TERRESTRIAL WILDLIFE

Baseline Studies for Passerines, Mountain Goat and Cliff-nesting Raptors

Constantine Metal Resources: Palmer Project Site

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EXECUTIVE SUMMARY

The purpose of the 2015 terrestrial wildlife studies for the Palmer Project was to provide an assessment of current baseline conditions for each of four Valued Components (VC) (mountain goat, cliff-nesting raptors, passerines/near-passerines, and invasive plants) that were identified as part of formal selection process in 2014. This information has been obtained to inform and support potential future permit applications and longer term monitoring efforts that may arise as the Project advances. These field surveys build on a summary of existing historical information, and habitat mapping previous conducted for species of interest (SOI) that were identified within each VC. That existing information was coupled with input from key personnel within the Alaska Department of Fish and Game (ADFG) to guide field studies implemented by Hemmera in June and September.

Four studies were completed in 2015; three studies focused on terrestrial wildlife values (mountain goat, cliff nesting raptors and songbirds) and one study focused on invasive plant species. This report summarizes the results of the wildlife studies. Information from the invasive plant survey is provided as a separate report.

Mountain goat was selected as an SOI for the project as a significant population of mountain goat is known to occur within the region. Public concern has been raised with respect to mountain goats, their habitat and interaction with helicopters, by multiple tenure holders, during the Bureau of Land Management's (BLM) Ring of Fire Resource Management Planning (RMP) process and related Draft Environmental Impact Statement (dEIS). In 2015, Constantine undertook studies to develop an improved understanding of mountain goat values within, and surrounding, the Project area. Understanding mountain goat habitat use and distribution within the study area will aid determination of need for focused management efforts.

Studies of mountain goats included aerial surveys in late June (summer) and late September (fall) and assessment of a winter habitat model provided by ADFG biologists. Aerial surveys were conducted within a biologically relevant subpopulation unit bounded by the Tsirku River, Klehini River, and icefields to the west (Tsirku-Klehini Block). The Tsirku-Klehini Block encompasses a total area of 34,785 ha and includes the smaller 11,729 ha Palmer Project core and buffer study areas. The core and buffer study areas entirely encompass, and extend beyond, Constantine's total land package of federal mining claims, and defines the area within which potential Project related activities may occur.

Totals survey counts of mountains goats were 116 in June and 134 in September. Kid to adult ratios, which declined from 40% to 23% between surveys, indicate relatively high reproductive productivity. No goats were observed in the Project core and buffer study areas, in either survey. The general distribution of mountain goats and total survey numbers were similar to annual counts conducted by ADFG in the area over the last six years, suggesting populations are stable. Densities of mountain goats in the Tsirku-Klehini Block are in the mid-range of densities observed in other areas within the surrounding Haines mountain goat census area.

Information from the 2015 Hemmera surveys was analyzed with data from parallel and previous ongoing monitoring data from ADFG to provide a broader regional context for population abundance of mountain goat within and adjacent to the Project area. An existing resource selection function (RSF) model, for winter habitat, was used to quantify habitat values within the study area to better understand potential anticipated Project related effects to mountain goat.

No goats were observed in the Saksaia Glacier and Flower Mountain areas, including the Palmer Project core and buffer study areas, in either survey in 2015. The pattern of distribution of mountain goats in the Tsirku-Klehini block surveys, including the absence or low number of mountain goats in the Palmer Project area, is regarded as typical for this area and is consistent with observations from ADFG surveys conducted within the Porcupine Creek Block. Nevertheless, incidental observations of mountain goats in the core and buffer study areas have been noted in the past and RSF models predict suitable mountain goat habitat within the area. For these reasons, development of mountain goat management measures to mitigate potential adverse impacts to mountain goat are recommended.

Management measures were developed and recommended based on an area-specific and current understanding of population abundance and distribution. Recommended management measures were informed by quantification of habitat values for mountain goat within and adjacent to the project area. Management measures are consistent with management guidance used by the ADFG and are specifically designed to recognize and accommodate requirements related to Project development for the Palmer Project.

Cliff-nesting Raptors were selected as an SOI for the project as the US Fish and Wildlife Service (USFWS) recognize raptor conservation as a management priority. Golden eagle (*Aquila chrysaetos*) and peregrine falcon (*Falco peregrinus*) and are listed respectively as Sensitive by BLM or as a Species of Greatest Conservation Need (SGCN) by ADFG. Aerial surveys were conducted to assess the presence of cliff-nesting raptor species within both the core and the buffer areas at the Palmer Project site. Results from the 2015 survey support the conclusion that there are no extant nests of any cliff-nesting raptor species within either the core of buffer areas for the Palmer project although both species were confirmed to occur (as supported by survey observations). Current and future (anticipated) Project related effects are considered negligible for the Palmer project area; no current mitigation is required.

Passerines and Near Passerines[1] were selected as a SOI group because several species are listed as species of concern. Dawn point-count surveys for passerine and near-passerine species (songbirds) were completed each day between June 23 and June 28, 2015. Survey included 74 stations along six transects.

[1] Species that are also regularly detected by the point count survey protocol used for passerines

Standard point count surveys over six days resulted in the detection of 540 birds across 51 species. The total number of species and total number of individual birds varied substantially across 12 broad habitat types. The highest richness and abundance of birds occurred in mature forest types however unique species occurred in all types. Four avian SOI were detected: Olive-sided Flycatcher, Townsends Warbler, Rock Ptarmigan, and Smith's Longspur. Two passerine species of regulatory concern (olive-sided flycatcher and grey-cheeked thrush) were confirmed within the project area.

Potential Project effects on birds are expected to be limited to habitat effects associated with vegetation clearing for Project infrastructure and mitigation measures to minimize those effects are discussed.

Invasive plant surveys were also conducted within the Project study area. Collaborative efforts were initiated between the Alaska Bureau of Land Management (BLM) and the University of Alaska (UofA) Heritage Program; results from this study are reported separately. The highest identified priorities for the Palmer project was the prevention of the spread of new invasive plant species into currently un-infested areas, and the prevention of introduction of new invasive plant species not currently found in the area, especially noxious weeds, highly invasive species, and species of special concern.

Information from each of these baseline studies will be used to inform and support future anticipated considerations regarding Project related effects on local wildlife and wildlife habitat at the Palmer Project site[2].

[2] This Work was performed in accordance with the contract between Hemmera Envirochem Inc. ("Hemmera") and Constantine Metal Resources Ltd. ("Client"), dated 2014 ("Contract"). This Report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Constantine Metal Resources Ltd. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

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LIST OF ACRONYMS

ADFG	State of Alaska, Department of Fish and Game
AWAP	Alaska's Wildlife Action Plan
AKNHP	Alaska Natural Heritage Program
BAFA	Boreal Altai Fescue Alpine biogeoclimatic zone
BLM	Bureau of Land Management
CWH	Cedar Western Hemlock biogeoclimatic zone
CMA	Coastal Mountain Heather biogeoclimatic zone
EA	Environmental Assessment
EAO	Canadian Environmental Assessment Office
EIS	Environmental Impact Statement
MH	Mountain Hemlock biogeoclimatic zone
RSF	Resource Selection Function
SOI	Species of Interest
SGCN	Species of Greatest Conservation Need
SSOC	State Species of Conservation Concern
SWB	Spruce-Willow-Birch biogeoclimatic zone
TDR	Technical Data Report
USFWS	United States Fish and Wildlife Service
VC	Valued Component
WHA	Wildlife Habitat Assessment

1.0 INTRODUCTION

Hemmera Envirochem Inc. ("Hemmera") is pleased to submit this Technical Data Report (TDR) documenting studies for three selected terrestrial wildlife valued components (VCs). Studies were conducted to provide an understanding of baseline conditions for selected species of Interest (SOI) identified for consideration during the 2015 field season.

A preliminary list of SOI was developed, by Hemmera, in 2014 and reviewed by Constantine in 2015, to guide selection and prioritization of field studies completed in 2015 and summarized herein. Studies were completed within the Constantine Palmer Project (the Project) study area.

The information presented in this TDR will aid Constantine in designing future work plans, and inform discussion and consideration during community engagement and consultation and during future regulatory approval processes. These activities will benefit, and be supported by, an understanding of species abundance, distribution, habitat association and habitat use in the Palmer study area for the selected VCs under current conditions. The study area was delineated to include core areas of activity, and a surrounding buffer, that may ultimately be influenced by Project operations. Certain surveys, particularly mountain goat, extended well beyond the buffer study area boundary. Specific objectives of the 2015 terrestrial wildlife baseline studies are as follows:

- Collection of wildlife observation data. Data was collected for focal taxa for each of three VCs including mountain goat (*Oreamnos americanus*), passerines (and near-passerines (e.g., ptarmigan) and cliff-nesting raptors. Formal studies were conducted following recognized standards and, for mountain goats, included consultation and participation by Alaska Department of Fish and Game (ADFG) biologists.
- Compilation of anecdotal observations collected by Constantine field staff in 2014 and 2015 for inclusion in data analysis.
- Review of best available information from published literature to better understand species habitat use, abundance and potential for project-related effects as they may occur in the study area.
- Assessment of habitat values for mountain goat within and adjacent to the Project area. An accepted GIS-based Resource Selection Function (RSF) habitat model was used to estimate areas of potential winter habitat available for mountain goat within the Tsirku-Klehini Block (Palmer Project) census area). The Tsirku-Klehini Block (348 km^2) included a subpopulation of mountain goat that might be reasonably anticipated to be affected by Project related activities within the core (direct effects) and buffer (indirect effects) areas mapped for the Project. This assessment was required to inform quantification of project-related effects on the resident local mountain goat population.
- Review of available mountain goat census data from 13 nearby census areas, conducted by the ADFG, in the Haines ADFG mountain goat census area (5,033 km^2). Data provides a comparative basis to better understand habitat use, association, distribution, population health (adult:kid ratios) and animal density at the landscape scale within the Haines census area.

These objectives were addressed in this study and findings are reported herein. Field studies conducted in 2015 were completed by qualified environmental professionals between June 3 to June 28, 2015 and September 22, 2015. Baseline wildlife studies focused on identification of habitat use, and quantification of presence and abundance, for selected VCs.

This study was limited to terrestrial SOI and did not consider invertebrates or aquatic species such as fish. Separate studies were completed and reported independently, by Hemmera, for invasive plants in July 2015.[3]

1.1 BACKGROUND INFORMATION

The Palmer Project is a mineral exploration project, led by Constantine Metal Resources (Constantine), located in coastal southeast Alaska, on the southeast margin of the Saint Elias Mountain Range. The Project area is accessible by existing road infrastructure (Highway 7 and Highway 3) connecting Haines, Alaska, through British Columbia, with Haines Junction in the Yukon. The Project area hosts high-grade volcanogenic massive sulphide mineralization within the Alexander Triassic Metallogenic Belt. A mineral exploration project is underway by Constantine Metal Resources Ltd.

Project activities in 2014 and 2015 included exploration drilling, road construction and environmental and geotechnical studies.

1.2 SELECTION OF VALUED COMPONENTS

In 2014, a Wildlife Habitat Assessment (WHA) was completed for the Palmer Project area (by Hemmera). A list of species, with potential to occur within the study area, was reviewed by Hemmera and Constantine to identify SOI. The SOI selection process considered the following four criteria

- **Criteria 1: Federal Endangered Species Recognition:** The Environmental Protection Agency has assigned responsibility to the Alaska Regional office (Region 10) to maintain and enforce national standards under a variety of environmental laws including the United States (US) Environmental Protection Act (EPA). The *Endangered Species Act* (*ESA*) recognizes species as endangered, threatened or under consideration in Alaska. Special management is required and enforced for listed species by the ADF&G.

[3] This Work was performed in accordance with the contract between Hemmera Envirochem Inc. ("Hemmera") and Constantine Metal Resources Ltd. ("Client"), dated 2014 ("Contract"). This Report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Constantine Metal Resources Ltd. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

- **Criteria 2: State of Alaska Conservation Concern:** To recognize and incorporate management planning for Alaskan species of conservation concern the ADF&G developed, and is the main coordinator of, Alaska's Wildlife Action Plan (AWAP). The AWAP serves to: fulfill the department's legal mandate to protect and conserve the state's natural resources, to ensure responsible development and to prevent new species listings under the federal and state *Endangered Species Act(s).*
- **Criteria 3: Societal Value:** Species of high cultural significance (sustenance, societal value and/or traditional value). (e.g., mountain goat, moose, brown bear, golden eagle etc.)
- **Criteria 4: Resident Species with Localized/Limited Distribution within the State of Alaska:** Some species have a very restricted distribution in the State of Alaska and are limited to the southeast region of the state where the Projected is sited. For these species the study area may support significant occurrences with the species' range in the state and hence higher conservation concern may be prudent or warranted.

In 2014, a total of 19 SOI were identified based on regulatory or social concern (within the state of Alaska), their potential to occur within the study area and the potential of each SOI to experience project related effects. SOI included six species of amphibian, nine species of bird and four species of mammal (Hemmera 2015). None of the 19 SOI are listed as federally endangered species.

In 2015, three VC's representing eight SOI were selected for field study from the list of 19 identified SOI. Selection of VCs was based on the following three criteria:

1. **Presence in Study Area**
2. **Potential to interact with the Project (and thus experience effects)**
3. **Importance:**
    - **Regulatory importance** – regulatory requirements or specific request for inclusion by a regulatory agency.
    - **Aboriginal group considerations** – anticipated or known Aboriginal group interest.
    - **Conservation or scientific importance** – species identified as a conservation concern including, but not limited to, species listed under state or Federal legislation, such as the Endangered Species Act, identification in federal or state databases or federal statute (i.e., legal protection required).
    - **Significance to other stakeholders, including local government** – Determination of significance to government, the public, and other stakeholders was based on state and regional management plans and/or as expressed through consultation programs.

If conditions one and two were met <u>AND</u> the VC (species or guild) is a key value or management priority (i.e., significant) then selection as a VC was recommended.

Selected VCs were: mountain goat, cliff-nesting raptors and avifauna (including passerines[4] and near-passerines[5]). Additional species, or guilds, may be added during future Project related environmental considerations. Habitat mapping completed in 2014 was used to quantify habitat, and to inform study design, for selected SOI for each of three VCs as detailed in **Table 1**.

Table 1 Hectares of Available High, Moderate, Low and Nil Value habitats within the study area for each species of Interest / VC

Species of Interest / VC	High (ha)	Moderate (ha)	Low (ha)	Nil (ha)	Total Area (ha)
Mammals					
Mountain goat	4,176.58	0.00	3,540.77	4,012.11	11,729.47
Passerines and near-passerines					
Northern goshawk	2,017.85	339.34	2,949.72	6,422.56	11,729.47
Ptarmigan (Rock, Willow and White-tailed)	3,253.06	3,115.56	2,291.07	3,069.78	11,729.47
Olive-sided flycatcher	2,676.65	333.98	1,662.81	7,056.03	11,729.47
Gray-cheeked thrush	2,178.06	824.98	1,583.68	7,142.76	11,729.47
Townsend's warbler	2,504.44	498.59	7.59	8,718.84	11,729.47
Cliff-nesting raptors					
Peale's peregrine falcon	1,806.82	2,135.99	4,537.43	3,249.23	11,729.47
Golden eagle	2,548.90	2,243.64	4,079.47	2,857.47	11,729.47

Based on habitat mapping presented and summarized in 2014 (Hemmera 2015) the above noted species were anticipated to occur. In 2015, baseline studies confirmed presence of each of these SOI and (for mountain goat) provided information regarding relative population density, productivity (kid:adult ratios), habitat use and distribution within and adjacent to the Project core and buffer areas.

4 Passerines describe a large guild of ‘perching’ birds from several avian families. These species are generally most effectively surveyed using point-count survey methods (see **Section 3**)

5 Near-passerines include non-passerine avian species that can still be effectively inventoried using point-count survey methods (e.g., ptarmigan) (see **Section 3**)

2.0 PHYSICAL SETTING

The year-round deep sea port of Haines is located 60 kilometers south of the Project area. Average annual weather patterns are described for Haines as follows: average temperature varies between -7°C to 18°C and rarely below -15°C. The warm season extends from May 18 through to September 8 with average daily high temperatures above 14°C. The cold season extends from November 14 through to March 14 with average daily high temperatures below 2°C. Daylight hours at the summer solstice (June 21) are 18:34 hours (hrs); by winter solstice there are only 6:06 hours of daylight. Median cloud cover ranges from 69% (partly cloudy) to 99% (overcast). The climate is temperate rain forest with average precipitation of 47 inches (119 cm), approximately two-thirds of which occurs as snow.

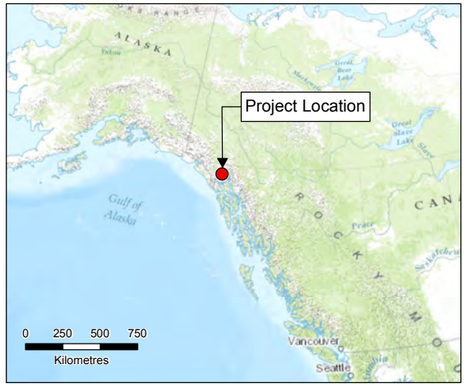
The Project study area is situated primarily in the Glacier Creek watershed and includes 11,729 hectares (ha) of largely undeveloped habitats. The study area includes the Glacier Creek watershed and portions of the Porcupine Creek watershed and the Klehini River drainage catchment. The Project area, and associated study area, is in steep, mountainous terrain, with 1,219 m (4,000 ft.) of relief. At upper elevations several glaciers originate from the summit of Mt. Henry Clay at the western edge of the Project area. The Klehini River defines the northern extent of the study area. The Tsirku River defines the southern extent of the study area.

The extent of the survey areas for each VC was tailored to account for ecological factors and potential ways in which the Project may affect the VC. Baseline studies for passerines/near-passerines and cliff nesting raptors, focused on a Core study area that encompassed the area of anticipated and current high levels of human activity including current drilling activities, the drilling camp and areas of road improvement. A buffer was applied to this area to delineate a zone of influence for habitats that may be affected by disturbance from Project activity; disturbance is primarily associated with operation of helicopters, heavy machinery, vehicles, generators and blasting. The core area encompassed a total of 2,401 ha. The buffer area encompassed a total of 11,729 ha (including the core area) (**Figure 1**). Previous exploration work by Constantine, which has occurred intermittently over the past 10 years, has been almost exclusively focused within a small subset of the core study area where exploration drilling has targeted mineral resources with the South Wall area.

Baseline studies for mountain goat encompassed a much larger area (348 km^2) to provide a regional context for goat habitat value and species use. It also accounts for relatively large home ranges and long distance movements the species has been known to exhibit to meet annual habitat requirements (e.g. using different winter and summer ranges) and life requisites (e.g. breeding and rearing of young). The area selected for mountain goat assessment is referred to as the Tsirku-Klehini Block. It is bounded by large rivers on the north, east and south, and by icefields to the west, which limit immigration and emigration to occasional dispersal events, forming a natural subpopulation unit. Understanding potential Project effects on mountain goats requires an assessment of how the Project may interact at scales up to the subpopulation level. The Tsirku-Klehini Block encompassed a total area of 34,785 ha and includes the core and buffer areas used for avifauna (**Figure 1**).

Terrestrial Wildlife and Habitat Assessment
Constantine Metal Resources
Palmer Project Site

Overall Study Area at the Constantine Palmer Project Site



Legend

- Tsirku-Klehini Block
- Wildlife Habitat Assessment (WHA) Core
- Wildlife Habitat Assessment (WHA) Buffer
- Road
- International Boundary
- Federal Mining Claims

Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Basedata: Government of Canada, Government of British Columbia, State of Alaska
- Aerial Image: Alaska SPOT 5 m Colour.
- Basemap & Inset: ESRI World Topographic Map

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3.0 METHODS

3.1 MOUNTAIN GOAT POPULATION SURVEYS

Study design and aerial survey methods generally followed standards outlined by the BC Resource Inventory Standards Committee (RISC) (RISC 2002) and methods used by Alaska Department of Fish and Game (White et al. 2014). ADFG forms and data codes were used to maximize the consistency of methods for comparison of results to historic and future ADFG surveys. ADFG staff participated in both of the aerial surveys conducted in 2015.

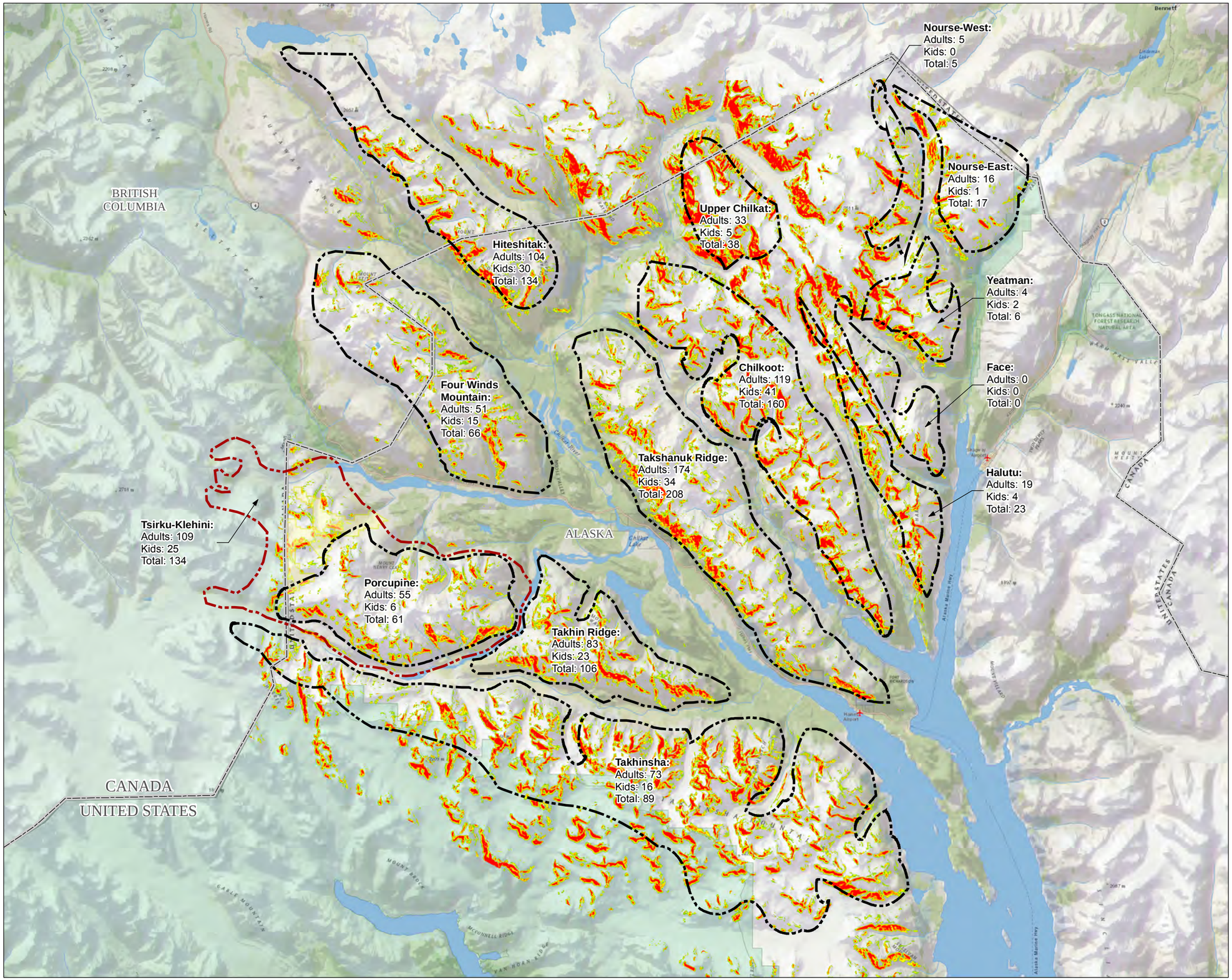
Before survey, a census area was delineated to capture a discrete mountain block bordered by the Tsirku River to the south and east, the Klehini River to the north; the international US: Canada border (approximately) defined the western extent. The area is referred to as the Tsirku-Klehini Block. The Tsirku-Klehini Block occurs within the ADFG Haines mountain goat census area, and includes an expanded area relative to the ADFG Porcupine Block (**Figure 2**). The Tsirku-Klehini Block was delineated to incorporate additional area on the west side of the Porcupine Block based on advice provided by Kevin White (ADFG mountain goat biologist, pers. comm. 2015).

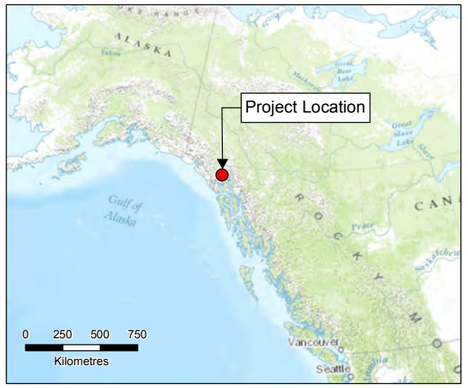
Surveys consisted of aerial transects using a one-kilometer fixed-width distance (or as limited by extent of sightability) (see **Results** and **Discussion** sections). Two surveys of the Tsirku-Klehini Block were conducted: the first (summer) survey was completed on June 23, 2015 and the second (fall) survey was completed on September 22, 2015. Both surveys were conducted during the morning to take advantage of cooler conditions (<10°C) when goats are most likely to be active and visible. We used an A-Star 350B2 helicopter (piloted by Tighe Daugherty) for the summer survey: Kevin White, Jared Hobbs and Todd Mahon were observers. For the fall survey we used a Cessna 172 fixed-wing aircraft (piloted by Drake Olson): Jared Hobbs, Carl Koch and Andrew Venning were observers.

All alpine and sub-alpine habitats and areas of broken or disjointed cliffs and avalanche chutes (extending below tree-line) were searched for mountain goats during survey flights. Flight routes/transects were mapped using a Garmin Map60CSX GPS unit. Navigation was aided by an iPad GIS tablet pre-loaded with ortho-imagery of the Tsirku-Klehini Block. All goats were geo-referenced by GPS from the aircraft and assigned to either adult or kid (<1yr) age cohorts. Goats marked with radio-telemetry collars (n=2) were noted when observed. We also recorded data on habitat including terrain type (smooth, broken, very broken) and habitat type (rocky, alpine, thicket, snow, subalpine forest and mature forest), as per ADFG protocols. Mountain goat behaviour was recorded as bedded, feeding, sleeping, walking and running. Incidental wildlife sightings (e.g., bear, eagle and ptarmigan) were also recorded.

Terrestrial Wildlife and Habitat Assessment
Constantine Metal Resources
Palmer Project Site

Location Map of ADFG Mountain Goat Survey Units within the Haines/Skagway Area





Legend

- Tsirku-Klehini Block Boundary
- Mountain Goat Block Boundary
- International Boundary
- Federal Mining Claims

Winter Mountain Goat Model

- Low - Moderate Use
- Moderate Use
- Moderate - High Use
- High Use

Notes

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Sources

- Basedata: Government of Canada, Government of British Columbia, State of Alaska
- Aerial Image: Alaska SPOT 5 m Colour.
- Basemap & Inset: ESRI World Topographic Map

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3.2 ANALYSIS OF MOUNTAIN GOAT WINTER HABITAT AVAILABILITY

A resource selection function (RSF) model, depicting winter habitat within the Haines mountain goat census area, was procured from ADFG (White et al 2011a) for analysis of available winter habitat within the Tsirku-Klehini Block. Key information about the model is summarized in this paragraph; for more details refer to White et al. (2011). The winter habitat RSF model was developed to spatially predict mountain goat winter habitat quality and distribution within the Haines mountain goat census area to support consideration of mountain goat habitat in land management decisions in the area. Mountain goat location data used in the RSF consisted of 189 locations from 12 goats in the Kelsall area[6] collected in 1981-1983[7]. Habitat variables used in the model include slope, aspect, elevation, and distance to vertical escape terrain (areas with slope >40°) from a Digital Elevation Model (DEM) and broad habitat type (forested, vegetated, and non-vegetated) from a terrestrial ecosystem landcover map[8]. The RSF used a logistic regression model and a k-fold cross validation procedure to quantify the relationship between the goat locations and habitat covariates (White et al. 2011). The resulting RSF model was then applied across the Haines census area and RSF scores were categorized into 5 quantile classes representing a gradient of habitat quality from low (1) to high (5). For analyses presented in this report, we combined RSF classes 2-5 (low-moderate – high value) as suitable habitat and considered RSF class 1 (low value) as unsuitable habitat. White et al. (2011) noted that there are potential limitations to extending the RSF predictions beyond the Kelsall area where the goat data was collected, however, the extrapolation was conducted under the circumstance of that information being the best available information at the time. Based on their review of model predictions relative to their experience and expectations, the authors identified one particular bias: "*the model may accurately reflect use patterns only for mountain goats that exhibit the* "*high-elevation wintering strategy" and may not provide a fair representation of mountain goats described by the low and mid elevation wintering strategies*" (White et al. 2011a).

Model predictions from the winter RSF were used in three ways: (1) to provide a geospatial summary of the amount and distribution of potential winter habitat within the Tsirku-Klehini Block; (2) to provide a comparison of the relative amounts of potential winter habitat between the Tsirku-Klehini Block and the 13 ADFG survey areas; and (3) as a method to comparatively evaluate density when comparing mountain goat surveys from this study relative to previous ADFG surveys (White et al. 2014) (i.e. to provide a comparative region-wide mountain goat density estimate relative to available suitable winter habitat).

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6 The Kelsall area includes portions of the Hiteshitak and Four Winds Mountain areas in **Figure 2**

7 A revised winter RSF is currently under development using a larger dataset of goat locations from across the Haines mountain goat census area collected over the last 10 years (K. White, pers. comm. 2015)

8 The Nature Conservancy, unpublished data, Juneau, AK.

A preliminary summer season RSF has also been developed by WEST Inc.[9] for the broader Haines mountain goat census area (Kevin White, pers. comm;). However, review of the summer model output indicated that it was too coarse a resolution to be useful for conducting a similar analysis, as described above for winter habitat.

3.3 PASSERINES – POINT COUNT SURVEYS

Breeding bird surveys employed a stratified habitat study design with the objective of obtaining a representative sample across the proposed development area and adjacent habitats. Focal survey areas and associated habitats are outlined in **Table 2**. Prior to field surveys, preliminary transects were established in GIS across the survey areas, based on access, proposed and existing development features, and habitat. Those preliminary transects were refined in the field and survey stations were established along them. Each station was surveyed once, maximizing the number of unique stations that were surveyed vs. replicating surveys at fewer stations.

Table 2 Focal survey areas for breeding bird surveys at the Palmer Project site in June 2015.

Survey Area	Point Count Stations	Avian Habitats
'South Wall' – area of concentrated exploration drilling	all Dp and HE labelled stations	Non-vegetated, high elevation, mountain top down to alpine low shrub zone
Laydown area and proposed access road above laydown area	MR-09 to MR-18	subalpine tall shrub and riverine habitats along Glacier Cr.
Proposed access road from Camp to Laydown area	AR-01 to AR-10 and MR-01 to MR-08	Mature and young coniferous forest, recent cutblocks
Klehini floodplain	RI-01 to 04	mature cottonwood forest, gravel bars, river
Flower Ridge – replicate and control area for South Wall	All Fl labelled stations	Non-vegetated, high elevation, mountain top down to alpine low shrub zone

Field surveys followed standard point count survey methodologies (Matsuka et al. 2014, RISC 1999; Ralph et al. 1995) and utilized an 8-minute detection period and an unlimited recording distance. At each point count station, observers recorded all birds detected (visual or auditory) during the 8-minute detection period by plotting their locations on a point count map form and recording the standardized 4 letter species name abbreviation, time of detection, sex, age, number, behaviour, and the habitat type they occurred in. Birds estimated to be >100 m distant were assigned a distance of 101 m due to high uncertainty of estimates at those distances. .

[9] Report not available

Spacing between stations along transects varied from 250 – 500 m depending on the setting and the target habitats. Other studies have found that stations less than or equal to 300 m can sometimes be non-independent (i.e. can detect the same bird(s) at adjacent stations; Matsuka et al. 2014). However, in this study, stations were deemed to be independent due to a variety of factors: terrain (e.g. a ridge between stations), significant elevation differences, environmental and anthropogenic noise (e.g. streams and drilling rigs), and, in the alpine, occurrence only of species with short detection distances. Field surveys were conducted by one experienced birder and an assistant (i.e. two observers at each point count) June 23-28, 2015. All surveys were conducted during the dawn chorus (a half hour before dawn to ~8:30) when territorial singing rates are highest and under acceptable weather conditions (i.e. no to light precipitation, no to moderate winds).

At forested sites, following the completion of each point count station, a call playback recording of a Northern Goshawk alarm call was broadcast and the suitability of the area as nesting habitat for goshawks was assessed.

3.4 CLIFF-NESTING RAPTORS

Aerial surveys for cliff nesting raptors were conducted using an A-Star 350 B2 helicopter (piloted by Tighe Daugherty) on June 24, 2015 and June 28, 2015. Two experienced observers (Jared Hobbs and Todd Mahon) were positioned on both sides of the helicopter to effectively search potential cliff nesting habitat for any evidence of raptor nesting. Standard methods for survey of cliff nesting raptors were followed (RIC 1996, Hobbs 2010).

All vertical rock features (i.e., cliffs) within the core and the buffer of the Project study area were systematically searched by approaching each cliff directly and from the front to avoid startling potential nesting birds and to avoid forcing juveniles off the ledge (from rotor ‘wash’). Each cliff was visually searched, from the helicopter, at the closest possible flight distance. Observers scanned each cliff for any evidence of use by cliff nesting raptors including adult and immature (nestling) birds, eggs, nest structures and perch platforms (as evidenced by whitewash). For cliffs with a large vertical dimension, the helicopter would circle back and make several passes at different heights to ensure thorough visual assessment of the entire cliff face.

A UTM location coordinate was recorded for all raptor observations using a Garmin Map60CSX GPS unit. Flight routes were also recorded using a GPS. Navigation was aided by an iPad GIS tablet pre-loaded with ortho-imagery of the Project area.

4.0 RESULTS

In 2015 one mammal (mountain goat) and several species of avifauna, including two species of cliff-nesting raptors, were investigated, using methods described in **Section 3**. These studies contribute to an understanding of extent of occurrence, species abundance and habitat association for these SOI within the Palmer Project area (and surrounding adjacent habitats with the study area). Results from each study are presented below.

4.1 MOUNTAIN GOAT POPULATION SURVEYS

4.1.1 Summer Survey

An aerial survey was conducted, by helicopter (pilot: Tighe Dougherty), on June 23, 2015 between 11:30AM-1:45PM (2:15 total survey time) within the Tsirku-Klehini Block. Survey personnel included Kevin White (ADFG mountain goat specialist), Jared Hobbs and Todd Mahon. Conditions were clear, with high ceiling and unlimited visibility. The Tsirku-Klehini Block was surveyed from the Constantine base camp, by flying up Glacier Creek and following the Saksaia Glacier into the Tsirku River valley. The flight route followed the Tsirku River downstream (east) before turning back west along the Klehini River, towards Glacier Creek and continuing west towards the edge of the survey block just across the international border. Temperatures were mild and winds were calm. In terms of seasonal chronology, the survey occurred during mid-summer conditions. Alpine snow melt was largely complete, with residual snow patches limited to accumulation zones (e.g. avalanche tracks), cool aspect slopes, and the highest elevations. Herbaceous forage green-up had progressed into the highest alpine zone.

A total of 116 goats were observed: 83 adults and 33 kids (28% kids) in 20 distinct groups (**Figure 3**). A single additional incidental goat sighting was added to the dataset from a separate flight on June 28, 2015. Universal Transverse Mercator (UTM) coordinates were recorded for each group however, to reduce disturbance to goats, the animal's position was marked from the aircraft without approaching goats directly. As such, coordinates do not reflect the precise group location in most instances. UTM positions, ranged from 673-1322m ASL with an average elevation of 1,057m. Group size ranged from 1-33 animals. Three large groups of goats were observed (n=12, 14 and 33). The group of 14 was of adult males. The groups of 12 and 33 were nursery groups composed of adult females, with and without kids, and sub-adults. The group of 33 was observed on a 145° aspect meadow, associated with talus and small-cliff habitat, at 931m ASL, near the eastern edge of the Tsirku-Klehini Block, above the Tsirku River. Average group size was 5.5 (3.2 excluding large groups). Two radio-collared animals were sighted during the survey, which represents all known collared mountain goats within the Tsirku-Klehini Block (K. White pers. comm.). No goats were observed in the Saksaia Glacier and Flower Mountain areas, including the Palmer Project Core and Buffer Study Areas.

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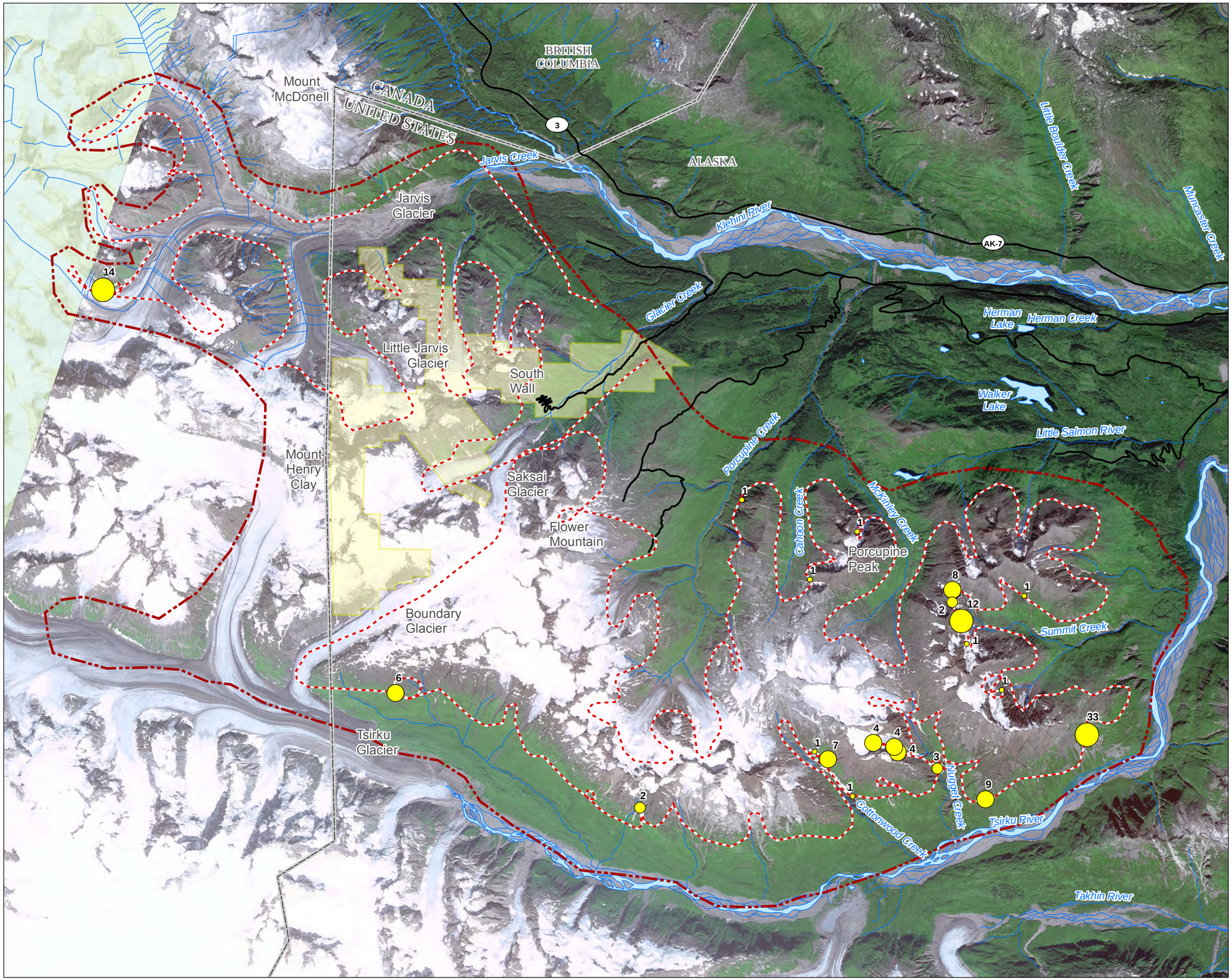
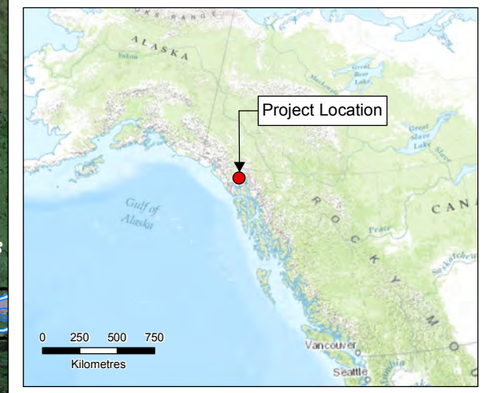
Mountain Goat Survey Observation Data and Flight Path for the June 25, 2015 Survey





Legend

Moutain Goat Aerial Survey Observations - June 2015

Total Number of Mountain Goats Observed

- 1
- 2 - 3
- 4 - 9
- 10 - 33
- Aerial Survey Flight Path - June 2015
- Road
- International Boundary
- Watercourse
- Waterbody
- Federal Mining Claims
- Tsirku-Klehini Block

Notes

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Sources

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- Basemap & Inset: ESRI World Topographic Map

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Kilometres

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Page Size: 11" x 17"

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4.1.2 Fall Survey

An aerial survey was conducted, by fixed-wing plane (pilot: Drake Olson), on September 22, 2015 between 11:09AM and 1:14PM (2:05 total survey time) within the Tsirku-Klehini Block. Survey personnel included Carl Koch (ADFG biologist), Jared Hobbs and Andrew Venning. A high pressure system resulted in a lifting ceiling, above 10,000 feet, with unlimited visibility and minor turbulence and localized pressure cells during the flight. Visibility was unlimited. The Tsirku-Klehini Block was surveyed, departing Haines Alaska, and commencing at the eastern end of the Tsirku River. The flight path followed the Tsirku River upstream and then traversed over the Saksai Glacier to Glacier Creek. The survey route continued west, along the Klehini River before circling back to survey the area along Flower Mountain, and continuing downstream along the Klehini river valley back to the Tsirku river. A final low elevation pass, along the Tsirku River, was flown to survey for any mountain goats using habitat located in avalanche chutes and gullies at lower elevations. For the section where the flight routes overlapped along the Tsirku River, observations were assessed to ensure no goats were double counted by checking for counts with identical group size and cohort composition in the same vicinity. Temperatures were mild during the survey and sightability was estimated to be excellent. Neither of the two marked animals were detected during the survey as the distance between the aircraft and mountain goats was too large to permit collar detection. In terms of seasonal chronology, the survey occurred during the transition period between summer and winter periods for mountain goats. Herbaceous forage in the alpine was mostly senescent. Fresh snow was present at higher elevations but accumulations would not hinder travel by mountain goats.

A total of 134 goats were observed: 109 adults and 25 kids (23% kids) in 50 distinct groups (**Figure 4**). Group size ranged from 1-12 animals. There were two medium-sized groups detected (12 and11 goats). Average group size in September was 2.7 (2.3 excluding the two largest groups). Similar to the June surveys, the position of each group was marked from the aircraft without approaching goats directly. As such, coordinates do not reflect the precise group location in most instances. UTM positions ranged from 278-1,231m ASL with an average elevation of 764m.

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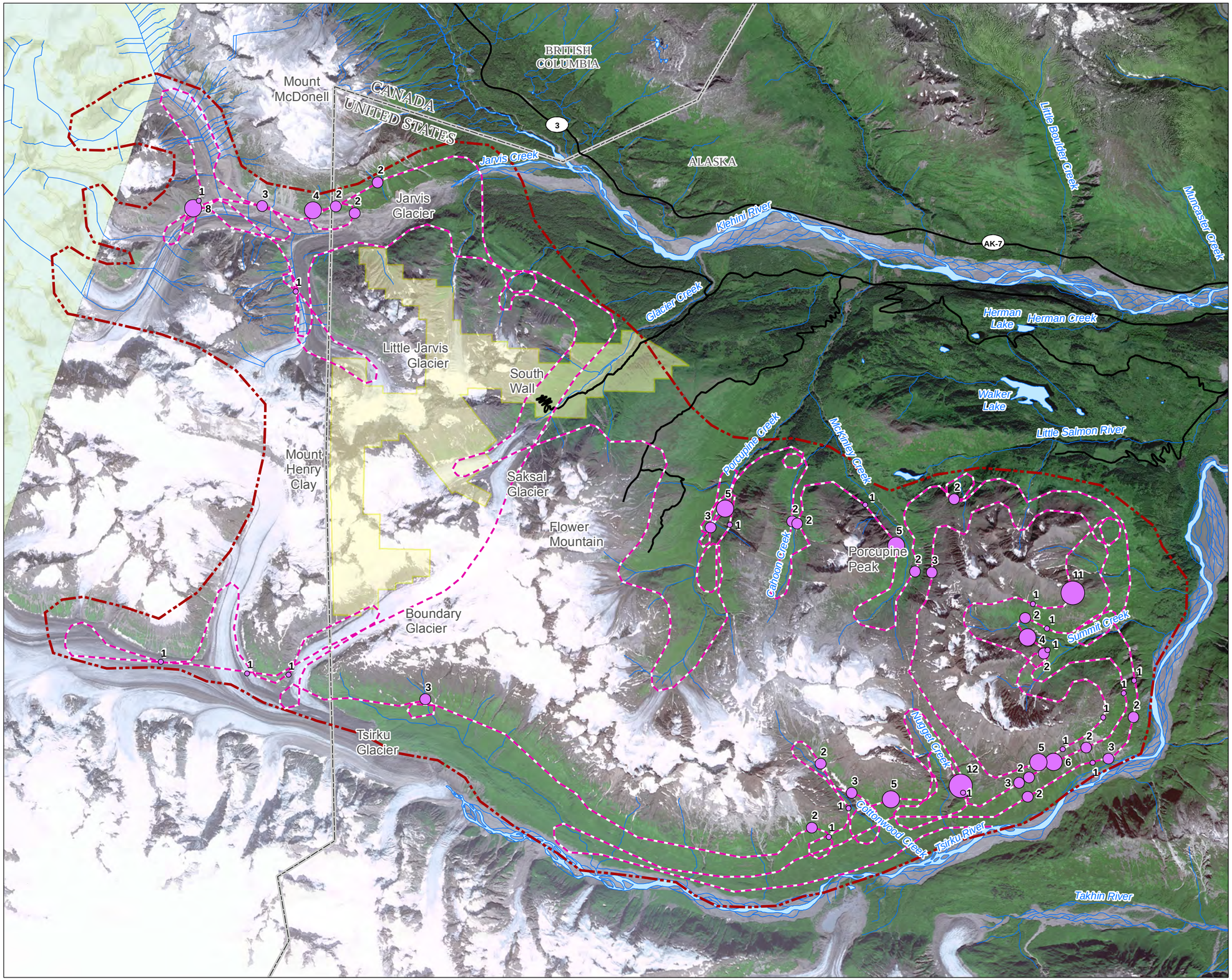
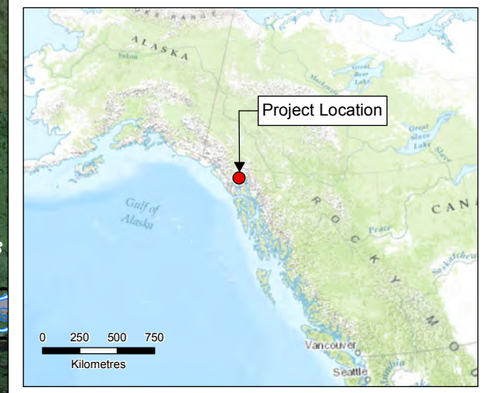
Mountain Goat Survey Observation Data and Flight Path for the September 22, 2015 Survey





Legend

Moutain Goat Aerial Survey Observations - September 2015

Total Number of Mountain Goats Observed

- 1
- 2 - 3
- 4 - 9
- 10 - 33

- Aerial Survey Flight Path - September 2015
- Road
- International Boundary
- Watercourse
- Waterbody
- Federal Mining Claims
- Tsirku-Klehini Block

Notes

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Terrestrial Wildlife and Habitat Assessment
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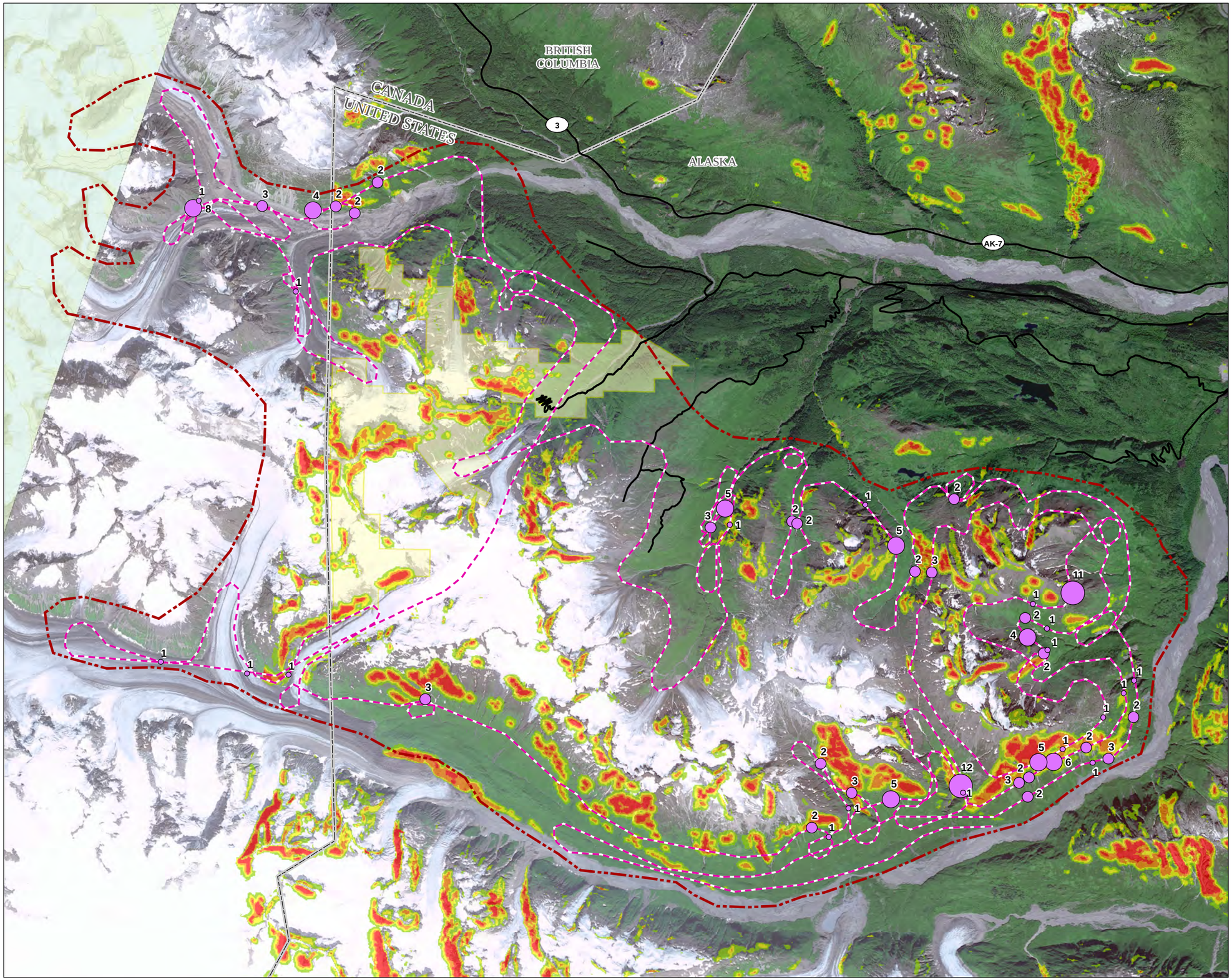
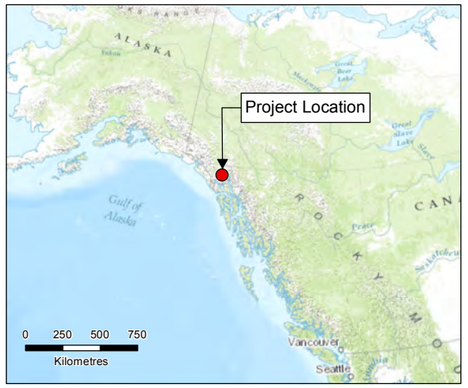
Palmer Project Site

Mountain Goat Survey Observation Data and Flight Path for the September 22, 2015 Survey





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Moutain Goat Aerial Survey Observations - September 2015

Total Number of Mountain Goats Observed

- 1
- 2 - 3
- 4 - 9
- 10 - 33
- Aerial Survey Flight Path - September 2015
- Road
- International Boundary
- Federal Mining Claims
- Tsirku-Klehini Block

Winter Mountain Goat Model

- Low - Moderate Use
- Moderate Use
- Moderate - High Use
- High Use

Notes

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At a coarse scale the distribution of goats in the Tsirku-Klehini Block was similar between studies with concentrations of goats in the southeast portion of the study area, and smaller numbers of goats associated with Porcupine Peak, and south aspect slopes above Tsirku and Jarvis Glaciers. No goats were observed in the Saksaia Glacier and Flower Mountain areas, including the Palmer Project Core and Buffer study areas, in either survey in 2015. At a finer scale, differences in group sizes and habitat selection were evident. In the summer mountain goats had aggregated into larger groups and were using higher elevations as herbaceous forage developed. By the fall goats had broken up into smaller groups and had shifted downslope where shrubby browse forage was available.

A map of the winter habitat RSF model predictions is shown with the September aerial survey observations in **Figure 4**[10]. A total of 3,821 ha of potential winter habitat occurs, which is 15% of the total area of the Tsirku-Klehini Block where model predictions were available. Potential winter habitat predicted by the model is relatively well distributed across the Tsirku-Klehini Block. The highest concentration and largest patches of contiguous habitat occur along the southern portion of the Block, above the Tsirku River. Within the Palmer Project area, much of the 'South Wall' exploration area is predicted to be potentially suitable winter habitat. The same sources indicate they have not observed goats within the Project Area in winter. Similarly, no goats have been observed by Constantine staff within the 'South Wall' exploration area during winter aerial snowpack and avalanche monitoring programs. Collectively, this information suggests goats may not evenly utilize winter habitat predicted by the RSF model. Ultimately, determining use of the Project area by mountain goats in the winter will require formal surveys at that time of year. A comparison of the proportion of potential winter habitat in the Tsirku-Klehini Block to the 13 ADFG census areas is provided in **Section 5.1: Discussion**.

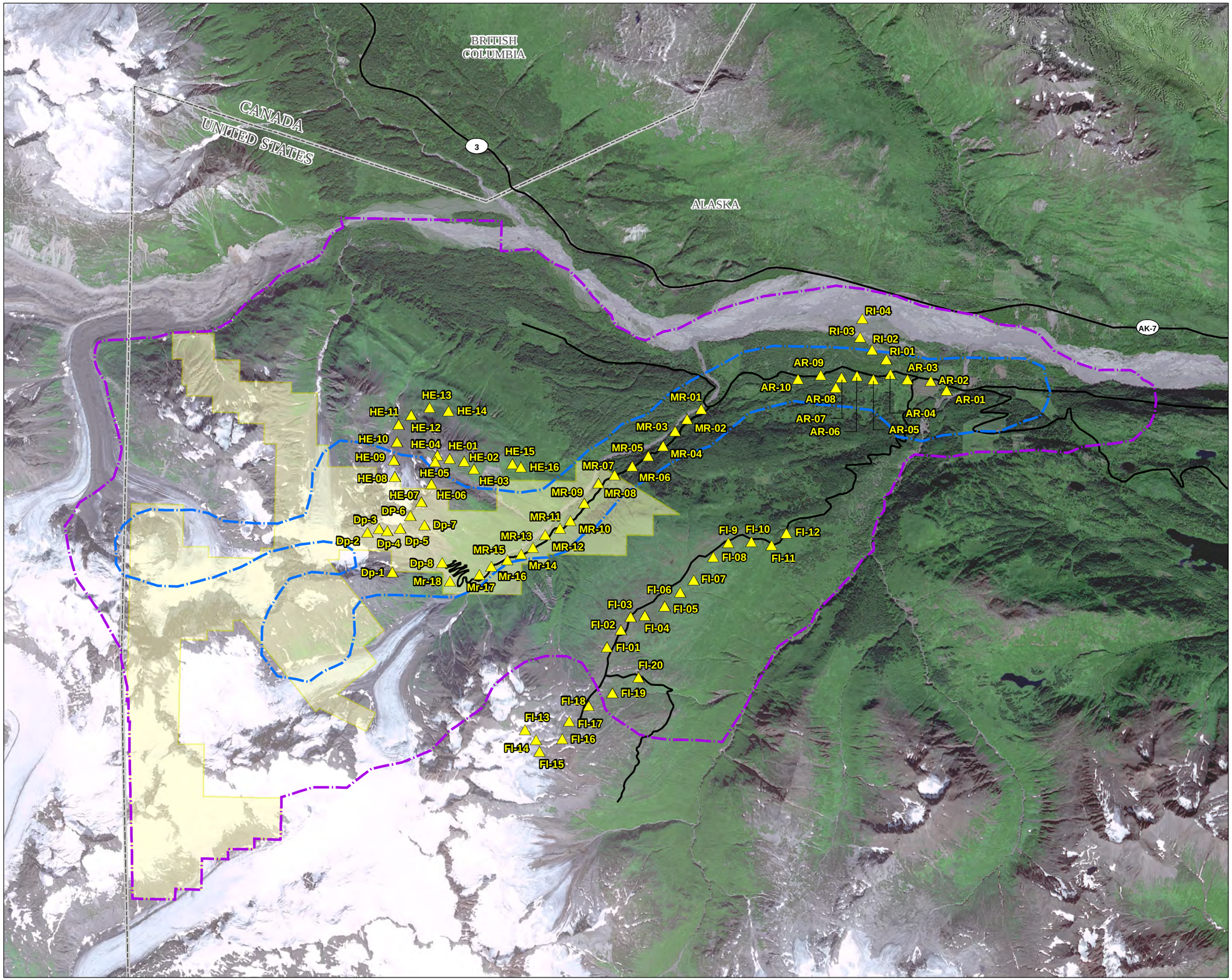
4.2 PASSERINES - POINT COUNT SURVEYS)

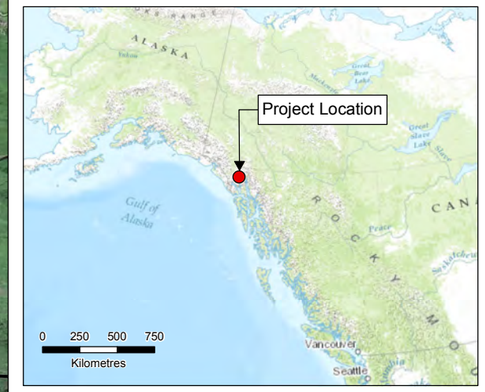
A total of 74 point count stations were surveyed, resulting in the detection of 540 birds across 51 species. The location of point count stations is mapped in **Figure 5**.

[10] Note that model predictions are truncated for the western portion of the study area outside the United States border.

Terrestrial Wildlife and Habitat Assessment
Constantine Metal Resources
Palmer Project Site

Location of Avian Point Count Stations at the Palmer Study Area in June 2015





Legend

- Avian Point Count Station - June 2015
- Road
- International Boundary
- Federal Mining Claims
- Wildlife Habitat Assessment (WHA) Core
- Wildlife Habitat Assessment (WHA) Buffer

Notes

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Twelve broad habitat types were identified during surveys (Table 3). Low and mid elevations were dominated by mature to old coniferous forests of Western hemlock (*Tsuga heterophylla*), mountain hemlock (*Tsuga mertensiana*), and Sitka spruce (*Picea sitchensis*) with occasional cottonwood (*Populus trichocarpa*) on wetter sites. Several recent cutblocks, and stands of younger coniferous forest resulting from historic logging also occured in the mature forest matrix. Deciduous and mixed forest occured in two settings: (1) as a 50-300 m wide band of mature cottonwood on nutrient poor, well drained high bench floodplain along the south side of the Klehini River, and (2) rich, wet alluvial fans at the toe positions of Porcupine and Glacier Creeks, that are vegetated with mature cottonwood and Sitka spruce, and that have well-developed tall shrub layer of alder. Although these two ecosystem types offer somewhat different habitat for birds, data from these two types were lumped due to small sample sizes in each type and broad similarity of being dominated by cottonwood. Two types of Tall Shrub habitats were also surveyed at low to mid elevations: (1) 8-25 year old cutblocks with alder, willow and regenerating conifers to 8 m tall, and (2) natural alder/devil's club patches in wet draws and lower and toe receiving sites. Bird detections in these two habitat types were also lumped due to broad similarity of vegetation and structure and due to low samples sizes in each type. Low Shrub habitat occurred at two recent (<8 year old) cutblocks with limited shrub regeneration <2 m tall.

The subalpine zone in the study area is dominated by lush 2-6 m tall alder (*Alnus spp*.) with devil's club (*Oplopanax horridus*), stinging nettle (*Urtica dioica*), ferns and various rich site forbs. This appears to be a disclimax community where the combination of heavy snow pack, persistent soil moisture from snow melt, and lush forb and shrub growth exclude tree establishment. This habitat type is similar to the natural tall shrub habitats that occur at lower elevations, however, the two types were kept separate for analysis purposes due to the differences in elevation and pattern that could affect bird distribution (e.g. Subalpine Tall Shrub was the most extensive habitat type).

The alpine zone contained three different avian habitat types. The habitat type in the lower alpine zone consists of a low shrub/forb meadow complex. This habitat differs from the subalpine tall shrub habitat in that willow (*Salix spp*.) is the dominant shrub (vs. alder in subalpine tall shrub), shrub heights are generally <1.5 m, and lush forb meadows comprise about half of the area of this type. The extent of the alpine low shrub/forb meadow band varies across the study area in relation to gradient and site conditions that occur in the suitable elevation band. On the shoulders of Flower Ridge this habitat is quite extensive, occurring in a 100-500 m wide band. On the South Wall, where the slope is steeper and soil moisture and nutrients are poorer, the band is often <100 m, and sometimes not present at all. The habitat type in the mid alpine zone also occurs as a complex of types: grass dominated tundra (typically sparsely vegetated

and <20 cm), heather dominated heaths, and non- or very sparsely vegetated fellfields[11]. Although these three habitats are quite distinct, they were lumped into a composite type because they typically occurred in a complex where individual patches were much smaller than the territory sizes of bird species occurring there. The alpine tundra/heath/fellfield habitat type generally varies as a 200-500 m wide band across the study area. The degree of cover and height of vegetation decreases with elevation within this band. Above the alpine tundra band the habitat consists of non-vegetated rock and ice.

Two riverine habitat types were also observed in the study area. The first was low bench floodplain along the Klehini River, which consisted of predominantly non-vegetated gravel bars with occasional beds of willow, soopalallie (*Sheperdia canadensis*) and/or mountain avens (*Dryas spp*.). The second type consisted of active, braided gravel bars along the Porcupine, Glacier and Klehini Rivers. These areas were targeted for surveys due to the potential occurrence of specialized riverine bird species, including Harlequin Duck, American Dipper and Wandering Tattler. These two riverine types were also combined for data summary due to broad similarities and low sample sizes.

A summary of survey effort (number of point count stations) in each habitat type is summarized in **Figure 6**.

Table 3 Broad habitat types encountered during breeding bird surveys in the Palmer Project Area in June, 2015.

Broad Habitat Type	Description/Comments
Mature/old conifer forest	Mature/old Western Hemlock (Hw), Mountain Hemlock Hm), Sitka Spruce (Ss) and occasional Cottonwood (Act), >24 m tall, on lower-mid slopes; frequent canopy gaps and alder/devil's club swales; weak evidence of different subalpine coniferous zone typical in inland and southern systems; subalpine within Core Study Area is dominated by disclimax alder ecosystems
Mature Deciduous - Cottonwood/soopalallie mid-bench floodplain	Mature Act, mid-high bench floodplain 50-300m wide along the active Klehini River floodplain;
ActSs/Alder/Devil's club	Alluvial fans of Porcupine and Glacier Creeks at toe slopes in valley bottoms; more productive than the Klehini floodplain sites, with larger trees and well developed tall shrub layer; limited to one survey station, so lumped with Act floodplain, above.
Young forest stage conifer and mixed forest	primarily a result of historic logging; 12-20 m tall; lower and toe slope;
Tall shrub (cutblocks and natural alder swales)	8-25 yr cutblocks with alder, willow and regenerating conifers to 8 m tall; lumped with natural alder/devil's club swales due to small sample size
Low shrub (cutblocks)	Recent (<8 yr old) cutblocks with limited regeneration, <2 m tall

[11] Non- or sparsely vegetated areas of poor soil/gravel where frequent freeze/thaw cycles during the growing season inhbit vegetation from establishing

Broad Habitat Type	Description/Comments
Subalpine tall shrub	Alder is dominant shrub; 2-6 m tall; lush sites with devil's club, stinging nettle, ferns and various rich site forbs; dominant subalpine vegetation community within study area
AT (alpine) low shrub/forb meadow	Willow is dominant shrub; typically <1.5 m; lush forb meadows to 50 cm comprise about half of area
AT tundra/heath/fellfield	Patchwork of grass dominated alpine tundra, heather heaths and fellfields[1]; vegetation generally <20 cm; dominates mid alpine zone
AT rock/snow	Highest elevations, rocky ridges, and glacial features with very sparse vegetation <10% of area
Dryas (Willow) low bench floodplain	Active floodplain; predominantly non-vegetated gravel bars with occasional beds of willow, soopalallie or *Dryas*
Braided riverine	Porcupine, Glacier, Klehini Rivers

[1] Non- or sparsely vegetated areas of poor soil/gravel where frequent freeze/thaw cycles during the growing season inhbit vegetation from establishing

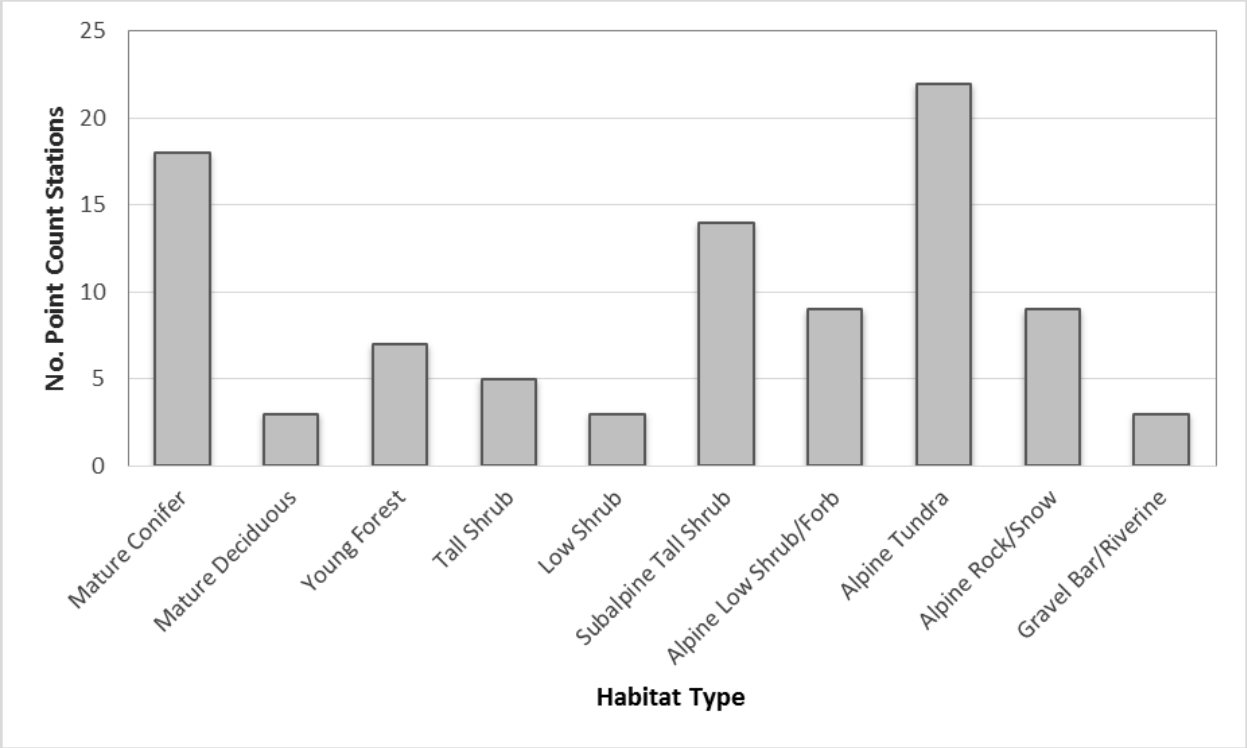

Figure 6 Breeding bird survey effort across 10 broad habitat types at the Palmer Project Area in June 2015.

Total number of birds and number of species varied across habitat types (**Figure 7**). The highest counts and highest number of species detected per point count occurred in the three forested habitat types. Mature Conifer had the highest species richness (number of species) at 26 and the highest number of species unique to a habitat at nine (**Figure 8**). Species that occurred at highest densities or were unique to Mature Conifer included conifer cone seed eaters, such as Pine Siskin and Red Crossbill, two woodpeckers, American Three-toed Woodpecker and Hairy Woodpecker, and two species of concern, Gray-cheeked Thrush and Olive-sided Flycatcher (**Table 4**). Bird species composition in Young Forest was similar to Mature Conifer but lacked, or had lower density of, species associated with mature forest elements (e.g. snags, large trees, complex stand structure), such as the species just listed. Species composition in Mature Deciduous was also most similar to Mature Conifer. No bird species were uniquely detected in Mature Deciduous, however, two deciduous associated species, Warbling Vireo and Alder Flycatcher, were only detected in Mature Deciduous and Tall Shrub.

After the forest habitat types, Subalpine Tall Shrub had the next highest average counts. Species there were dominated by several species of warblers and sparrows. The three alpine habitat types contained several species that are specialized to the harsh climate and sparse vegetation that occurs in the alpine zone. These species included Willow, Rock and White-tailed Ptarmigan, Common Redpoll, Horned Lark, American Pipit, Smith's Longspur, and Gray-crowned Rosy Finch. One shorebird, Semipalmated Plover, was also observed at meltwater ponds in the Alpine Tundra/Heath habitat. Within the alpine zone, the average number of species and average total bird counts decreased with increasing elevation band. Only one species, Gray-crowned Rosy Finch was regularly observed in the highest alpine band, the Alpine Rock/Snow habitat.

Riverine habitats contained three riverine specialists, American Dipper, Harlequin Duck, and Spotted Sandpiper.

Four avian Species of Interest were detected during surveys. Gray-cheeked thrush was detected at two locations, one in Mature Conifer near the camp along Porcupine Creek and one in subalpine Young Conifer at the north end of Flower Ridge (station FL-10). One Olive-sided Flycatcher was detected in Mature Conifer along the edge of a recent clearcut (station AR-10). Townsend's Warbler was the most numerously detected SOI and was observed at ten Mature Conifer sites, one Young Forest site, and two Subalpine Tall Shrub sites. Rock Ptarmigan was detected at two sites on Flower Ridge (FL-01, 04). Additionally a Golden Eagle was observed incidentally (see cliff nesting raptor survey section).

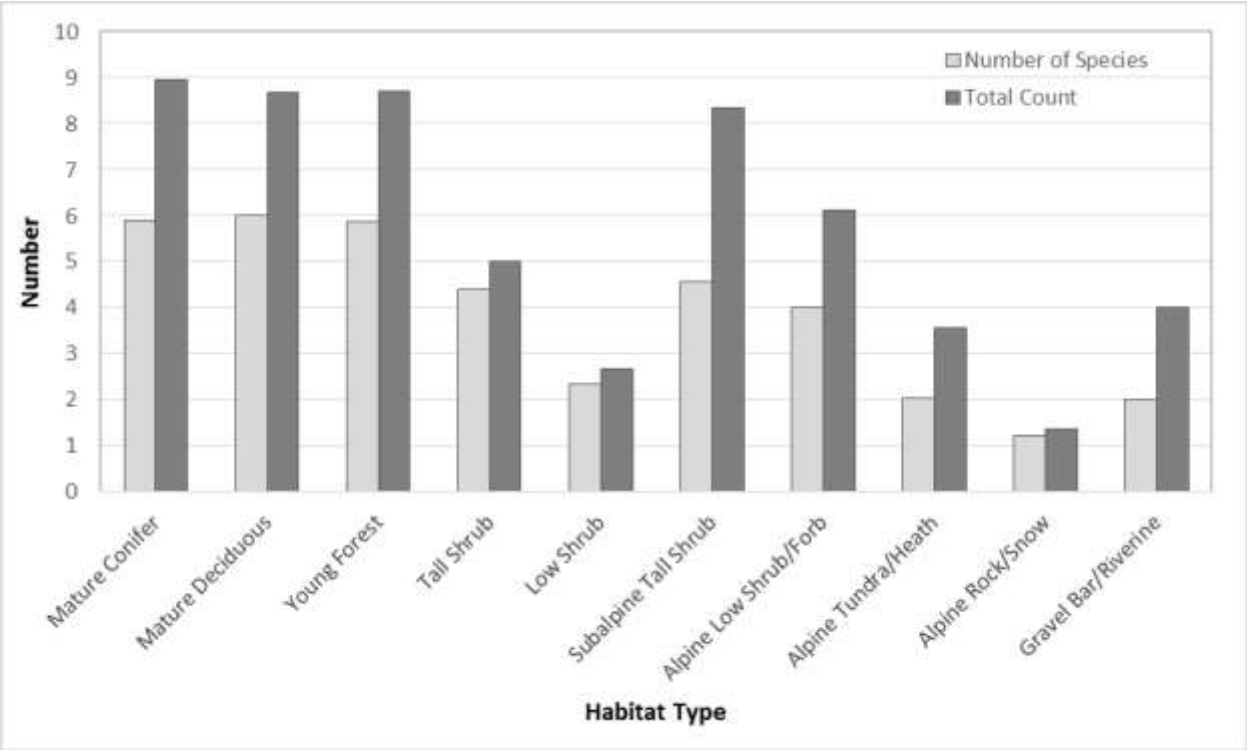

Figure 7 Average number of bird species and average count of birds per point count station detected among habitat types at the Palmer Project Area in June 2015.

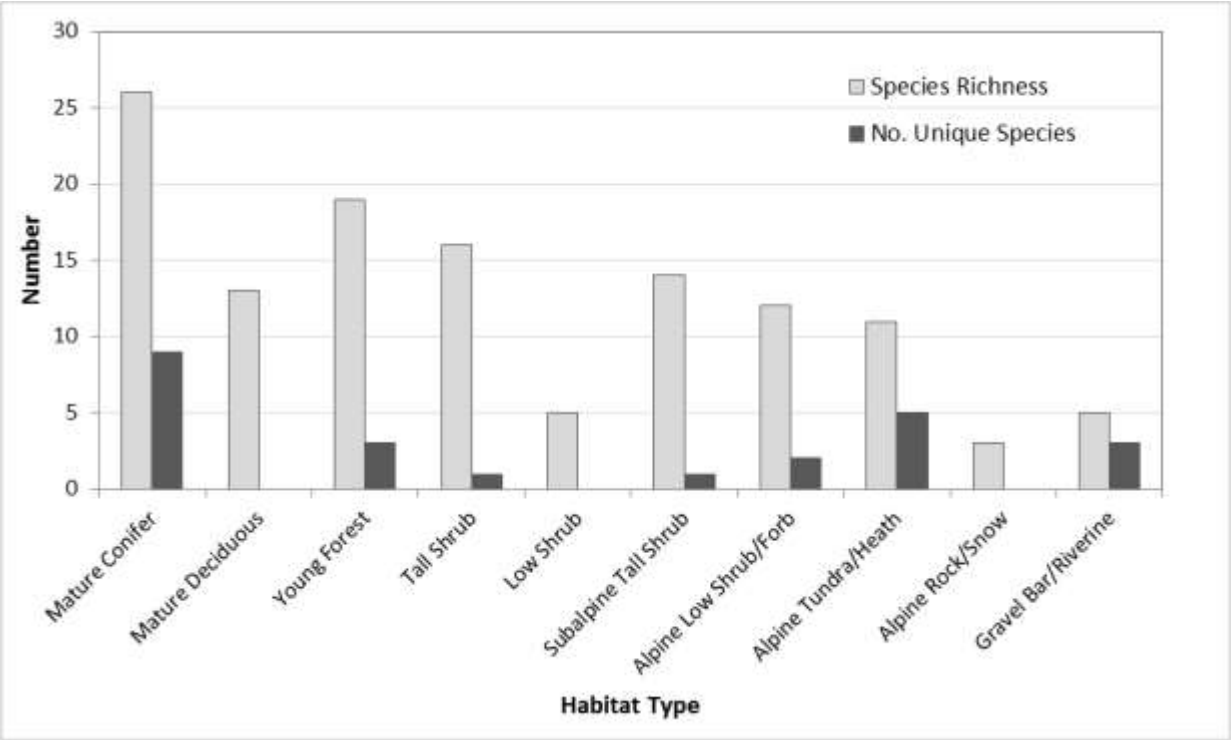

Figure 8 Species richness and number of unique bird species observed within 10 habitat types at the Palmer Project Area in June 2015.

No Northern Goshawks were detected at the 32 stations where call playback was conducted. In terms of nesting habitat, moderate and high quality habitat was observed only at five sites, all along the lower section of the laydown road (MR-02, 03, 04, 06, 07). These sites were Mature Conifer habitat with forest structure that provided suitable nesting requirements - branch platforms adequate to support large stick nests and good sub-canopy flyways below a relatively closed canopy. At the other forested sites that were surveyed the amount and quality of nesting habitat was limited by natural forest structure (poor branch platforms, poor flyways, open canopies, and/or the small size of suitable forest stands) and anthropogenic disturbance (recent and historic cut-blocks). Although the number of point count stations with suitable nesting habitat was relatively small, additional potentially suitable nesting habitat was observed from the helicopter in similar mid-slope positions above the Klehini Valley. In terms of foraging habitat, high to moderate quality foraging habitat occurs throughout the forested portion of the study area. Lower portions of the alpine may also be used to hunt ptarmigan, ground squirrels and marmots. Based on the low but adequate amount of nesting habitat and extensive suitable foraging habitat, it is likely that the study area is part of a goshawk territory.

Table 4 Average detection rates (birds per point count) for 51 bird species across 10 broad habitat types at the Palmer Project Area in June 2015. Numbers in brackets indicate the number of point counts in each habitat type. Species are ordered first following typical habitat associations described from the broad literature and second following taxonomic order. Shaded cells indicate the six most abundant species in each habitat type.

Species	Habitat Association	Mature Conifer (18)	Mature Deciduous (3)	Young Forest (7)	Tall Shrub (5)	Low Shrub (3)	Subalpine Tall Shrub (14)	Alpine Low Shrub/Forb (9)	Alpine Tundra/Heath (22)	Alpine Rock/Snow (9)	Gravel Bar/Riverine (3)	Total Detections
Rufous Hummingbird	Generalist						0.071					1
Common Raven	Generalist	0.17										4
Swainson's Thrush	Generalist	0.33	1.67	0.43	0.40	0.33	0.29					21
Hermit Thrush	Generalist	0.94	0.33	0.43	0.20		0.50					31
American Robin	Generalist	0.28	0.33	0.29	0.20	1.00		0.33			1.00	18
Varied Thrush	Generalist	1.17	0.33	0.71	0.20		1.29	0.11				47
Yellow-rumped Warbler	Generalist	0.17	0.33	0.29								6
Chipping Sparrow	Generalist			0.14								1
Dark-eyed Junco	Generalist	0.11	1.00		0.20		0.21	0.22				11
Sooty Grouse	Forest-Conifer											1
Red-breasted Sapsucker	Forest-Conifer	0.39	1.00	0.29	0.20							14
American Three-toed Woodpecker	Forest-Conifer	0.06										1
Olive-sided Flycatcher	Forest-Conifer	0.06										1
Hammond's Flycatcher	Forest-Conifer	0.39	0.33	0.29								10
Pacific-slope Flycatcher	Forest-Conifer	0.06										1
Steller's Jay	Forest-Conifer	0.06										1
Pacific Wren	Forest-Conifer	0.83		0.29	0.20		0.36					23

Species	Habitat Association	Mature Conifer (18)	Mature Deciduous (3)	Young Forest (7)	Tall Shrub (5)	Low Shrub (3)	Subalpine Tall Shrub (14)	Alpine Low Shrub/Forb (9)	Alpine Tundra/Heath (22)	Alpine Rock/Snow (9)	Gravel Bar/Riverine (3)	Total Detections
Ruby-crowned Kinglet	Forest-Conifer	0.22	0.33	0.86								11
Gray-cheeked Thrush	Forest-Conifer	0.06		0.14								2
Townsend's Warbler	Forest-Conifer	0.67		0.29			0.14					16
Western Tanager	Forest-Conifer	0.06										1
Pine Grosbeak	Forest-Conifer	0.06										1
Red Crossbill	Forest-Conifer	0.28										5
Pine Siskin	Forest-Conifer	1.61	0.67	2.57		0.33			0.18		1.33	58
Hairy Woodpecker	Forest-Decid/Mixed	0.11										2
Western Wood-Pewee	Forest-Decid/Mixed			0.14								1
Warbling Vireo	Forest-Decid/Mixed		0.67		0.60							5
Northern Waterthrush	Forest			0.29								2
Alder Flycatcher	Shrub		0.33		0.40							4
Orange-crowned Warbler	Shrub			0.29	0.20	0.33	0.57	0.33				15
MacGillivray's Warbler	Shrub	0.06			0.60							4
Yellow Warbler	Shrub				0.20		0.71	0.22				13
Wilson's Warbler	Shrub	0.22	1.33	0.43	0.60		1.43	0.56				39
Song Sparrow	Shrub				0.20							1
Lincoln's Sparrow	Shrub	0.11		0.14	0.40	0.67						8
Fox Sparrow	Shrub-Conifer			0.29	0.20		0.93	0.56	0.05			22
American Tree Sparrow	Subalpine						0.07	0.11				2
Golden-crowned Sparrow	Subalpine							0.11				2

Species	Habitat Association	Mature Conifer (18)	Mature Deciduous (3)	Young Forest (7)	Tall Shrub (5)	Low Shrub (3)	Subalpine Tall Shrub (14)	Alpine Low Shrub/Forb (9)	Alpine Tundra/Heath (22)	Alpine Rock/Snow (9)	Gravel Bar/Riverine (3)	Total Detections
Common Redpoll	Subalpine						1.71	2.00	0.45	0.11		53
Willow Ptarmigan	Alpine							0.11				1
Rock Ptarmigan	Alpine								0.09			2
White-tailed Ptarmigan	Alpine								0.05	0.11		2
Horned Lark	Alpine								0.27			6
American Pipit	Alpine								0.59			13
Smith's Longspur	Alpine								0.05			1
Savannah Sparrow	Grass/Forb						0.07	1.44	0.68			29
Gray-crowned Rosy-Finch	Alpine								0.36	0.89		16
Harlequin Duck	Riverine										0.33	1
Spotted Sandpiper	Riverine										0.67	2
American Dipper	Riverine	0.11									0.67	4
Semipalmated Plover	Wetland								0.18			4
Total Species Detected		26	13	19	16	5	14	12	11	3	5	

4.3 CLIFF-NESTING RAPTORS

Peregrine falcon was selected as an SOI for the project as it is listed as a Species of Greatest Conservation Need (SGCN) by the state of Alaska. Golden eagle was selected as an SOI as it is listed as sensitive by the US federal Bureau of Land Management (BLM). In addition, the US Fish and Wildlife Service (USFWS) recognize raptor conservation as a management priority. Other cliff-nesting raptor species with potential to occur include red-tailed hawk and gyrfalcon.

An aerial survey was conducted, on June 24, 2015 and June 28, 2015 to assess the presence of cliff-nesting raptor species within both the core and the buffer areas. Wildlife habitat suitability studies completed in 2014 (Hemmera 2015) confirmed the presence of appropriate nesting habitat for golden eagle and Peale's peregrine falcon (**Table 5**).

Table 5 Hectares of Available High, Moderate, Low and Nil Value Habitats within the Study Area for Each Species of Interest

Species	High (ha)	Moderate (ha)	Low (ha)	Nil (ha)	Total Area (ha)
Peale's peregrine falcon	1,806.82	2,135.99	4,537.43	3,249.23	11,729.47
Golden eagle	2,548.90	2,243.64	4,079.47	2,857.47	11,729.47

On June 24, 2014 we flew 65.6km of linear transect and searched all cliffs within the core and buffer areas (**Figure 9)**. One red-tailed hawk nest (inactive) was identified on a cliff along Porcupine Creek. A pair of mature golden eagles were observed, in flight, near the drill operation area. There were also several anecdotal reports of eagles from Constantine pilot: Tighe Daugherty in the drill operations area in the days preceding this detection. No nest structures were detected during the formal survey. On June 28, 2015 we flew 38.2km of linear transect and conducted a more intensive search of the area immediately west and south of the active drilling operations. During that survey remnants of an old (inactive) golden eagle nest were detected on an east aspect rock ledge, at mid elevation, within 300m of an active drilling area. There was no recent evidence of use. No other evidence of nesting, by any species of cliff nesting raptor, was detected.

Terrestrial Wildlife and Habitat Assessment
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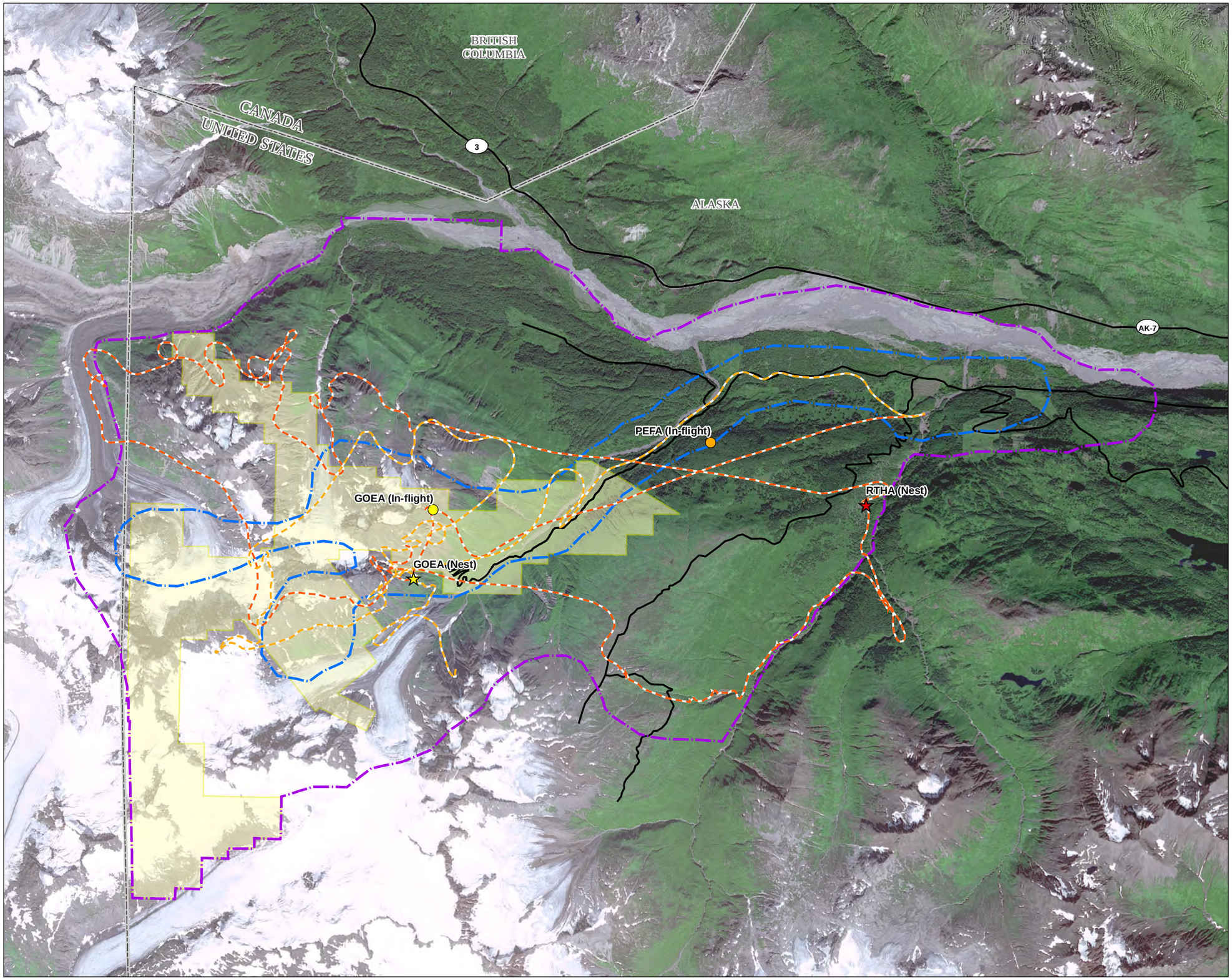
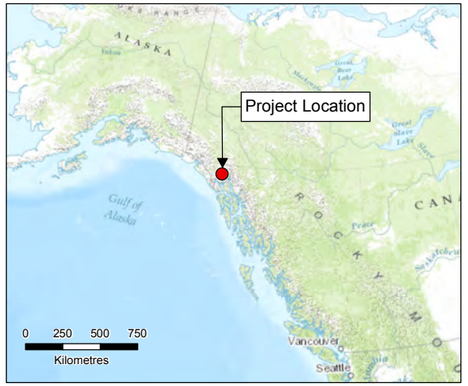
Flight Paths and Obervations of an Aerial Nest Survey at the Palmer Project Area in June 2015





Legend

- Golden Eagle (GOEA) In-flight
- Red-tailed Hawk (RTHA) Nest
- Golden Eagle (GOEA) Nest
- Peregrine Falcon (PEFA) In-flight
- Raptor Survey Flight Path - June 24
- Raptor Survey Flight Path - June 28
- Road
- International Boundary
- Federal Mining Claims
- Wildlife Habitat Assessment (WHA) Core
- Wildlife Habitat Assessment (WHA) Buffer

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Basedata: Government of Canada, Government of British Columbia, State of Alaska
- Aerial Image: Alaska SPOT 5 m Colour.
- Basemap & Inset: ESRI World Topographic Map

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A single adult female peregrine falcon and a pair of golden eagles were detected, in flight, on June 24 at 9:31PM. No evidence was observed to suggest active or recent nesting by either peregrine falcon or golden eagle during either survey. The falcon was travelling east, over forested habitat, downslope of Flower Ridge. The pair of golden eagles was travelling north towards the Klehini River. In both cases the raptors we observed were likely foraging or briefly travelling through the study area.[12] Both species are present in the project area but nesting is not suspected at the time surveys were conducted.

[12] Short-eared owl (Asio flammeaus) was also confirmed (BLM-Sensitive) on Flower Ridge (buffer area) by anecdotal observation (D. Green pers com 2015). An owl pellet, most likely from a short-eared owl, was found in this area during a dawn bird survey on June 28, 2015.

5.0 DISCUSSION

The key objective of the 2015 terrestrial wildlife studies for the Palmer Project was to provide an assessment of current baseline conditions for each of three selected VCs (mountain goat, cliff-nesting raptors and passerines/near-passerines). This information will aid Constantine in designing future work plans, and inform and support future regulatory approval processes. Implications of the results of the three wildlife field studies (mountain goats, passerines and near passerines and cliff-nesting raptors,) are discussed below.

5.1 MOUNTAIN GOATS

Mountain goats are common and widespread in the mountains of southeast Alaska. They are recognized as an important game animal by ADFG and have been, and continue to be, a focal species for monitoring and research in the Haines mountain goat census area, including the Tsirku-Klehini area where the Project occurs.

All mountain goat populations are associated with steep 'escape' terrain, which is critical for predator avoidance. The angle that constitutes suitable escape terrain can vary depending on geology and terrain, however, slopes ≥ 40° are typically used (Mountain Goat Management Team 2010). Except when making long distance movements, such as seasonal range movements, excursions to mineral licks and when dispersing, mountain goats rarely venture more than 400-500 m from escape terrain (Chadwick 1973; Poole and Heard 2003; Taylor et al. 2006). The quality of seasonal ranges is therefore dependent on the combination of forage habitat in proximity to escape terrain (Mountain Goat Management Team 2010). Four types of habitat are often considered for annual mountain goat life requisites: winter habitat, summer habitat, natal areas, and mineral licks. Distances among different habitat types, and associated seasonal movement patterns, varies widely among populations and geographic regions, and can include substantial differences in elevation as well as horizontal distances of up to 35 km (Nichols 1985; Poole and Heard 2003).

The winter season, and associated habitats, are often the most limiting conditions for mountain goats due to reduced forage availability, cold temperatures, and high energetic cost of travelling through deep snow (Chadwick 1983; Fox et al. 1989; Côté and Festa-Bianchet 2003; Taylor and Brunt 2007; Poole et al. 2009). In addition to escape terrain and forage availability, winter habitat typically includes factors that result in reduced snow depths. These factors can include, independently or in combination: slopes steep enough to shed snow, low elevation, south aspect, windblown ridges, and conifer canopy that provides snow interception (Hebert and Turnbull 1977; Smith 1994; Gordon and Reynolds 2000; Taylor et al. 2006; Taylor and Brunt 2007; Poole et al. 2009). Two types of winter habitat are regularly described. The first type are areas with steep, warm aspect slopes, at or below treeline, where the combination of aspect, lower elevation and forest canopy reduce snow depths. The second type are windblown ridges and

mountain tops. Often, the first type of habitats are more associated with coastal areas and the second with interior areas (Hebert and Turnbull 1977). Local data from the Haines mountain goat census area suggests that mountain goats in this region may use both types of habitats, and White et al. (2011b) subdivide lower elevation use into two types: mid elevation use at or below treeline, and low elevation use, well below treeline, in lower slope positions, often near valley bottoms or the ocean. Limited telemetry data and snow depth information suggests that mountain goats in the Tsirku-Klehini Block primarily use high elevation, alpine type, with secondary use of mid-elevation treeline habitats (White et al. pers. comm. 2015). Deep snow down to valley bottom elevations is believed to preclude the low elevation habitat strategy. However, more detailed information (i.e. winter surveys or more intensive telemetry studies) are required to confirm winter habitat use strategies in the Tsirku-Klehini Block. Winter ranges typically comprise a small proportion of an annual home range and may be as small as 8-20 ha (Fox et al. 1989; Taylor et al. 2006).

Summer habitat includes a wider range of characteristics than winter, although proximity to escape terrain remains a key factor. Mountain goats tend to travel more frequently and over greater distances in the summer and have larger ranges than in the winter (Côté and Festa-Bianchet. 2003). Habitat use and within season movements in southeast Alaska often include an elevational shift that follows the progression of green-up (BLM 2012).

Natal sites are where nannies give birth in late May and June and spend their first few days in isolation with their kids. Natal sites general occur near or within winter ranges (Mountain Goat Management Team 2010). They are typically secluded sites that offer screening cover and that are not regularly frequented by other goats. Several days after birth, nannies with kids tend to form nursery groups that may include other adult females and subadults of both sexes, and begin moving to summer range.

Mineral licks can be important habitat areas for mountain goats in many areas, especially in interior populations. The primary mineral being sought after in most areas is believed to be sodium, possibly due to low sodium content in most alpine plants (Mountain Goat Management Team 2010). Elevated levels of magnesium, manganese, iron, and copper have also been reported at lick sites, and are known to be important mineral supplements for other ungulates (Ayotte et al. 2006; Dormaar and Walker 1996). Many populations of mountain goats make regular use of natural mineral licks, often travelling to low elevation sites or areas distant from their usual home ranges (Rideout 1974; Hebert and Turnbull 1977; Hopkins et al. 1992; Ayotte et al. 2008; Poole et al. 2010). The use of mineral licks by mountain goats in coastal areas, however, is unreported (Mountain Goat Management Team 2010) including from studies in the Haines mountain goat census area (K. White pers comm. 2015). This may be due to higher levels of naturally occurring salts and minerals in coastal soils and bedrock, which are reflected in forage plants, or naturally occurring mineral deposits that can used as licks may simply not occur.

5.1.1 Population Surveys

At a coarse scale, patterns of goat distribution were similar between the June and September surveys. The majority of observations were concentrated in the southeastern portion of the Tsirku-Klehini Block, associated with unnamed mountains at the heads of Cottonwood, Nugget and Summit Creeks (**Figures 3** and **4**). Smaller number of goats were also observed during both surveys on Porcupine Peak, south aspect slopes above Tsirku River and Tsirku Glacier, and south aspect slopes above Jarvis Glacier in the northwest. No goats were observed in the Saksaia Glacier and Flower Mountain areas, including the Palmer Project Core and Buffer study areas, in either survey in 2015. However incidental observations of mountain goats in the Core and Buffer study areas have been noted in the past (Hemmera 2015). This pattern of distribution of mountain goats, including the absence or low number of mountain goats in the Palmer Project Area, is regarded as typical for this area (K. White pers. comm. 2015) and is consistent with observations from the ADFG survey conducted within the Porcupine Creek Block in the past (White et al. 2014).

Although the broad distribution of goats was similar between the June and September surveys, group size and other factors differed between the two surveys (**Table 6**). Generally, these differences are consistent with general patterns of group association, population dynamics, and seasonal movements associated with seasonal timing factors discussed in the broader literature. Typically, mountain goat populations (and associated survey counts) decrease as the season progresses (Côté and Festa-Bianchet. 2003). The 15% increase in total mountain goats observed between the June and September surveys in this study likely reflects higher sightability during the September survey (White et al. 2014). The decrease in numbers of kids and the decrease in kid:adult ratios is consistent with reduced numbers of kids observed in other studies (Côté and Festa-Bianchet. 2003), which generally report predation as the primary cause of kid losses in the first summer. June surveys observed higher levels of aggregation than September, as reflected in higher average group size and higher proportion of goats in groups of four or more animals. The larger groups observed in June were of bachelor groups of adult males and nursery groups of nannies with and without kids and subadults. This pattern of group associations during the summer and disbanding prior to the winter is consistent with behavioural patterns observed in other studies (Côté and Festa-Bianchet. 2003), including in southeast Alaska (BLM 2012). Differences in average elevation between seasons are also consistent with local studies that observed mountain goats foraging on herbaceous plants at higher elevations during the summer and moving to lower elevations in the fall and winter where browse species are available (Fox and Smith 1988).

Table 6 Differences in June and September survey results for mountain goats in the Tsirku-Klehini Block in 2015.

Survey Date	June 23	September 22
Total Mountain Goats (n)	116	134
No. Kids	33	25
Kid:Adult Ratio	40%	23%
No. Groups	21	50
Average Group Size	5.5	2.7
% Goats in Groups ≥ n=4	87%	49%
Average Elevation (m ASL)	1057	764

Results of the September 2015 survey from this study were compared with results collected during an ADFG led 2015 survey of a subset of the Tsirku-Klehini Block, referred to as the Porcupine Block (See **Section 3.1: Figure 2**). This smaller area, within the Tsirku-Klehini Block, was surveyed by ADFG on September 13, 2015; nine days prior to our September 22nd survey. During that survey ADFG observed a total of 86 goats, composed of 60 adults and 26 kids (30% kids) (K. White pers. comm. 2015). A tally of mountain goat observed on the September 22nd Hemmera-led survey within only the smaller ADFG census area (i.e., Porcupine Block observations only) was 108 goats (87 Adults, 21 kids; 20% kids), 21% higher than the preceding ADFG survey in 2015.

Data from annual fall population and recruitment surveys for mountain goats in the Haines mountain goat census area by ADFG are available since 2010 (White et al. 2014). With the exception of a low count of 61 goats in 2014, the total number of mountain goats observed in the Porcupine Creek Block has been within a relatively narrow range of 86-113 (mean = 94 goats/year; Figure 10). The slightly negative trendline in Figure 10 is driven by the low count in 2014. Otherwise, the census trend is flat over the last six years.

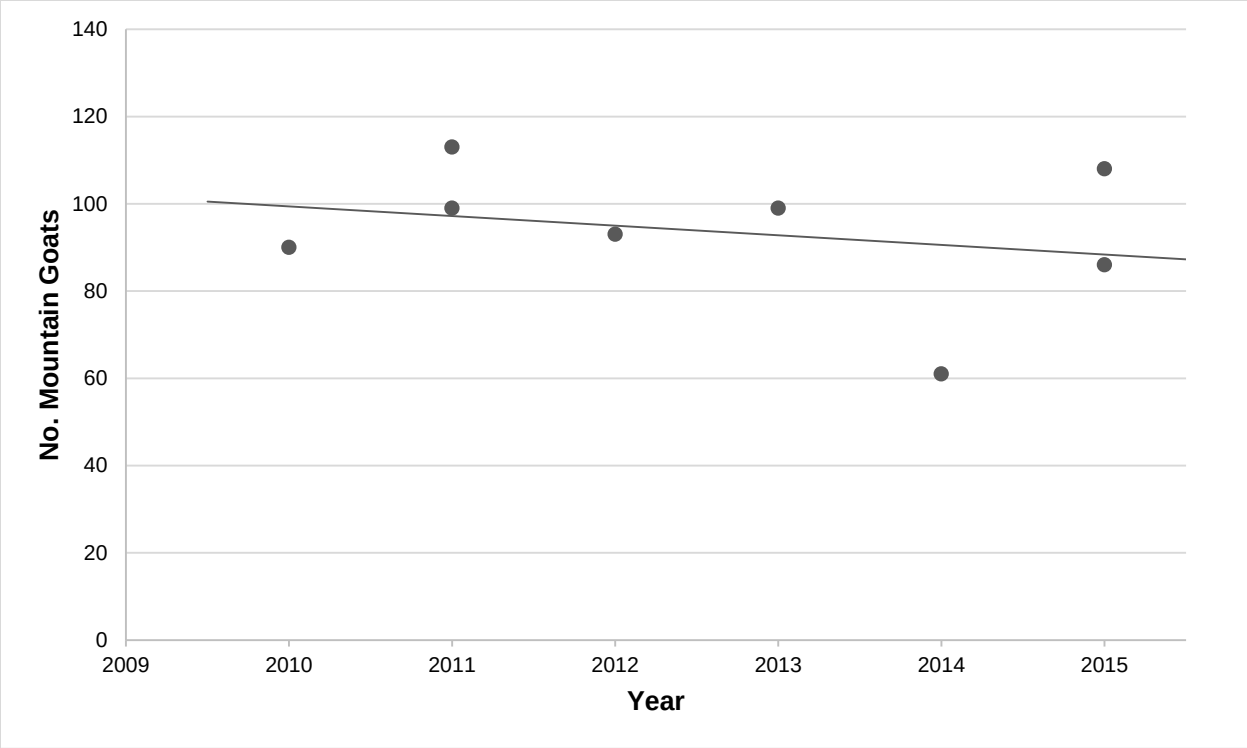


Figure 10 Historic aerial census results for mountain goats in the Porcupine Creek survey area during September, 2010-2015.

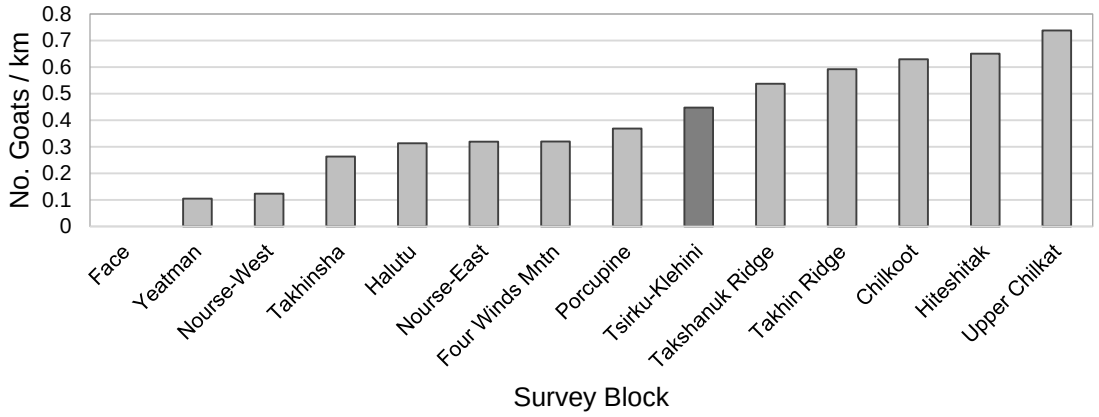
Aerial survey results from this study (2015) were compared to historic mountain goat census data from 2014, for all 13 ADFG Haines mountain goats census areas (White et al. 2014; Appendix 5). (See **Section 3: Figure 2**). Three density estimates are discussed for comparative purposes, each with inherent assumptions and biases that could affect the estimate.

1. The simplest estimate was calculated as the number of goats per kilometer of flight transect (Figure 11-A). This estimator has the fewest assumptions associated with it, but estimates may be biased by the degree of tortuosity of the flight path.
2. The second estimate was determined by applying a 1,000 m buffer to the flight path and calculating the number of goats per hectare of transect buffer (Figure 11-B). This estimator tends to smooth out the estimate of survey coverage where tortuous flight path occur, but it can be biased by differences in sightability and habitat suitability within the 1 km buffer among survey areas.
3. The third estimate was calculated as the number of goats per hectare of suitable habitat (habitat classes 2-5 from ADFG's RSF model [White et al. 2011]) (Figure 11-C). This estimator accounts for habitat suitability in the estimate of survey coverage, however, this adds another set of assumptions and potential biases to the estimator.

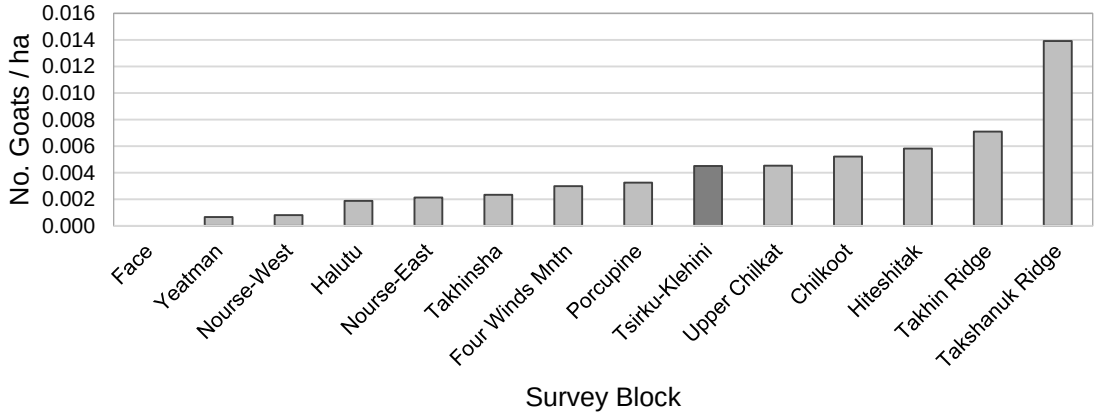
The purpose of providing these three density estimates is to account for the uncertainty associated with survey coverage conditions that vary across survey areas. If the pattern of relative densities among the survey areas is similar across the three estimators, that increases confidence in the robustness of the estimates.

As indicated in **Figure 11**, the relative ranking of density estimates across the 14 survey areas using the three density estimators is relatively consistent, which suggests the estimates are relatively robust, and not especially sensitive to the criteria used as the denominator in the density calculation. The density of mountain goats in the Tsirku-Klehini area is consistently in the mid-range of all survey areas for the three estimators. Due to inherent limitations of the survey data (e.g. mostly single surveys and known sightability issues) and the biases associated with the method used to calculate density (i.e. what factor is used as the denominator) we caution against making inferences in the data beyond broad patterns. For example, we conducted this analysis to assess the general question of whether the density of mountain goats was within the low, mid, or high range of densities across the Haines census area. Finer patterns in the figures, such as whether there are statistically significant differences between certain survey areas, likely cannot be supported by the data. The relatively higher ranking of the Tsirku-Klehini block, using the number of goats per hectare of suitable habitat (estimate #3), reflects the relatively low amount of suitable habitat predicted by the winter RSF model (see Section 5.1.2, below).

11-A



11-B



11-C

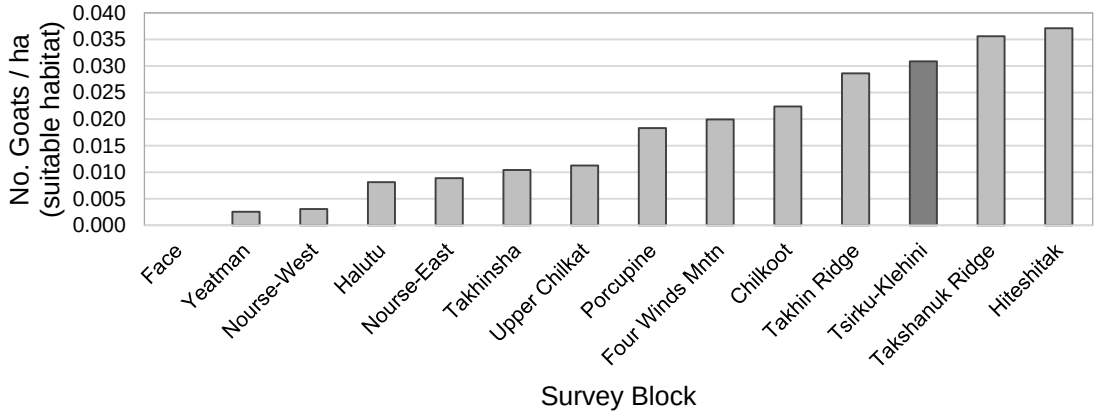


Figure 11 Comparison of fall mountain goat densities in the Tsirku-Klehini Block (2015) to 13 ADFG survey areas in the surrounding Haines mountain goat census area (2014) using three estimators: A – goats per km flight transect, B – goats per ha using a 1 km fixed width buffer, and, C – goats per ha of suitable habitat within 1 km width buffer.

For many ungulates, including mountain goats, the ratio of young of the year to adult females is used as a measure of productivity. Due to the difficulty of sexing mountain goats via aerial survey without unduly disturbing them, ADFG protocols normally exclude sex classification and limit age classification to young of the year (kids) and older than young of the year (adults). The same approach was used during the surveys for this study. Therefore, young of the year ratios are reported relative to total adults, which includes yearlings and both sexes. For this study the kid:adult ratio was 39.8% in June (33 kids:83 adults). Other studies have reported kid:female ratios in summer of 42-100:100 (Côté and Festa-Bianchet 2003). Applying a multiplier of 2x to the kid:adult ratio in this study (assuming an equal sex ratio and not accounting for breeding age) corresponds to an estimate of 80:100 kids:females, which is indicative of relative high juvenile productivity. By September the kid:adult ratio had declined to 22.9% (25 kids:109 adults). This rate of decline is consistent with mortality rates of kids in other studies (Côté and Festa-Bianchet 2003), which generally identified predation as the primary cause of kid mortality during the first year. The September ratio of 22.9% is very close to the average kid:adult ratio of 22.2% observed among the 13 ADFG Haines mountain goat census areas (White et al. 2014). The range of kid:adult ratios across the 13 ADFG census areas is shown in **Figure 13**. For all but three areas the ratio is between 10-30%. The high ratio of 50% at Yeatman may be an artifact of small sample size as it is based on only 2 kids and 4 adults.

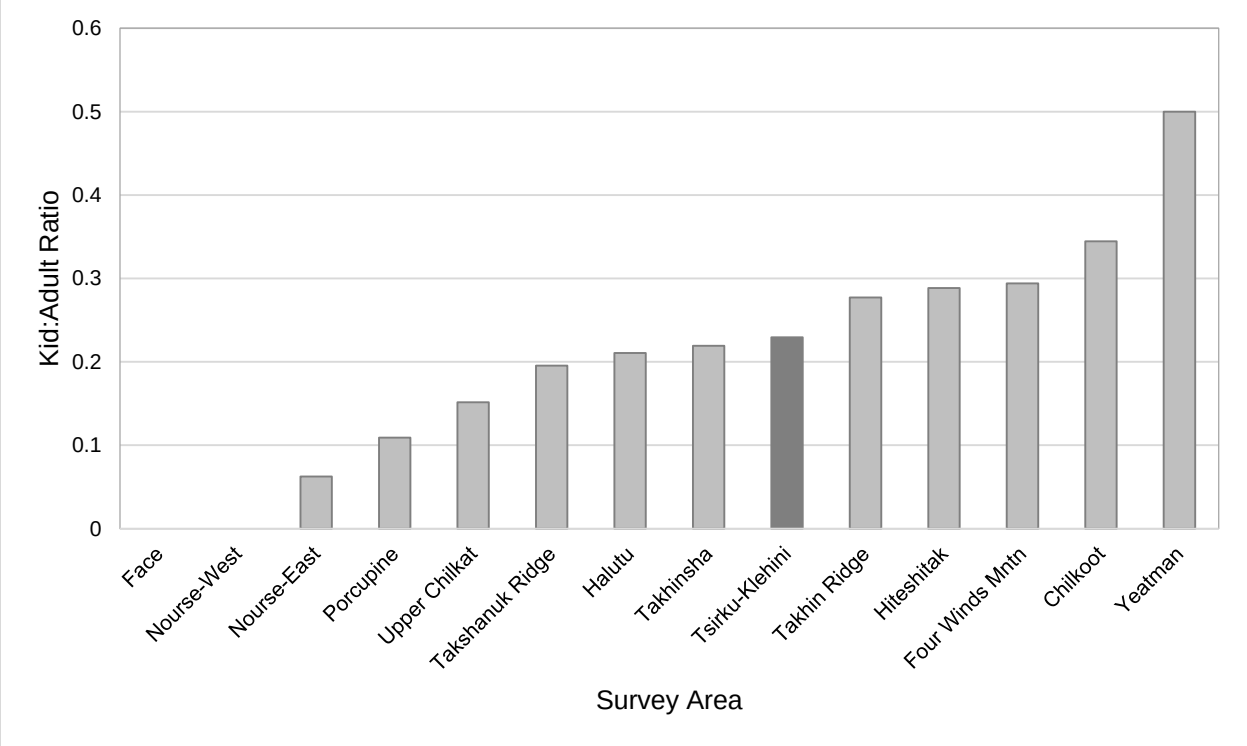


Figure 12 Comparison of fall kid:adult ratios of mountain goats in the Tsirku-Klehini Block (2015) to 13 ADFG survey areas in the surrounding Haines mountain goat census area (2014).

5.1.2 Winter Habitat

A comparison of the proportion of potential winter habitat predicted by the RSF model in the Tsirku-Klehini Block (estimate corrected for truncated portion of the Tsirku-Klehini Block lacking RSF output) to the ADFG census areas is provided in **Figure 13**. This may suggest that winter habitat is more restricted in the Tsirku-Klehini than in the majority of adjacent mountain blocks. However, the estimate of proportion of winter habitat is sensitive to the total area used in the denominator of the estimates and the criteria used to define the survey area extents were subjective, and possibly biased. For example, the boundary of the Tsirku-Klehini block tends to extend to lower elevations than most other survey areas. This bias would result in a larger denominator in the estimate and a lower estimate of the proportion of winter habitat.

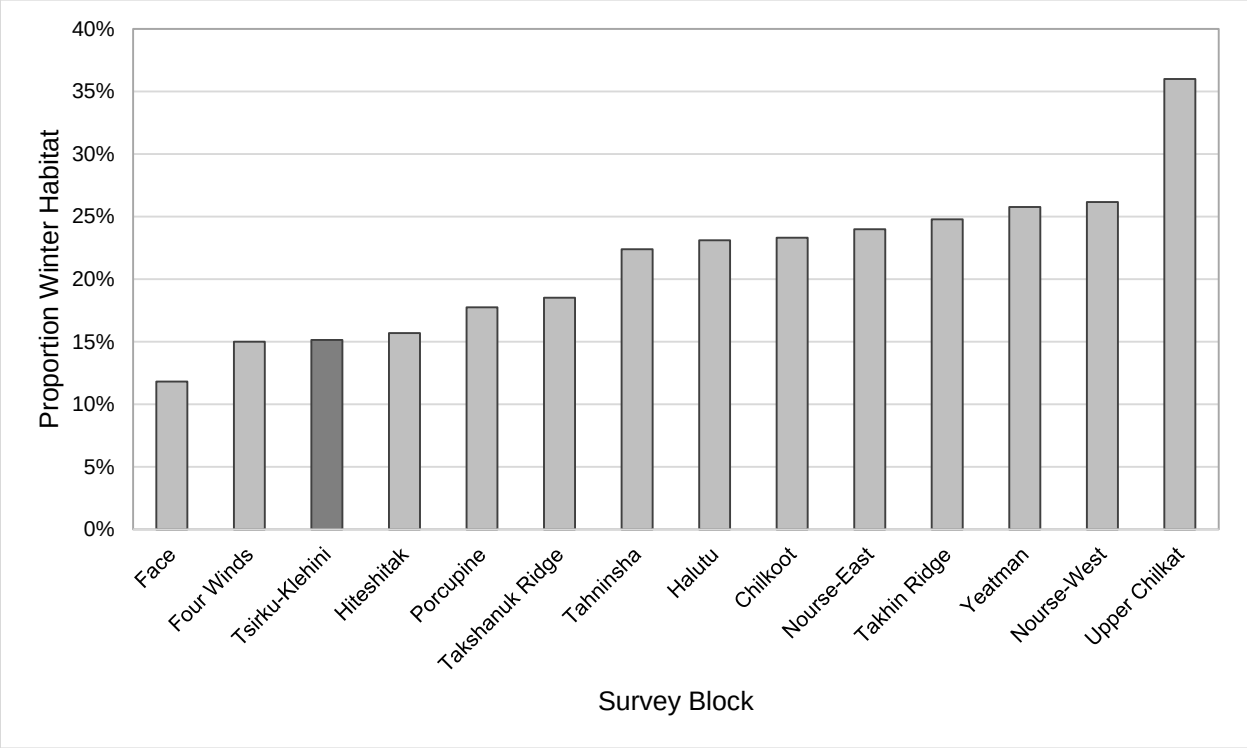


Figure 13 Comparison of proportion of potential winter habitat in the Tsirku-Klehini Block to 13 ADFG census areas in the surrounding Haines census area

Although the ADFG winter habitat RSF (White et al. 2011a) model represents the best information currently available for assessing potential winter habitat distribution in the area, there are specific considerations that may limit the accuracy of the model. One factor is that the model was developed from a relatively small dataset. This includes use of a small number of animals (n=12), a small number of winters (n=2) and a relatively small total number of locations (n=189). The primary potential limitation associated with a small dataset is that the sample is not representative of the broader patterns of habitat use. For example habitat use patterns by those 12 animals may not be representative of habitat use

patterns of the broader population. Also, weather conditions during the two years of study may not be typical of longer, average conditions over multiple years. Small datasets can sometimes lack statistical power to identify relationships, however, that did not appear to be a problem in this model. A second potential concern specific to assessment of the Palmer Project, relates to not having mountain goats from the Tsirku-Klehini Block included in the data. That can increase the risk of the sample data not being representative if either the environmental conditions or the habitat use patterns in the Tsirku-Klehini Block differed from the Kelsall area. A third issue affecting model confidence is that no formal model validation exercise have been documented. Notwithstanding the value of formal model validation procedures could add, it is important to note that model evaluation exercises were conducted and that those exercise indicate the model outputs correspond well with expert expectations and mountain goat location data. Model evaluation has included review of model predictions relative to local studies (e.g. Fox et al. 1989), the experience of local mountain goat biologists, and comparison of model predictions to mountain goat locations from annual population surveys and ongoing telemetry studies. As previously mentioned, one known bias of the RSF is that it may not capture mid and low elevation winter habitat strategies (White et al. 2011a) which become more prevalent in areas closer to the coast (White et al. 2011b).

ADFG staff are aware of the potential limitations of the current RSF model. ADFG has been collecting additional data from across the Haines census area over the last 10 years and is in the process of updating the RSF analysis (K. White pers. comm. 2015).

One issue that will always be inherent to any habitat model, including the current or updated mountain goat RSF, is limited confidence in using the model predictions for site specific assessments, such as predicting habitat use within the Palmer Project area. The nature of all habitat models is that they are a generalization of habitat use patterns relative to a subset of relevant habitat variables. Actual habitat use at local scales can vary substantially from model predictions due to several factors. For example, snow depth, which is not a variable in the model, may preclude mountain goats from using an area that otherwise has suitable winter habitat characteristics (White et al. 2015). Ultimately, the only way to confidently determine local winter use by mountain goats in the Project area will be to conduct winter surveys of those areas, ideally over multiple years.

5.2 PASSERINES AND NEAR-PASSERINES

Overall, the results of point count surveys were consistent with the expected avian species assemblages. As part of the initial wildlife and habitat assessment for the Palmer Project (Hemmera (2015a), 195 species of birds were identified as potentially occurring in the overall study area based on historic records and range maps (Appendix 2). Of those, 96 species had potential to be detected in this study based on breeding range, habitat requirements, and detectability via point count survey methodology. This total includes 73 species of songbirds that typically conduct territorial singing during the dawn chorus, as well as 26 species that are often recorded incidentally during point counts, or along transects

between point count stations, such as soaring diurnal raptors, grouse and ptarmigan, and certain shorebirds. Of the remaining 99 species, 83 were unlikely to occur due to limited suitable breeding habitat (e.g. lack of lakes and ponds for waterfowl) or because their normal breeding range was outside the study area (e.g. arctic breeding shorebirds); 16 were of species that may breed in the study area but were unlikely to be detected via point count surveys, such as owls.

For the bird species that were listed as potentially occurring in the study area, but were not observed during surveys, it should be assumed they still have the potential to occur. Several factors may have contributed to not detecting some of the expected species. These factors could include low density of occurrence, occurrence at sites not surveyed, annual variation in species occurrence, and environmental and seasonal timing factors that affected detectability. Weather conditions were good on five of the six survey days. On the one poor day, along the laydown road, the weather was acceptable, but suboptimal, with low overcast and drizzle at most stations, which may have reduced singing activity or detectability somewhat. In terms of time of year, the surveys were towards the end of the breeding season. Territorial singing appeared to underway for most species, especially at lower and mid elevations. Some early nesters, like Dark-eyed Juncos and Yellow-rumped Warblers, appeared to have been phonologically past their peak singing period; most observations of these species were visual. Singing rates seemed somewhat subdued in the alpine habitats (based on a relatively high rate of visual detections to auditory detections) but that may have just reflected the relatively low density and richness of birds there.

Nine bird species were identified as Species of Interest in the initial wildlife assessment (Hemmera 2015a). Since that initial assessment a revised version of the Alaska Wildlife Action Plan has been released and several changes to conservation rankings of birds were made (ADFG 2015). As a result, we recommend a slight revision to the bird SOI for the Palmer Project (Table 7). That consists of removing Gray-cheeked Thrush, which is no longer consider a species of concern, and adding Smith's Longspur, which is an alpine/tundra specialist whose range is largely restricted to Alaska. Five of the nine SOI were detected during surveys.

Olive-sided Flycatcher is an aerial insectivore that is associated with mature trees or snags adjacent to open areas or forest gaps. It uses this juxtaposition of structure to perch on the tall trees to spot and hunt insects in the adjacent open space. Examples of habitats that provide suitable conditions for Olive-sided Flycatchers are forest edges, including edges along cutblocks and roads, burns, and forest stands with frequent canopy gaps. Olive-sided Flycatchers are a species of concern due to significant population declines over portions of their range. Causes of decline are not well understood but are consistent with declines of several other aerial insectivores in North America (Altman and Sallabanks 2012). Olive-sided Flycatchers are considered a sentinel species because their response to declining aerial insect prey could be an early warning of effects on ecosystem processes and services that could extend to numerous other

species and to humans. Townsend's Warbler is a wood-warbler that occurs in montane and coastal coniferous forests of Oregon, Washington, British Columbia and Alaska. It is listed at the state level due to potential impacts associated with forest management (ADFG 2006). Smith's Longspur is an alpine and arctic tundra specialist and is considered a stewardship species because the majority of its range limited to Alaska. Ptarmigan are not a species of concern within the study area, however, all three species that occur are hunted and changes in access could affect populations in the area.

The Queen Charlotte subspecies of Northern Goshawk is listed as vulnerable by NatureServe and a Species of Concern by the Alaska Raptor Group. The primary reasons for its status are small population size of the coastal *laingi* subspecies and substantial habitat loss associated with forest management. Although no goshawks were detected during this study, suitable nesting and foraging habitat was observed to occur within the study area and it is possible that the area is being used as part of a goshawk territory.

Species appropriate surveys were not conducted for Marbled Murrelets or Western Screech Owls, however, anecdotal notes about habitat were recorded. For Marbled Murrelets, no suitable nesting habitat was noted in any of the mature forest stands surveyed. Specifically, the combination of branch sizes and amount of moss development on branches was inadequate to meet the nest platform requirements for the species (Nelson 1997). For Western Screech Owls, potentially suitable nesting habitat (i.e. mature forest with potential cavity trees) occurred in the mature cottonwood and mixed forest stands along the Klehini River floodplain and riparian forest along the lower sections of Glacier and Porcupine Creeks. The range of both species occurs across the Palmer Project study area, but no historical records occur within the study area (Alaska Natural Heritage Program, Biotics species explorer tool. 2015)

Table 7 List of avian Species of Interest identified for the Palmer Project.

Species of Interest	SoA[13] SOC Status	BLM Status	Potential to Occur	Potential to Interact/ Mechanism	Comment
Olive-sided Flycatcher	Declining Birds Landbird Plan Sentinel Species[14]	Sensitive	Confirmed	Moderate - Habitat loss, disturbance	One detection in valley bottom mature conifer habitat along cutblock edge
Gray-cheeked Thrush	Not listed	Not listed	Confirmed	Low	Remove from list due to reduced status
Townsend's Warbler	Stewardship Species[15] Sentinel Species	Watch	Confirmed	Low - Habitat loss, disturbance	Species of concern related to forest management
Smith's Longspur	Landbird Plan Stewardship Species Sentinel Species	Not listed	Confirmed	Moderate – Habitat loss, disturbance	New SOI. Observed on the ridge north of concentrated exploration activity
Rock Ptarmigan	Not listed	Not listed	Confirmed	High - Habitat loss, disturbance, increased hunting pressure	Observed on adjacent Flower Ridge east of Project
Queen Charlotte Goshawk	Raptor Group	Sensitive	High	Moderate – Habitat loss, disturbance	Ranked *Threatened* by NatureServe
Golden Eagle	Stewardship species	Not listed	Confirmed	High - Habitat loss, disturbance	Old nest near exploration area, birds observed annually by exploration crews
Peale's Peregrine Falcon	Stewardship species	Sensitive	Moderate	Moderate – Habitat loss, disturbance	Occasional sightings of individuals in area by project staff
Western Screech-Owl	State of the Birds Sentinel Species	Not listed	Moderate	Moderate - Habitat loss, disturbance	Limited project overlap with suitable nesting habitat
Marbled Murrelet	Seabird Plan Stewardship Species	Sensitive	Moderate	Low - Habitat loss, disturbance	Ranked *Vulnerable* by NatureServe Preliminary habitat assessments suggest suitable breeding habitat is limited or non-existent in study area

13 State of Alaska, Species of Concern, from Alaska Wildlife Action Plan (ADFG 2015)
14 Sentinel species may provide an early warning of risks to major ecosystem processes or services that could affect numerous other species, including humans
15 A species whose population or range exists largely within a specified jurisdiction and where the future success of the species may depend on management actions within that jurisdiction

5.3 CLIFF-NESTING RAPTORS

Results from the 2015 survey support the conclusion that there are no extant raptor cliff nests within either the core or buffer areas of the Palmer project. However, observations of Golden Eagles, Peregrine Falcons and Red-tailed Hawks by Hemmera personnel during the June 2015 survey program, and incidental observations by project staff in 2014 and 2015, suggest these species may be breeding in the surrounding area and may be using the Core and Buffer areas as foraging habitat. If sightings of cliff nesting raptor species occur with increased frequency in future years, or a nest or other evidence of breeding is observed, additional survey and development of management recommendations, by a QEP, may be required.

An expert-based consideration of available cliff-nesting raptor habitat supports the conclusion that this habitat type is not likely a limiting factor on local raptor population health. Suitable habitat for cliff nesting raptors is common and widespread within the Core and Buffer areas, as well as the larger Tsirku-Klehini Block. Anticipated project related impacts to cliff-nesting raptors will be localized and will affect a very small proportion of this available habitat type. As such, anticipated current and future Project related effects are considered negligible for the Palmer project area; no immediate mitigation is required. Potential future nesting use by raptors should be monitored and, if nesting is confirmed, appropriate management will be required.

6.0 MANAGEMENT RECOMMENDATIONS

In all jurisdictions of the United States (U.S.) the *National Environmental Policy Act* (NEPA), 42 U.S.C. § 4321 *et seq.*, is the primary statute addressing the federal decision making process for actions that affect the environment. Within NEPA, regulations, 40 C.F.R. parts 1500–1508, provide a procedural framework for federal agencies. In the State of Alaska there are three acts that govern wildlife management and provide species specific protection for Alaska's wildlife:

1. The *Endangered Species Act* (ESA) (36 USC 1531-1544) provides authority for management of threatened and endangered species. The ESA requires federal agencies, specifically the federal Environmental Protection Agency (EPA) to ensure all authorized activities do not jeopardize the continued existence of any threatened or endangered species or designated critical habitat. There are no federally listed species with potential to occur within the Project Area, and no areas designated as critical habitat.
2. The *Migratory Bird Treaty Act* (MBTA) of 1918 (16 USC 703-712) implements various treaties and conventions between the U.S., Canada, Mexico, Japan and the former Soviet Union to afford protection to migratory birds. Under the MBTA it is unlawful to take, kill, or possess migratory birds. In addition, the. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), issued in 2001, provides for the conservation of migratory birds and their habitats and requires evaluation of effects of federal actions (including approvals) on migratory birds, with an emphasis on species of concern.
3. The *Bald and Golden Eagle Protection Act* (1940 (16 USC 668) applies to wildlife in the project area. This act makes it illegal, unless specially permitted, to "*take*" any bald or golden eagle, alive or dead and including any eagle part, nest, or egg.

Potential effects to wildlife, associated with exploration, mine construction and mine operation may include habitat loss (direct and indirect (i.e., displacement)), effects on survival (mortality during clearing or operations), attraction of wildlife to project facilities (with a long-term adverse effect), and introduction or spread of non-native invasive species (plants and animals). Consideration and mitigation of effects to flora is considered under a separate report (Hemmera 2015b). Consideration and proposed mitigation of current effects to fauna (specifically terrestrial vertebrate fauna identified as VCs for assessment in 2015) is considered here.

Mitigation is defined as: "*practical means of preventing or reducing to an acceptable level any potential adverse effects of the project*." (EAO 2013)[16]. In this context recommendations are provided for mitigation of project related effects on the three VCs selected for assessment during the 2015 field season. Recommendations should be considered in an adaptive context and should allow for future progression and amendment as the project advances and/or as new information is collected, or becomes available, regarding population dynamics and species-specific responses for selected VCs. Future recommendations for additional consideration, and inclusion of additional VCs, should be solicited through ongoing stakeholder engagement and ongoing monitoring programs.

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[16] The Canadian Environmental Assessment Office (EAO) considers mitigation to be "any practical means or measures taken to avoid, minimize, restore on-site, compensate, or offset the potential adverse effects of a project."

The information collected in 2015 and presented here is intended to provide a context of baseline (pre-development) conditions for these VCs. Future considerations may be expanded to include additional wildlife VCs or additional detail to help quantify magnitude, extent, duration, reversibility and frequency of each activity and interaction on the VCs identified and assessed in this report. These considerations are beyond the scope of this report.

6.1 MOUNTAIN GOAT

Mountain goat populations have been documented to be sensitive to three primary types of human stressors: human hunting, habitat effects, and disturbance (activity and noise) effects from industrial development and aircraft. Over periods of one to a few years, and especially for small populations, severe winters and natural predation can also be locally significant natural factors that can interact with human stressors (Mountain Goat Management Team 2010). Mountain goat populations are sensitive to human harvest rates due to relatively low productivity compared to other ungulates. During the 1950's through to the 1980's, a combination of liberal hunting regulations and dramatically increased road access, associated with logging and other resource development, led to locally significant population declines of mountain goats in parts of their range in British Columbia, Alberta and Washington (Phelps et al. 1983; Hamel et al. 2006; Rice and Gay 2010). Over the last three decades many managed goat populations have stabilized or recovered, with targeted harvest rates typically between 2-5% of the total population (Toweill et al. 2004). Local population effects associated with creation of new access into mountain goat range continues to be a factor is some areas (Mountain Goat Management Team 2010).

Potential threats to mountain goat habitat includes direct and indirect effects. Due to the rugged, high elevation, alpine setting that mountain goats often inhabit, direct threats to habitat are typically somewhat limited. Most threats relate to habitat effectiveness, which is the reduction of habitat suitability due to indirect effects, such as disturbance (see below). Where goats occur below treeline and on gentler slopes, notably in association with winter range and mineral licks, forest clearing and road construction can impact those habitats (Gordon and Wilson 2004; Taylor et al. 2006). If vegetated security cover is removed from mineral licks, or along well developed trails leading to mineral licks, those features may be abandoned (Taylor and Brunt 2007; Poole et al. 2010). In situations where mountain goat groups or metapopulations are separated by forested area, forest development may also reduce the frequency of goat movements among areas and lead to habitat fragmentation and isolation (Smith and Raedeke 1982).

Mountain goats have been documented to respond to a range of human disturbances including aircraft, resource exploration (blasting and drilling), road construction, timber harvesting, and recreational off highway vehicle use (Mountain Goat Management Team 2010). Responses can range from short duration behavioural responses (e.g. increased vigilance and flight response), to physiological stress responses, to long term habitat displacement, and demographic effects, such as reduced fecundity (Mountain Goat Management Team 2010).

Mountain goats can exhibit high sensitivity to helicopter disturbance (Côté 1996; Gordon and Wilson 2004; Goldstein et al. 2005). Responses are inversely related to distance between the helicopter and goats (Côté 1996; Goldstein et al. 2005), with regular responses to helicopter flights out to 1500 m (Côté 1996). Factors, in addition to distance, that affect responses, are poorly understood and appear to vary among studies, but may include degree of visual and auditory screening, topography, and degree of prior exposure to helicopters (that may result in either sensitization or habituation) (Mountain Goat Management Team 2010). Fixed-wing aircraft appear to be less disruptive to goats and sheep than helicopters (Frid 2003) but little comparative data exists. Long term mountain goat monitoring programs have been established surrounding the nearby Kensington gold mine, which may help inform impact analysis in the future for the Palmer Project (White et al. 2015).

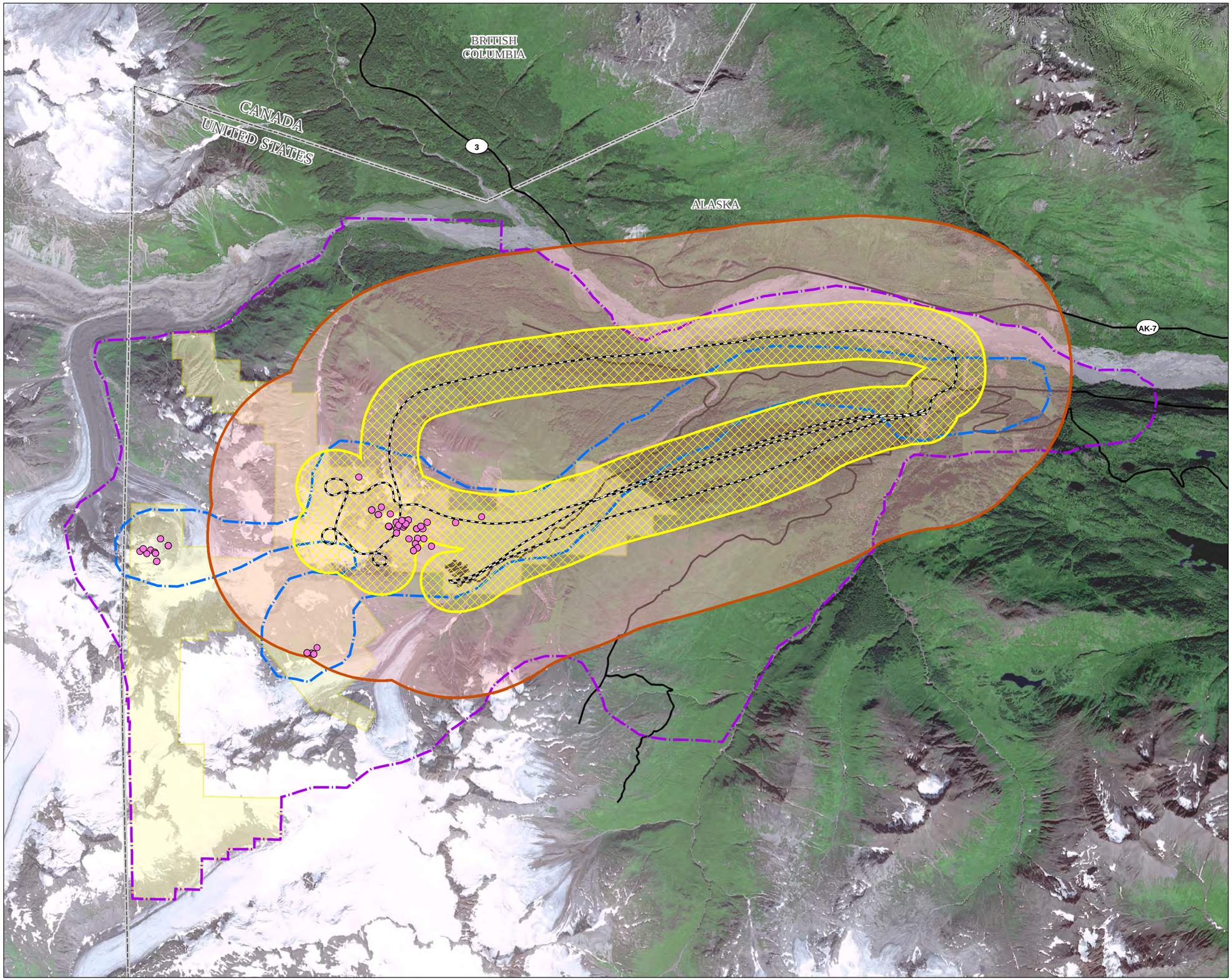
No goats were observed in the Saksaia Glacier and Flower Mountain areas, including the Palmer Project Core and Buffer study areas, in either survey in 2015. The pattern of distribution of mountain goats in the Tsirku-Klehini block surveys, including the absence or low number of mountain goats in the Palmer Project Area, is regarded as typical for this area (K. White pers. comm. 2015) and is consistent with observations from the ADFG survey conducted within the Porcupine Creek Block in the past (White et al. 2014). Nevertheless, incidental observations of mountain goats in the Core and Buffer study areas have been noted in the past (Hemmera 2015) and RSF models predict suitable mountain goat habitat within the area. For these reasons, Hemmera recommends development of a Mountain Goat Management Plan to mitigate potential adverse effects to mountain goats within the Core and the Buffer area surrounding the active exploration areas.

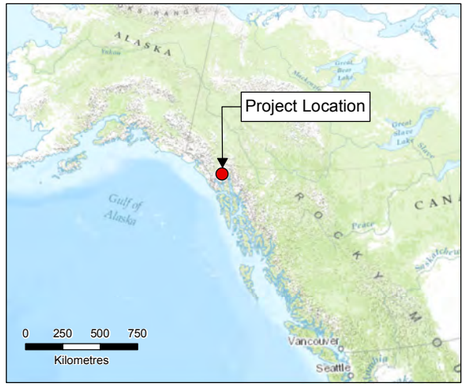
Key components of a Mountain Goat Management Plan should include designation of specific flight corridors (including altitudes), to minimize the potential zone of influence of helicopter disturbance, and development of modified operating procedures for times when goats are present in the Core area. In Alaska, Goldstein et al. (2005) and the BLM (2012) recommend 1,500 ft (452 m) buffer zones around all wildlife, including mountain goats. This should be the minimum distance maintained between approaching aircraft and mountain goats where practical and safe to do so. A review of available literature illustrated variation in recommended buffer distances for helicopter flight around occupied mountain goat habitat of up to 1500 m to 2000 m (Foster and Rahs 1983; Côté 1996; Frid 1997; Wilson and Shackleton 2001; Festa-Bianchet and Côté 2008; Gordon and Wilson 2004; Hurley 2004; B.C. Ministry of Environment 2006; Côté et al. 2013). For this reason, it is recommended that the Mountain Goat Management Plan include provision to adjust established flight corridors between the base of operations and established work sites (e.g. drill sites) when goats are present, with a target of achieving >1500m separation to the extent practicable. Potential zones of influence associated with operational helicopter flight routes conducted during exploration activities in 2015 are shown in Figure 14 using 500 m and 2,000 m buffers (range of disturbance distances discussed in the literature).

Recommendations for vertical separation range from 400 to 600 m (Foster and Rahs 1983; Harrison 1999; Alberta Fish and Wildlife Division 2001; Goldstein et al. 2005). With respect to ground-based exploration activities, there is less empirical data to guide management. Recommendations for buffer zones vary from 400 to 2,000 m adjacent to mountain goat habitat (Foster and Rahs 1985; Haynes 1992; Lemke 1999). In situations where application of recommended buffers are not feasible without halting operations, the Management Plan could include an adaptive management component that involves monitoring the response of goats to specific Project activities, and adjusting activities to meet acceptable response thresholds.

Terrestrial Wildlife and Habitat Assessment
Constantine Metal Resources
Palmer Project Site

2015 Regular Operational Helicopter Flight Routes and Potential Zone of Influence for Disturbance Effects on Mountain Goats





Legend

- 2010 Drill Hole Location
- Operations Flight Route
- Operations Flight Route 500 m Buffer
- Operations Flight Route 2,000 m Buffer
- Road
- International Boundary
- Federal Mining Claims
- Wildlife Habitat Assessment (WHA) Core
- Wildlife Habitat Assessment (WHA) Buffer

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Basedata: Government of Canada, Government of British Columbia, State of Alaska
- Aerial Image: Alaska SPOT 5 m Colour.
- Basemap & Inset: ESRI World Topographic Map

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6.2 PASSERINES

In Alaska, federal agencies are required to support the intent of the MBTA by integrating bird conservation, measures, and practices into agency activities, including permitting. Project proponents are expected to avoid or minimize, to the extent practicable, adverse impacts on migratory birds.

The Project has the potential to affect passerines in two primary ways: (1) direct habitat loss via vegetation clearing and (2) disturbance, in the form of industrial activity and noise, that could lead to habitat becoming unoccupied (indirect habitat loss). The primary recommendation to mitigate these effects is to minimize the Project footprint as much as possible. Based on the data collected from this study and historic information, there are no site specific recommendations at this time (e.g. areas to avoid, such as known nesting areas).

To avoid inadvertently disturbing or destroying any active bird nests, vegetation clearing should be conducted outside the breeding season (April-June 30) to the greatest extent practicable. If vegetation clearing is to be conducted during the breeding season, it is recommended that a mitigation plan be developed in conjunction with a QEP. That plan could include species-focussed surveys, habitat-specific timing windows, and pre-clearing nest surveys.

Finally we recommend that wildlife education and awareness training be provided to field personnel on an annual basis. Components of that training that are specific to avifauna should include education on relevant Species of Concern in the study area, information about the behaviours associated with nesting birds and characteristics of their nests, and guidance to prevent harassment or feeding of relevant species, such as ptarmigan and corvids, respectively.

6.3 CLIFF-NESTING RAPTORS

Although no cliff-nesting raptor nests were found in the core or buffer during the 2015 survey work a pair of golden eagles was observed on several occasions in June and July 2015. In addition, a single adult (female) peregrine falcon was observed, in flight, on June 24, 2015. Both species are afforded management protection by USFWS. The USFWS recommendations require aircraft to avoid eagle nest sites by maintaining a 400m (1/4 mile) avoidance buffer from eagle nest sites. This requirement should be communicated to project pilots and enforced in the event that an active raptor nest is identified in future.

To ensure compliance Hemmera recommends future anecdotal incidental reporting of raptor sightings by site field staff. If a raptor nest (or behaviour indicative of breeding by raptors) is noted Constantine should engage a QEP to conduct an assessment and develop mitigation consistent with USFWS recommendations.

7.0 CLOSURE

Information collected from this work, and from future environmental studies, will be important during future assessment of Project related effects on VCs identified for the Palmer Project. This document provides information regarding baseline conditions for the VCs described herein. This information will facilitate and inform future monitoring programs should they be required during subsequent stages of Project permitting.

As the Project advances, future studies are recommended to support conservation, mitigation and management of terrestrial wildlife, aquatic wildlife and vegetation values that might be influenced by future Project activity.

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned.

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8.0 LITERATURE CITED

Alaska Department of Fish and Game. 2006. Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824p.

Alaska Department of Fish and Game. 2015. Alaska's wildlife action plan, draft for public and agency review, 8-1-2015. Division of Wildlife Conservation, Juneau.

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for mountain goat and bighorn sheep ranges in Alberta. Alberta Sustainable Resource Development, May 2001.

Ayotte, J.B., K.L. Parker, J.M. Arocena, and M.P. Gillingham. 2006. Chemical composition of lick soils: functions of soil ingestion by four ungulate species. Journal of Mammalogy 87:878–888.

Altman, B. and R. Sallabanks. 2012. Olive-sided Flycatcher (*Contopus cooperi*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/502.

B.C. Ministry of Environment. 2006. Wildlife guidelines for backcountry tourism/commercial recreation in British Columbia. Victoria, B.C. http://www.env.gov.bc.ca/wld/twg/index.html

Boyce, M. S., Vernier, P. R., Nielsen, S. E., & Schmiegelow, F. K.. 2002. Evaluating resource selection functions. Ecological modelling, 157(2), 281-300.

BLM. 2012. Ring of Fire Draft Resource Management Plan Amendment. Haines Block Planning Area. DOI-BLM-AK-A010-2012-0027-EIS Anchorage Field Office, Anchorage District. BLM Alaska

Chadwick, D.H. 1973. Mountain goat ecology – logging relationships in the Bunker Creek drainage of western Montana. Final report, project W-120-R-3, 4. Montana Fish and Game Department, Helena, MT.

Côté, S.D. 1996. Mountain goat responses to helicopter disturbance. Wildlife Society Bulletin 24:681–685.

Côté, S. D. and M. Festa-Bianchet. 2003. Mountain goat, *Oreamos americanus*. pp 1061-1075 *In*: Wild mammals of North America (2nd edition). GA Feldhamer and B. Thompson, eds. The John Hopkins University Press, Baltimore, Maryland.

Côté, S. D., Hamel, S., St‐Louis, A., & Mainguy, J. 2013. Do mountain goats habituate to helicopter disturbance?. The Journal of Wildlife Management, 77(6), 1244-1244.

Dormaar, J.F. and B.D. Walker. 1996. Elemental content of animal licks along the eastern slopes of the Rocky Mountains in southern Alberta, Canada. Canadian Journal of Soil Science 76:509–512.

EAO [Environmental Assessment Office]. 2013. Guideline for the selection of valued components and assessment of potential effects. Environmental Assessment Office. 45pp.

Festa-Bianchet, M. and S.D. Côté. 2008. Mountain goats: ecology, behaviour, and conservation of an alpine ungulate. Island Press, Washington, DC.

Foster, B.R. and E.Y. Rahs. 1983. Mountain goat response to hydroelectric exploration in northwestern British Columbia. Environmental Management 7:189–197.

Foster, B.R. and E.Y. Rahs. 1985. A study of canyon-dwelling mountain goats in relation to proposed hydroelectric development in northwestern British Columbia, Canada. Biological Conservation 33:209–228.

Fox, J.L, C.A. Smith, and J.W. Schoen. 1989. Relation between mountain goats and their habitat in southeastern Alaska. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. PNW-GTR-246.

Frid, A. 2003. Dall's sheep responses to overflights by helicopters and fixed-wing aircraft. Biological Conservation 110:387–399.

Goldstein, M.I., A.J. Poe, E. Cooper, D. Youkey, B.A. Brown, and T.L. McDonald. 2005. Mountain goat response to helicopter overflights in Alaska. Wildlife Society Bulletin 33:688–699

Gordon, S.M. and S.F. Wilson. 2004. Effect of helicopter logging on mountain goat behavior in coastal British Columbia. Biennial Symposium of the Northern Wild Sheep and Goat Council 14:49–63.

Gross, J.E. 2001. Evaluating effects of an expanding mountain goat population on native bighorn sheep: a simulation model of competition and disease. Biological Conservation 101:171–185.

Gross, J.E., M.C. Kneeland, D.F. Reed, and R.M. Reich. 2002. GIS-based habitat models for mountain goats. Journal of Mammalogy 83:218–228.

Griswold, J., Nielson, R., & Swayer, H. 2009. Mountain Goat Habitat Selection in Southeast Alaska. Laramie, WY: WEST, Inc.

Hamel, S. and S.D. Côté. 2007. Habitat use patterns in relation to escape terrain: are alpine ungulate females trading off better foraging sites for safety. Canadian Journal of Zoology 85:933–943.

Hamel, S., S.D. Côté, K.G. Smith, and M. Festa-Bianchet. 2006. Population dynamics and harvest potential of mountain goat herds in Alberta. Journal of Wildlife Management 70:1044–1053.

Harrison, D.G. 1999. Distribution and movements of canyon-dwelling mountain goats along Pinto Creek, Alberta. M.Sc. thesis, Univ. Northern B.C., Prince George, BC.

Haynes, L.A. 1992. Mountain goat habitat of Wyoming's Beartooth Plateau: implications for management. Biennial Symposium of the Northern Wild Sheep and Goat Council 8:325–339.

Hebert, D.M. and W.G. Turnbull. 1977. A description of southern interior and coastal mountain goat ecotypes in British Columbia. Pages 126–146 in W. Samuel and W.G. Macgregor, eds. Proceedings of the First International Mountain Goat Symposium, Kalispell, Montana. BC Fish and Wildlife Branch, Victoria, BC.

Hemmera. 2015a. TERRESTRIAL WILDLIFE AND HABITAT ASSESSMENT Constantine Metal Resources Palmer Project Site. Prepared for Constantine Metal Resources Ltd. Prepared by: Hemmera Envirochem Inc. 58pp.

Hemmera. 2015b. Existing Conditions Report – Invasive Plant Species. Constantine Metal Resources Palmer Project Site. Prepared for Constantine Metal Resources Ltd. Prepared by: Hemmera Envirochem Inc. 27pp.

Hobbs, J. 2010. (British Columbia) Provincial Interior Falcon Breeding Surveys. B.C. Minist. Environ., Lands and Parks, Wildl.Branch, Victoria, BC. 33pp

Hopkins, A., J.P. Fitzgerald, A. Chappell, and G. Byrne. 1992. Population dynamics and behavior of mountain goats using Elliot Ridge, Gore Range, Colorado. Biennial Symposium of the Northern Wild Sheep and Goat Council 8:340–356.

Hurley, K. 2004. Northern Wild Sheep and Goat Council position statement on helicopter-supported recreation and mountain goats, July 2004. Biennial Symposium of the Northern Wild Sheep and Goat Council 14:131–136.

Joslin, G. 1986. Mountain goat population changes in relation to energy exploration along Montana's Rocky Mountain front. Biennial Symposium of the Northern Wild Sheep and Goat Council 5:253–269.

Kern, M. 2014. Glacier Creek Investigation Trip Report (Memo). State of Alaska ADF&G. +27p.

Lemke, S.L. 1999. Cayoosh Range mountain goat study results and recommendations. Unpublished report for BC Ministry of Environment, Lands and Parks, Kamloops, BC, Canada.

Matsuoka, Steven M., C. Lisa Mahon, Colleen M. Handel, Péter Sólymos, Erin M. Bayne, Patricia C. Fontaine, and C. John Ralph. 2014. Reviving common standards in point-count surveys for broad inference across studies. The Condor. 116(4): 599-608.

Mountain Goat Management Team. 2010. Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 87 pp.Naughton, D. 2012. The Natural History of Canadian Mammals. University of Toronto Press: Toronto.

Nelson, S.K. 1997. Marbled Murrelet (*Brachyramphus marmoratus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/276

Nichols, L. 1985. Mountain goat fidelity to given areas by season and seasonal movements. Alaska Department of Fish and Game, Juneau, AK.

Penner, D.F. 1988. Behavioral response and habituation of mountain goats in relation to petroleum exploration at Pinto Creek, Alberta. Biennial Symposium of the Northern Wild Sheep and Goat Council 6:141–158.

Phelps, D.E., B. Jamieson, and R.A. Demarchi. 1983. The history of mountain goat management in the Kootenay Region of British Columbia. B.C. Fish and Wildlife Branch, Cranbrook, BC. Fish and Wildlife Bulletin No. B-20.

Poole, K.G. and D.C. Heard. 1998. Habitat use and movements of mountain goats as determined by prototype GPS collars, Robson Valley, British Columbia. Biennial Symposium of the Northern Wild Sheep and Goat Council 11:22–35.

Poole, K.G., K. Stuart-Smith, and I.E. Teske. 2009. Wintering strategies by mountain goats in interior mountains. Canadian Journal of Zoology 87:273–283.

Poole, K.G., K.D. Bachmann, and I.E. Teske. 2010. Mineral lick use by GPS radio-collared mountain goats in southeastern British Columbia. Western North American Naturalist 70(2):208-217.

Ralph, C.J., J.R. Sauer and S. Droege. 1995. Monitoring bird populations by point counts. U.S. Dep. Agric. For. Serv. PSW-GTR-149, Albany, CA. 187 pp.

Resources Inventory Committee. 1999. Inventory Methods Forest and Grassland Songbirds. Version 2. Standards for Components of British Columbia's Biodiversity No. 15. http://archive.ilmb.gov.bc.ca/risc/pubs/tebiodiv/songbird/index.htm. Accessed April 22, 2013.

Resources Inventory Committee. 2001. Inventory Methods for Raptors: Standards for Components of British Columbia's Biodiversity No. 11. The Province of British Columbia.

Rice, C.G. and D. Gay. 2010. Effects of mountain goat harvest on historic and contemporary populations. Northwestern Naturalist. 91(1):40-57

Rideout, C.B. 1974. A radio telemetry study of the ecology and behavior of the mountain goat in western Montana. Ph.D dissertation, Univ. Kansas, Lawrence, KY.

Smith C.A, and K.J. Raedeke. 1982. Group size and movements of a dispersed, low density goat population with comments on inbreeding and human impact. Bienn. Symp. North. Wild Sheep and Goat Counc. 3:54-67.

Taylor, S. and K. Brunt. 2007. Winter habitat use by mountain goats in the Kingcome River drainage of coastal British Columbia. BC Journal of Ecosystems and Management 8:32–49.

Taylor, S., W. Wall, and Y. Kulis. 2006. Habitat selection by mountain goats in south coastal British Columbia. Biennial Symposium of the Northern Wild Sheep and Goat Council 15:141–157.

Tetra Tech, Inc. 2009. Red Dog Mine Extension – Aqqaluk Project. Supplemental Environmental Impact Statement. Volume 1. U.S. Environmental Protection Agency, Seattle, WA 98101, 1128pp.

Toweill, D.E., S. Gordon, E. Jenkins, T. Kreeger, and D. McWhirter. 2004. A working hypothesis for management of mountain goats. Biennial Symposium of the Northern Wild Sheep and Goat Council 14:5–45.

White, K. S. and G. P. Pendleton. 2011. Mountain goat population monitoring and survey technique development. Wildlife Research Annual Progress Report. Alaska Department of Fish and Game, Juneau, AK. 9pp

White, K. S., G. Pendleton & A. Crupi. 2011a. Resource selection of mountain goats during winter in the Kelsall River area: application for management of helicopter skiing. Alaska Department of Fish and Game, Division of Wildlife Conservation PO Box 110024, Juneau, AK 99811

White, K. S. A. Crupi, R. Scott and B. Seppi. 2011b. Mountain goat movement patterns and population monitoring in the Haines-Skagway area. Research Progress Report. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., A. Crupi. R. Scott and B. Seppi. 2014. Mountain goat movement patterns and population monitoring in the Haines-Skagway Area.. Alaska Department of Fish and Game, Division of Wildlife Conservation PO Box 110024, Juneau, AK.

White, K.S., N.L. Barten, R. Scott, and A. Crupi. 2015. Mountain goat population monitoring and movement patterns near the Kensington Mine, Alaska. Wildlife Research Annual Progress Report.

Online Resources

www.allaboutbirds.org , Published by the Cornell Lab of Ornithology.

www.birdatlas.bc.ca , Published by the BC Breeding Bird Atlas.

http://eia.unu.edu/course/index.html%3Fpage_id=120.html EIA process information.

http://a100.gov.bc.ca/pub/eswp/ , BC Conservation Data Center (CDC): BC Species and Ecosystem Explorer

http://www.adfg.alaska.gov/index.cfm?adfg=specialstatus.main (ESA)

http://www.adfg.alaska.gov/index.cfm?adfg=animals.main (Accounts)

https://weatherspark.com/averages/32966/Haines-Alaska-United-States (Weather)

MOF 2014a. https://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro31.pdf (Coastal Western Hemlock BEC zone)

MOF 2014b. http://www.for.gov.bc.ca/hre/becweb/Downloads/Downloads_SubzoneReports/IMA.pdf (Alpine BEC zones)

MOF 2014c. http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro61.pdf (Spruce-Willow-Birch BEC zone)

MOF 2014d. https://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro51.pdf (Mountain Hemlock BEC zone)

http://www.adfg.alaska.gov/index.cfm?adfg=species.wapabout (Alaska Wildlife Action Plan)

http://aknhp.uaa.alaska.edu/maps-js/integrated-map/biotics.php# (Alaska Natural Heritage Program, Biotics species explorer tool)

APPENDIX 1

Terrestrial Species of Interest and Project Interaction Pathways

Appendix 1 Terrestrial Species of Interest and Project Interaction Pathways

Species of Interest	Clade	SoA[17] status	BLM status	Potential to Occur	Potential to Interact	Interaction Comment
Red-legged frog	Amphibians	Not listed	Not listed	Low	Low	Habitat loss, water contamination and road mortality
Long-toed salamander	Amphibians	Not listed	Not listed	High	Low	Habitat loss, water contamination and road mortality
Northwestern salamander	Amphibians	Not listed	Not listed	Moderate	Low	Habitat loss, water contamination and road mortality
Rough-skinned newt	Amphibians	Not listed	Not listed	High	Low	Habitat loss, water contamination and road mortality
Western toad	Amphibians	Not listed	Not listed	High	Low	Habitat loss, water contamination and road mortality
Wood frog	Amphibians	Not listed	Not listed	High	Low	Habitat loss, water contamination and road mortality
Northern goshawk	Birds	SSOC	Sensitive	High	Moderate	Habitat loss, disturbance
Peale's peregrine falcon	Birds	Not listed	Sensitive	Moderate	Moderate	Disturbance
Marbled murrelet	Birds	Not listed	Sensitive	Moderate	Low	Habitat loss, disturbance
Olive-sided flycatcher	Birds	SSOC	Sensitive	High	Moderate	Habitat loss, disturbance
Gray-cheeked thrush	Birds	SSOC	Sensitive	High	High	Habitat loss, disturbance
Townsend's warbler	Birds	SSOC	Sensitive	High	Low	Habitat loss, disturbance
Rock ptarmigan	Birds	Not listed	Not listed	High	HIgh	Habitat loss, disturbance
Golden eagle	Birds	Not listed	Not listed	High	HIgh	Habitat loss, disturbance
Western screech-owl	Birds	Not listed	Not listed	High	High	Habitat loss, disturbance
Brown bear	Mammals	Not listed	Not listed	High	HIgh	Habitat loss, disturbance
Mountain goat	Mammals	Not listed	Not listed	High	HIgh	Habitat loss, disturbance
Moose	Mammals	Not listed	Not listed	High	HIgh	Habitat loss, disturbance
Wolverine	Mammals	Not listed	Not listed	High	High	Habitat loss, disturbance

[17] State of Alaska

APPENDIX 2

List of bird species potentially occurring in the Palmer Project study area

Appendix 2 List of bird species potentially occurring in the Palmer Project study area

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Greater White fronted Goose	*Anser albifrons*	Ducks, Geese, & Swans	Waterfowl	Yes		
Snow Goose	*Chen caerulescens*	Ducks, Geese, & Swans	Waterfowl	Yes		
Brant	*Branta bernicla*	Ducks, Geese, & Swans	Waterfowl	Yes		
Cackling Goose	*Branta hutchinsii*	Ducks, Geese, & Swans	Waterfowl	Yes		
Canada Goose	*Branta canadensis*	Ducks, Geese, & Swans	Waterfowl	Yes		
Trumpeter Swan	*Cygnus buccinator*	Ducks, Geese, & Swans	Waterfowl	Yes		
Tundra Swan	*Cygnus columbianus*	Ducks, Geese, & Swans	Waterfowl	Yes		
Gadwall	*Anas strepera*	Ducks, Geese, & Swans	Waterfowl	Yes		
Eurasian Wigeon	*Anas penelope*	Ducks, Geese, & Swans	Waterfowl	Yes		
American Wigeon	*Anas americana*	Ducks, Geese, & Swans	Waterfowl	Yes		
Mallard	*Anas platyrhynchos*	Ducks, Geese, & Swans	Waterfowl	Yes		
Blue winged Teal	*Anas discors*	Ducks, Geese, & Swans	Waterfowl	Yes		
Northern Shoveler	*Anas clypeata*	Ducks, Geese, & Swans	Waterfowl	Yes		
Northern Pintail	*Anas acuta*	Ducks, Geese, & Swans	Waterfowl	Yes		
Green winged Teal	*Anas crecca*	Ducks, Geese, & Swans	Waterfowl	Yes		
Canvasback	*Aythya valisineria*	Ducks, Geese, & Swans	Waterfowl	Yes		
Redhead	*Aythya americana*	Ducks, Geese, & Swans	Waterfowl	Yes		
Ring necked Duck	*Aythya collaris*	Ducks, Geese, & Swans	Waterfowl	Yes		
Greater Scaup	*Aythya marila*	Ducks, Geese, & Swans	Waterfowl	Yes		
Lesser Scaup	*Aythya affinis*	Ducks, Geese, & Swans	Waterfowl	Yes		
Steller's Eider	*Polysticta stelleri*	Ducks, Geese, & Swans	Waterfowl	Yes		
Harlequin Duck	*Histrionicus histrionicus*	Ducks, Geese, & Swans	Waterfowl	Yes	Possible	1
Long tailed Duck	*Clangula hyemalis*	Ducks, Geese, & Swans	Waterfowl	Yes		
Bufflehead	*Bucephala albeola*	Ducks, Geese, & Swans	Waterfowl	Yes		

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Common Goldeneye	*Bucephala clangula*	Ducks, Geese, & Swans	Waterfowl	Yes		
Barrow's Goldeneye	*Bucephala islandica*	Ducks, Geese, & Swans	Waterfowl	Yes		
Common Merganser	*Mergus merganser*	Ducks, Geese, & Swans	Waterfowl	Yes		
Red breasted Merganser	*Mergus serrator*	Ducks, Geese, & Swans	Waterfowl	Yes		
Ruffed Grouse	*Bonasa umbellus*	Grouse	Grouse	Yes	Possible	
Spruce Grouse	*Falcipennis canadensis*	Grouse	Grouse	Yes	Possible	
Willow Ptarmigan	*Lagopus lagopus*	Grouse	Grouse	Yes	Possible	1
Rock Ptarmigan	*Lagopus muta*	Grouse	Grouse	Yes	Possible	2
White tailed Ptarmigan	*Lagopus leucura*	Grouse	Grouse	Yes	Possible	2
Sooty Grouse	*Dendragapus fuliginosus*	Grouse	Grouse	Yes	Possible	1
Pacific Loon	*Gavia pacifica*	Loons	Waterfowl	Yes		
Common Loon	*Gavia immer*	Loons	Waterfowl	Yes		
Horned Grebe	*Podiceps auritus*	Grebes	Waterfowl	Yes		
Red necked Grebe	*Podiceps grisegena*	Grebes	Waterfowl	Yes		
Western Grebe	*Aechmophorus occidentalis*	Grebes	Waterfowl	Yes		
Great Blue Heron	*Ardea herodias*	Herons, Bitterns, & Allies	Herons, Bitterns and Cranes	Yes		
Osprey	*Pandion haliaetus*	Ospreys	Raptors	Yes	Possible	
Bald Eagle	*Haliaeetus leucocephalus*	Hawks, Eagles, & Allies	Raptors	Yes	Possible	
Northern Harrier	*Circus cyaneus*	Hawks, Eagles, & Allies	Raptors	Yes	Possible	
Sharp shinned Hawk	*Accipiter striatus*	Hawks, Eagles, & Allies	Raptors	Yes		
Northern Goshawk	*Accipiter gentilis*	Hawks, Eagles, & Allies	Raptors	Yes		
Red tailed Hawk	*Buteo jamaicensis*	Hawks, Eagles, & Allies	Raptors	Yes		
Rough legged Hawk	*Buteo lagopus*	Hawks, Eagles, & Allies	Raptors	Yes		
Golden Eagle	*Aquila chrysaetos*	Hawks, Eagles, & Allies	Raptors	Yes	Possible	

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Sandhill Crane	*Grus canadensis*	Cranes	Herons, Bitterns and Cranes	Yes	Possible	
Black-bellied Plover	*Pluvialis squatarola*	Lapwings and Plovers	Shorebirds	Yes		
American Golden-Plover	*Pluvialis dominica*	Lapwings and Plovers	Shorebirds	Yes		
Pacific Golden-Plover	*Pluvialis fulva*	Lapwings and Plovers	Shorebirds	Yes		
Semipalmated Plover	*Charadrius semipalmatus*	Lapwings and Plovers	Shorebirds	Yes	Possible	4
Killdeer	*Charadrius vociferus*	Lapwings and Plovers	Shorebirds	Yes	Possible	
Spotted Sandpiper	*Actitis macularius*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Yes	2
Solitary Sandpiper	*Tringa solitaria*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Yes	
Gray-tailed Tattler	*Tringa brevipes*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Wantering Tattler	*Tringa incana*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Yes	
Greater Yellowlegs	*Tringa melanoleuca*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Possible	
Lesser Yellowlegs	*Tringa flavipes*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Possible	
Wood Sandpiper	*Tringa glareola*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Upland Sandpiper	*Bartramia longicauda*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Possible	
Whimbrel	*Numenius phaeopus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Bristle-thighed Curlew	*Numenius tahitiensis*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Hudsonian Godwit	*Limosa haemastica*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Bar-tailed Godwit	*Limosa lapponica*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Marbled Godwit	*Limosa fedoa*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Ruddy Turnstone	*Arenaria interpres*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Black Turnstone	*Arenaria melanocephala*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Red Knot	*Calidris canutus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Surfbird	*Calidris virgata*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Sharp-tailed Sandpiper	*Calidris acuminata*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Stilt Sandpiper	*Calidris himantopus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Red-necked Stint	*Calidris ruficollis*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Sanderling	*Calidris alba*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Dunlin	*Calidris alpina*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Rock Sandpiper	*Calidris ptilocnemis*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Baird's Sandpiper	*Calidris bairdii*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Least Sandpiper	*Calidris minutilla*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Buff-breasted Sandpiper	*Calidris subruficollis*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Pectoral Sandpiper	*Calidris melanotos*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Semipalmated Sandpiper	*Calidris pusilla*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Western Sandpiper	*Calidris mauri*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Short-billed Dowitcher	*Limnodromus griseus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Long-billed Dowitcher	*Limnodromus scolopaceus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Wilson's Snipe	*Gallinago delicata*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes	Yes	
Common Snipe	*Gallinago gallinago*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Red-necked Phalarope	*Phalaropus lobatus*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Red Phalarope	*Phalaropus fulicarius*	Sandpipers, Phalaropes, & Allies	Shorebirds	Yes		
Parasitic Jaeger	*Stercorarius parasiticus*	Jaegers	Gulls, Terns, Jaegars	Yes		
Long-tailed Jaeger	*Stercorarius longicaudus*	Jaegers	Gulls, Terns, Jaegars	Yes		
Bonaparte's Gull	*Chroicocephalus philadelphia*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Mew Gull	*Larus canus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes	Possible	
California Gull	*Larus californicus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes	Possible	
Herring Gull	*Larus argentatus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes	Possible	
Slaty-backed Gull	*Larus schistisagus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Glaucous-winged Gull	*Larus glaucescens*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Glaucous Gull	*Larus hyperboreus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Aleutian Tern	*Onychoprion aleuticus*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Caspian Tern	*Hydroprogne caspia*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Arctic Tern	*Sterna paradisaea*	Gulls and Terns	Gulls, Terns, Jaegars	Yes		
Eurasian Collared Dove	*Streptopelia decaocto*	Pigeons and Doves	Pigeons and Doves	Yes		
Great Horned Owl	*Bubo virginianus*	Typical Owls	Owls	Yes		
Northern Hawk Owl	*Surnia ulula*	Typical Owls	Owls	Yes		
Barred Owl	*Strix varia*	Typical Owls	Owls	Yes		
Great Gray Owl	*Strix nebulosa*	Typical Owls	Owls	Yes		
Short eared Owl	*Asio flammeus*	Typical Owls	Owls	Yes	Possible	
Boreal Owl	*Aegolius funereus*	Typical Owls	Owls	Yes		
Northern Saw whet Owl	*Aegolius acadicus*	Typical Owls	Owls	Yes		
Black Swift	*Cypseloides niger*	Swifts	Swifts	Yes		
Vaux's Swift	*Chaetura vauxi*	Swifts	Swifts	Yes		
Rufous Hummingbird	*Selasphorus rufus*	Hummingbirds	Hummingbirds	Yes	Possible	1
Belted Kingfisher	*Megaceryle alcyon*	Kingfishers	Kingfisher	Yes	Yes	
Red breasted Sapsucker	*Sphyrapicus ruber*	Woodpeckers	Woodpeckers	Yes	Yes	14
Downy Woodpecker	*Picoides pubescens*	Woodpeckers	Woodpeckers	Yes	Yes	
Hairy Woodpecker	*Picoides villosus*	Woodpeckers	Woodpeckers	Yes	Yes	2
American Three toed Woodpecker	*Picoides dorsalis*	Woodpeckers	Woodpeckers	Yes	Yes	1
Black backed Woodpecker	*Picoides arcticus*	Woodpeckers	Woodpeckers	Yes	Yes	
Northern Flicker	*Colaptes auratus*	Woodpeckers	Woodpeckers	Yes	Yes	
American Kestrel	*Falco sparverius*	Falcons	Raptors	Yes	Possible	
Merlin	*Falco columbarius*	Falcons	Raptors	Yes	Possible	
Gyrfalcon	*Falco rusticolus*	Falcons	Raptors	Yes		

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Peregrine Falcon	*Falco peregrinus*	Falcons	Raptors	Yes		
Olive sided Flycatcher	*Contopus cooperi*	Tyrant Flycatchers	Perching Birds	Yes	Yes	1
Western Wood Pewee	*Contopus sordidulus*	Tyrant Flycatchers	Perching Birds	Yes	Yes	1
Alder Flycatcher	*Empidonax alnorum*	Tyrant Flycatchers	Perching Birds	Yes	Yes	4
Hammond's Flycatcher	*Empidonax hammondii*	Tyrant Flycatchers	Perching Birds	Yes	Yes	10
Pacific slope Flycatcher	*Empidonax difficilis*	Tyrant Flycatchers	Perching Birds	Yes	Yes	1
Say's Phoebe	*Sayornis saya*	Tyrant Flycatchers	Perching Birds	Yes	Yes	
Northern Shrike	*Lanius excubitor*	Shrikes	Perching Birds	Yes	Yes	
Warbling Vireo	*Vireo gilvus*	Vireos	Perching Birds	Yes	Yes	5
Gray Jay	*Perisoreus canadensis*	Crows and Jays	Corvids	Yes	Yes	
Steller's Jay	*Cyanocitta stelleri*	Crows and Jays	Corvids	Yes	Yes	1
Black billed Magpie	*Pica hudsonia*	Crows and Jays	Corvids	Yes	Yes	
Northwestern Crow	*Corvus caurinus*	Crows and Jays	Corvids	Yes		
Common Raven	*Corvus corax*	Crows and Jays	Corvids	Yes	Yes	4
Horned Lark	*Eremophila alpestris*	Larks	Perching Birds	Yes	Yes	6
Tree Swallow	*Tachycineta bicolor*	Swallows	Perching Birds	Yes	Possible	
Violet green Swallow	*Tachycineta thalassina*	Swallows	Perching Birds	Yes	Possible	
Bank Swallow	*Riparia riparia*	Swallows	Perching Birds	Yes		
Cliff Swallow	*Petrochelidon pyrrhonota*	Swallows	Perching Birds	Yes		
Barn Swallow	*Hirundo rustica*	Swallows	Perching Birds	Yes		
Black capped Chickadee	*Poecile atricapillus*	Chickadees	Perching Birds	Yes	Yes	
Chestnut backed Chickadee	*Poecile rufescens*	Chickadees	Perching Birds	Yes	Yes	
Boreal Chickadee	*Poecile hudsonicus*	Chickadees	Perching Birds	Yes	Yes	
Red breasted Nuthatch	*Sitta canadensis*	Nuthatches	Perching Birds	Yes	Yes	
Brown Creeper	*Certhia americana*	Creepers	Perching Birds	Yes	Yes	
Pacific Wren	*Troglodytes pacificus*	Wrens	Perching Birds	Yes	Yes	23

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
American Dipper	*Cinclus mexicanus*	Dippers	Perching Birds	Yes	Yes	4
Golden crowned Kinglet	*Regulus satrapa*	Kinglets	Perching Birds	Yes	Yes	
Ruby crowned Kinglet	*Regulus calendula*	Kinglets	Perching Birds	Yes	Yes	11
Arctic Warbler	*Phylloscopus borealis*	Leaf Warblers	Perching Birds	Yes		
Northern Wheatear	*Oenanthe oenanthe*	Old World Flycatchers and Allies	Perching Birds	Yes	Yes	
Townsend's Solitaire	*Myadestes townsendi*	Thrushes	Perching Birds	Yes	Yes	
Gray cheeked Thrush	*Catharus minimus*	Thrushes	Perching Birds	Yes	Yes	2
Swainson's Thrush	*Catharus ustulatus*	Thrushes	Perching Birds	Yes	Yes	21
Hermit Thrush	*Catharus guttatus*	Thrushes	Perching Birds	Yes	Yes	31
American Robin	*Turdus migratorius*	Thrushes	Perching Birds	Yes	Yes	18
Varied Thrush	*Ixoreus naevius*	Thrushes	Perching Birds	Yes	Yes	47
European Starling	*Sturnus vulgaris*	Starlings	Perching Birds	Yes		
American Pipit	*Anthus rubescens*	Wagtails and Pipits	Perching Birds	Yes	Yes	13
Bohemian Waxwing	*Bombycilla garrulus*	Waxwings	Perching Birds	Yes	Yes	
Cedar Waxwing	*Bombycilla cedrorum*	Waxwings	Perching Birds	Yes	Yes	
Lapland Longspur	*Calcarius lapponicus*	Longspurs and Snow Buntings	Perching Birds	Yes	Yes	
Smith's Longspur	*Calcarius pictus*	Longspurs and Snow Buntings	Perching Birds	Yes	Yes	1
Snow Bunting	*Plectrophenax nivalis*	Longspurs and Snow Buntings	Perching Birds	Yes	Yes	
Northern Waterthrush	*Parkesia noveboracensis*	Wood-Warblers	Perching Birds	Yes	Yes	1
Orange crowned Warbler	*Oreothlypis celata*	Wood-Warblers	Perching Birds	Yes	Yes	15
MacGillivray's Warbler	*Geothlypis tolmiei*	Wood-Warblers	Perching Birds	Yes	Yes	4
Common Yellowthroat	*Geothlypis trichas*	Wood-Warblers	Perching Birds	Yes	Yes	
American Redstart	*Setophaga ruticilla*	Wood-Warblers	Perching Birds	Yes	Yes	
Yellow Warbler	*Setophaga petechia*	Wood-Warblers	Perching Birds	Yes	Yes	13
Blackpoll Warbler	*Setophaga striata*	Wood-Warblers	Perching Birds	Yes	Yes	
Yellow rumped Warbler	*Setophaga coronata*	Wood-Warblers	Perching Birds	Yes	Yes	6

Common Name	Scientific Name	Family	Species Group	Potential to Occur	Detectable by Point Count	Total 2015
Townsend's Warbler	*Setophaga townsendi*	Wood-Warblers	Perching Birds	Yes	Yes	16
Wilson's Warbler	*Cardellina pusilla*	Wood-Warblers	Perching Birds	Yes	Yes	39
American Tree Sparrow	*Spizella arborea*	Emberizids	Perching Birds	Yes	Yes	2
Chipping Sparrow	*Spizella passerina*	Emberizids	Perching Birds	Yes	Yes	1
Savannah Sparrow	*Passerculus sandwichensis*	Emberizids	Perching Birds	Yes	Yes	29
Fox Sparrow	*Passerella iliaca*	Emberizids	Perching Birds	Yes	Yes	22
Song Sparrow	*Melospiza melodia*	Emberizids	Perching Birds	Yes	Yes	1
Lincoln's Sparrow	*Melospiza lincolnii*	Emberizids	Perching Birds	Yes	Yes	8
White crowned Sparrow	*Zonotrichia leucophrys*	Emberizids	Perching Birds	Yes	Yes	
Golden crowned Sparrow	*Zonotrichia atricapilla*	Emberizids	Perching Birds	Yes	Yes	2
Dark eyed Junco	*Junco hyemalis*	Emberizids	Perching Birds	Yes	Yes	11
Western Tanager	*Piranga ludoviciana*	Cardinals and Allies	Perching Birds	Yes	Yes	1
Red winged Blackbird	*Agelaius phoeniceus*	Blackbirds	Perching Birds	Yes		
Rusty Blackbird	*Euphagus carolinus*	Blackbirds	Perching Birds	Yes		
Gray crowned Rosy Finch	*Leucosticte tephrocotis*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	16
Pine Grosbeak	*Pinicola enucleator*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	1
Red Crossbill	*Loxia curvirostra*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	5
White winged Crossbill	*Loxia leucoptera*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	
Common Redpoll	*Acanthis flammea*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	53
Hoary Redpoll	*Acanthis hornemanni*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	
Pine Siskin	*Spinus pinus*	Fringilline and Cardueline Finches	Perching Birds	Yes	Yes	58