Species Management Report and Plan ADF&G/DWC/SMR&P–2018–1

Dall Sheep Management Report and Plan, Game Management Unit 14C:

Report Period 1 July 2011–30 June 2016, and

Plan Period 1 July 2016–30 June 2021

David Battle

Cory Stantorf

2018

Alaska Department of Fish and Game Division of Wildlife Conservation

Dall Sheep Management Report and Plan, Game Management Unit 14C:

Report Period 1 July 2011–30 June 2016, and

Plan Period 1 July 2016–30 June 2021

PREPARED BY:

David Battle
Area Biologist

Cory Stantorf
Assistant Area Biologist

APPROVED BY:

Cynthia Wardlow
Management Coordinator

REVIEWED BY:

Dr. Thomas Lohuis
Research Coordinator

Alaska Department of Fish and Game
Division of Wildlife Conservation
PO Box 115526
Juneau, AK 99811

This project was funded with a combination of state and federal money. Hunters are important founders of the modern wildlife conservation movement. They, along with trappers and sport shooters, provided funding for this publication through payment of federal taxes on firearms, ammunition, and archery equipment, and through state hunting license and tag fees. This funding provided support for Federal Aid in Wildlife Restoration Dall Sheep Survey and Inventory Project 6.0.

Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's public website.

This species management report and plan was reviewed and approved for publication by Cynthia Wardlow, Management Coordinator for Region II for the Division of Wildlife Conservation.

Species management reports and plans are available via the Alaska Department of Fish and Game's public website (www.adfg.alaska.gov) or by contacting Alaska Department of Fish and Game's Division of Wildlife Conservation, PO Box 115526, Juneau, Alaska 99811-5526; phone: (907) 465-4190; email: dfg.dwc.publications@alaska.gov. The report may also be accessed through most libraries, via interlibrary loan from the Alaska State Library or the Alaska Resources Library and Information Services (www.arlis.org).

Please cite this document as follows:

Battle, D. and C. Stantorf. 2018. Dall sheep management report and plan, Game Management Unit 14C: Report period 1 July 2011–30 June 2016 and plan period 1 July 2016–30 June 2021. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2018-1, Juneau.

Contents

List of Figures

List of Tables

List of Appendices

Purpose of this Report

This report provides a record of survey and inventory management activities for Dall sheep in Unit 14C for the 5 regulatory years 2011–2015 and plans for survey and inventory management activities in the 5 years 2016–2021. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY11 = 1 July 2011–30 June 2012). This report is produced primarily to provide agency staff with data and analysis to help guide and record its own efforts, but is also provided to the public to inform it of wildlife management activities. In 2016 the Alaska Department of Fish and Game's Division of Wildlife Conservation launched this report type to more efficiently report on trends and describe potential future changes in data collection activities. It replaces the Dall sheep management reports of survey and inventory activities that were previously produced every 3 years.

I. RY11–RY15 Management Report

Management Area

Unit 14C is located in Southcentral Alaska and is approximately 1,912 mi^2. The boundaries of Unit 14C closely approximate those of the Municipality of Anchorage (MOA). The MOA is a mosaic of wildlife habitat and human development. Most of the MOA is characterized by large tracts of natural lands, including Chugach State Park, Chugach National Forest, the Anchorage Coastal Wildlife Refuge, and Joint Base Elmendorf-Richardson (an 84,000-acre military base). Within 14C lies a small portion of the Chugach Mountains, which represents about 487 mi^2 of sheep habitat above 2,000 ft. elevation. This portion of the Chugach Mountain Range is the only Dall sheep habitat in Unit 14C.

Summary of Status, Trend, Management Activities, and History of Dall Sheep in Unit 14C

Systematic aerial surveys have been conducted sporadically in the Chugach Mountains since 1949. In 1951, 477 sheep were estimated between Turnagain Arm and the Knik River (now Unit 14C). Current sheep populations in Unit 14C are twice as large as estimated in 1951.

Sport hunting was not considered to have had much influence on statewide sheep populations in the early twentieth century. However, the annual harvest reported to the U.S. Fish and Wildlife Service was 3 to 4 times higher in the mid-1940s compared to a decade earlier, increasing from about 200 per year to 600 per year (Scott et al. 1950). Beginning in 1942, the bag limit was reduced from 2 or 3 rams in various areas to 1 ram. Hunting pressure was heaviest near human settlements, and accessible ranges near Anchorage were closed to sheep hunting to protect sheep that otherwise might have been hunted to depletion (Scott et al. 1950). Hunting season was reopened in 1961, except for the Rainbow Closed Area, which extended along Turnagain Arm from Potter to Girdwood.

In 1968, the sheep habitat bounded by the Knik River, Turnagain Arm, Lake George, and the Twentymile River was established as the West Chugach Controlled Use Area. No motorized vehicles other than boats and airplanes were allowed for hunting or transporting game in this

area during the sheep hunting season. In 1971, much of this area was incorporated into Chugach State Park, which continued to allow sheep hunting in most of the park but prohibited all motorized access, except along the north side of Eklutna Lake. The bag limit for ¾-curl rams was further restricted to ⅞-curl rams in 1979. This regulation remained in effect for 10 years. Because of increasing demand for sheep hunting in Unit 14C, a drawing permit was instituted in 1982 to maintain the number of large rams and aesthetic hunting conditions.

As the number of sheep increased through the 1980s, managers became concerned about exceeding the carrying capacity of the range. Sheep populations appear to be regulated primarily by deep snow and ice cover. However, if overabundant sheep deplete vegetation on winter ranges, subsequent severe snow and ice conditions could have an even greater effect. Consequently, the bag limit was changed to "any sheep" in 1989 for some drawing hunts to better control the population through ewe harvests. This regulation remained in effect through 1995. From 1996 through 2008, the bag limit for non-archery drawing permit hunts allowed the taking of either a full curl ram or ewe, or the hunts have been ewe-only hunts. Since 2008, non-archery sheep permits have been issued for full curl rams only.

Management Direction

EXISTING WILDLIFE MANAGEMENT PLANS

Direction for the management of Unit 14C sheep was outlined in the Southcentral wildlife management plan (ADF&G 1976). This plan has been reviewed and modified through public comments, staff recommendations, and Board of Game actions over the years. A record of these changes can be found in the division's management report series. The plan portion of this report contains the current management plan for Dall sheep in Unit 14C.

In 2000, a wildlife plan called "Living with Wildlife in Anchorage: A Cooperative Planning Effort" was created in an attempt to outline common goals for Anchorage wildlife management. The planning effort was initiated and led by ADF&G, and involved a team from local, state, and federal agencies with wildlife responsibilities, as well as people from various wildlife-related interest groups and members of the general public. This plan was intended to be used as a guide as Anchorage continued to be developed.

GOALS

- Maintain a harvestable population of Dall sheep that fluctuates in size within historical limits of abundance.

CODIFIED OBJECTIVES

<u>Amounts Reasonably Necessary for Subsistence Uses</u>

None.

MANAGEMENT OBJECTIVES

- Maintain a minimum harvest of 30 full curl or larger rams throughout Unit 14C while maintaining aesthetically pleasing hunting conditions and avoiding overcrowding of hunters in the field.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct aerial surveys for Dall sheep to get an estimate of the minimum number of Dall sheep in Unit 14C.

Data Needs

Dall sheep tags in Unit 14C are highly sought after and prized. Minimum counts and population trend information are needed to monitor Dall sheep and maintain a viable and huntable population.

Methods

Every year, post lambing, we attempt to conduct a minimum count survey for Dall sheep across the Unit 14C portion of the Chugach Mountain Range (Fig. 1). Sheep are classified into the following categories: legal rams (full curl or larger), sublegal rams (less than full curl), lambs, ewes and yearling rams ("ewe-like"), and unidentified sheep. Yearling rams are difficult to distinguish from ewes, so their numbers are summarized together. Data from these surveys were recorded on the "14C Sheep Survey Datasheet" (Appendix A).

Results and Discussion

Summer 2011 (RY11): We were able to conduct and complete a minimum count survey across the Unit 14C portion of the Chugach Mountain Range. Within the count area, we found a total of 1,051 sheep (Rams, ewe-likes, and lambs combined; Appendix B, Table 1).

Summer 2012 (RY12): Surveys were not conducted.

Summer 2013 (RY13): We were able to conduct and complete a minimum count survey across the Unit 14C portion of the Chugach Mountain Range. Within the count area (Fig. 2) we found a total of 948 sheep (Rams, ewes-likes, and lambs combined; Appendix C, Table 1).

Summer 2014 (RY14): We were able to conduct and complete a minimum count survey across the Unit 14C portion of the Chugach Mountain Range. Within the count area (Fig. 3) we found a total of 1,062 sheep (Rams, ewe-likes, and lambs combined; Appendix D, Table 1). A portion of the surveyed area was flown again the following day due to the survey continuing past the cutoff time, resulting in a reduction in sheep detections as compared to previous years (Fig. 4 and Appendix D).

Summer 2015 (RY15): We were able to conduct and complete a minimum count survey across the Unit 14C portion of the Chugach Mountain Range. Within the count area (Figure 5) we found a total of 1,054 sheep (Rams, ewe-likes, and lambs combined; Appendix E, Table 1).

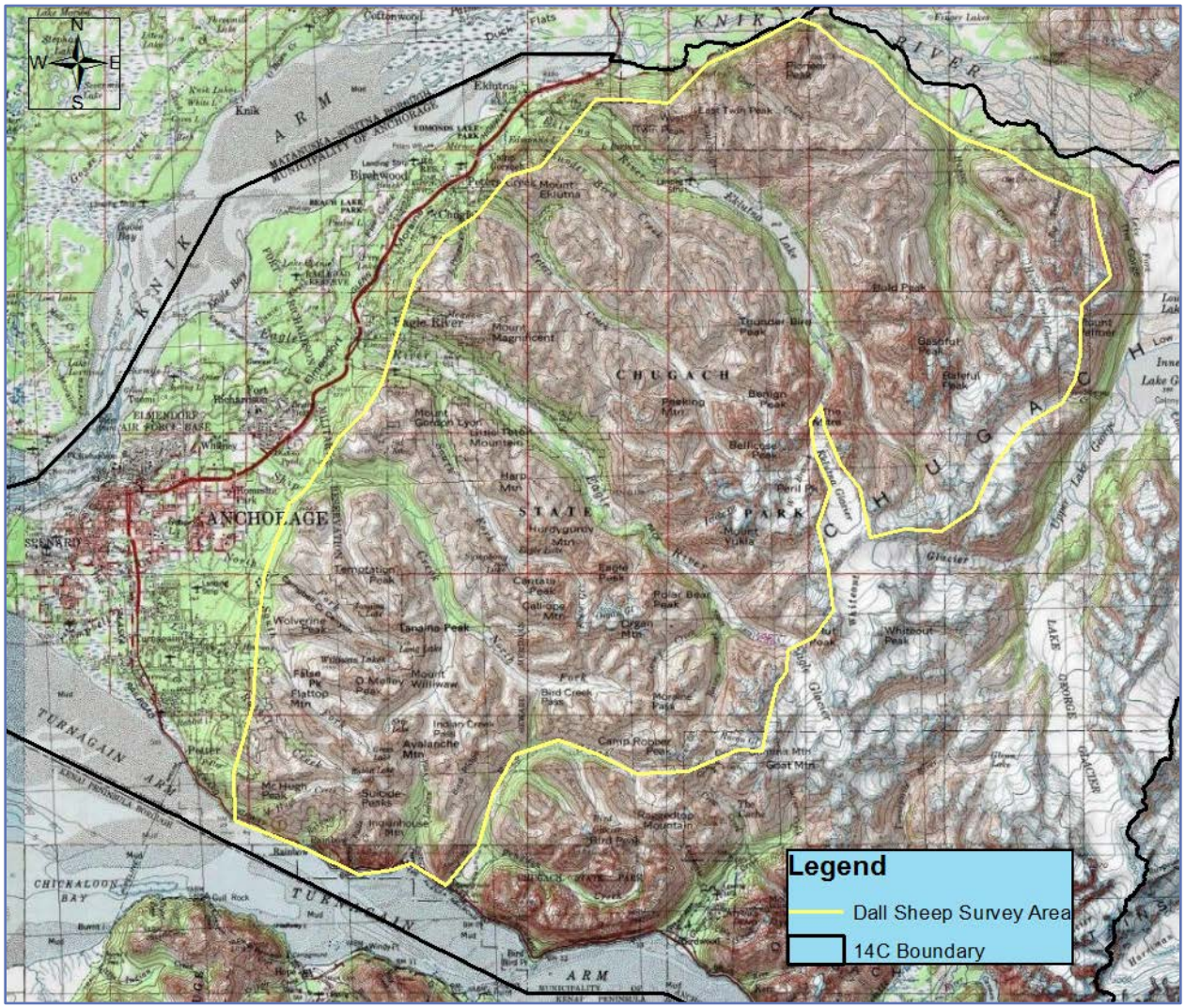


Figure 1. The Unit 14C, Alaska Dall sheep minimum count survey area.

Table 1. Minimum count sheep numbers for Unit 14C, Alaska, regulatory years[a] 2011–2015.

Regulatory Year	Rams	Ewe-likes	Lambs	Unknown	Total
2011	335	599	116	1	1,051
2012[b]	-	-	-	-	-
2013	334	523	85	6	948
2014	306	586	170	0	1,062
2015	293	561	200	0	1,054

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010=1 July 2010–30 June 2011.
[b] No survey was conducted.

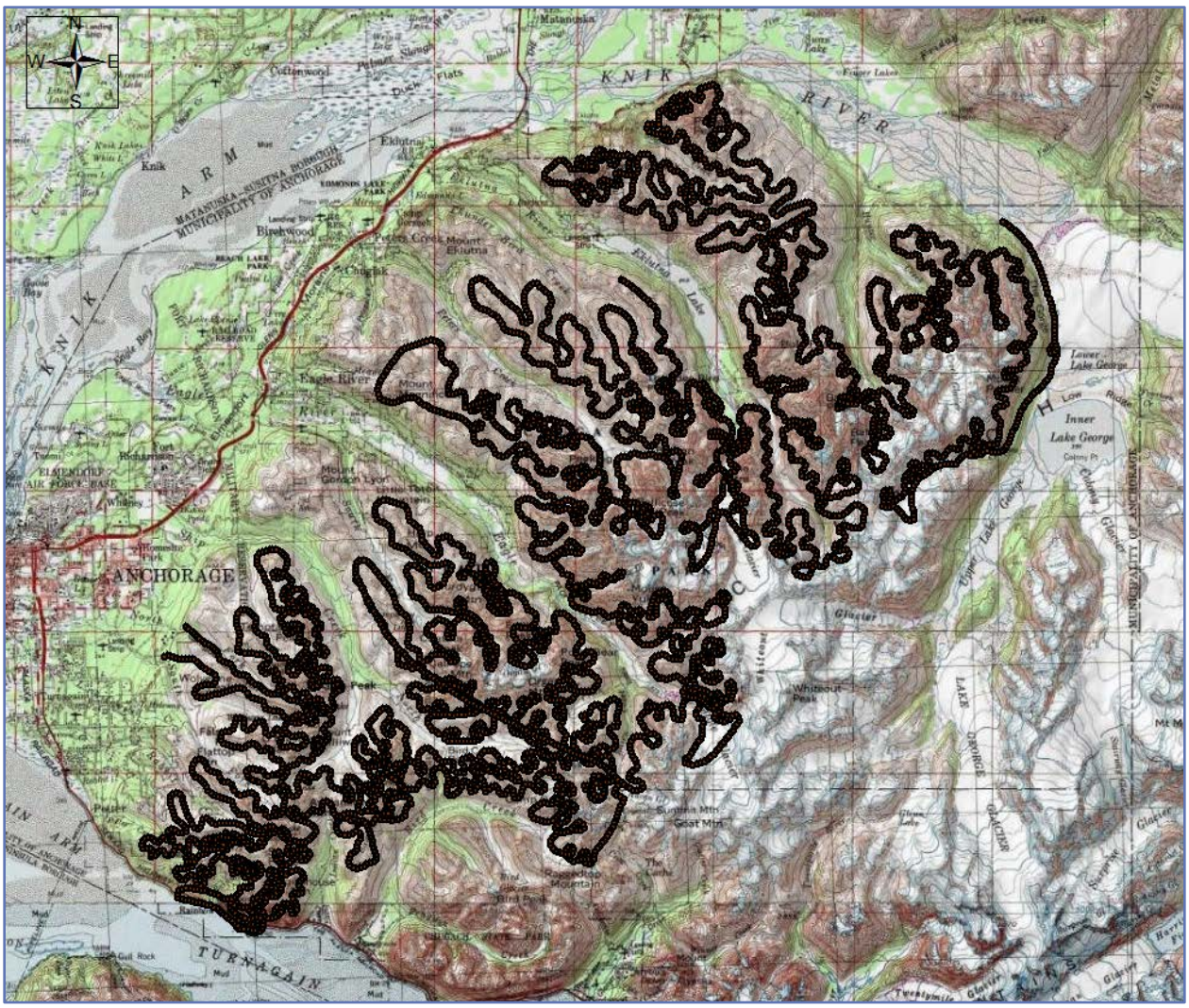


Figure 2. The 2013 Dall sheep survey tracks in the Unit 14C, Alaska portion of the Chugach Mountain Range.

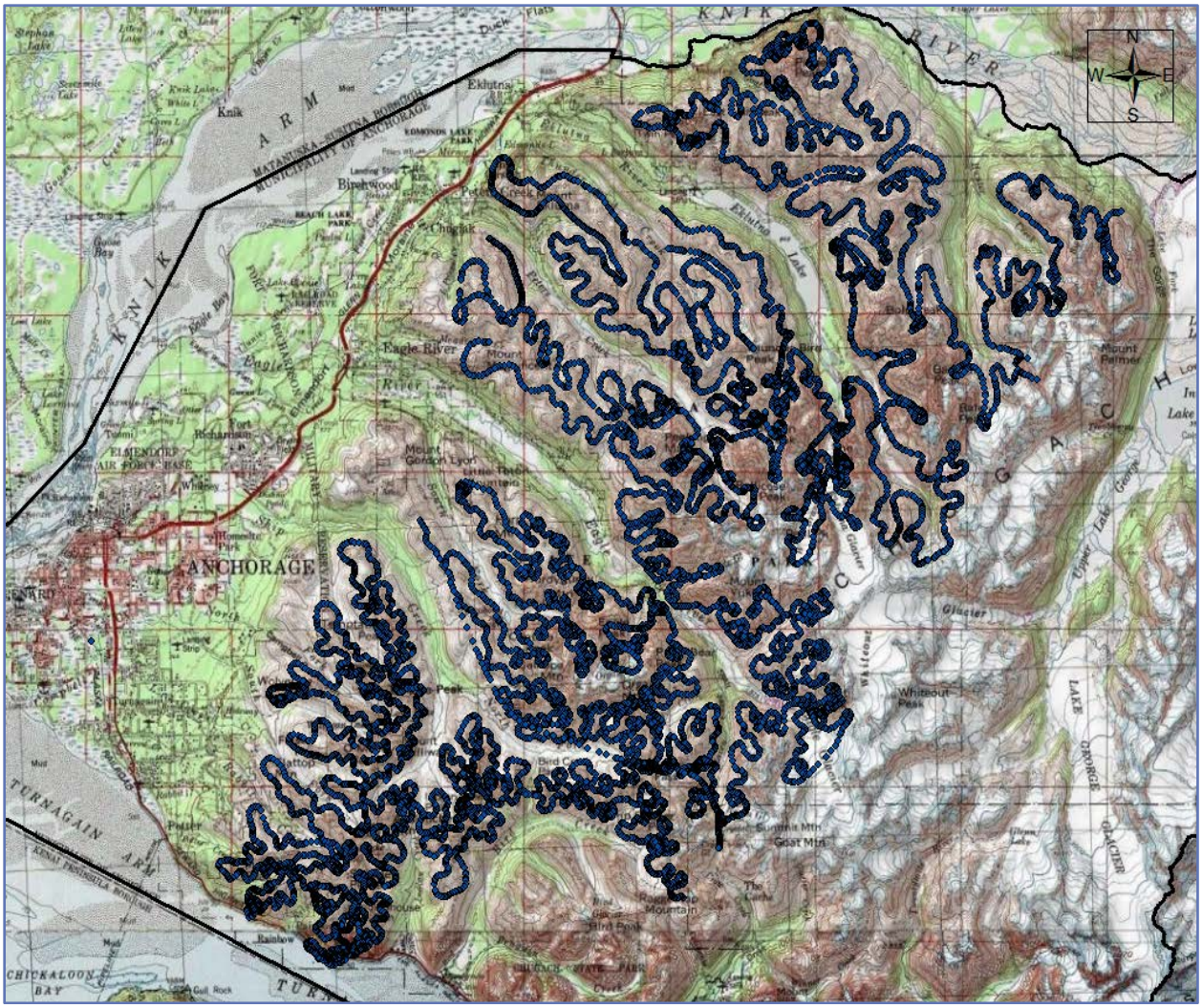


Figure 3. The 2014 Dall sheep survey tracks in the Unit 14C, Alaska portion of the Chugach Mountain Range.

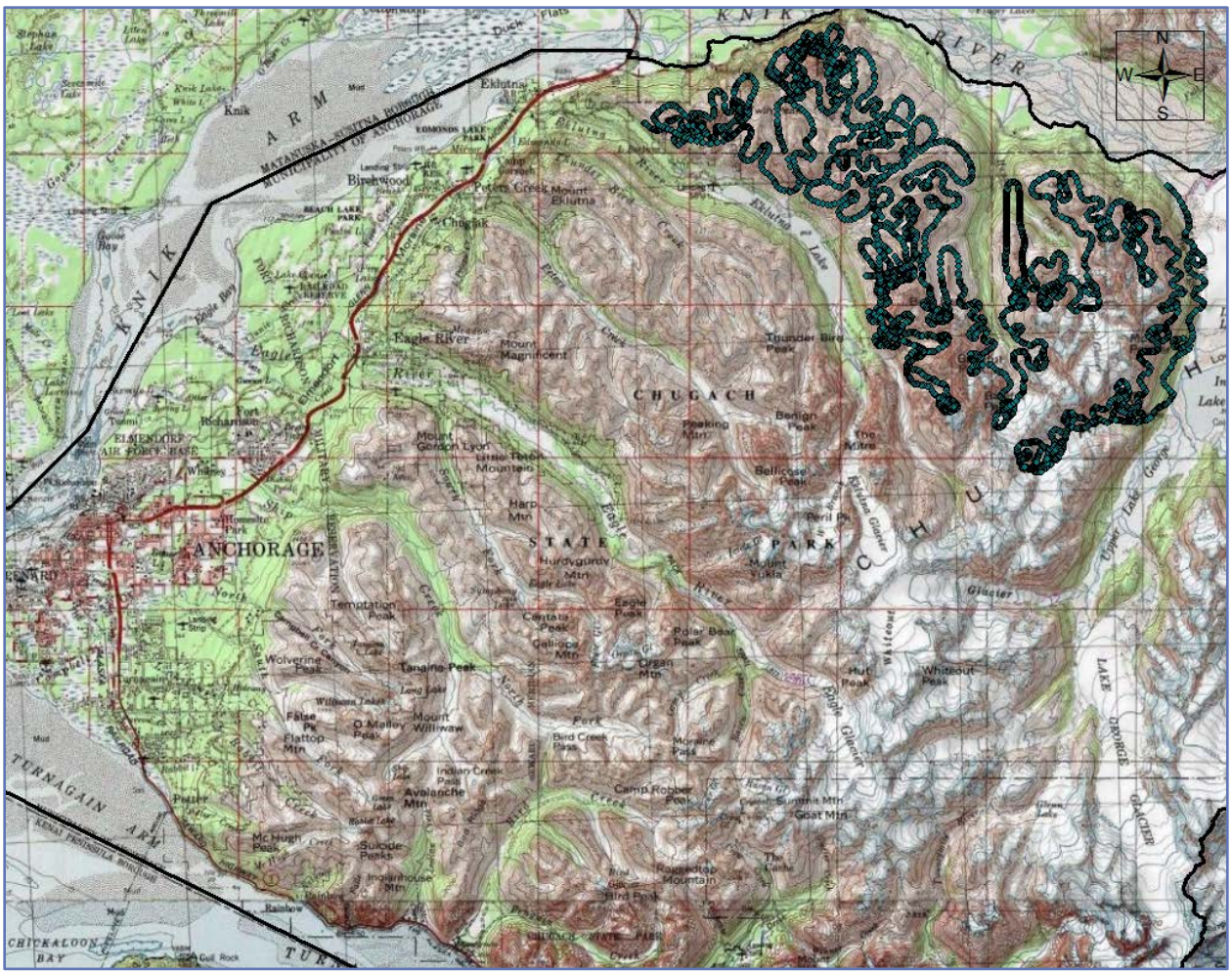


Figure 4. Tracks of the area resurveyed during the 2014 Dall sheep survey in Unit 14C, Alaska. The area was resurveyed because of reduced sheep detections after the survey was continued past the cutoff time.

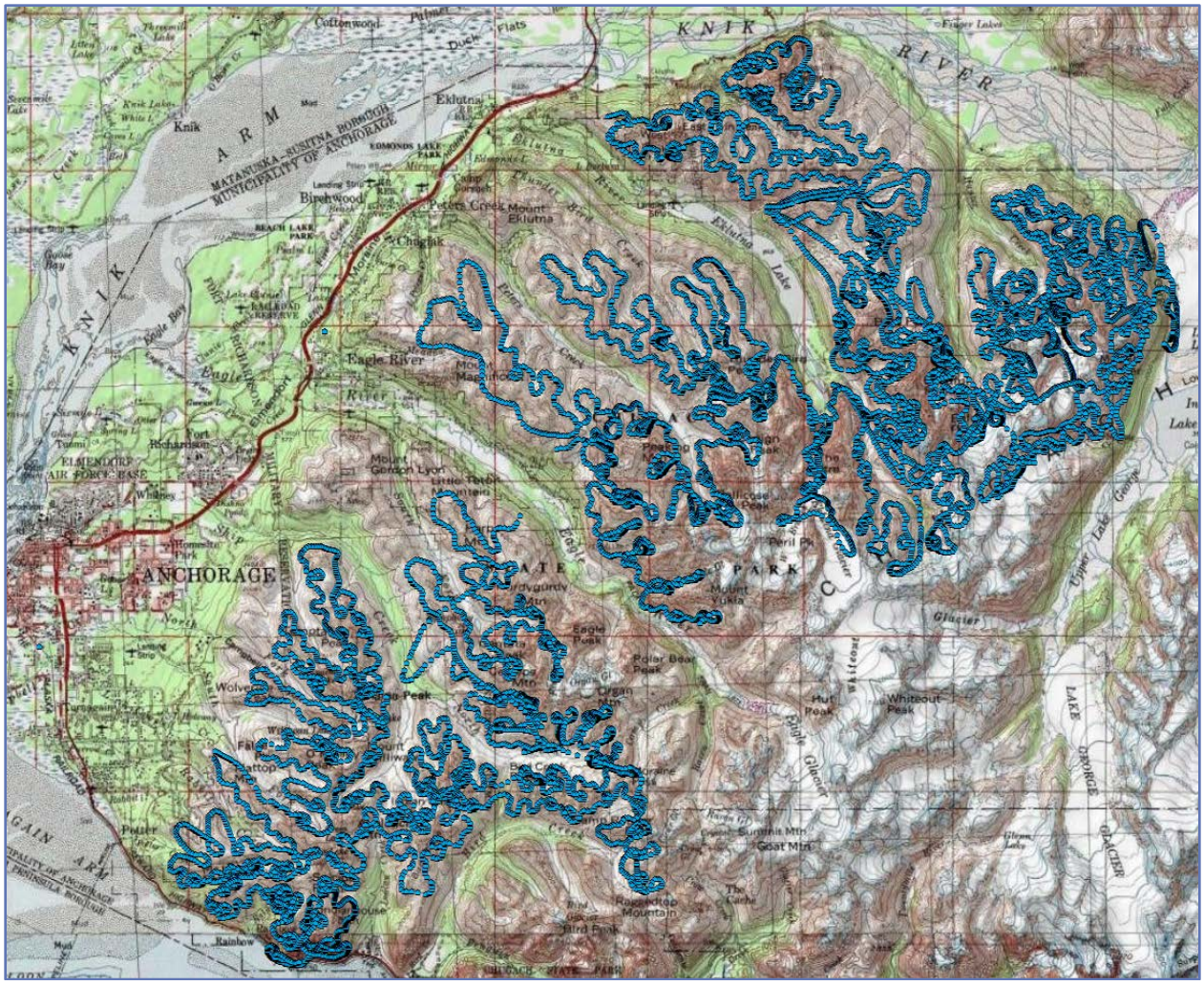


Figure 5. The 2015 Dall sheep survey tracks in the Unit 14C, Alaska portion of the Chugach Mountain Range.

Recommendations for Activity 1.1

Distance sampling does not appear to be feasible in Unit 14C due to the steeper terrain found in the Chugach Mountains as compared to the Brooks Range, where the methodology was developed. We recommend continuing with minimum count surveys and investigating other more robust survey methodology.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor mortality and harvest in Unit 14C annually.

Data Needs

Monitoring annual harvest data is vital in order to help inform management strategies and ensure that harvest is sustainable.

Methods

Examine hunter harvest reports and records at the end of each season to quantify how many sheep were harvested.

Season and Bag Limit

Hunts were offered RY11–15 under 24 different hunt numbers (of which 4 were archery-only hunts for "any sheep") with varying seasons and bag limits (Table 2). Harvest was regulated by the number of permits issued (Table 3).

Results and Discussion

The harvest of Dall sheep within Unit 14C is limited to special drawing permits only. There is no general season opportunity for hunters. During this reporting period Unit 14C issued between 139 and 143 permits for Dall sheep per year (Table 3).

Hunter Harvest

During this reporting period, hunters harvested an average of 16 sheep per year. The highest number of sheep harvested was in RY13 at 21 animals (Table 3). Of the sheep harvested over this reporting period, 94% were rams and 6% were ewes. Between all the hunt areas in Unit 14C, the Southwest, West, and Northwest areas accounted for 40%, 15%, and 22% of the harvest, respectively.

Hunter Residency and Success

During this reporting period, a total of 50 nonresidents hunted sheep, with 27 successfully harvesting a sheep. During the same period, 376 residents hunted sheep in Unit14C with only 55 harvesting a sheep. Residents accounted for 67% of the total harvest while nonresidents accounted for 33%. Of the hunters that hunted, nonresidents were more successful than residents with success rates of 54% and 15%, respectively, during this reporting period.

Other Mortality

There are currently no data on out-of-season take. It is assumed that some out-of-season take does occur but is relatively small given the large amount of backcountry recreational use that occurs year-round in the unit.

Survival data from collared animals (adult ewes and lambs) indicate that the main source of mortality for sheep in Unit 14C is not predation as has been documented for other sheep populations in Alaska, but is rather from other causes, such as avalanches, old age, and starvation. This population does not appear to be predation limited (Lohuis 2016).

Table 2. Unit 14C, Alaska Dall sheep season dates and bag limits for regulatory years[a] 2011–2015.

Hunt Number	Season	Legal Animal
DS123	10 Aug–30 Sep	One ram with full curl horn or larger
DS124	10 Aug–22 Aug	One ram with full curl horn or larger
DS125	23 Aug–4 Sep	One ram with full curl horn or larger
DS126	5 Sep–17 Sep	One ram with full curl horn or larger
DS130	10 Aug–22 Aug	One ram with full curl horn or larger
DS131	23 Aug–4 Sep	One ram with full curl horn or larger
DS132	5 Sep–17 Sep	One ram with full curl horn or larger
DS134	23 Aug–4 Sep	One ram with full curl horn or larger
DS135	5 Sep–17 Sep	One ram with full curl horn or larger
DS136	10 Aug–22 Aug	One ram with full curl horn or larger
DS137	23 Aug– 4 Sep	One ram with full curl horn or larger
DS138	5 Sep–17 Sep	One ram with full curl horn or larger
DS140	1 Oct–10 Oct Certified Bowhunters only	Any Sheep
DS141	Day After Labor Day–30 Sep Certified Bowhunters only	Any Sheep
DS224	10 Aug–22 Aug	One ram with full curl horn or larger
DS230	10 Aug–22 Aug	One ram with full curl horn or larger
DS231	23 Aug–4 Sep	One ram with full curl horn or larger
DS232	5 Sep–17 Sep	One ram with full curl horn or larger
DS233	10 Aug–22 Aug	One ram with full curl horn or larger
DS236	10 Aug–22 Aug	One ram with full curl horn or larger
DS237	23 Aug– 4 Sep	One ram with full curl horn or larger
DS238	5 Sep–17 Sep	One ram with full curl horn or larger
DS240	1 Oct–10 Oct Certified Bowhunters only	Any Sheep
DS241	Day After Labor Day–30 Sep Certified Bowhunters only	Any Sheep

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2011 = 1 July 2011–30 June 2012.

Table 3. Harvest and hunter participation, regulatory years[a] 2011–2015 for Dall sheep drawing hunts in Unit 14C, Alaska.

Hunt No. / Area	Regulatory year	Permits issued	No. hunters	% Successful	Rams	Ewes	Total harvest
DS124-126,224	2011	9	7	29	2	0	2
Northeast	2012	7	4	50	2	0	2
	2013	8	6	0	0	0	0
	2014	7	4	0	0	0	0
	2015	7	6	17	1	0	1
DS130-132,230-232	2011	18	15	20	3	0	3
Northwest	2012	18	14	21	3	0	3
	2013	18	14	29	4	0	4
	2014	18	11	36	4	0	4
	2015	18	17	24	4	0	4
DS123	2011	1	1	0	0	0	0
Central	2012	1	1	0	0	0	0
	2013	1	1	100	1	0	1
	2014	1	1	100	1	0	1
	2015	1	1	0	0	0	0
DS134-135,233	2011	3	2	50	1	0	1
Upper Eagle River	2012	3	1	100	1	0	1
	2013	3	1	0	0	0	0
	2014	3	1	100	1	0	1
	2015	3	2	50	1	0	1
DS136-138,236-238	2011	24	19	21	4	0	4
Southwest	2012	24	15	47	7	0	7
	2013	24	19	42	8	0	8
	2014	24	21	29	6	0	6
	2015	24	20	40	8	0	8

Hunt No. / Area	Regulatory year	Permits issued	No. hunters	% Successful	Rams	Ewes	Total harvest
DS140 & 240	2011	61	34	12	2	2	4
West (rifle and archery)	2012	60	30	0	0	0	0
	2013	61	37	16	5	1	6
	2014	60	31	3	0	1	1
	2015	60	24	4	1	0	1
DS141 & 241	2011	26	10	20	1	1	2
West Eklutna (archery only)	2012	25	6	0	0	0	0
	2013	25	17	12	2	0	2
	2014	25	15	13	2	0	2
	2015	25	19	5	1	0	1
Governor's Tag	2011[b]	1	0	0	0	0	0
SS123	2012	1	1	0	0	0	0
	2013[b]	1	0	0	0	0	0
	2014[b]	1	0	0	0	0	0
	2015	1	1	1	1	0	1
Total	2011	143	88	18	13	3	16
RY11–RY15	2012	139	72	18	13	0	13
	2013	141	95	22	20	1	21
	2014	139	84	18	14	1	15
	2015	139	90	19	17	0	17

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2011 = 1 July 2011–30 June 2012.
[b] Ram harvested in 13D.

Alaska Board of Game Actions and Emergency Orders

RY11:

- No actions were taken

RY12:

- No Southcentral BOG meeting

RY13:

- BOG directed ADF&G to use discretionary authority to expand the DS123 hunt area to include Ram Valley and Falls Creek drainage. The change went into effect in RY14.

RY14:

- No Southcentral BOG meeting

RY15:

- No Southcentral BOG meeting

Recommendations for Activity 2.1

We recommend continuing harvest and mortality monitoring.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. None.

During this reporting period, ADF&G did not conduct any Dall sheep habitat evaluations or assessments in Unit 14C.

Data Needs

Very little is known about the habitat and forage quality for sheep in Unit 14C. Considering the wide fluctuation in sheep numbers in this unit within the last 40 years, this represents a significant knowledge gap.

Methods, Results, and Discussion

No habitat evaluations or assessments were conducted during this reporting period.

Recommendations for Habitat Assessment-Enhancement

Research currently being conducted indicates that the sheep population in Unit 14C is either at or near the carrying capacity of the landscape. This is evident through lower than normal body condition scores and low and variable pregnancy rates over consecutive years (Lohuis 2016).

Very little is known about quantity and quality of habitat in Unit 14C. We recommend conducting some sort of habitat quantification in an attempt to delineate how much true sheep

habitat is available and conducting forage quality analysis in hopes of explaining the overall poor body condition of the Unit 14C sheep population.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

As more domestic sheep and goats (including pack goats) are brought into the Anchorage bowl and surrounding communities, there is a growing concern for the introduction of disease and pathogens into wild stock. The most important of these diseases are respiratory infections that result in pneumonia (The Wildlife Society 2015). One in particular that is carried and transmitted by domestic livestock is *Mycoplasma ovipneumoniae* (*M. ovi*). Once a sheep is infected, endemic nasal bacteria are able to get into the lungs and bronchi, leading to pneumonia and causing large die-offs in some cases. Typically, incidents of pneumonia associated die-offs are linked with the presence of domestic sheep and goats (George et al. 2008). Bighorn populations in the Lower 48 states have already seen the introduction of this bacterium with devastating impacts to their wild sheep populations (Besser et al. 2012). Currently, there is very little surveillance or guidelines for *M. ovi*, and this should be addressed proactively. Once introduced, the only way to stop the spread of this bacterium is through the complete culling of the infected herd (Wehausen et al. 2011).

Data Recording and Archiving

- Surveys
    - Survey hard copies are stored in the Anchorage Fish and Game office in office 2006. Electronic copies are stored on the Division of Wildlife Conservation common server in Anchorage at the following address: O:\DWC\common\Anch_Wildlife_Management\BGDIF\Dall Sheep
- Harvest Data
    - Harvest data for all Unit 14C hunts are stored in the WinfoNet Database.

Agreements

None

Permitting

All management staff hold ADF&G collection permits.

Conclusions and Management Recommendations

The sheep population in Unit 14C climbed from approximately 1,000 sheep in the late 1970s to a high of 2,430 sheep in 1996. Following the late 1990s sheep numbers in Unit 14C began to decline until 2007, when the population reached 904 sheep. This decline has been attributed primarily to several severe winters which may have reduced recruitment during those years;

however, other variables undoubtedly impact the population as well. As a result of this decline and current population status, the number of full curl permits available has been reduced. We have not met the harvest objective of at least 30 full curl rams annually during this reporting period. Given the current population, the number of permits available, hunter success rates, and horn morphometrics within this population, the harvest objective of 30 full curl rams is no longer feasible. We consider the new goals and objectives, found in the RY16–RY20 Plan section of this publication, to be more realistic and achievable.

The Unit 14C sheep population has increased slightly since 2007, and currently appears to be stable; however, this population should be watched closely as current research indicates it is at or near carrying capacity. Other harvest strategies should be examined in the event additional harvest is needed. The addition of "any ram" permits would provide additional harvest opportunity, ease enforcement issues, and allow for the harvest of rams from younger age classes.

II. Project Review and RY16–RY20 Plan

Review of Management Direction

MANAGEMENT DIRECTION

The prior management objective of a harvest of at least 30 full curl rams per year has not been achieved since 2008 and is not feasible at the current population level. In addition, current research has shown that sheep in Unit 14C have very poor body condition, indicating that they are at or near carrying capacity of the habitat. Due to these considerations, management objectives will be evaluated and modified in an effort to move toward a healthier and more sustainable sheep population. We plan to begin looking at harvest strategies other than full curl in order to maximize hunting opportunity while keeping the population from expanding beyond carrying capacity.

GOALS

- Maintain a healthy and harvestable population of Dall sheep that fluctuates in size within historical limits of abundance.

- Provide for both consumptive and nonconsumptive uses.

MANAGEMENT OBJECTIVES

The department will evaluate the harvest objective relative to the sheep population size with the goal of identifying a sustainable harvest strategy and management objective and may change the management objective for this population during the RY16–RY20 reporting period. A specific numerical harvest objective has not been identified, but it is expected that new strategies to allow additional harvest opportunity, including possibly the addition of an "any ram" permit, will be evaluated and discussed with the Board of Game at its Southcentral meeting in 2019. The RY11–RY15 objective will remain in place until new objectives are identified:

- Maintain a minimum harvest of 30 full curl or larger rams throughout Unit 14C while maintaining aesthetically pleasing hunting conditions and avoiding overcrowding of hunters in the field.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

None.

REVIEW OF MANAGEMENT ACTIVITIES

Activities undertaken RY11–RY15 will continue during RY16–RY20, with adjustments as noted below and a new activity to research habitat and forage will be undertaken.

1. Population Status and Trend

ACTIVITY 1.1. Conduct aerial surveys for Dall sheep to get an estimate of the minimum number of Dall sheep in Unit 14C (*same as RY11–RY15).*

Data Needs

A more robust population estimate, preferably with a sightability correction factor, is needed for the Unit 14C sheep population.

Methods

Continue minimum counts, and investigate more robust means of surveying sheep.

2. Mortality/Harvest Monitoring

ACTIVITY 2.1. Monitor mortality and harvest in Unit 14C annually (*same as RY11–RY15).*

Data Needs

In addition to data needs from the prior reporting period, we would like to begin collecting more detailed horn growth measurements, particularly the age at which the degree of curl equaled or exceeded 360 degrees. There is anecdotal information that a portion of rams in Unit 14C that are eight years or older (legal to harvest based on age) never reach full curl. Most hunters only select for rams that are obviously full curl. We would like to investigate this further to determine if there is additional harvest opportunity that could be realized through issuing a limited number of "any ram" permits in addition to existing full curl ram permits.

Methods

At the time of sealing, staff will collect additional measurements (distance between rings, profile pictures, etc.) from sheep horns.

3. Habitat Assessment/Enhancement

ACTIVITY 3.1. Research sheep habitat and forage that may be affecting Unit 14C sheep populations. *(New RY16–RY20)*

Data Needs

Very little is known about the habitat and forage quality for sheep in Unit 14C. Considering the wide fluctuation in sheep numbers in this unit within the last 40 years, this represents a significant knowledge gap.

Methods

Research was initiated in RY16 by Region II research staff to examine sheep habitat in Unit 14C; specifically, determining seasonal diets of sheep through field observations, field vegetation sampling and fecal collections, quantifying diet quality through laboratory analyses, constructing resource selection functions (RSFs) for Dall sheep using GPS collar datasets, determining seasonal habitat use and validating habitat types of sheep using GPS datasets from this project, and, lastly, quantifying the amount of existing sheep habitat. This research will be continuing throughout the time period covered by this plan.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

No change from prior reporting period.

Data Recording and Archiving

- Surveys
    - Survey hard copies will be stored in the Anchorage Fish and Game office in office 2006. Electronic copies will be stored on the DWC common server in Anchorage at the following address O:\DWC\common\Anch_Wildlife_Management\BGDIF\Dall Sheep
- Harvest Data
    - Harvest data for all 14C hunts will be stored in the WinfoNet database.

Agreements

None.

Permitting

All management staff hold ADF&G collection permits.

References

Alaska Department of Fish & Game (ADF&G). 1976. Alaska wildlife management plans: Southcentral Alaska. Draft proposal subsequently approved by the Alaska Board of Game. Division of Game, Federal Aid in Wildlife Restoration, Project W-17-R, Juneau.

Besser, T. E., M. A. Highland, K. Baker, E. F. Cassirer, N. J. Anderson, J. M. Ramsey, K. Mansfield, D. L. Bruning, P. Wolff, J. B. Smith, and J. A. Jenks. 2012. Causes of pneumonia epizootics among bighorn sheep, western United States, 2008–2010. Emerging Infectious Diseases 18(3):406–414. doi:10.3201/eid1803.11554.

George, J. L., D. J. Martin, P. M. Lukacs, and M. W. Miller. Epidemic pasteurellosis in a bighorn sheep population coinciding with the appearance of a domestic sheep. Journal of Wildlife Diseases 44(2): 388–403. doi:10.8589/0090-3558-44.2.388

Alaska Department of Fish and Game. 2000. Living with wildlife in Anchorage: A cooperative planning effort [web page]. Division of Wildlife Conservation, Anchorage. http://www.adfg.alaska.gov/index.cfm?adfg=anchoragewildlifeplanning.main

Lohuis, T. 2016. Ewe Dall's sheep survival, pregnancy and parturition rates, and lamb recruitment in GMU 14C, Chugach Mountains, AK. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid Annual Research Performance Report 1 July 2015–30 June 2016, Federal Aid in Wildlife Restoration Project 6.18, Juneau.

Scott, R. F., E. F. Chatelain, and W. A. Elkins. 1950. The status of the Dall sheep and caribou in Alaska. North American Wildlife Conference 15:612–626.

The Wildlife Society. 2015. The Wildlife Society and American Association of Wildlife Veterinarians joint issue statement: Domestic sheep and goats disease transmission risk to wild sheep. March 2015. http://wildlife.org/wp-content/uploads/2015/03/WS-DS_DiseaseTransmission_TWS-AAWV_JointStatement_APPROVED.pdf (Accessed May 2017).

Wehausen, J. D., S. T. Kelley, and R. R. Ramey II. 2011. Domestic sheep, bighorn sheep, and respiratory disease: A review of the experimental evidence. California Fish and Game 97(1):7–24.

Appendix A. The Unit 14C, Alaska Dall sheep survey datasheet.

14C Sheep Survey Datasheet

Page _____ of _____ pages

GMU:_____ **Weather Conditions:**_____

Date:_____ **Temperature:**_____

Time Off:_____ **Time On:**_____ **Precipitation: (Rain,.....Snow,.....or None)**

Time Start:_____ **Time End:**_____ **Snow Conditions: (clear,.. < ½,.. > ½,.. or Overcast)**

Pilot/Observer:_____ **Turbulence: (None, ... Light, ... or Moderate)**

Aircraft Type:_____ **LightInensity: (None,..Occasional,..Intermittent,..or Constant)**

Comments (e.g., sun intensity, horizon, & side of plane): _____

[A]Group Behaviour
B-Bedded
S-Standing
F-Feeding
W-Walking
R-Running

		Sheep						Goats				
Area	Waypoint #	Leg. Ram	Sub. Ram	Unk. Ram	Ewe	Lamb	Unid.	Adults	Kids	Group Beh.[A]	%Cover	%Snow
Total												

Appendix B. The 2011 Dall sheep survey memorandum for Unit 14C, Alaska.

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF WILDLIFE CONSERVATION

SEAN PARNELL / GOVERNOR

333 Raspberry Rd.
Anchorage, AK 99518
PHONE: (907) 267-2811
e-mail: jessica.coltrane@alaska.gov

MEMORANDUM

TO: Gino Del Frate
Management Coordinator
ADF&G/DWC/Reg. II
Anchorage

FROM: Jessy Coltrane
Area Biologist
ADF&G/DWC/Reg. II
GMU 14C Anchorage

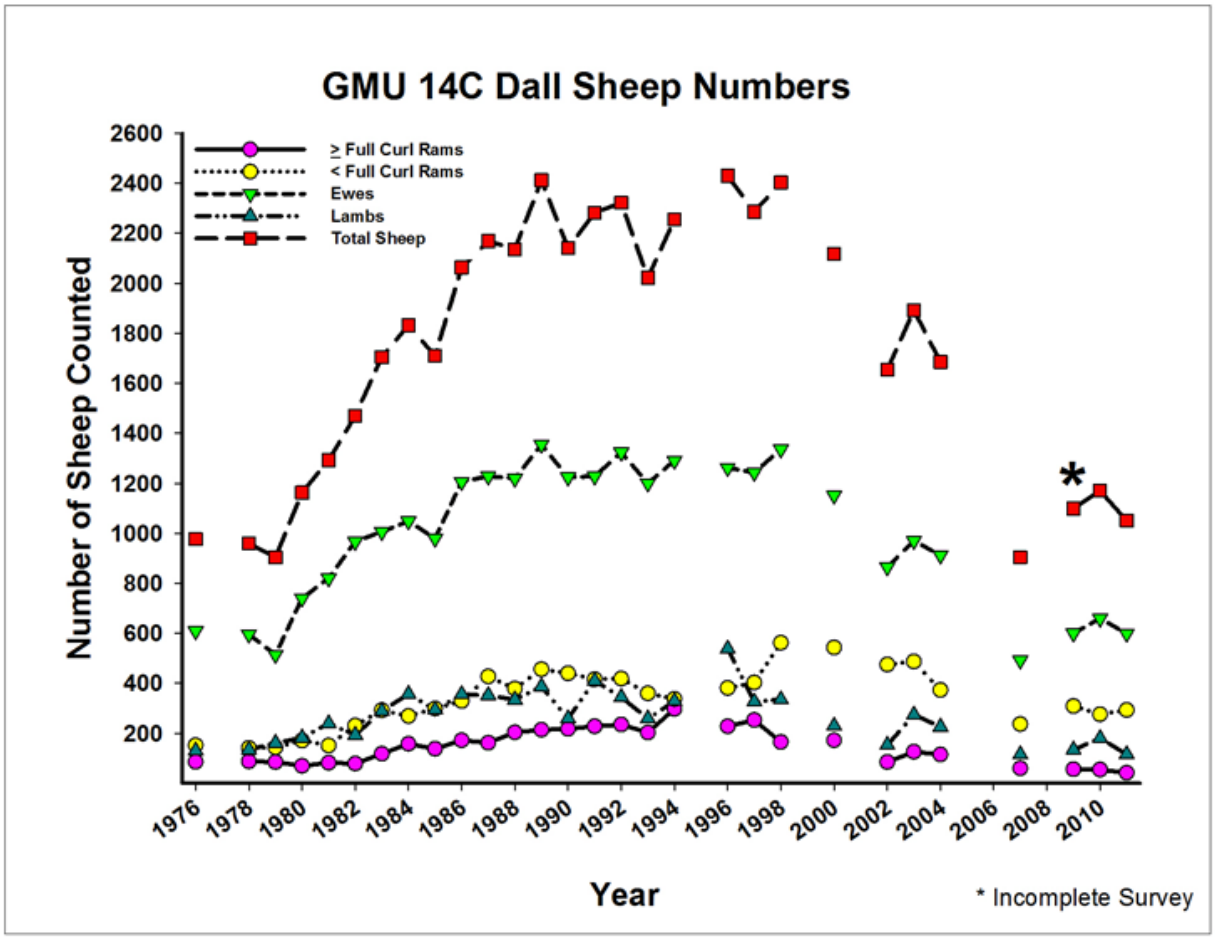
RE: GMU 14C Dall Sheep Survey 2011

19 August 2011

A Dall sheep survey was completed for GMU 14C using a fixed-wing super cub piloted by Billy Wiederkehr, Wiederkehr Air. Chase Korsmo (ADFG Wildlife Technician) was the observer for the entire survey. The survey was initiated on 6 July 2011. However, due to inclement weather, counts were completed 15-20 July 2011. All of the GMU 14C Dall sheep hunt areas within Chugach State Park and surrounding lands were surveyed, except for the upper reaches of Camp Creek and Ship Creek due to high winds. In addition, Snowhawk Valley was omitted from the survey due to heavy fog. A total of 1051 sheep were observed, including 11 % lambs, 57% ewes, and 32% rams. Please reference the following table for the number of sheep observed by drainage/area. The number of full curl rams is most likely an under-representation of actual full curl ram numbers, as we are very conservative in classifying full curls from the air.

The attached figure illustrates sheep survey information for GMU 14C since 1976. Considering the areas that were omitted or partially surveyed this year, we consider the population to be stable to slightly increasing since 2008.

Area	Full Curl Rams	< full curl rams	Unclassified Rams	Ewes	Lambs	Unid	Total Sheep
Bird Creek		9		20	5		34
Eagle River	6	61	2	118	28	1	216
Falls Creek				13	3		16
Goat Creek				38	5		43
Hunter Creek		10		8			18
Indian Creek	4	13		47	4		68
Lake George		1					1
McHugh Creek	7	27		3			37
Middle Fork Campbell Creek		6	1	8	4		19
Peters Creek	9	33	1	70	16		129
Rainbow Valley	1	13					14
Ship Creek	3	28		98	18		147
Thunderbird Valley				1			1
N. Fork Campbell Creek				4			4
West Eklutna	1	10		17	5		33
East Eklutna		3		9	3		15
S. Fork Eagle River	1	2		8			11
Eklutna	7	42		98	18		165
Twin Peaks	2	4		15	3		24
Pioneer Peak	1	21		24	4		50
Big Timber Creek		1					1
Troublesome Creek		5					5
Total	**42**	**289**	**4**	**599**	**116**	**1**	**1051**


GMU 14C Dall Sheep Numbers
≥ Full Curl Rams
< Full Curl Rams
Ewes
Lambs
Total Sheep
Number of Sheep Counted
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
*
Year
* Incomplete Survey

Appendix C. The 2013 Dall sheep survey memorandum for Unit 14C, Alaska.

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF WILDLIFE CONSERVATION

SEAN PARNELL / GOVERNOR

333 Raspberry Rd.
Anchorage, AK 99518
PHONE: (907) 267-2811
e-mail: jessica.coltrane@alaska.gov

MEMORANDUM

TO: Gino Del Frate
Management Coordinator
ADF&G/DWC/Reg. II
Anchorage

FROM: Jessy Coltrane
Area Biologist
ADF&G/DWC/Reg. II
GMU 14C Anchorage

RE: GMU 14C Dall Sheep Survey 2013

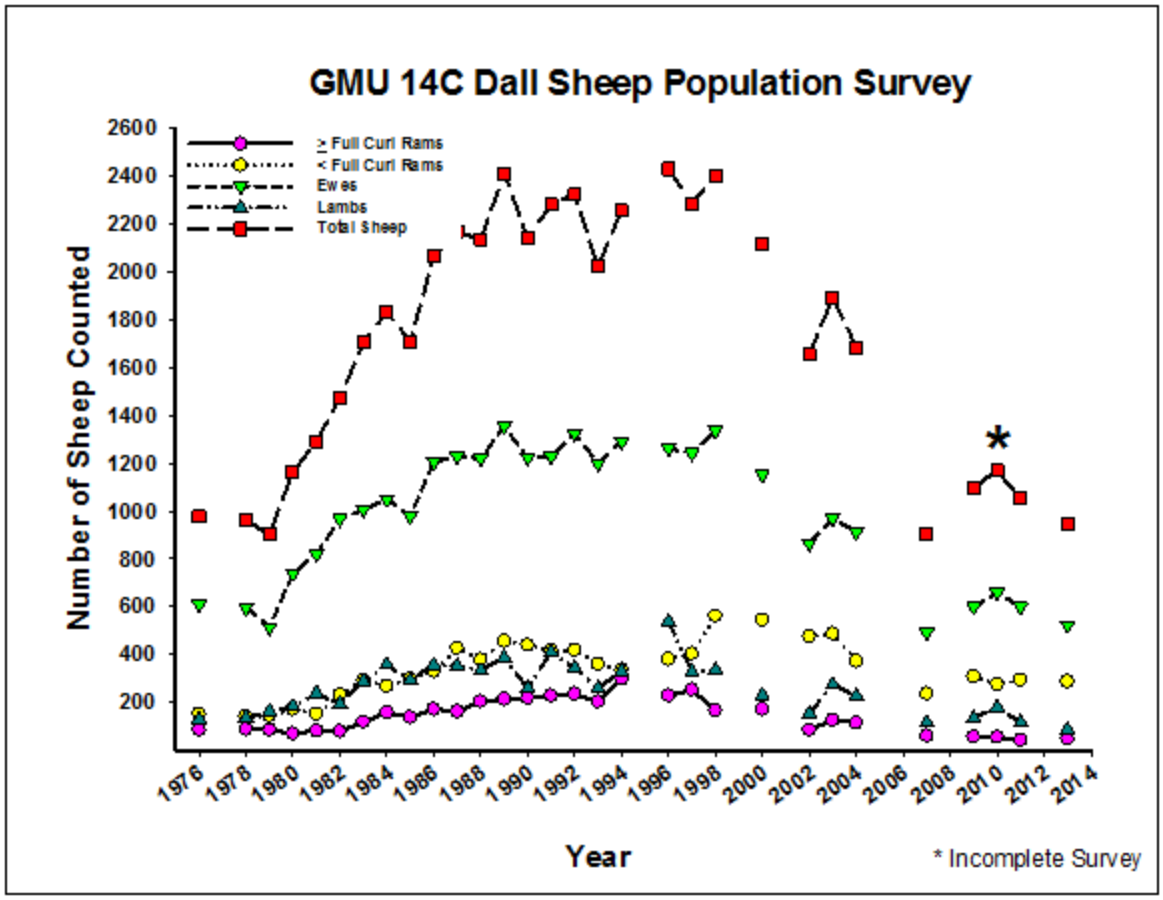
29 July 2013

A Dall sheep survey was completed for GMU 14C using a fixed-wing super cub piloted by Billy Wiederkehr, Wiederkehr Air. David Saalfeld (ADFG Wildlife Biologist) was the observer for the entire survey. The survey was conducted from 23 July – 25 July 2013. All of the GMU 14C Dall sheep hunt areas within Chugach State Park and surrounding lands were surveyed. A single pass transect was flown midway between the treeline and the top of each ridgeline. The aircraft followed this contour throughout all drainages within 14C and a global positioning system (GPS) track line was obtained to compare the area surveyed among years. Once sheep were observed the aircraft would make multiple passes to enumerate the number of individuals with a group, classify them into the number of legal rams, non-legal rams, ewes, and lambs, and obtain a GPS waypoint.

Viewing conditions were good throughout the survey with sparse to no snow cover and partly cloudy to sunny conditions. Winds were light with temperatures ranging from 12 C to 18 C. Surveys were flown between 0600 and 1140 with a total flight time of 15 hours and 33 minutes and total survey time of 14 hours and 19 minutes. Although viewing conditions were good, warmer air temperatures throughout the survey could have caused sheep to occupy lower elevations dominated by alders, potentially reducing detections. A total of 948 sheep were observed, including 9% lambs, 55% ewes, and 35% rams. A total of 66.8 sheep per hour were observed during this survey. Please reference the following table for the number of sheep observed by drainage/area. The number of full curl rams is most likely an under-representation of actual full curl ram numbers, as we are very conservative in classifying full curls from the air.

The attached figure illustrates sheep survey information for GMU 14C since 1976. Considering that all areas were surveyed this year, we consider the population to be stable to slightly decreasing since 2010.

Area	Full Curl Rams	< Full Curl Rams	Unclassified Rams	Ewes	Lambs	Unidentified	Total Sheep
Bird Creek		7		25	5		37
Eagle River	3	19		57	6	2	87
Eklutna	5	43		66	10		124
Falls Creek		6		3		1	10
Goat Creek				27	2		29
Hunter Creek	1	15		39	3		58
Indian Creek		2		1	1		4
Knik River (Twin Peaks, Pioneer Peak, etc.)	7	43		25	3		78
McHugh Creek	4	16		40	8		68
Middle Fork Campbell Creek	2	3					5
North Fork Campbell Creek		3		24	7		34
Peters Creek	13	33		37	8	2	93
Rainbow Valley	3	13		1	1		18
Raven Creek		6		2	2	1	11
Ship Creek	7	65		146	24		242
Snowbird Creek		1		5			6
South Fork Campbell Creek				2	1		3
South Fork Eagle River		2		7			9
Thunderbird Valley	2	4		12	3		21
Troublesome Creek		6		4	1		11
Total	**47**	**287**		**523**	**85**	**6**	**948**


GMU 14C Dall Sheep Population Survey
≥ Full Curl Rams
< Full Curl Rams
Ewes
Lambs
Total Sheep
Number of Sheep Counted
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
*
Year
* Incomplete Survey

Appendix D. The 2014 Dall sheep survey memorandum for Unit 14C, Alaska.

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF WILDLIFE CONSERVATION

SEAN PARNELL / GOVERNOR

333 Raspberry Rd.
Anchorage, AK 99518
PHONE: (907) 267-2811
e-mail: jessica.coltrane@alaska.gov

MEMORANDUM

TO: Gino Del Frate
Management Coordinator
ADF&G/DWC/Reg. II
Anchorage

FROM: Jessy Coltrane, Dave Battle, and Dave Saalfeld
Anchorage Area Management Team
ADF&G/DWC/Reg. II
GMU 14C Anchorage

RE: GMU 14C Dall Sheep Survey 2014

07 October 2014

A Dall sheep survey was completed for GMU 14C using fixed-wing super cubs piloted by Billy Wiederkehr of Wiederkehr Air and Matt Keller of Blue Ice Aviation. David Battle (ADFG Wildlife Biologist) and Cory Stantorf (ADFG Wildlife Technician) were the observers. The survey was conducted on 15, 16, 21 and 22 July 2014. All of GMU 14C Dall sheep hunt areas within Chugach State Park and surrounding lands were surveyed. Viewing conditions were good throughout the survey with sparse to no snow cover and overcast to sunny conditions. Normally, sheep surveys are not conducted past 1200 because warmer air temperatures often drive sheep into lower elevations dominated by alders, potentially reducing detections; however, on 21 July sheep were counted until 1400 in an attempt to complete the survey. When sheep numbers from this survey were compared to surveys from previous years, we found there to be fewer sheep than normal in the area surveyed after 1200. On the morning of 22 July, that area was resurveyed, and numbers were found to be similar to previous years. During the first survey, flown during the afternoon we saw 191 sheep compared to 301 sheep on the second day flown in the morning prior to 1200, a percent increase of 57.6%. A total of 1062 sheep were observed, including 16% lambs, 55% ewes, and 29% rams (Table 1). The number of full curl rams reported is most likely an under-representation of actual full curl ram numbers, as we are very conservative in classifying full curls from the air. Based on annual surveys, the population appears to be stable since 2010 (Figure 1).

In an attempt to estimate a detection probability for Dall sheep in 14C, a distance sampling based survey was attempted. Distance sampling was being tested because it has several advantages

over traditional minimum count surveys including reduced survey effort, an estimate of detection probability, and an estimate of error around the population estimate. Our survey design was modeled after studies conducted by the National Park Service (NPS) in the Brooks Range, Alaska (see Schmidt et al. 2012, Schmidt and Rattenbury 2013). We removed all non-sheep habitat from the study area within GMU 14C, defined as areas below 600 m and above 1600 m (based on NPS studies and 14C collar data), resulting in a total survey area of 1715 km^2 (Figure 2). Then we generated transect center points using a 5.5 km grid to provide uniform coverage throughout the study area and to minimize transect overlap. Within the study area, we created a total of 47 transects. Each 15 km transect was centered on a grid point and followed contours at the elevation of this grid point (Figure 3). Based on several trials where we varied grid cell size (created grids with cell size between 5 – 10 km at 0.5 km increments) and transect length (varied transect length between 10 – 20 km), we selected grid cell size at 5.5 km and transect length at 15 km. This design reduced the amount of overlap among transects and provided the best coverage of the study area. The initial study design was to survey each transect 3 times from 15 June - 1 July depending on snow and weather conditions. Two aircrafts were to survey simultaneously with one covering the northern transects and one the southern. Pilots and observers were to then switch transects for the 2nd replicate.

Aircrafts were flown at roughly 90 m above ground level at ~ 100 – 120 km/hr. The pilot and observer were treated as double observers using methodology develop by Earl Becker. Both observers searched only uphill from the transect line and upon detecting a group of sheep, the aircraft deviated from the transect line recording the initial location of the group with a GPS. If the group was large and/or diffuse, the center of the group was recorded and we considered sheep > 100 m apart as belonging to separate groups. Before leaving a transect to collect information on a group of sheep, we continued past the group ~ 150 m to search any upcoming habitat to ensure that additional sheep were not detected after leaving the transect. After marking locations of each sheep group, the aircraft circled each group to confirm count and composition. Additionally, because the aircraft could not always follow the transect lines exactly, flight lines were recorded to replace the transect lines in the analyses. With each transect/observation we collected the following covariates: observers, aircraft type, weather, cloud cover (clear, < ½, > ½, or Overcast), precipitation, turbulence (None, Light, or Moderate), temperature, group size, group composition (lambs, ewes, full curl etc.), group behavior, transect #, % cover, % snow, search distance, observation type (both, pilot only, or observer only), sun intensity, and transect start and end time.

Due to poor weather conditions, lingering snow, and issues with our survey design, we were unable to finish a complete replicate. Lingering snow and poor weather conditions kept us from surveying until late July. We attempted our first replicate on 23 July 2014, using fixed-wing super cubs piloted by Mike Meekins of Meekins Air Service and Matt Keller of Blue Ice Aviation. Observers were Dave Saalfeld and Jessy Coltrane. Viewing conditions were excellent with little to no snow and overcast skies, however issues with the survey design caused us to reevaluate our methodology and redesign our survey prior to completing this first replicate. We found that during this first replicate , the slope of the mountains within 14C and the flight altitude of only 90 m drastically reduced the amount of area we were able to effectively survey. Due to this small survey area we were unable to detect enough groups of sheep to employ distance sampling methodology. Previous studies by NPS (see Schmidt et al. 2012, Schmidt and Rattenbury 2013), found that a minimum of 100–150 groups of sheep detected were necessary to use this technique. With our small survey area, we were only able to detect 18 groups in 22

transects, resulting in < 1 group of sheep detected per transect. With only 47 transects, we would have had to fly 3–4 replicates to obtain enough detections. This realization rendered the methodology not very cost effective, especially if our goal was to replace the minimum count survey with this new technique. In an effort to increase our detection rate, we redesigned the survey to eliminate transects surveyed below 900 m and to increase our flight altitude to 300 m. These values were selected based on our experiences on the first day of surveying; however, due to weather we were not able to test our new methodology.

In conclusion, this methodology has several potential advantages over our minimum count surveys; however, the methodology needs to be reevaluated to suit our study area and management objectives. Future work should focus on how to modify our design to increase detections, because without increasing detections, this methodology would be less cost effective than minimum count surveys even though it may provide better a better estimate of the population.

Literature Cited

Schmidt, J. H., and K. L. Rattenbury. 2013. Reducing effort while improving inference: estimating Dall's sheep abundance and composition in small areas. Journal of Wildlife Management 77:1048-1058.

Schmidt, J. H., K. L. Rattenbury, J. P. Lawler, and M. C. MacCluskie. 2012. Using distance sampling and hierarchical models to improve estimates of Dall's sheep abundance Journal of Wildlife Management 76:317-327.

Table 1: Number of Dall sheep observed by drainage for GMU 14C during a minimum count survey conducted on 15 – 16 July and 21 – 22 July 2014.

Area	Full Curl Rams	<Full Curl Rams	Unclassified Rams	Ewes	Lambs	Unidentified	Total Sheep
Big Timber	0	0	0	0	0	0	0
Bird Creek	0	10	0	39	11	0	60
Camp Creek (ER)	2	5	0	18	6	0	31
Campbell Creek	1	6	0	10	2	0	19
Eagle River	9	42	0	62	18	0	131
Eklutna	1	49	0	56	15	0	121
Falls Creek	3	16	0	34	18	0	71
Goat Creek	0	2	0	13	2	0	17
Hunter	1	9	0	49	15	0	74
Indian Creek	0	0	0	3	2	0	5
Knik	0	34	0	21	3	0	58
McHugh Creek	5	12	0	22	8	0	47
North Fork Campbell Creek	1	5	0	10	3	0	19
Peters Creek	3	19	0	57	15	0	94
Rainbow	0	3	0	1	1	0	5
Raven Creek (ER)	2	5	0	7	0	0	14
S. Fork Campbell Creek	0	0	0	1	0	0	1
S. Fork Eagle River	0	5	0	12	0	0	17
Ship Creek	1	46	0	97	28	0	172
Thunderbird Creek	0	2	0	13	2	0	17
Troublesome Creek	0	0	0	0	0	0	0
Twin Peaks	0	7	0	61	21	0	89
Grand Total	**29**	**277**	**0**	**586**	**170**	**0**	**1062**

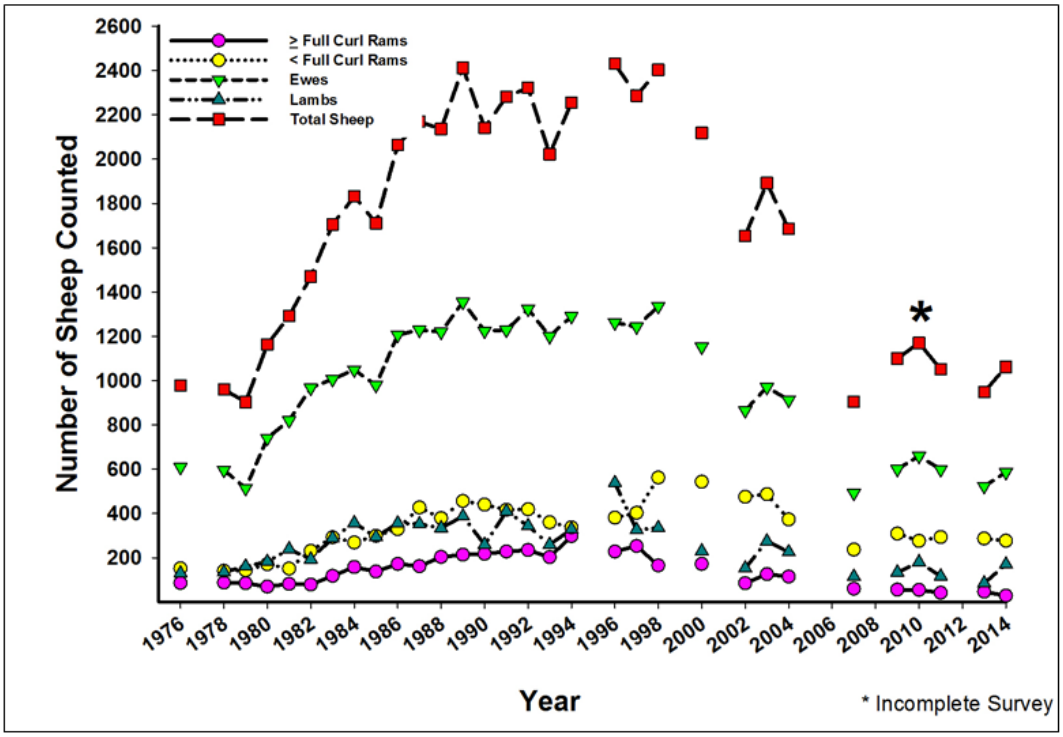


Figure 1: GMU 14C Dall sheep numbers based on a minimum count survey conducted on 15 – 16 July and 21 – 22 July 2014.

5

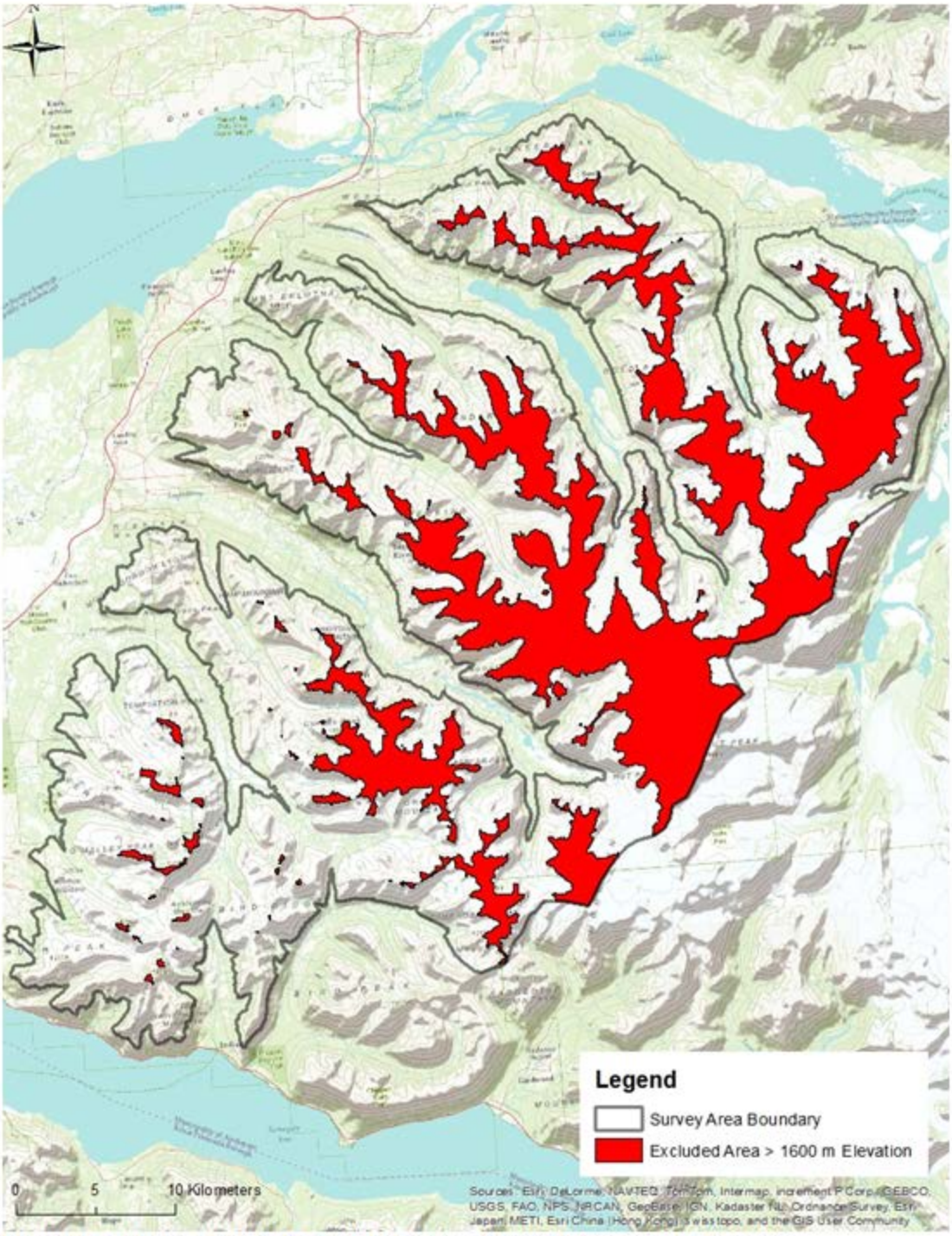


Figure 2: Study area within GMU 14C for Dall sheep distance sampling survey.

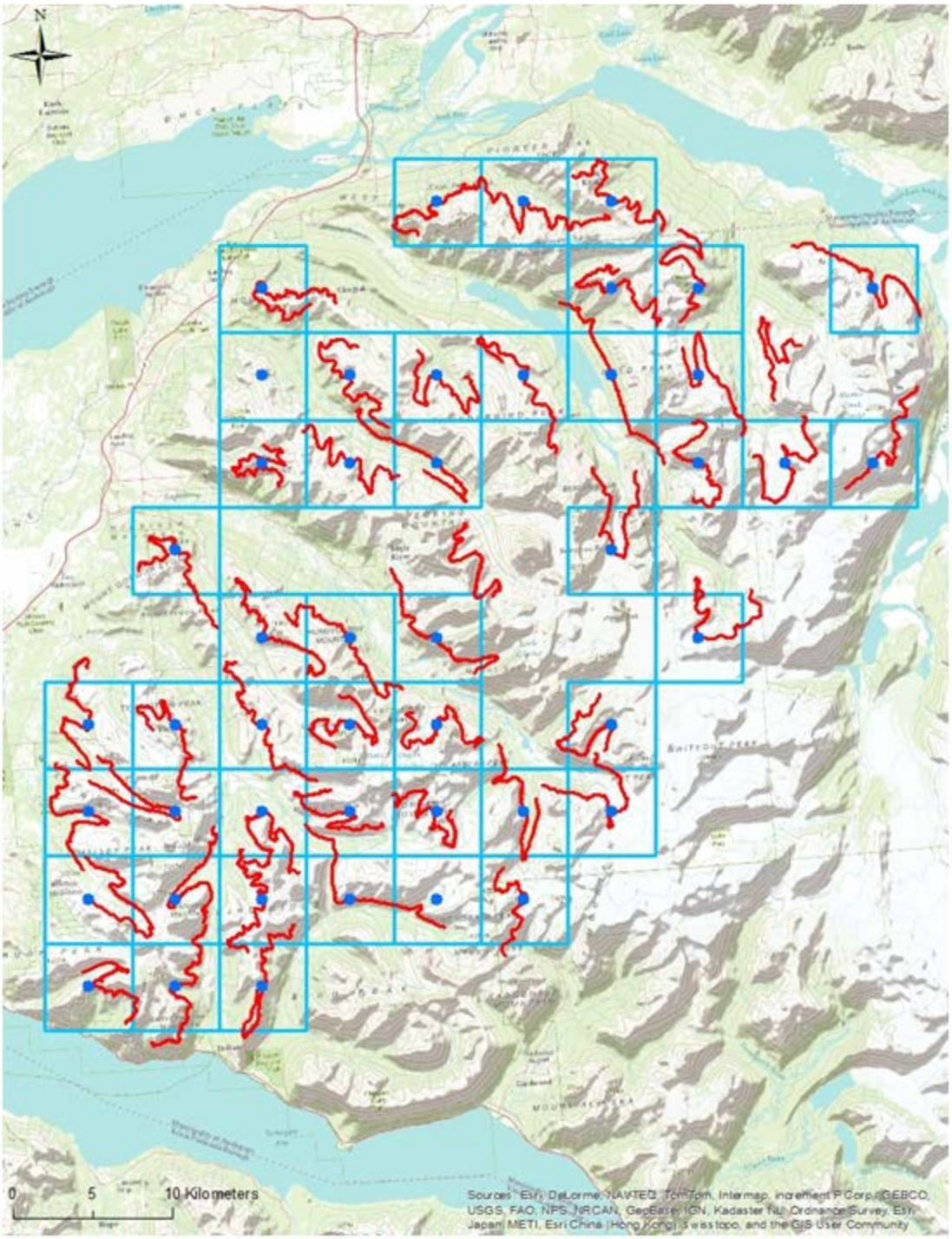


Figure 3: 15 km transects created using the center of a 5.5 km regular spaced grid within GMU 14C for Dall sheep distance sampling survey.

Appendix E. The 2015 Dall sheep survey memorandum for Unit 14C, Alaska.

STATE OF ALASKA

BILL WALKER, GOVERNOR

DEPARTMENT OF FISH AND GAME

Division of Wildlife Conservation

333 Raspberry Road
Anchorage, AK 99518
PHONE: (907) 267-2137
e-mail: wade.schock@alaska.gov

MEMORANDUM

TO: Gino Del Frate
Management Coordinator
ADF&G/DWC/Region II
Anchorage

FROM: Wade Schock
Wildlife Technician III
ADF&G/DWC/Region II
GMU 14C Anchorage

RE: GMU 14C Dall Sheep Survey 2015

DATE: August 28, 2015

A Dall sheep survey was completed for GMU 14C using fixed-winged Supercubs piloted by Billy Wiederkehr (Wiederkehr Air Service) and Matt Keller (Blue Ice Aviation). Wade Schock (ADFG Wildlife Technician) and Cory Stantorf (ADFG Wildlife Biologist) were the observers for this survey. The survey was conducted from 3 July – 10 July 2015. A portion of the survey area flown on June 23 was resurveyed to account for sheep movement. This data was not included in our totals. Although we typically attempt to fly surveys over 3 consecutive days, this year we had to extend the survey period due to weather conditions and pilot availability. We concluded each survey day at geographic barriers that would limit movement of sheep into or out of areas not yet surveyed, reducing the chance of double counting sheep.

Most Dall sheep habitat within Chugach State Park and surrounding lands were surveyed, with the exception of south Eagle River (Figure 1). Dall sheep habitat not flown during this survey period (e.g., south Eagle River, and Bird/Penguin Creek) was included in our mountain goat survey areas, where sheep are counted incidental to goats. Surveys typically entail a single transect flown midway between treeline and the top of each ridgeline. However, additional passes are sometimes necessary to adequately survey all sheep habitat. The aircraft followed this contour throughout all drainages within 14C and a global positioning system (GPS) track line was obtained to compare the area surveyed among years. Once sheep were observed the aircraft would make multiple passes to enumerate the number of individuals with a group, classify them into the number of legal rams, non-legal rams, ewes, and lambs, and obtain a GPS waypoint.

Viewing conditions were good throughout most of the survey with sparse to no snow cover and partly cloudy to sunny conditions. Winds were light, except for July 6, 2015 where increased winds and turbulence impacted survey conditions. Additionally, low clouds and fog

prevented surveying the southern portion of Eagle River on July 10, 2015 (Figure 1). During this survey, temperatures ranged from 7° C to 17° C (44° F to 63° F). Surveys were flown between 0600 and 1215 with total flight time of 30 hours and 48 minutes and total survey time of 18 hours and 21 minutes (excluding the survey flown on June 23). Although viewing conditions were good, warmer air temperatures throughout the survey could have caused sheep to occupy lower elevations dominated by alders, potentially reducing detections. A total of 1054 sheep were observed, including 19% lambs, 53% ewes, and 28% rams (Table 1). A total of 57.5 sheep per hour were observed during this survey. In the area that was not surveyed this year (the southern portion of Eagle River), approximately 100 sheep were counted in both the 2013 and 2014 surveys. Also, during the 2015 goat survey 149 sheep were observed in this area incidental to goat observations but not included in the 1054.

Please reference Table 1 for the number of sheep observed by drainage/area. The number of full curl rams is most likely an under-representation of actual full curl ram numbers, as we are conservative in classifying full curls from the air. Figure 2 illustrates sheep survey information for GMU 14C since 1976. Considering that most areas were surveyed this year, we consider the population to be stable to slightly increasing.


ALASKA
DEPARTMENT OF FISH AND GAME