Wildlife Research Annual Progress Report

Mountain Goat Assessment and Monitoring along the Juneau Access Road Corridor and near the Kensington Mine, Southeast Alaska

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Alaska Department of Fish and Game
Division of Wildlife Conservation

October 2009

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Cover photo: Photo of an adult female and yearling mountain goat walking along an alpine ridge east of Berners Bay, July 2009.

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INTRODUCTION

This annual progress report was prepared to meet the reporting requirements for State of Alaska Department of Transportation and Public Facilities and Coeur Alaska. Funding for this project was made available in September 2005 and this report summarizes activities completed by September 30, 2009.

Background

Coeur Alaska has recently re-initiated development activities at the Kensington mine site, located a short distance northwest of Berners Bay. In addition, the Department of Transportation and Public Facilities is planning to construct an all-season highway between Echo Cove and the Katzehin River. Among the wildlife species potentially affected by mine development and road construction activities are mountain goats (Oreamnos americanus). A small-scale study of mountain goats conducted in the vicinity of the Kensington mine by Robus and Carney (1995) showed that goats moved seasonally from high alpine elevations in the summer and fall to low, timbered elevations during winter months. One of the main objectives of the Robus and Carney (1995) study was to assess the impacts of the mine development activities on habitat use, movement patterns and, ultimately, productivity of mountain goats. However, the mine never became operational, thus these objectives could not be achieved, and by 1995 goat monitoring in the area wound down and eventually ended. Currently, the mine is in the process of re-opening and the Alaska Department of Fish and Game maintains that many of the same concerns that prompted the Robus and Carney (1995) study are still valid and need to be addressed. In addition, large-scale plans for development of the Juneau Access road raise new, potentially more substantial, concerns regarding not only the enlarged “footprint” of industrial development activities in eastern Lynn Canal, but also the cumulative impacts of both development projects on wildlife resources.

The potential effects of mining and road development activities on local mountain goat populations in the vicinity of the Kensington mine and eastern Lynn Canal are not well known. However, studies conducted elsewhere indicate that mountain goats can be negatively impacted by industrial development activities. Such effects include temporary range abandonment, alteration of foraging behavior and population decline (Chadwick 1973, Foster and Rahs 1983, Joslin 1986, Cote and Festa-Bianchet 2003). Consequently, information about the distribution of mountain goats proximate to the mine and road development corridor is needed to determine the extent to which populations may be affected by associated industrial activities. Information collected by Robus and Carney (1995), in the vicinity of Kensington mine, as well as Schoen and Kirchhoff (1982), near Echo Cove, suggest that spatial overlap between mountain goats and the proposed industrial activity will be most pronounced when goats are over-wintering in low-elevation habitats. In addition, it is not clear where goats spend non-winter months and, by extension, the spatial extent to which development activities are thereby translated across the landscape.

In response to the above concerns, the Alaska Department of Fish and Game, with funding provided by the Department of Transportation and Public Facilities and Coeur Alaska, has initiated monitoring and assessment activities to determine possible impacts of road construction and mine development on mountain goats and identify potential mitigation measures, to the extent needed. Assessment and monitoring work includes collection of vital rate, habitat use and movement data from a sample of radio-marked mountain goats in addition to conducting annual aerial population abundance and productivity surveys. These efforts are aimed at providing the Alaska Department of Fish and Game with information necessary to appropriately manage mountain goats in the proposed areas of development.

STUDY OBJECTIVES

This research is designed to investigate the spatial relationships, vital rates and abundance of mountain goats in the Berners Bay and upper Lynn Canal area. The specific objectives are as follows:

1) Determine seasonal movement patterns of mountain goats in areas near the Kensington mine and Juneau Access road corridor;

2) Characterize mountain goat habitat selection patterns and the extent of spatial overlap with areas impacted by Kensington mine and Juneau Access road corridor development activities;

3) Estimate reproductive success and survival of mountain goats in areas near the Kensington mine and Juneau Access road corridor; and

4) Estimate mountain goat population abundance and composition in areas near the Kensington mine and Juneau Access road corridor.

STUDY AREA

Mountain goats were studied in a ca. 600 km^2 area located in a mainland coastal mountain range east of Lynn Canal, a post-glacial fiord located near Haines in southeastern Alaska. The study area is oriented along a north-south axis and bordered in the south by Berners Bay (58.76N, 135.00W) and by Dayebas Creek (59.29N, 135. 35W) in the north. Within this area, three separate study sites were delineated based on the actual or expected extent of industrial activity occurring in or near each locality.

An additional study area located east of Berners Bay was established in spring 2006. This area was not originally included in the study design however recent information about road construction timelines resulted in a re-evaluation of the efficacy of conducting research activities in this area. Research efforts in this area will be limited in scope and low intensity sampling in this area is intended to provide managers with baseline information needed to assist future management efforts in light of the road construction, gravel crushing and/or stock-piling that is likely to occur in this area. Additional ADFG funding was allocated to partially offset costs associated with research activities in this area.

Elevation within the study areas range from sea-level to 6300 feet. This area is an active glacial terrain underlain by late cretaceous-paleocene granodiorite and tonalite geologic formations (Gehrels 2000). Specifically, it is a geologically young, dynamic and unstable landscape that harbors a matrix of perennial snowfields and small glaciers at high elevations (i.e. above 4000 feet) and rugged, broken terrain that descends to a rocky, tidewater coastline. The northern part of the area is bisected by the Katzehin river, a moderate volume (ca. 1500 cfs; USGS, unpublished data) glacial river system that is fed by a tributary of the Juneau Icefield.

The maritime climate in this area is characterized by cool, wet summers and relatively warm snowy winters. Annual precipitation at sea-level averages 55 inches and winter temperatures are rarely less than 5º F and average 30º F (Haines, AK; National Weather Service, Juneau, AK, unpublished data). Elevations at 2600’ typically receive ca. 250 inches of snowfall, annually (Eaglecrest Ski Area, Juneau, AK, unpublished data). Predominant vegetative communities occurring at low-moderate elevations (<1500’) include Sitka spruce (Picea sitchensis)-western hemlock (Tsuga heterophylla) coniferous forest, mixed-conifer muskeg and deciduous riparian forests. Mountain hemlock (Tsuga mertensiana) dominated ‘krummholtz” forest comprises a subalpine, timberline band occupying elevations between 1500-2500 feet. Alpine plant communities are composed of a mosaic of relatively dry ericaceous heathlands, moist meadows dominated by grasses and forbs and wet fens. Avalanche chutes are common in the study area, bisect all plant community types and often terminate at sea-level.

Figure 1: Post-capture photograph of LG124 (5-year old male), north of Lions Head, illustrating use of shaded, subalpine habitats (ie. elev.: 2850 ft.) during warm days in early-August 2009.

METHODS

Mountain Goat Capture

Mountain goats were captured using standard helicopter darting techniques and immobilized by injecting 3.0 - 2.55mg of carfentanil citrate, depending on sex and time of year (Taylor 2000), via projectile syringe fired from a Palmer dart gun (Cap-Chur, Douglasville, GA). During handling, all animals were carefully examined and monitored following standard veterinary procedures (Taylor 2000) and routine biological samples and morphological data collected. Following handling procedures, the effects of the immobilizing agent was reversed with 100mg of naltrexone hydrochloride per 1mg of carfentanil citrate (Taylor 2000). All capture procedures were approved by the State of Alaska Animal Care and Use Committee.

GPS Location Data

Telonics TGW-3590 GPS radio-collars (Telonics, Inc., Mesa, AZ) were deployed on most animals captured (Figure 1). Telonics MOD-500 VHF radio-collars have been deployed on a subset (n = 20) of animals to enable longer-term monitoring opportunities. GPS radio-collars were programmed to collect location data at 6-hour intervals (collar lifetime: 2-3 years). During each location attempt, ancillary data about collar activity (i.e. percent of 1-second switch transitions calculated over a 15 minute period following each GPS fix attempt) and temperature (degrees C) were simultaneously collected. Complete data-sets for each individual were remotely downloaded (via fixed-wing aircraft) at 8-week intervals. Location data were post-processed and filtered for “impossible” points and 2D locations with PDOP (i.e. position dilution of precision) values greater than 10, following D’Eon et al. (2002) and D’Eon and Delparte (2005).

Diet Composition

Fresh fecal pellets were collected from live-captured animals during the summer-fall period (late-July to mid-October). Samples were frozen and achived at ADFG facilities in Douglas, AK. Samples will analyzed using microhistological techniques (Wildlife Habitat Analysis Lab, Pullman, WA) in the future.

Habitat Selection and Movement Patterns

Altitudinal Distribution.—Comprehensive analyses of mountain goat habitat use and movement patterns will not be conducted until all GPS location information is collected (i.e. 2011). Nevertheless, preliminary analyses focused on describing sex specific variation in terrain use, and movement patterns were conducted using a subset of the data (White 2006). Additional topics related to altitudinal and spatial distriution have been addressed in White et al. (2006, 2007).

Winter Severity and Snow Modeling Data Collection

Winter distribution of mountain goats is strongly influenced by snow depth and distribution. Since patterns of snow accumulation vary at both small and large spatial scales it is often necessary to collect site-specific field data in order to accurately characterize these relationships within focal areas. Unfortunately, standardized snow depth monitoring information is extremely limited within the study area and additional information is needed in order to properly characterize spatial patterns of snow accumulation and, ultimately, mountain goat winter distribution. Consequently, in 2006 we initiated field efforts designed to create a snow depth database in order to generate spatially explicit snow depth models within the study area. However, during the winter of 2008/2009 field surveys were not conducted as planned in the Echo Cove area because of access limitations. Nonetheless, daily climate information for reference weather stations was acquired from the National Weather Service (Haines Weather Station).

Reproduction and Survival

Kidding rates and subsequent survival were estimated by monitoring individual study animals during monthly surveys using fixed-wing aircraft (Piper PA-18 Super Cub) equipped for radio-telemetry tracking. During surveys, radio-collared adult female mountain goats were monitored to determine whether they gave birth to kids and, if so, how long they survived. Monitoring kid production and survival was only possible during the non-winter months when animals could be reliably observed in open habitats. We assumed that kids did not survive winter if they were not seen with their mothers the following spring. Cases in which kid status assessments were equivocal were filtered from the data set and not used for subsequent estimates of kid survival.

Figure 2: Remains of LG-94 (13-year old female) and kid recovered in upper Davies Creek. This animal died on 1/16/09 as a result of wolf predation. Cause of death was confirmed by overlaying mountain goat GPS collar locations with those of a GPS-collared wolf.

Mortality of individual radio-collared mountain goats was determined by detecting radio-frequency pulse rate changes during monthly monitoring surveys. In cases where mortality pulse rates were detected, efforts were made to investigate sites as soon as possible via helicopter or boat. To the extent possible, all mortalities were thoroughly investigated to ascertain the cause of death and relevant biological samples collected. We determined date of mortalities via examination of activity sensor data logged on GPS radio-collars. Annual survival of radio-collared animals was estimated using the Kaplan-Meier procedure (Pollock et al. 1989). This procedure allows for staggered entry and exit of newly captured or deceased animals, respectively.

Population Abundance and Composition Estimation

Aerial Surveys.—Population abundance and composition surveys were conducted using fixed-wing aircraft (Heliocourier and PA-18 “Super Cub”) and helicopter (Hughes 500) during August-Septmeber 2007. Original project planning required flying 3 replicate surveys in the Lions Head, Sinclair and Villard study areas. Additional funding provided by the Alaska Department of Fish and Game provided the opportunity to fly surveys in the East Berners area and additional replicate surveys in the three focal study areas.

Aerial surveys were typically conducted when conditions met the following requirements: 1) flight ceiling above 5000 feet ASL, 2) wind speed less than 20 knots, 3) sea-level temperature less than 65 degrees F. Surveys were typically flown along established flight paths between 2500-3500 feet ASL and followed geographic contours. Flight speeds varied between 60-70 knots. During surveys, the pilot and experienced observers enumerated and classified all mountain goats seen as either adults (includes adults and sub-adults) or kids. In addition, each mountain group observed was checked (via 14X image stabilizing binoculars) to determine whether GPS-collared animals were present. Flight conditions, terrain complexity and animal behavior often complicated efforts to determine whether observed mountain goats were collared. As a result, the number of adults for which collar presence could be ascertained with a high degree of confidence was also recorded for each group observed.

Estimating the probability of observing mountain goats on a given survey (i.e. sightability) is critical for deriving population size estimates for focal areas. This is typically achieved by comparing the number of marked animals in an area to the number of marked animals actually seen (or re-sighted) during a survey. This fairly simple procedure can be complicated when its not always possible to assess whether observed animals are marked. This situation occurs on mountain goat surveys and requires additional refinement of standard mark-resight population estimators. New analytical methods appropriate for estimating mountain goat population size in this study are currently being developed. As a result, mountain goat survey data were summarized in this report to include estimates of population composition and the minimum number of mountain goats seen on surveys (i.e. the number observed) but not the estimated actual number of mountain goats in focal areas.

Ground Surveys.—Evaluation of ground-based techniques for estimating mountain goat population size and composition were conducted in a small portion of the Lions Head study area in June 2006, the Mt. Villard area during June 2007, the Mt Villard and Mt Selby areas during June-July 2008, and the East Berners Mountains in July 2009. Previous research has concluded that aerial surveys are often inadequate for providing accurate estimates of the proportion of adult males and females, as well as sub-adults during aerial surveys (Cote and Festa-Bianchet 2003); only the proportion of adults and kids in a population can be reliably estimated. As a result, ground-based survey techniques were tested to evaluate whether this method might serve as a reliable tool for classifying individuals of separate sex and age classes during survey efforts (Figure 3).

Figure 3: Photograph of a mountain goat nursey group located in the east Berners mountains in late-July 2009. This group is composed of 7 adult females, 2 yearlings and 4 kids.

Additional field efforts involved collection of GPS-collar activity sensor validation data. In these cases, individual study animals were observed during pre-programmed activity sensor evaluation periods (i.e. 15 minute intervals following fix initiation events). During observation periods, detailed behavioral data were collected using focal animal sampling procedures (Altman 1974).

RESULTS AND DISCUSSION

Mountain Goat Capture and Handling

Capture Activities.—Mountain goats were captured over 3 days on August 5 and 30, and September 1, 2009. Overall, 19 animals (10 females and 9 males) were captured using standard helicopter darting methods. Eleven animals were deployed with Telonics TGW-3590 GPS radio-collars and 8 were deployed with Telonics MOD-500 VHF radio-collars (including one re-capture). We deployed VHF radio-collars on a subset of captured mountain goats because battery life-span is significantly longer (radio-collar battery life span: VHF = 8 years, GPS = 2-3 years). The extended life span of VHF radio-collars will enable collection of supplementary mountain goat survival and reproduction data and reduce the frequency in which mountain goats must be captured.

Helicopter captures were attempted during periods when mountain goats were distributed at high elevations and weather conditions were favorable (i.e. high flight ceiling and moderate wind speed). Additionally, captures were scheduled to avoid periods within 8 weeks of parturition in order to avoid unnecessary disturbance of adult females and associated neonates. Captures were attempted in areas where mountain goat access to dangerously steep terrain was limited. As a result of these constraints, opportunities to capture mountain goats were fairly limited. Nevertheless, given the fairly large area of study and decent summer weather conditions, it was typically possible to capture approximately six mountain goats per day of effort.

Biological Sample Collection.—During handling procedures, standard biological specimens were collected and morphological measures recorded. Specific biological samples collected from study animals included: whole blood (4 mL), blood serum (8 mL), red blood cells (8mL), ear tissue, hair and fecal pellets. Whole blood, serum, red blood cells and fecal pellet sub-samples were either sent to Dr. Kimberlee Beckmen (ADFG, Fairbanks, AK) for disease screening or archived at ADFG fcilities in Douglas, AK. In addition, tissue sub-samples were sent Dr. Steeve Cote/Aaron Shafer (University of Laval/University of Alberta) for inclusion in a broad-scale mountain goat population genetics analysis.

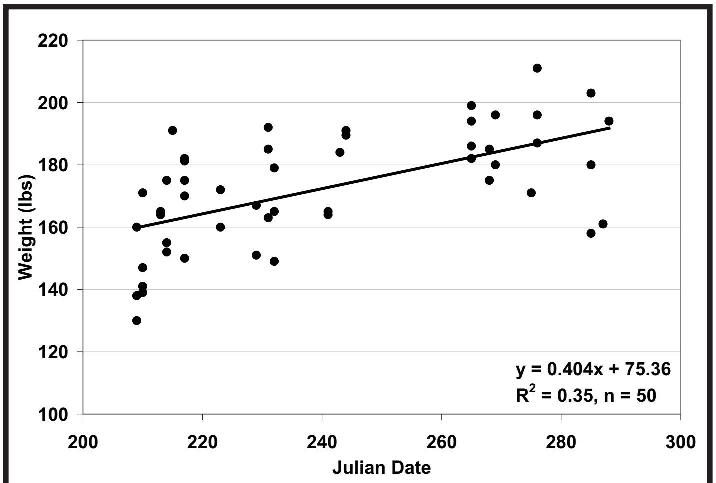

Figure 4a: Relationship between body weight and date for adult female mountain goats (4+ years old), 2005-2009, Lynn Canal, AK

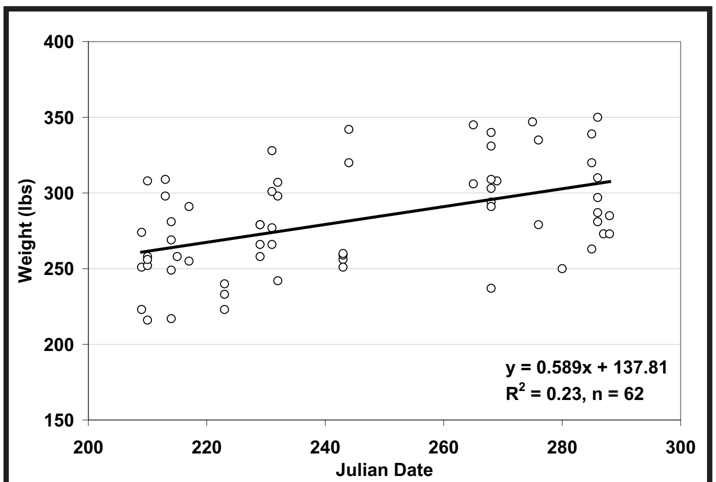

Figure 4b: Relationship between body weight and date for adult male mountain goats (4+ years old), 2005-2009, Lynn Canal, AK.

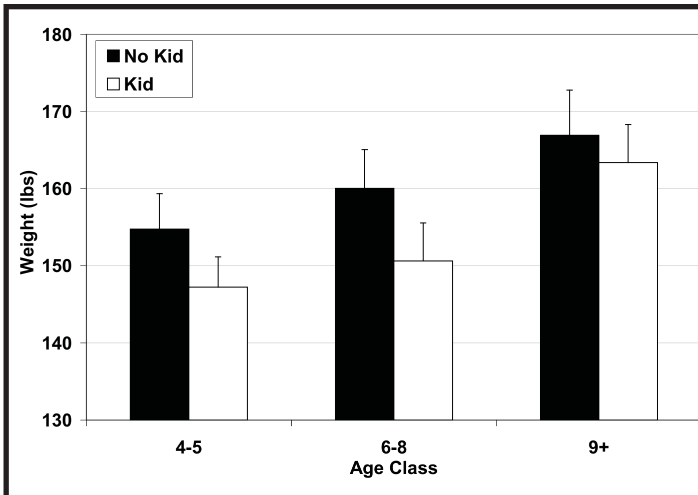

Figure 5: Estimated body weight of female mountain goats with kids (n = 28) and without kids (n = 22) at heel in late-summer, 2005-2009, Lynn Canal, AK. Body weights are standardized to estimated weight on July 15.

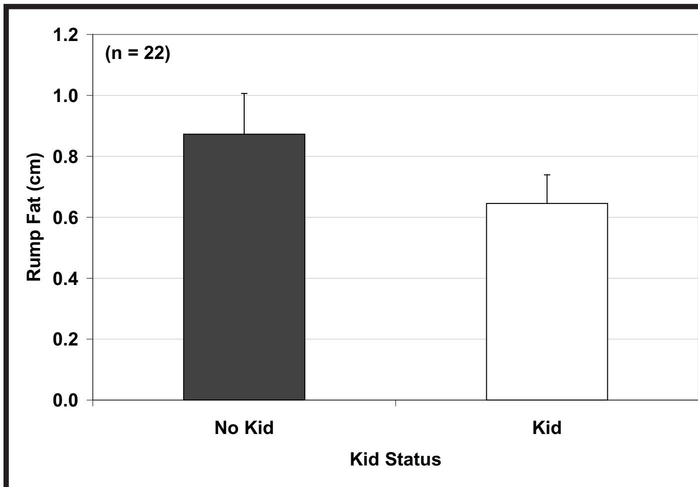

Figure 6: Maximum rump fat thickness (cm) for adult female mountain goats with a kid (n = 11) and without a kid (n = 11) at heel in late summer, Lynn Canal, AK, 2005-2009.

Mountain Goat Body Mass.—Data relating to morphological characteristics of mountain goats were collected for all animals, when practicable. Body mass data were standardized following Cote et al. (1998) to control for the effects of capture date on body mass and allow for comparisons with other studies. Overall, we determined that adult male and female mountain goat consistently gained weight during summer (Aug 1-Oct 15). Specifically, females gained 0.40 lbs of body mass per day (figure 4a), while males gained 0.59 lbs/day (Figure 4b). From a seasonal perspective, females gained 30 lbs and males 44 lbs of body mass between early-August and mid-October, on average. In other words, females and males increased total body mass by 14% and 16%, respectively, during this period.

Reproductive status and age influenced body mass of adult females. In particular, females with kids at heel were lighter than animals without kids; older females also tended to be heavier than younger females (Figure 5). In addition, animals with kids at heel tended to have less subcutaneous rump fat reserves than those without kids at heel (Figure 6). Overall, these findings are consistent with previous studies of northern ungulates (Testa and Adams 1998, Cook et al. 2004), including mountain goats (Hamel and Cote 2009), and indicate that reproductive costs associated with gestation and lactation effect acquisition of body mass and body fat during summer.

GPS Location Data

GPS System Performance.—The performance of GPS radio-collars (as of 8/21/07) has been evaluated for 79 collars deployed since the beginning of the study. In general, the remote GPS data collection system used in this study worked as expected. We did not encounter any problems with GPS collar performance, nor did significant problems occur with remote data download attempts. This high level of success was achieved despite occasionally poor weather conditions and, in some cases, substantial download distances between aircraft and mountain goats (i.e. up to 3 miles). However, several pre-programmed bi-monthly GPS data download periods were missed due to weather conditions. Nevertheless, it was always possibly to download missed GPS data on subsequent surveys.

Collar Retrieval.—Of the 17 animals that died during 2008/2009, 16 collars were retrieved from the field and GPS data were downloaded from each collar. One collar has not been collected due to its location in an inaccessible ravine. Eleven of the 17 collars still had significant battery life remaining at the time of recovery and were subsequently re-deployed on new animals during captures in August 2009.

Five GPS collars that automatically released in fall 2008 were collected in summer 2009. These collars had not been previously collected in fall 2008 due to site conditions at the time of release (ie. snow, ice, etc.). Otherwise, no collars were scheduled for automatic release during 2009.

Winter Severity and Snow Modeling

Climate Data.—Daily climate data were archived from the National Weather Service database to characterize broader scale climate patterns. Mean daily snow depth and snowfall data were summarized from data collected at the National Weather Service station in Haines, AK (Appendix 1). Mean snow depth and snowfall in Haines during midwinter (January-March) 2008/2009 was 145% and 161% of normal, respectively. While substantial, recorded snow depths were notably less than the historical record winter of 2006/2007 (Appendix 1). The previous three winters should be considered severe relative to the historical record for Haines. Nonetheless, the winter of 2008/2009 was similar to 2007/2008 but differed from 2006/2007 in two important ways. In 2007/2008 and 2008/2009, substantial snow accumulation (i.e. snow depth > 20 inches) was not evident until late-December while in 2006/2007 the equivalent snow depth threshold was reached by mid-November, six weeks earlier. Also, substantially more now accumulated during late-winter (i.e. March) in 2006/2007 as compared to 2007/2008 and 2008/2009 (Appendix 1).

Survival and Reproduction

Survival.—Mountain goats were monitored monthly during fixed-wing aerial telemetry flights. Of the 74 animals monitored during 2008/2009 (i.e. 6/1/2007– 5/30/2008), 17 animals died of various causes (including one harvest-related mortality that was not included in subsequent analyses). An additional 25 animals had GPS radio-collars

Table 1: Estimates of mountain goat survival for different sex classes during 2005-2009, Lynn Canal, AK. Mean winter snow depth and total snowfall recorded in Haines, AK is provided to index relative winter severity between years.

	Males				Females				Total				Haines	
													Snow Depth	Snowfall
Year	At Risk	Died	Ŝ	SE	At Risk	Died	Ŝ	SE	At Risk	Died	Ŝ	SE	Mean (in)	Total (in)
2005/2006	9.6	2	0.79	0.13	10.0	1	0.90	0.09	19.6	3	0.85	0.08	6	114
2006/2007	25.4	11	0.57	0.10	22.1	4	0.82	0.08	47.5	15	0.68	0.07	46	309
2007/2008	26.5	7	0.77	0.08	20.8	4	0.83	0.08	47.3	11	0.80	0.05	24	208
2008/2009	24.2	10	0.66	0.09	21.4	6	0.73	0.09	45.6	16	0.69	0.06	18	240
All years	83.8	29	0.71	0.04	72.8	14	0.82	0.04	156.7	43	0.76	0.03	23	218

At Risk = average number of animals monitored per month (per time period)

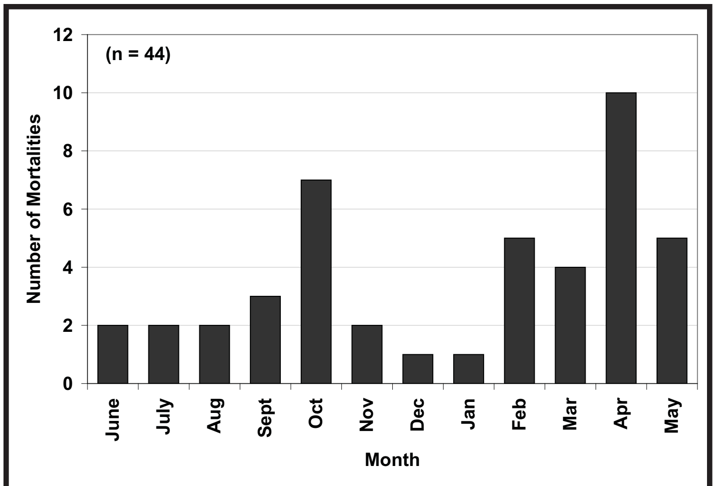

Figure 8a: Seasonal frequency of radio-marked mountain goat mortalities in the Lynn Canal study area, 2005-2009.

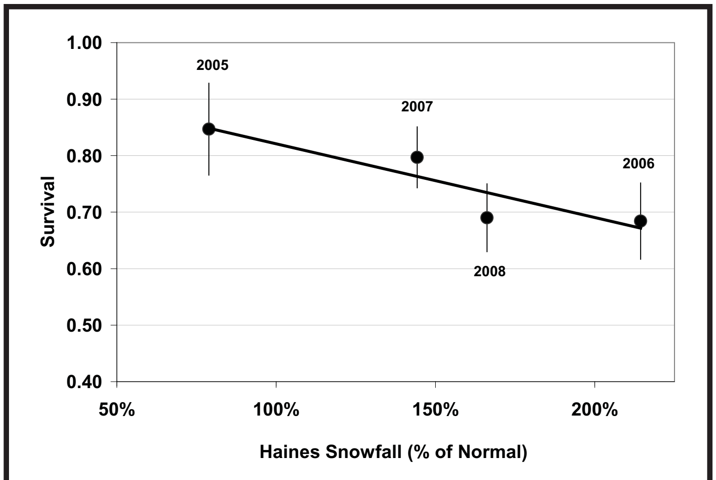

Figure 8b: Relationship between mountain goat survival (males and females combined) in Lynn Canal and snowfall in Haines, AK, 2005-2008.

that released in mid-Septmeber 2008 (as planned). Consequently, for most of the biological year, we monitored 45 animals.

Overall, preliminary survival estimates were 11% lower in 2008/2009 than in 2007/2008 (Table 1). In general, survival of females was higher than males (Table 1) and older animals were more likely to die than younger animals (White et al. 2007). In general, most mortality occurred during late winter (February-May), however, substantially mortality also occured during October-November, a period coinciding with the onset of winter conditions and the rut (Figure 8a). Overall estimates of survival for 2008/2009 and 2006/2007 are lower than has been documented elsewhere (Smith 1986, Festa-Bianchet and Cote 2007) and are correlated with high levels of snowfall during those periods (Figure 8b). The most recent 3 winters have resulted in substantially greater amounts of snowfall than the long-term average and raise concerns about the cumulative effects of consecutive severe winters on mountain goat populations in this area.

Causes of Mortality and Scavenging.—Unequivocally assigning cause of death for mountain goat mortalities was difficult. This results because known predators of mountain goats will also readily scavenge carcasses that die from other causes. Most mortality sites investigated in this study had also been previously visited by known predators of mountain goats (i.e. bears, wolves and wolverines) and in most cases it was not clear whether study animals were killed or, died from other causes and subsequently scavenged. Nonetheless, in two cases it was possible to definitively assign wolf predation as the cause of death. In these cases, GPS locations acquired from a radio-marked wolf and mountain goat indicated spatial and temporal overlap coinciding with the time of death (Figure 2, Figure 9). In one case (LG24), subsequent scavenging by a radio-collared wolverine was also documented (Steve Lewis, pers. comm.).

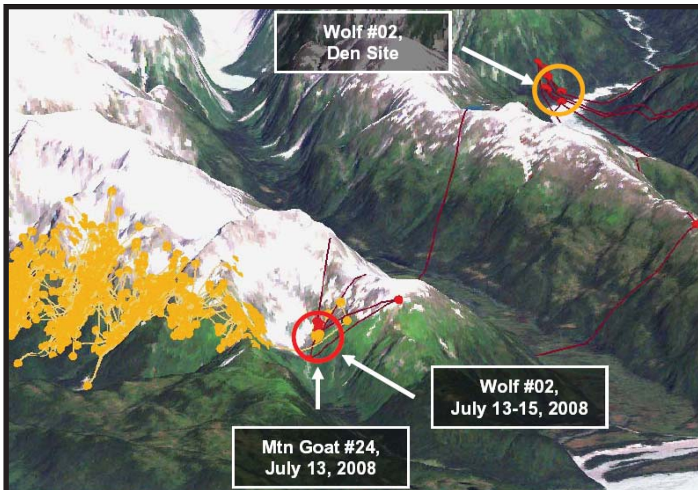

Figure 9: Map illustrating temporal and spatial overlap of GPS-collared a mountain goat (LG24) and wolf, coinciding with the time of death on 7/13/2008.

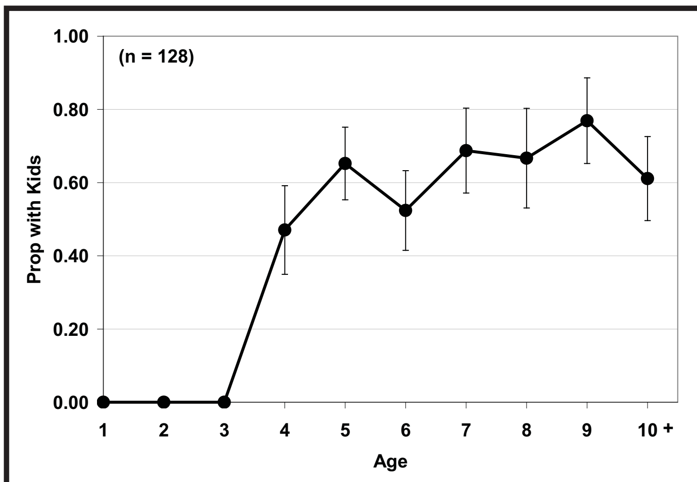

Figure 10: Age-specific estimates of kid production for female mountain goats in different age classes during 2005-2008, Lynn Canal, AK.

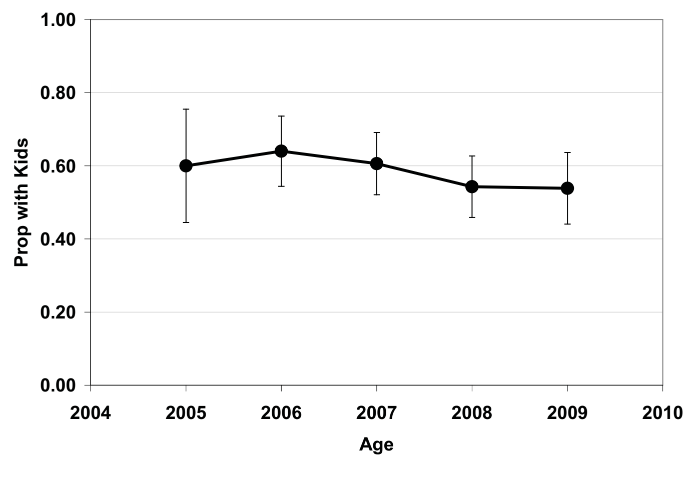

Figure 11: Annual estimates of the proportion of radio-marked adult females with kids at heel during summer 2005-2009, Lynn Canal, AK.

Kid Recruitment.—Kid recruitment of radio-marked female mountain goats was estimated by determining the percentage of radio-marked females seen with kids during May-June aerial telemetry surveys (n = 4). Since each radio-marked female was not observed daily during the kidding period, it was not possible to determine if kids were born and subsequently died prior to, or between, surveys. As such, estimates of kid production reported here are presumably lower than the actual percentage of females that gave birth. Nevertheless, our estimates of kid production were similar to estimates of kidding rates reported elsewhere (Festa-Bianchet and Cote 2007).

Past studies have documented late age at first reproduction for mountain goats, as compared to other ungulates (Festa-Bianchet and Cote 2007, Galliard et al. 2000). Consistent with these findings, we did not document any cases where females less than four years of age had kids at heel in summer. Overall, kid production estimates varied with female age (range = 47-77%) such that younger and older females were generally less likely to have a kid at heel than prime-aged females (i.e. 7-9 years old; Figure 10). Annual estimates of kid production ranged from 54-64% between 2005-2009 (Figure 11), however variability in estimates precluded detection of differences between years.

Population Abundance and Composition

Aerial Surveys.—Overall, 7 aerial surveys were conducted in September-October 2008 (Lions Head, n = 2, Sinclair Mountain, n = 2, Mount Villard, n = 2, East Berners, n = 1; Appendix 3). Of the complete surveys flown (n = 7), substantial variation was observed in the minimum number of mountain goats observed and the proportion of kids (Appendix 2). These findings underscore the value of conducting replicate surveys in each area.

The proportion of mountain goats for which the presence or absence of a collar could be ascertained was variable and primarily depended upon weather conditions and aircraft type. Use of 14X image stabilizing binoculars (Fujinon) significantly increased the ability to assess collar status, as compared to past years. During 2008, habitat and behavioral covariate data were collected for 40 marked mountain goats during surveys. These data were paired with records of whether animals were either seen or not seen during routine surveys in order to compile a database suitable for determining factors related to mountain goat survey sighting probability. Overall, data has been collected on 87 “sightability trials” involving marked mountain goats have been conducted between 2007-2008.

Ground-based Surveys.—Ground based surveys were conducted in the east Berners mountains during July 25-30, 2009 (Figure 3). In addition to gathering age and sex composition data for mountain goats in these areas, detailed behavioral data was collected for GPS radio-collared adult females in order to validate data collected by activity sensors imbedded in radio-collars. In addition, focal animal and scan sampling behavioral data were collected to compile baseline activity budget and behavioral data for animals in these areas.

FUTURE WORK

Study animals will continue to be monitored monthly to assess reproductive status and survival. Additionally, at 8-week intervals GPS data will be downloaded from each animal during aerial surveys. These data will be post-processed and integrated with the existing GPS location database. Three replicate aerial surveys will be conducted in early-fall 2010, weather permitting, in order to estimate mountain goat sightability, population abundance and composition. Results of these efforts will be summarized and submitted as an annual research progress report by November 1, 2010.

PROJECT PUBLICATIONS

White, K. S., N. L. Barten and D. Larsen. 2006. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 65pp.

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Appendix 1: Daily snowfall (in.) and snow depth records collected at the NWS weather station in Haines, AK between 2005-2009. Snowfall data depict distinct "peaks" associated with snowfall events. Snow depth data describe the seasonal snow profile and integrate temperature such that distinct "dips" in the snow depth profile depict warm, melting phases.

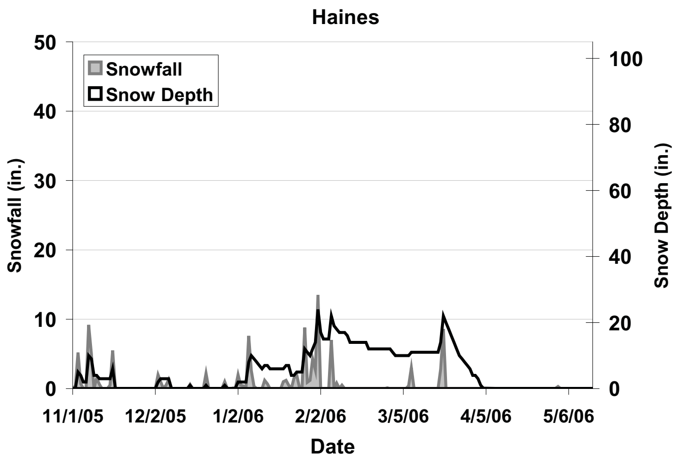


Figure 1: Daily measures of snowfall and snow depth recorded at the NWS station in Haines, AK during the winter of 2005-2006. Snowfall events are depicted by the grey colored peaks; the black solid line describes snow depth patterns. These data indicate two snowfall events > 10 inches during the winter season.

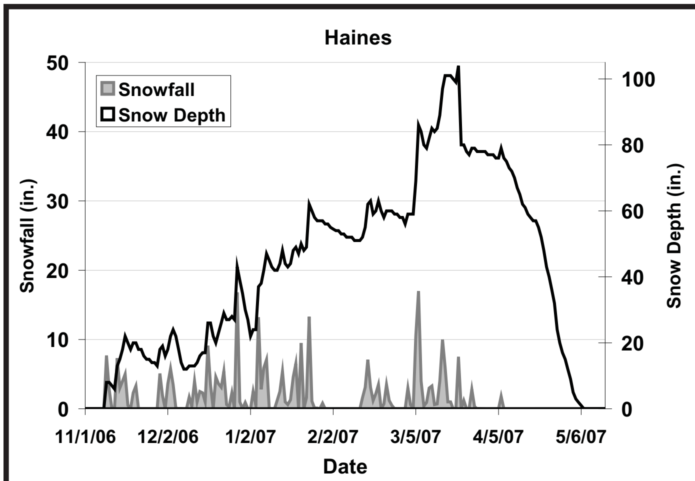


Figure 2: Daily measures of snowfall and snow depth recorded at the NWS station in Haines, AK during the winter of 2006-2007. Snowfall events are depicted by the grey colored peaks; the black solid line describes snow depth patterns. These data indicate five snowfall events > 10 inches during the winter season.

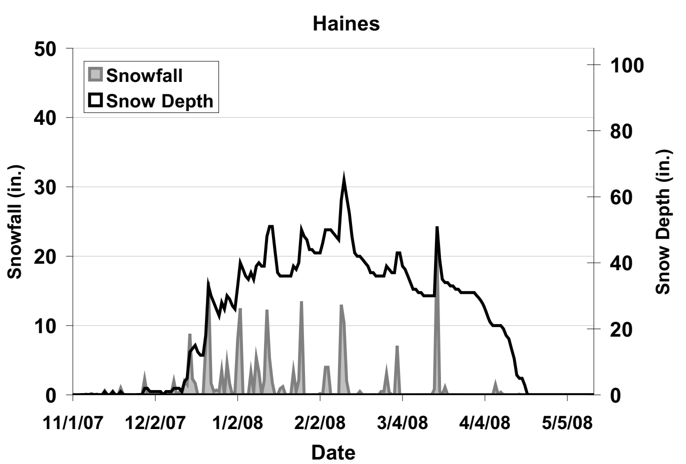


Figure 3: Daily measures of snowfall and snow depth recorded at the NWS station in Haines, AK during the winter of 2007-2008. Snowfall events are depicted by the grey colored peaks; the black solid line describes snow depth patterns. These data indicate six snowfall events > 10 inches during the winter season.

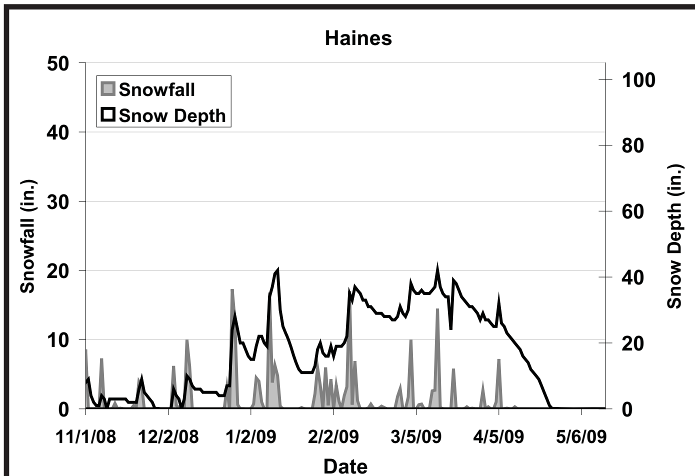
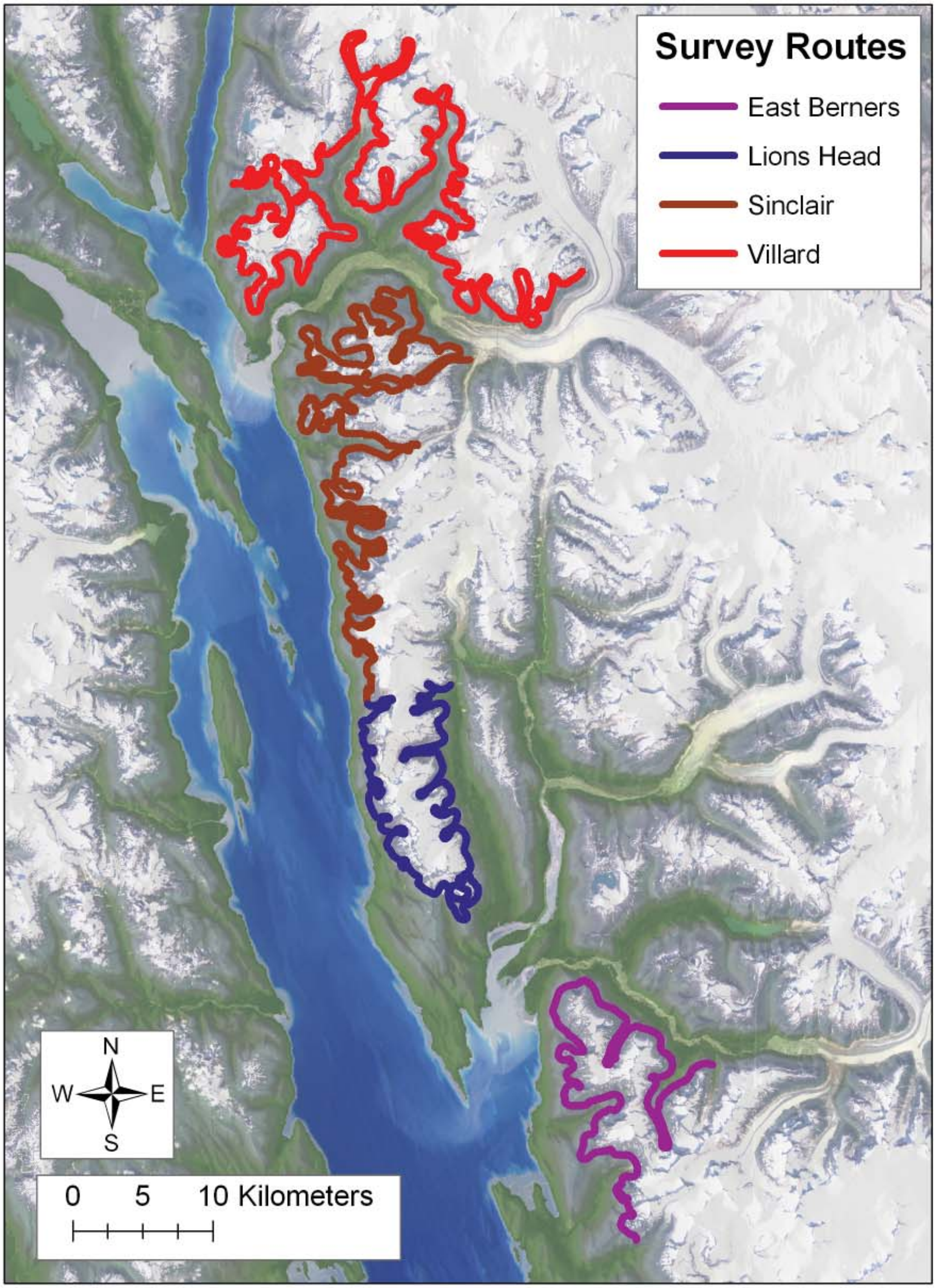


Figure 4: Daily measures of snowfall and snow depth recorded at the NWS station in Haines, AK during the winter of 2008-2009. Snowfall events are depicted by the grey colored peaks; the black solid line describes snow depth patterns. These data indicate six snowfall events > 10 inches during the winter season.

Appendix 2: Mountain goat aerial survey routes in the Lynn Canal study area. Each area is normally surveyed by fixed- and/or rotor-wing aircraft in August-October each year.



Appendix 2a: Summary of mountain goat population composition and minimum abundance data collected during aerial surveys on the East Berners survey route, 2006-2008. These data do not account for differences in mountain goat sighting probabilities that occur between surveys. As a result, the number of mountain goats recorded represent the minimum number of animals on the survey route during a given survey.

Study Area	Date	Adults	Kids	Total	% Kids	Temp (F)	Weather	Wind	Aircraft
East Berners[1]	8/28/2006	86	42	128	32.8	40-50	Mostly Clear	0-10	Heliocourier
East Berners	9/3/2006	83	21	104	20.2	51	Partly Cloudy	0-10	Heliocourier
East Berners	10/3/2006	70	22	92	23.9	35-40	High Overcast	5-15	Heliocourier
East Berners	9/2/2007	105	28	133	21.1	44	Clear	0-5	Heliocourier
East Berners	9/22/2007	97	28	125	22.4	35-40	High Overcast	0-10	Cub
East Berners	9/25/2008	125	38	163	23.3	40	Mostly Clear	0-10 N	Hughes 500

[1] not complete survey: Davies Ck.-Antler Lk. only

Appendix 2b: Summary of mountain goat population composition and minimum abundance data collected during aerial surveys on the Lions Head survey route, 2006-2008. These data do not account for differences in mountain goat sighting probabilities that occur between surveys. As a result, the number of mountain goats recorded represent the minimum number of animals on the survey route during a given survey.

Study Area	Date	Adults	Kids	Total	% Kids	Temp	Weather	Wind	Aircraft
Lions Head	8/11/2005	35	5	40	12.5	70	Clear	0-10	PA-18
Lions Head	10/3/2005	55	8	65	12.3	45	Clear	0-10	Heliocouirer
Lions Head	8/28/2006	49	9	58	15.5	40-50	Mostly Clear	0-10	Heliocourier
Lions Head	9/3/2006	54	11	65	16.9	51	Partly Cloudy	0-10	Heliocourier
Lions Head	10/2/2006	92	13	105	12.4	26-31	Mostly Cloudy	5-15	Heliocourier
Lions Head	10/16/2006	91	23	114	20.2	35-42	Mostly Clear	10-25	Hughes 500
Lions Head	8/10/2007	18	2	20	10.0	51-57	Clear	2-7	Heliocourier
Lions Head	8/27/2007	43	3	46	6.5	44-50	High Overcast	0-5	Heliocourier
Lions Head	9/13/2007	46	5	51	9.8	~45-55	High Overcast/ Low Fog	0-5	Cub
Lions Head	9/28/2007	78	15	93	16.1	35-40	Mostly Clear	0-10	Hughes 500
Lions Head	9/25/2008	62	18	80	22.5	40	Mostly Clear	0-10 N	Hughes 500
Lions Head	10/7/2008	63	13	76	17.1	31	Clear/High Overcast	0-15S	Cub

Appendix 2c: Summary of mountain goat population composition and minimum abundance data collected during aerial surveys on the Mt. Sinclair survey route, 2006-2008. These data do not account for differences in mountain goat sighting probabilities that occur between surveys. As a result, the number of mountain goats recorded represent the minimum number of animals on the survey route during a given survey.

Study Area	Date	Adults	Kids	Total	% Kids	Temp	Weather	Wind	Aircraft
Sinclair Mtn.	8/11/2005	77	17	94	18.1	70	Clear	0-10	PA-18
Sinclair Mtn.	10/3/2005	159	30	189	15.9	45	Clear	0-10	Heliocouirer
Sinclair Mtn.[1]	8/28/2006	86	21	107	19.6	40-50	Mostly Clear	0-10	Heliocourier
Sinclair Mtn.	9/2/2006	128	31	159	19.5	50-56	High Overcast	0-10	Heliocourier
Sinclair Mtn.	9/23/2006	153	22	182	12.1	40-42	High Overcast	0-10	Heliocourier
Sinclair Mtn.	10/16/2006	227	41	268	15.3	35-42	Mostly Clear	10-25	Hughes 500
Sinclair Mtn.	8/27/2007	57	4	61	6.6	44-50	High Overcast	0-5	Heliocourier
Sinclair Mtn.	9/13/2007	75	13	88	14.8	~45-55	High Overcast/ Low Fog	0-5	Cub
Sinclair Mtn.	9/28/2007	173	38	211	18.0	35-40	High Overcast	0-10	Hughes 500
Sinclair Mtn.	9/25/2008	127	27	154	17.5	40	Mostly Clear	0-10 N	Hughes 500
Sinclair Mtn.	10/7/2008	123	26	149	17.4	31	Clear/High Overcast	0-15S	Cub

[1] not complete survey: to Katz lk. only

Appendix 2d: Summary of mountain goat population composition and minimum abundance data collected during aerial surveys on the Mt. Villard survey route, 2006-2008. These data do not account for differences in mountain goat sighting probabilities that occur between surveys. As a result, the number of mountain goats recorded represent the minimum number of animals on the survey route during a given survey.

Study Area	Date	Adults	Kids	Total	% Kids	Temp	Weather	Wind	Aircraft
Mt. Villard	8/12/2005	23	4	27	14.8	68	Clear	0-10	PA-18
Mt. Villard	9/2/2006	102	23	125	18.4	50-56	High Overcast	0-10	Heliocourier
Mt. Villard[1]	9/23/2006	90	12	102	11.8	40-42	High Overcast	0-10	Heliocourier
Mt. Villard[2]	10/1/2006	41	12	53	22.6	31	Mostly Cloudy	5-15	Heliocourier
Mt. Villard	10/2/2006	165	28	193	14.5	26-31	Mostly Cloudy	5-15	Heliocourier
Mt. Villard[3]	10/17/2006	145	29	174	16.7	35-31	High Overcast	0-10	Hughes 500
Mt. Villard	9/3/2007	88	23	111	20.7	47-54	Clear	0-10	Heliocourier
Mt. Villard[4]	9/14/2007	74	23	97	23.7	44	Overcast/Fog	0-27	Heliocourier
Mt. Villard	9/22/2007	132	22	154	14.3	35-40	Overcast/Lt Snow/Fog	0-15	Cub
Mt. Villard	9/6/2008	52	10	62	16.1	~45-55	High Overcast	0-10	Cub
Mt. Villard	9/25/2008	164	30	194	15.5	40	Mostly Clear	0-10 N	Hughes 500

[1] not complete survey: Meade Gl.-Katz Flats only

[2] not complete survey: Dayebas Ck. only

[3] not complete survey: N Meade Gl to NW fork Katzehin

[4] surveyed to Paradise Ridge only