds may have been migrating through to nesting grounds farther north.

Blackpoll warblers were detected in broadleaf/mixed forest habitat, broadleaf forest, and disturbed habitat types. Blackpoll warblers were relatively uncommon and resulted in only seven individuals being detected during the entire study. Blackpoll warblers are uncommon breeders on the Kenai Peninsula and are usually found in greater numbers breeding farther north and west in Alaska. Cotter and Andres (2000) found that this species prefers shrub habitat with a small percentage of overstory. We detected the species in areas where there was an understory of either alder or willow thickets. This is one of the latest arriving migrants in Alaska (Andres 1999). Therefore, it is likely that the individuals we observed in early June were migrating through the area to reach their northern breeding grounds.

Olive-sided flycatchers were observed exhibiting breeding behavior in broadleaf/mixed forest habitat types in the Project area. Olive-sided flycatchers were locally abundant in the broadleaf/mixed forest habitat type. Males are easily observed as they feed and sing from prominent perches of dead or partially dead trees. They were also found in forb and graminoid (five individuals) and one individual in each of disturbed areas, needleleaf forest, and scrub habitat types. Olive-sided flycatchers are considered an indicator species of the coniferous forest system biome in North America, although they are occasionally found in mixed deciduous/coniferous forests (Andres 1999).

Most of the bird species recorded during the study were recorded in appropriate habitat and seasons according to our extensive literature review on species in the area. Several species were probably underrepresented in our surveys as a result of behavioral characteristics that make them hard to detect. For example, American pipits are locally common in spring, summer and fall in southcoastal Alaska. However, they were only observed in the study area on June 19 and July 30, 2003, when several medium-sized flocks were observed passing through the Powerline Pass area. They breed in alpine meadows, open tundra, and rocky slopes. Usually this species is seen passing through appropriate habitat in large flocks in early spring and fall when traveling to and from breeding ground, at higher elevations in Alaska. It is possible that we missed the spring migration of this species because the surveys were not conducted in the higher alpine areas of Powerline Pass until mid-June.

Only 14 woodpeckers were observed in the study, which was fewer than expected. They are common in coniferous and deciduous forest, where they nest in holes in trees. They eat the larvae of wood-boring beetles and other insects (Andres 1999). The density of woodpeckers recorded during the surveys is low compared to breeding bird data from other areas of the state (Cotter and Andres 2000). Because they are dependent on certain forest characteristics, including snags and trees with heartrot for drumming, nesting, roosting, and feeding sites, woodpeckers are vulnerable to alterations of forest habitats (ADFG 2002). The widespread changes in forest vegetation throughout the Kenai Peninsula due to spruce bark beetle infestation may be a significant factor contributing to the relative paucity of woodpeckers documented in the study area.

In this study, the winter wren was only detected on one occasion at the Cooper Creek Campground in broadleaf/mixed forest habitat. However, winter wrens are commonly found in clearcuts and sapling/shrub habitats (Kessler and Kogut 1985), which are relatively uncommon in our study area, and this fact may explain the lack of winter wrens in the study area.

By understanding a species and its habitat associations, we can predict how that species would be impacted if there was a loss of its preferred habitat. Table 10 shows the typical terrestrial bird habitat associations for species and habitats that occurred in the study area, based on the literature reviewed (Appendix C). As can be seen in this table, many species associate with multiple habitat types. Table 10 also shows that among the habitat types present in the study area, the highest species diversity typically occurs in the needleleaf forest habitat, which is the most common vegetated habitat type (36%) in the study area. These habitat associations vary somewhat from the habitat associations documented in this study (Table 2); the results of this study indicate that the broadleaf/mixed forest (8.5% of vegetated area) and forb and graminoid (herbaceous) habitat type (18% of vegetated area) had the highest density and diversity of birds.

Table 10
Typical Terrestrial Bird Habitat Associations [1]

Cover Type	
Needleleaf Forest Type	
Hairy woodpecker	Steller's jay
Northern flicker	White-winged crossbill
Northern goshawk	Winter wren
Sharp-shinned hawk	Blackpoll warbler
Boreal chickadee	Red crossbill
Olive-sided flycatcher	Golden-crowned kinglet
Ruby-crowned kinglet	Northern shrike
Townsend's warbler	Pine grosbeak
Pine siskin	Red-breasted nuthatch
Swainson's thrush	Yellow-rumped warbler
Great-horned owl	Red-tailed hawk
Tree swallow	Violet-green swallow
Western-wood pewee	Fox sparrow
Lincoln's sparrow	Dark-eyed junco
Hermit thrush	American robin
Cover Type	
Broadleaf Forest Type	
Black-capped chickadee	Northern waterthrush
Pine grosbeak	Pine siskin
Red-breasted nuthatch	Swainson's thrush
Blackpoll warbler	Great-horned owl
Red-tailed hawk	Tree swallow
Violet-green swallow	Western-wood pewee
Fox sparrow	Lincoln's sparrow
Dark-eyed junco	Pine grosbeak
Common redpoll	Hermit thrush
American robin	Ruby-crowned kinglet
Alder flycatcher	
Cover Type	
Broadleaf/Mixed Needleleaf Forest	
Bald eagle	Belted kingfisher
Brown creeper	Gray jay
Spruce grouse	Varied thrush
Dark-eyed junco	Orange-crowned warbler
Hermit thrush	Common raven

Ruby-crowned kinglet	Northern shrike
Townsend's warbler	Downy woodpecker
Yellow-rumped warbler	Hairy woodpecker
Olive-sided flycatcher	
Cover Type	
Scrub Community Type	
Common raven	Orange-crowned warbler
Alder flycatcher	Common redpoll
American pipit	Fox sparrow
American robin	Golden-crowned sparrow
Black-billed magpie	Golden eagle
Northern wheatear	Lincoln's sparrow
Rock ptarmigan	Savannah sparrow
Rough-legged hawk	White-crowned sparrow
Wilson's warbler	Yellow warbler
Downy woodpecker	Hermit thrush
Northern shrike	Dark-eyed junco
Pine grosbeak	Pine siskin
Varied thrush	Ruby-crowned kinglet
Cover Type	
Herbaceous Community Type	
Hermit thrush	Common raven
American dipper	Bank swallow
Cliff swallow	Merlin
Northern harrier	Say's phoebe
Wilson's snipe	

[1] Species and Habitat Associations Data Sources: Armstrong 1995; Kessel 1998; Cotter and Andres 2000; Andres 1999; and USFWS 2001.

Terrestrial Mammal Species

Mammals are commonly underrepresented in wildlife surveys because of their secretive, often nocturnal nature, and because they frequently occur in very low densities. In some studies of mammals, the study species is rarely seen at all. This is especially true of small mammal species, many of which are arboreal and nocturnal. Many studies employ the use of small mammal trapping to determine species presence and density. Recording species signs such as tracks and scat allows the observers to census the mammal species present with accuracy and with little intrusion. Large mammals can usually be counted with relative ease and accuracy. Aerial censuses of large mammals have many advantages over land surveys because the pilot can easily fly over a group of animals or a patch of scrub to ensure the count is accurate.

We recorded the majority of mammal sightings along the Project powerline corridor and Snug Harbor Road. The powerline corridor contained all six habitat types described in the Results section of this report. Powerline ROWs have been found to facilitate the movement of wildlife in some cases, and this appears to be the case for the Project-related ROWs and roads. We observed black bear scat along many portions of the powerline corridor, suggesting that they are using the powerline as a travel corridor between feeding and resting areas. In addition, we observed many mammal species using Snug Harbor and the Dam Access roads as travel corridors. The vegetation along Snug Harbor Road was thick and dense, and we observed moose and black bears using the road to travel along, sometimes even choosing to continue along the road with a vehicle slowly closing in behind them. In many cases, traveling along a road or ROW corridor expends less energy than trying to negotiate dense vegetation. We observed the use of roads especially in the fall when vegetation outside the boundary of clearing was very dense and overgrown. For more specific information on roads and utility ROWs and their use by wildlife, refer to Appendix C, Terrestrial Wildlife Literature Review.

Moose and red squirrels were the most abundant mammal species detected. Red squirrels prefer spruce habitat and moose prefer areas with dense shrubs. Needleleaf forest type (36% occurrence in the vegetated areas of the study area and scrub community (31% of the vegetated area within the study area) were the dominant habitat types in the study area, and are the preferred habitat of red squirrels and moose, respectively.

Beavers have been able to colonize a section of former stream channel immediately below Cooper Lake Dam. Around the reservoir, fluctuating water levels have essentially eliminated potential beaver habitat along the shore. However, beavers were also documented on several tributaries that flow into the south end of Cooper Lake. Mink were only detected on one sampling point near the south end of Cooper Lake. Their preferred habitat of streams, lakes, and ponds with brushy or rocky cover nearby are plentiful at the south end of Cooper Lake. We expected to detect more mustelid species at the south end of Cooper Lake given the many tributaries and wet areas. Mink may be limited in the Project area by prey species more than habitat. Their preferred diet of muskrat is limited in the Project area. A single muskrat was detected at Cooper Lake on the southeast end near a tributary.

Table 11 shows the typical terrestrial mammal habitat associations for species that occurred in the study area. As indicated in this table, many mammals are adaptable and inhabit a wide variety of habitat types. Based on the literature reviewed (Appendix C), the highest species diversity for mammals typically occurs in the Scrub Community type, which is the second most common habitat type (31.5%) in the study area. As with the result for terrestrial birds, these mammal habitat associations vary somewhat from the habitat associations documented in this study (Table 7); the results of this study indicate that the broadleaf/mixed forest (8.5% of vegetated area) and forb and graminoid (herbaceous) habitat type (18% of vegetated area) had the highest density and diversity of mammals.

Table 11
Typical Terrestrial Mammal Habitat Associations [1]

Cover Type	
Needleleaf Forest Type	
Lynx	Coyote
Red squirrel	Least weasel
Snowshoe hare	Mink
Porcupine	Red fox
Red-backed vole	Shrew spp.
Wolf	
Broadleaf Forest Type	
Moose	Coyote
Beaver	Least weasel
Lynx	Mink
Snowshoe hare	Red fox
Porcupine	River otter
Red-backed vole	Shrew spp.
Wolf	
Broadleaf/Mixed Needleleaf Forest	
Beaver	Coyote
Lynx	Least weasel
Snowshoe hare	Mink
Porcupine	Red fox
Red-backed vole	River otter
Brown bear	Shrew spp.
Wolf	
Scrub Community Type	
Moose	Snowshoe hare
Beaver	Porcupine
Dall sheep	Red-backed vole
Hoary marmot	Arctic ground squirrel
Brown bear	Collared pika
Coyote	Least weasel
Mountain goat	Muskrat
River otter	Shrew spp.
Wolf	
Herbaceous Community Type	
Dall sheep	Moose
Red-backed vole	Muskrat
Coyote	Red fox
River otter	Shrew spp.
Wolf	

[1] Species and Habitat Associations Data Sources: Alaska Geographic Society 1996; and ADFG 2002.

Effects of Roads and Powerline ROWs and Access Routes

The effects of roads and powerline corridors (and their access routes) on forest wildlife depend on the species and characteristics of the specific features concerned. For some species, roads and powerline corridors can act as barriers, fragmenting populations. Prey species that utilize areas close to powerline corridors are at a higher risk of predation because many predators may be using the corridors for travel. Corridors can also act as intraspecific filters, allowing movement of a certain age class or gender. Roads and powerline corridors can also increase the human use of an area and lead to increased hunting and poaching and increased human trash, which can attract an unnatural population of certain species such as ravens, bears, and other scavengers. In areas where human trash has attracted ravens, ravens will prey on bird eggs and nestlings.

For other species, powerline ROWs can provide valuable habitat, but the value is influenced by the width of the corridor, the nature of the corridor vegetation, maintenance practices and other uses in the corridor, and the abruptness of the forest edge. For example, corridors can serve as travel lanes, connecting isolated areas of habitat. Manning & Shepherd (1999) conducted a three-year study on Vancouver Island to compare relative abundance of wildlife species related to forest harvest activities, and as a comparison, they included two transects on a transmission line ROW. They found that a census point on the transmission corridor had the second highest mean total of species detections, and consistently had high values in each of three years studied.

Vegetation clearing practices for powerline corridors and access routes can influence wildlife species. Studies have concluded that ROW maintenance provides overall habitat enhancement (Bramble & Byrnes 1979). Selective clearing of ROWs may be more beneficial than clear cutting. Cavanaugh et al. (1976) conducted a study that indicated that wildlife usage, number of wildlife observations, and wildlife diversity were all significantly greater in the selectively cut ROW than in the clear-cut ROW. Many bird species prefer the edge habitat created by ROW clearing to hunt from and to attract mates.

For the Cooper Lake Project, vegetation management practices along the powerline ROWs have been ongoing for more than 40 years. The overall effect of the clearing practices on wildlife appears to be beneficial because hand clearing vegetation creates forb and graminoid and low-scrub communities that many wildlife species associate with. Vegetation clearing is currently managed on a 9–10 year cycle (O'Brien 2003). The powerline management area is 100 feet wide in most places along the ROWs. The management practices employ a 200-foot-wide setback on both sides of the powerline for streams and roads. Most vegetation is removed by hand clearing or Hydro Axe. Some sections that are dominated by wetlands are cleared in the winter months to avoid impacts to sensitive wetland areas. No herbicides or growth inhibitors are used for vegetation clearing procedures. Plant material that is cut down is typically left on site and not removed, which can increase the habitat for birds and small mammals that use the piles for food and cover. The powerline access routes are not regularly maintained, nor are any herbicides or growth inhibitors used on these routes (F. Gwartney, Pers. Comm. to HDR, 2003).

The presence of the cleared powerline ROWs and Project-related roads and access routes appears to provide an overall habitat benefit to wildlife species, including both birds and mammals. Scrub thickets, forb meadows, and graminoid meadows are the dominant plant communities seen on the Project powerline ROW, and these communities provide valuable forage species to many birds and provide more cover and habitat diversity than would be present without the periodic clearing of vegetation. Bird species that we observed frequently along the edge of the ROW clearing include Townsend's warblers, orange-crowned warblers, hermit thrush, olive-sided flycatchers, black-capped chickadee, golden-crowned sparrow, savannah sparrow, and Wilson's warbler. These species all prefer open forests, forest gaps, and forest edges. In addition, the highest densities of mammal sightings were along the Project powerline ROWs. Finally, berry-producing shrubs associated with the edge habitat created along the Dam Access Road, Snug Harbor Road and along portions of the powerline provides good forage for bears during the summer and early fall. In addition, moose and snowshoe hares benefit by the increase in forb herbaceous growth along the cleared areas. Common plant species that are valuable forage to many species of mammals includes: fireweed, bluejoint grass, cowparsnip, Merten's sedge, salmonberry, tall blueberry, rush, willow, dandelion, pink wintergreen, and other low growing shrubs.

The habitat mapping for the Terrestrial Vegetation Study extended beyond the edge of disturbance on the powerline ROW, and this mapping provides a basis to describe the type of habitat that would occur in the ROW corridor if the vegetation were allowed to return to an "uncut" condition. Succession would occur according to its natural course, and the climax community would resemble the community adjacent to the ROW corridor (refer to the Terrestrial Vegetation Study report [HDR 2004] for a description of habitat communities along the ROW corridor). Wildlife species that prefer the shrub and meadow type habitat for forage and cover would be less likely to occur in the forested areas that would eventually take over. In addition, species that use the ROW corridor to travel would have to find other travel corridors or use more energy to negotiate the more densely vegetated habitat that would replace the "uncut" powerline corridor. Species such as hermit thrush, black-capped chickadee, Wilson's warbler, alder flycatcher, and black bears would lose preferred edge habitat. However, some species that prefer closed canopy, undisturbed forested habitat would thrive as the ROW corridor became forested. Species such as northern goshawk, boreal chickadee, brown creeper, pine grosbeak, spruce grouse, and sharp-shinned hawks would benefit from the "uncut" conditions because these species all prefer dense wooded habitat and non-disturbed habitat.

Public access into powerline ROW corridors and other areas of the Project facilitated by Project-related roads and access routes may have an adverse impact on wildlife species directly adjacent to those areas, although the results of this study do not point to any specific impacts. Access and recreational use by campers, hunters, and fishermen in these areas may create a disturbance factor for some wildlife species. For example, black and brown bears are sensitive to human disturbance, especially when raising young. Considering that many bears use the Project powerline ROW corridors for travel, there may be an increase in bear-human interactions in this portion of the Project area compared to Cooper Lake.

Powerlines and Birds

This study also addressed the possible effects on raptors and other birds of the powerlines themselves. Bird collisions and electrocutions at powerlines are difficult to observe, and therefore, the frequency of such events and the effects on bird populations can be difficult to assess. Wounded birds are not typically observed at powerlines, because they can leave the area to recuperate. Likewise, bird mortalities often go undocumented, especially in unpopulated areas, because the carcass is may be eaten or removed relatively soon after the event, obscured by vegetation or terrain, or lost in water. Further confounding information gathering regarding powerline-caused bird mortalities is the fact that some predators bring their prey to powerline ROWs to consume it there (APRLIC 1994).

Unlike with collisions, however, it is possible to judge the relative risk of electrocution on a particular powerline system by determining whether it is configured to meet current standards. For powerlines that do meet current standards, the conductors are far enough apart that even large birds are unable to touch two electrical contacts at the same time; hence electrocutions are rare incidents. The Project's 115kV and 69kV transmission lines are consistent with the guidelines contained in "Suggested Practices for Raptor Protection of Power Lines - State of the Art 1996" (Olendorff et al. 1996) and thus pose a minimal risk of electrocution. To further evaluate the situation, however, we consulted with the USFWS Law Enforcement Office and Chugach Electric Operations and Maintenance Office to determine if any raptor electrocutions had occurred along the Project powerlines. Neither the USFWS database nor Chugach records document any raptor electrocutions occurring on the Project powerlines (Birchell 2004; Burnier 2004).

The risk of bird collision posed by the Project powerlines is similarly low, based on existing information and findings from this study. Previous research has addressed the potential for bird collisions with powerlines in general. Daytime and nighttime bird collisions with powerlines were studied at seven sites in Oregon and Washington from October 1977 to January 1978 and from February 19 to May 15, 1978 (Meyer 1978). Sites were located in wetland areas, and transmission lines studied ranged from wood pole 115kV lines to 500 kV steel tower lines. Birds were observed to collide with powerlines at all times of day, at night, and under various weather conditions. A total of 31 birds of 12 species were found dead within 5.9 km of transmission lines. Mortality was highest in the fall, with ducks representing 35.5% of total mortality. Remaining mortality consisted of 16.1% shorebirds, 16.1% starlings (*Sturnus vulgaris*), 9.7% red-winged blackbirds (*Agelaius phoeniceus*), 9.7% glaucous-winged gulls (*Larus glaucescens*), 6.5% mourning doves (*Zenaidura macroura*), 3.2% American robin (*Turdus migratorius*), and 3.2% American coot (*Fulica americana*). These rates of mortality due to collisions with the transmission lines studied were determined to be biologically insignificant for the bird populations involved. The study concluded that species most vulnerable to collisions were fast-flying, low-altitude birds that travel in tight flocks and birds flying at altitudes equal to or lower than the upper-most wire of the lines (Meyer 1978). Large-bodied birds with limited flying maneuverability (such as cranes, geese, herons, and pelicans) have also been identified as being highly susceptible to colliding with powerlines, while passerines have been found to have low potential for collisions (Anderson and Murphy 1988). Raptors also are infrequently involved in fatal collisions with powerlines because of their relatively slow flight, high maneuverability, and visual acuity (Olendorff and Lehman 1986).

The Project powerlines are not expected to be a significant collision hazard for raptors or other birds because of the relatively low density of typically susceptible, migratory birds along the powerline. No portions of the powerline support a shorebird migration pathway. Sandhill cranes that were observed passing above the powerline during the fall migration survey were flying at much higher altitudes than the powerline. The density of raptors along the Project powerlines is relatively low compared to locations in the Lower 48 states, where problems with collisions have been described. As with information concerning electrocutions, no raptor collisions have been reported to the USFWS database along the Project powerline (Birchell 2004).

Kenai Peninsula Brown Bears

The low number of brown bear detections within the Project area was not an unexpected finding. While suitable brown bear habitat (e.g., fall berry foraging areas and winter denning sites) does occur within the Project area, during summer the majority of Kenai Peninsula brown bears are concentrated at salmon-bearing streams, which are lacking in the immediate vicinity of the Project. Salmon-bearing streams most likely occur adjacent to portions of the powerline in remote areas where human-bear interactions would be less likely to occur. Brown bears killed in defense of life or property (DLP) are usually linked to the density of salmon streams, trails, roads, and recreation sites in an area (Suring and Del Frate, in prep.). Based on this knowledge, it is unlikely that the continued operation of the Project will result in any additional DLPs or large-scale changes in bear distribution and abundance in the Project area.

Specific findings regarding brown bears on the Kenai Peninsula and in the study area are discussed in the following paragraphs.

Brown Bears Killed in Defense of Life or Property on the Kenai Peninsula

The brown bear population of the Kenai Peninsula is listed as a Population of Special Concern by ADFG. (Refer to Appendix C for a detailed life history and description of the Kenai Peninsula Brown Bear.) These bears move extensively throughout the Peninsula and utilize a wide variety of resources to sustain the population (Suring and Del Frate, in prep). The number of bears killed in DLP has increased dramatically with a steady increase in human population on the Kenai Peninsula since the 1960s. While the average number of DLP bear deaths recorded during the 1960s was less than one per year, that number increased to five bear deaths per year during the 1990s (Suring and Del Frate, in prep.). Using a model to conduct a spatial analysis of locations of bears killed in DLP on the Kenai Peninsula, Suring and Del Frate (in prep.) determined that as the density of salmon streams, trails, roads, and recreation sites increased on the landscape, so did the probability of DLP kills of brown bears. Brown bear DLP kills tended to occur in rural areas in situations where people had firearms immediately available, such as at their homes or while hunting. The probability that brown bears will be killed in DLP will increase as human access to rural areas continues to increase (Suring and Del Frate, in prep).

The number of human-caused brown bear deaths on the Peninsula has increased with the expanding human population, as would be predicted. However, whereas the human population has grown relatively steadily each year, DLP kills spiked in the 1990s (Suring and Del Frate, in prep) and have continued to trend sharply upward in the 2000s. In 2002, a total of 16 brown bears were killed during human-related encounters, 7 of which were attributed to vehicle collisions and the remaining 9 in DLP. Of the 9 bears killed in DLP, 2 were killed during hunting trips, 4 over livestock and poultry, and 3 kills were related to fishing incidents. A total of 18 brown bears were killed in 2003, all in DLP. Five DLP kills occurred outside homes, 5 were related to hiking incidents, 4 were related to fishing incidents (Russian River), 3 were related to hunting incidents, and 1 was killed while it was eating a moose calf. No brown bears on the Kenai Peninsula are known to have died in vehicle collisions during 2003.

Few of the recently recorded human-caused brown bear mortalities have occurred near the Cooper Lake Project area, and none can be attributed to Cooper Lake Project operations.

Brown Bear Detections within the Cooper Lake Project Study Area

During the 2003 and 2004 terrestrial wildlife surveys, only two brown bear detections were recorded. The first occurred as an incidental observation in mid-July on Snug Harbor Road. That bear was located in a needleleaf forest cover type. The second bear location was recorded during a mammal survey at the end of July. Brown bear tracks were found at Survey Point 15 along the powerline corridor. The tracks were associated with a forb and graminoid cover type. Scat identified as black bear scat was found in a number of locations in the Project area. However, there is much overlap between adult black bear and brown bear scat, and it is therefore not recommended to use scat characteristics to distinguish between the two species. Some of the scat recorded in this study as black bear scat may in fact have been from a small brown bear. Habitat requirements of the two bears are similar on the Kenai Peninsula and therefore habitat cannot be used along with scat to determine species.

Reservoir Operating Level Impacts to Wildlife Habitat

Closest to the Cooper Lake shoreline, within the reservoir fluctuation zone, are graminoid meadows and areas of exposed gravels. At the upper reaches of the fluctuation zone are communities of low scrub, alder, and willow. Beyond the scrub communities, the farthest mapped communities from the reservoir are usually cottonwood and spruce-hemlock forests.

Between elevations 1,168 and 1,194 feet MSL (the multi-year fluctuation zone), most of the steeper shorelines, and the gentler shorelines exposed to waves generated by summer winds from the south, are gravel/cobble or bedrock with little or no vegetation. These areas of exposed shoreline provide very little wildlife habitat value due to the lack of vegetation or browse material. Moose and bear tracks were observed along gently sloping areas of the shoreline, but these tracks were most likely created by animals traveling to areas along the shoreline where vegetation has become established, such as at the south end of the reservoir.

Lower gradient shorelines at the south end of the reservoir, particularly those above 1,185 feet MSL, support denser vegetation. The south shoreline area is not exposed to summer wind-driven waves because the higher summer winds are from the south. Thus, the wave-driven effects on substrate are lesser factors in vegetation establishment along the south end of the reservoir. However, the periodic inundation due to seasonal reservoir level fluctuation does affect vegetation in this area. In an average year, areas above 1,185 feet MSL (where dense vegetation becomes established) are not inundated until after the growing season. But in half of the years, those areas may become inundated at any time after early June. When these areas are inundated early in the season valuable moose browse may be lost; however, during the summer months there is plentiful moose browse in other areas around the reservoir.

Although no increase in the current normal maximum reservoir level (1,194 feet MSL) is proposed for the new license term, an increased normal reservoir operating level could be expected to inundate shrubs and graminoid meadows that provide forage for moose as well as cover and food for certain bird species. Savannah and golden crowned sparrows build their nests on the ground in areas with low-lying shrubs and graminoid meadows. Therefore, if the reservoir operating level were raised, some nesting habitat for these sparrows would be flooded.

If the reservoir level were kept at a "static" level of 1,168 feet MSL[1] mature vegetation would eventually extend to near the water's edge, eliminating the more sparsely vegetated fluctuation zone and changing the habitat quality for some species of terrestrial wildlife. As discussed in the Terrestrial Vegetation Study (HDR 2004), if the water level were hypothetically to be maintained at a constant elevation,[2] woody vegetation would encroach on much of the shoreline. On the south shoreline of Cooper Lake it would be expected that the exposed area would be colonized with forb and graminoid meadows, low scrub communities, willow and alder thickets and then eventually cottonwood or spruce hemlock forest. The north end of Cooper Lake is steep and has sloping hillsides that may preclude vegetation from establishing if the reservoir were lowered.

Under this "static" reservoir scenario, habitat quality would diminish for species that prefer beach habitat for traveling and foraging; these species include American dipper, American pipit, varied thrush, mink, moose, and black bear. In addition, if the reservoir were kept at a static level of 1,168 feet MSL, there may be a loss of the flooded emergent wetlands that occur within the fluctuation zone of the reservoir. A loss of these wetlands would result in a reduction in habitat for species such as Lincoln's sparrow, northern waterthrush, Wilson's snipe, red fox, mink, and moose. These species all prefer marshes and muskegs for feeding and/or nesting habitat. However, habitat for species that prefer shrub thickets and wooded habitat would increase under this scenario; dark-eyed junco, yellow-rumped warbler, hermit thrush, blackpoll warbler, fox sparrow, coyote, and short-tailed weasel would all benefit from vegetation encroaching up to the waterline.

CONCLUSIONS

The goal of the Cooper Lake Terrestrial Wildlife Study was to evaluate the existing and potential future effects of Project operations by describing the current terrestrial wildlife use of the Project area. The results of this study can also be used as baseline information against which to evaluate future conditions. Wildlife surveys in 2003 and 2004 documented the presence and habitat use of a total of 63 terrestrial bird species and 22 mammal species and their habitat use in the study area, which encompassed Cooper Lake, Cooper Creek, the Project powerline ROWs, and Project-related roads and access routes. The majority of the potentially occurring terrestrial wildlife species were confirmed to be present, and it is probable that additional species are present within the Project area.

Beneficial effects from the ongoing operation of the Project include the perpetuation of early successional shrubs and willow/alder vegetation within the zone of periodic reservoir inundation on the south and southwest shores of Cooper Lake (HDR 2004), thereby providing forage for moose. Other beneficial effects include maintaining forage and shelter for birds and small mammals, as well as facilitating travel for larger mammals, along the periodically cleared portions of the powerline ROW corridor. Adverse impacts include access via Project-related roads and access routes for the purposes of recreational use by campers, hunters, and fishermen, which may create a disturbance factor for some wildlife species. Wildlife disturbance may also

[1] Such a scenario is incompatible with operation of the Project, and is not a potential licensing proposal.
[2] Maintaining a near-constant reservoir level is not feasible, given the characteristics of Project facilities and inflow patterns.

occur during periodic vegetation management activities along the powerline ROW and Project-related roads and access routes. In addition, seasonal reservoir fluctuation precludes establishment of beaver habitat adjacent to the shoreline of Cooper Lake.

Chugach has no plans to change operations or maintenance practices at the Project. Thus, long-term impacts associated with ongoing operation of the Project are expected to continue to be minimal. Any disturbance- or habitat-related impacts to wildlife species that may occur during periodic vegetation clearing or due to reservoir operations will continue at existing levels. However, the overall impact of these continuing Project effects appears to be negligible, and therefore no changes in terrestrial wildlife species or populations relative to existing conditions are expected to occur over the long-term as a result of the Project.

The existing habitat in Cooper Creek does not support a large diversity and density of wildlife species, and, aside from any effects associated with the Dam Access Road, the Project currently exerts no direct impact on the species that are present along Cooper Creek. However, some degree of change would be expected to occur under scenarios involving alternative flow conditions. For example, an increase in flows above the Stetson Creek confluence with Cooper Creek could potentially result in a reduction of browsing habitat for moose and other browsing mammals, due to removal of vegetation in this area with higher flows. On the other hand, if an alternative flow regime created additional habitat for salmon, this could have a positive impact on brown bears in the Cooper Creek watershed by providing additional food, but would also increase human/bear interactions.

As noted above, human access into and use of some portions of the Project area is facilitated by the presence of Project-related roads and access routes. Because use of the areas accessed by these roads and routes is relatively low under existing conditions, the probability of bears encountering humans in these areas is relatively low. However, if improved recreational access and secondary development occur in the Project area, it could result in diminished quality of bear habitat, displacement of bears, and direct mortality of bears in defense of life and property.

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Attachment 1

Summary of Responses to Comments on the Draft Report

June 2004

Summary of responses to comments on the draft report for the Terrestrial Wildlife Study.

Date of Letter/Email	Commenting Party	Comment / Study Request	Chugach Response / Report Changes
Data presentation/analysis			
4/30/04	ADFG	No site-specific habitat information was provided to allow assessment of existing wildlife-habitat relationships.	Site-specific vegetation community data were collected during the 2003 survey season and were used to describe habitat associations in the Terrestrial Wildlife Report. Habitat data were collected at each sampling point and entered into a database to allow the researchers to query by habitat type or wildlife species. Refer to Table 2, 7, 10, and 11 for habitat associations. [No changes to report in response to this comment.]
4/30/04	ADFG	All wildlife studies were focused on Cooper Lake shore. Cooper Creek was not sampled and therefore no evaluations can be made.	Cooper Creek was surveyed twice during the 2003 field season for terrestrial wildlife. The methodology for surveying Cooper Creek was originally to conduct point counts and line transects, but the terrain in the creek and the noise made it difficult to use the planned protocol. Instead the creek was surveyed by walking then entire creek corridor twice and recording all wildlife encountered and habitat where each animal was encountered. [No changes to report in response to this comment.]
4/30/04	ADFG	ADF&G requested: 1) that the activities of species be noted upon observation, 2) descriptions of habitat use, and 3) association of activity with aquatic habitats. However, none of these observations were presented, thus making any scientifically-based decisions regarding dependence of wildlife species on project-influenced resources impossible.	For all wildlife surveys the following data were recorded: behavior, vegetation community, foraging substrate, detection method, and distance from edge of water. For birds, the field researchers recorded whether the bird was flying over point, flying into point, or flying away from point on our survey data forms. (See the example survey data forms in Appendix B of the report for types of

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			survey data collected). We also noted breeding behavior in birds encountered during the surveys and included observations of mammal signs. The survey data are summarized in Tables 2 through 9 in the report. All field observations are included in the database of survey information that was created for this study. This survey database is available upon request. [No changes to report in response to this comment.]
4/30/04	USFS	In the conclusions on p. 37, the report mentions several beneficial and adverse effects related to the operations of the reservoir and powerlines. The Forest Service presumes that the Study is referring to changes in conditions from before and after Project construction. We do not believe that this study has provided the data needed to reach the stated conclusions of effects.	The report is referring to the effects from the ongoing operation of the Project (i.e., reservoir fluctuation and periodic vegetation maintenance along the powerlines). Chugach feels that the report's conclusions, which are based on analysis of the extensive survey data, accurately describe the effects of ongoing operations to terrestrial wildlife at the reservoir. [No changes to report in response to this comment.]
Brown bears			
4/30/04	FCCC/ACE	FCCC/ACE are reviewing information concerning Kenai Peninsula brown bears and will provide comments at a later date.	Noted.
4/30/04	USFS	In the section of Kenai Peninsula Brown Bears (p. 35), the report states, "The low number of brown bear detections within the Project area was not an unexpected finding." The explanation of detection in the study apparently refers to bears that were seen when field studies were ongoing. The study does not give spatial, temporal, or statistical context to these detections. The Forest Service does not believe that detections provide a valid population censusing technique for animals with a broad habitat range such as brown bears.	The survey only consisted of one year of data collection, which only allows the study to provide observed presence data for brown bears. Because of the small number of brown bear observations during the study, relating the observations in a statistical context was deemed not applicable. Censusing the brown bear population in the study area was not a study objective (see final 2003 study plan). However, for all brown bear detections, the following data were recorded: vegetation cover type, behavior, distance from

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			observer, time of day, location, and detection method. Meetings with ADF&G and USFS early in the Study scoping process determined that brown bears would most likely not occur in the study area except for those bears passing through the study area en route to salmon streams. Because brown bears are difficult to detect away from salmon-bearing streams, the study did not rely on direct observation alone to assess potential Project impacts; instead, the study evaluated distribution of berry resources and salmon resources in the Project area to determine if the continued operation of the Project would affect brown bears. Based on the lack of salmon-bearing streams in the Project area together with data collected during this study, the study concluded that the continued operation of the Project would not result in any changes in bear distribution and abundance in the Project area. [No changes to report in response to this comment.]
Project effects / Comparison to pre-Project conditions			
4/30/04	USFS	The CEA studies have not determined quantity and quality of habitat around Cooper Reservoir or along the powerlines. No determinations have been made as to the changes in habitat quantity and quality around the Reservoir or along the powerlines from the cut to the uncut condition. The Forest Service again requests that the [following] information be included in the study:	
		1) Determine the quantity and quality of wildlife habitat in the ring around Cooper Reservoir between elevations 1194 and 1206 feet above msl.	The necessary data to analyze the wildlife habitat in the range of elevations between 1,194 and 1,206 feet MSL were collected as described in the study plans. Although no detailed analysis of these data will be conducted at this time (because Chugach no longer plans to increase the reservoir operating range to 1,206 feet MSL), the final report for this

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			study has been modified to include a brief, qualitative description of wildlife habitat in this elevation range. [Changes made at p. 4 (under Study Area, item 1) and p. 37 (new section: added: "Reservoir Operating Level Impacts to Wildlife Habitat").]
		2) Determine the quantity and quality of wildlife habitat around Cooper Reservoir assuming a static water level at 1168 feet above msl, and presence of mature shoreline vegetation up to the water's edge.	Although such a scenario is incompatible with operation of the Project, and is not a potential licensing proposal, the report has been modified to include a qualitative discussion of changes in habitat for various species that would be expected to occur assuming a "static" water level at elevation 1,169 feet MSL. [See new text added at p. 38, 1st and 2nd full paragraphs.]
		3) Determine if the wildlife habitat around Cooper Reservoir between elevations 1194 and 1206 feet above msl is replaceable.	See response to item 1 above. Also, because Chugach no longer proposed to increase the operating range up to 1,206 feet MSL, there is no need to determine whether the zone above the normal maximum reservoir level of 1,194 feet MSL. [No changes to report in response to this comment.]
		4) Run the Cumulative Effects Model of the Interagency Brown Bear Study Team both with and without the entire Cooper Lake Hydroelectric Project to evaluate project effects to brown bears both around Cooper Reservoir and along Cooper Creek.	The draft study plan included the requested brown bear modeling. However, the final 2003 study plan eliminated this study element because members of the Interagency Brown Bear Study Team indicated to Chugach that they did not believe the Cumulative Effects Model would be an appropriate tool for modeling existing and potential future effects of the Project. Therefore, the study employed a qualitative approach to evaluating the effect of the Project on brown bears. [No changes to report in response to this

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			comment.]
		5) Model the effect of returning full flows to Cooper Creek on wildlife other than brown bears including: eagles, harlequin ducks, and other waterbirds.	Preliminary analysis of the potential effects on wildlife of potential alternative flow regimes in Cooper Creek is presented in the draft license application, and further analysis will be conducted during development of the final licensing proposal. The analysis of these potential secondary (wildlife) effects will be qualitative, however; modeling (if such model were developed) would not likely provide any greater understanding of potential outcomes than would the more qualitative approach in this case. [No changes to report in response to this comment.]
		6) Determine the ongoing effects on wildlife habitat of vegetation removal along the powerlines. Quantify habitat quality and quantity for cut and uncut conditions.	The Terrestrial Vegetation Study determined habitat quantity and quality through aerial photo interpretation and ground truthing. In addition, the Terrestrial Wildlife Study Literature Review (Appendix C to this report) contains extensive information on powerline rights-of-way maintenance and wildlife habitat. Although Chugach has no plans to propose a transition to "uncut" conditions along the powerline ROW corridor during the new license term, the final report has been modified to include a qualitative analysis of the effects on wildlife habitat and general inferences about habitat conditions that would exist if ROW vegetation were allowed to return to an "uncut" condition. [See new text added to 1st full paragraph on p. 34.]

<u>Note</u>:

1. ADFG = Alaska Department of Fish and Game. USFS = USDA Forest Service (Chugach National Forest). FCCC/ACE = Fish for Cooper Creek Coalition and the Alaska Center for the Environment.