Dall Sheep Management Report and Plan, Game Management Units 12, 13C, and 20D, Tok Management Area:

Report Period 1 July 2016–30 June 2021, and Plan Period 1 July 2021–30 June 2026

Jeffrey J. Wells



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Alaska Department of Fish and Game

Division of Wildlife Conservation

2025

Dall Sheep Management Report and Plan, Game Management Units 12, 13C, and 20D, Tok Management Area:

Report Period 1 July 2016–30 June 2021, and Plan Period 1 July 2021–30 June 2026

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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. These taxes and fees fund the federal Wildlife Restoration Program and the State of Alaska's Fish and Game Fund, which provided funding for the work reported on in this publication.

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 Jason Caikoski, Management Coordinator for Region III for the Division of Wildlife Conservation.

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This document, published in PDF format only, should be cited as:

Wells, J. J. 2025. Dall sheep management report and plan, Game Management Units 12, 13C, and 20D, Tok Management Area: Report period 1 July 2016–30 June 2021, and plan period 1 July 2021–30 June 2026. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2025-11, Juneau.

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Cover Photo: Dall sheep rams observed during an aerial survey within the Tok Management Area. ©2015 ADF&G. Photo by Jeff Wells.

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Purpose of this Report

This report provides a record of survey and inventory management activities for Dall sheep (*Ovis dalli*) in the Tok Management Area (TMA) for the 5 regulatory years 2016–2020 and plans for survey and inventory management activities in the next 5 regulatory years, 2021–2025. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY16 = 1 July 2016–30 June 2017). This report is produced primarily to provide agency staff with data and analysis to help guide and record agency 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 (ADF&G, the department) Division of Wildlife Conservation (DWC) launched this 5-year report to report more efficiently on trends and to describe potential changes in data collection activities over the next 5 years. It replaces the Dall sheep management report of survey and inventory activities that was previously produced every 3 years.

I. RY16–RY20 Management Report

Management Area

The TMA is in east-central Alaska on the eastern edge of the Alaska Range and is centered on lat 63°17′N, long 143°21′W (Fig. 1). It is managed within the Division of Wildlife Conservation's Region III management area (Interior and Northeast Alaska) and includes portions of Game Management Units 12, 13C, and 20D. Major drainages within the TMA include the Tok, Robertson, and Johnson river drainages. The TMA encompasses 1,800 mi², of which approximately 70% is generally considered suitable Dall sheep habitat (approximately 1,250 mi² is at or above 4,000 feet in elevation). Elevations within the TMA range from 1,600 feet in the lowland areas to >8,000 feet at the highest peaks. Tree line varies but typically occurs at 3,000–4,000 feet. Lowland areas are dominated by spruce forest, and higher elevations are dominated by shrub communities, subalpine and alpine tundra, and large swaths of glaciated areas. The climate is typical of Interior Alaska, where temperatures at lower elevations frequently reach 80° F in summer and -40° F in winter, and overall precipitation is relatively light.

Summary of Status, Trend, Management Activities, and History of Dall Sheep in the Tok Management Area

The TMA was created in 1974 to provide Dall sheep hunters with the opportunity to harvest large-horned, trophy rams in uncrowded, high-quality hunting conditions (ADF&G 1976). This particular area was chosen based partially upon the trophy horn growth potential of rams within the area (ADF&G 1976). In comparing horn growth qualities of Dall sheep rams inhabiting 18 areas within 7 mountain ranges in Alaska, rams in the TMA had the fourth highest quality index value, which was based on a variety of factors, including horn volume, maximum sustained growth, and diameter of curl (Heimer and Smith 1975). In addition to the trophy horn growth potential of rams, the area within the TMA was selected based upon the relative accessibility of the area to hunters using a variety of transportation methods (ADF&G 1976). Additional information on the early history of the TMA can be found in Kelleyhouse (1989).



Produced by ADF&G, 2022 using ArcGIS[™] software (Esri, Redlands, California); base map source: ADF&G, GINA (UAF), USGS, ADF&G GIS.

Figure 1. Tok Management Area, Alaska, sheep survey units, regulatory years 2016–2021.

The most recent sheep population survey for the entire TMA was conducted in the mid-1980s, with a population estimate of 2,000 sheep (Kelleyhouse 1989). Anecdotal information from longtime area guides, transporters, and sheep hunters indicates that the population in TMA has declined since RY74. However, sheep survey data collected during RY74–RY01 is inadequate to analyze population trend during that time in the TMA. Sheep numbers during RY02–RY15 showed fluctuations, including a notable decline following the winter of 2012–2013, but were likely overall stable (Wells 2019).

Sheep harvest in the TMA is managed by controlling hunter numbers through a drawing permit system. This system is designed to keep annual harvests low enough to allow some rams to attain their maximum potential horn size and to reduce hunter crowding. In RY74, 60 permits were issued. From RY75 to RY01, 120 drawing permits were issued annually, except for RY85 when Tier II subsistence permits were issued. During RY02–RY09, 100 drawing permits were issued annually. Separate from the ram drawing permits, drawing and registration ewe hunts were conducted during some years prior to RY85, and governor's permits (1–2 per year) have been issued for most years since RY02. To address crowding concerns, permits were evenly split between 2 hunt periods beginning in RY09, and the total number of annual permits has ranged

from 60–100 since then. Beginning in RY14, ADF&G implemented a systematic method to determine the number of permits to award based on survey and harvest data, which was developed in conjunction with the Upper Tanana Fortymile Advisory Committee (Wells 2019). Overall, the TMA management strategy has resulted in minimal hunter crowding and competition and has generally resulted in an abundance of legal rams, including rams with horns \geq 40 inches. In addition, this management strategy has allowed ADF&G and the Alaska Board of Game to maintain components of a high-quality hunting experience, including unrestricted methods of access to the area.

Management Direction

EXISTING WILDLIFE MANAGEMENT PLANS

TMA Dall sheep survey and inventory management activities for RY16–RY20 were outlined in Wells (2019). Prior to RY16, *Alaska Wildlife Management Plans: Interior Alaska, Tok Sheep Management Plan* (ADF&G 1976) provided direction for Dall Sheep management, and was reviewed and modified through public comments, department recommendations, and Alaska Board of Game actions over the years. A record of these changes can be found in the TMA Dall sheep species management reports. The plan portion of this document contains the current management plan for sheep in the TMA.

GOALS

During RY16-RY20, the TMA Dall sheep management goals were as follows:

- G1. Maintain a harvestable population of Dall sheep fluctuating within historical limits of abundance and the carrying capacity of their habitat.
- G2. Provide for the opportunity to be selective in hunting and to hunt large-horned sheep.
- G3. Provide the opportunity to hunt sheep under aesthetically pleasing and uncrowded conditions.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The TMA sheep population has a negative customary and traditional use finding, as determined by the Board of Game.

Intensive Management

The TMA sheep population has not been identified as an intensive management population by the Board of Game.

MANAGEMENT OBJECTIVES

During RY16-RY20, the TMA Dall sheep management objectives were as follows:

M1. Maintain an annual average horn size of >36 inches on harvested rams.

M2. Maintain an annual average age of >8 years for harvested rams.

M3. Maintain at least 7% rams with \geq 40 inches horns in the annual harvest.

M4. Using a full-curl harvest strategy, maintain an annual harvest of 30-45 rams.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct population abundance (minimum count) and composition surveys (Goal G1).

Data Needs

Minimum count population data and composition estimates are used for 3 primary purposes. The first is to assist in determining the number of draw permits to award. The total number of sheep observed during surveys is 1 parameter used in the decision matrix that guides how many draw permits to award in any given year (Fig. 2). The second purpose is to inform the public, including hunters, advisory committees, and the Alaska Board of Game, of the population status and potential trends. Last, the third purpose is for general long-term monitoring of the population.

Methods

During RY16–RY20, we (ADF&G staff) conducted annual aerial population abundance (minimum count) and composition surveys within portions of the TMA. During RY16–RY19, we completed survey units (SUs) 1–7, which encompasses approximately 990 mi², or about two-thirds of the available sheep habitat in the TMA (Fig. 1). This area was surveyed annually during RY06–RY19 and includes the 580 mi² area surveyed during 2002–2004 (SUs 1–4). Due to budget constraints, we only completed SUs 2–3 (400 mi²) during RY20. All surveys were flown in Piper PA-18 Super Cubs and were flown during July when snow cover in the alpine is typically at or near its lowest level (outside of the hunting season). Surveys were usually conducted during early morning to avoid turbulence, and surveys were not conducted when there was low cloud cover obscuring portions of sheep habitat.

Survey crews consisted of a pilot and an observer seated behind the pilot. All the pilots were experienced with Dall sheep surveys, while observer experience levels varied. The flight path and technique varied by pilot-observer team, although typically the surveys were flown along contours in suitable sheep habitat, and flight paths were maintained at 300–700 feet above ground level at airspeeds of 60–80 mph. Our primary goal was to thoroughly search each survey unit and to observe as many of the sheep within the unit as possible. When we observed sheep,



Figure 2. Permit matrix for determining the number of sheep draw permits to issue within the Tok Management Area, Alaska. The permit matrix was first used during regulatory year 2014.

^a Total sheep counted within survey units 1–4.

we recorded the group size, location (latitude and longitude), and composition. Composition was defined by the following categories: ewe (or ewe-like; this category includes yearlings of both sexes and rams of ¹/₄ curl or less), lamb, <¹/₂ curl ram, ¹/₂ to ³/₄ curl ram, ³/₄ to <full-curl ram, \geq full-curl ram (Appendix A). We took photographs (using a Nikon D810 digital camera) of some of the groups to aid in determining the overall number and composition. No sightability correction factor was estimated during the RY16–RY20 surveys; therefore, the total number of sheep observed represents a minimum count estimate.

<u>2016</u>

We conducted aerial surveys during 5–13 July, and overall, survey conditions were good. Low snow cover persisted throughout the survey area, and weather conditions were generally favorable. Although it took over a week to complete the survey, the likelihood of sheep movements between SUs was considered to be minimal. We completed SUs 1 and 4–7 on 5 and 7 July and SUs 2–3, which are separated from the other SUs by the Tok River, on 13 July. The total flight time (including ferry time) was 36.2 hours and total survey time was 25.7 hours. Additional survey information can be found in the survey memo (Jeff Wells, Assistant Area Biologist, ADF&G, Tok, Tok Management Area aerial sheep survey memorandum, 24 August 2016).

<u>2017</u>

We conducted aerial surveys during 14–22 July, and overall, survey conditions were excellent. Low snow cover persisted throughout the survey area and, in general, weather conditions were excellent. The total flight time (including ferry time) was 31.6 hours and total survey time was 26.5 hours. Additional survey information can be found in the survey memo (Jeff Wells, Assistant Area Biologist, ADF&G, Tok, Tok Management Area aerial sheep survey memorandum, 31 July 2017).

2018

We conducted aerial surveys during 10–19 July, and overall, survey conditions were fair-togood. Although the weather conditions were overall excellent, significantly more snow than normal remained within portions of the survey area, especially on the north-facing slopes and within blocks with higher elevation areas (e.g., SU 1 along the West Fork Robertson River). The total flight time (including ferry time) was 34.8 hours and total survey time was 27.5 hours. Additional survey information can be found in the survey memo (Jeff Wells, Assistant Area Biologist, ADF&G, Tok, Tok Management Area aerial sheep survey memorandum, 27 August 2018).

2019

We conducted aerial surveys during 3–9 July, and overall, survey conditions were good-toexcellent. Due to a combination of low snow levels during the 2018–2019 winter and a warm spring and summer prior to the survey, snow levels were lower than average throughout the survey area. Furthermore, weather conditions during the survey were generally favorable. The total flight time (including ferry time) was 44.3 hours and total survey time was 32.2 hours. Additional survey information can be found in the survey (Jeff Wells, Assistant Area Biologist, ADF&G, Tok, Tok Management Area aerial sheep survey memorandum, 26 July 2019).

<u>2020</u>

Due to limited funding, we only conducted aerial surveys within SUs 2 and 3 (approximately 400 mi²) on 31 July. Greater than average snowfall during winter 2019-2020 in combination with cool summer temperatures led to greater snow persistence in the alpine compared to previous years. However, by the time of the survey, snow levels were approximately just above average and likely did not significantly affect sightability compared to previous years. Overall, the survey conditions were good, with the only factor that likely reduced sightability in some areas was turbulent conditions within the northwest section of the area surveyed. However, the area where turbulence was present was limited (e.g., Sheep Creek and Cathedral Creeks) and likely had a small overall impact on survey results. Total flight time (including ferry time) was 12.5 hours and total survey time was 10.9 hours. Additional survey information can be found in the survey memo (Jeff Wells, Assistant Area Biologist, ADF&G, Tok, Tok Management Area aerial sheep survey memorandum, 10 September 2020).

Results and Discussion

The TMA sheep population was likely relatively stable during 2016–2018 and likely declined between 2018–2020, with the most notable decrease occurring between summer 2019 to summer 2020. The average total number of sheep observed within SUs 1-7 during 2016-2019 was 1,141 (Table 1), which is similar to the previous 10-year annual average of 1,147. Similarly, the average total number of sheep observed within SUs 2–3 was 622 during 2016–2019 (Table 1) compared to the previous 10-year average of 569. Conversely, the total number of sheep observed during 2020 within SUs 2–3, which were the only SUs completed that year, was 294. That was the lowest number of sheep observed since regular surveys of these SUs began in 2002 and was 25% lower than the previous low of 390 observed in 2009. The reduction in the number of sheep observed was mostly the result of fewer ewes and lambs observed compared to previous years, while the number of rams observed was relatively similar to previous years. The number of ewes observed was 20% less than the previous low of 187 observed in 2009, while the number of lambs observed was 76% less than the previous low of 41 observed in 2013. The total number of rams observed was 134, slightly below the 2002–2019 average of 155. Although the specific factors that contributed to the decline in the population are unknown, it is likely that winter weather was a primary contributing factor. The snowpack in spring 2020 persisted through April and was considerably deeper than average in Tok and Mentasta Pass at the end of April (U.S. Department of Agriculture 2020).

Lamb-to-ewe ratios and ram composition varied during 2016–2020, with the most notable changes observed in 2020. Lamb-to-ewe ratio estimates ranged from 19–42 and averaged 31 lambs:100 ewes during 2016–2019 (Table 2), which matches the long-term (2002–2015) average. Conversely, the 2020 observed lamb-to-ewe ratio of 7:100 was the lowest observed since regular surveys began. For ram composition during this reporting period, the proportion of smaller rams increased while the proportion of larger rams decreased. The proportion of rams judged to be less than ½ curl increased to 20% in 2019 while the proportion of rams judged to be between ½ to less than ¾ curl increased to 37% in 2020 (Table 3), both of which are well above long-term averages. This was likely partially the result of the high number of lambs observed during 2017. Conversely, the proportion of rams judged to be full-curl or larger decreased from 28–30% during 2016–2018 to 16% in 2020. This decrease was likely due to a combination of factors, including poor lamb numbers observed during the 2012 and 2013 surveys (these rams

would have been 7-to-8-years old during the 2020 survey), higher than average harvest during the years preceding 2020 (especially RY18–RY19), and potentially the loss of some old-aged rams over the 2019–2020 winter.

Recommendations for Activity 1.1.

Continue.

ACTIVITY 1.2. Monitor distribution and movements (Goals G1 and G3).

Data Needs

There is anecdotal information from local longtime residents that sheep distribution within the TMA has changed over the last 20 or more years. Changes in sheep distribution could have direct impacts on the distribution of hunters on the landscape, and potentially on how permits are allocated both spatially and temporally since one of the primary management goals within the TMA is to provide the opportunity to hunt in uncrowded conditions.

Methods

Historic TMA sheep survey information was entered and digitized into ArcGIS for all years in which Global Positioning System (GPS) waypoints associated with observed sheep groups were recorded.

Results and Discussion

GPS waypoints were recorded for sheep groups observed during the 2002, 2003, 2010, 2011, and 2014–2021 surveys and for portions of the surveys conducted during 2004, 2008, 2009, 2012, and 2013. No formal analyses of this data were conducted during this reporting period.

Recommendations for Activity 1.2.

Discontinue. Although GPS locations of observed sheep groups should continue to be collected during future surveys, this activity should be removed for the next reporting period. The analytical power to detect changes in distribution since regular surveys began in 2002 is limited since GPS locations from observed sheep groups were not collected during most surveys prior to 2010. Instead, until more years of location data are available, sheep distribution can generally be assessed via Activity 1.1.

				Rams			Oth	er sheep		
	Survey	Legal	Sublegal	Unclassified	Total			Unidentified	Total	Total
Year	units	rams ^a	rams ^b	rams	rams	Ewes ^c	Lambs	sheep	other sheep	sheep
2016	1–7	92	238	0	330	571	177	2	750	1080
2017	1–7	115	290	0	405	643	270	0	913	1318
2018	1–7	116	275	0	391	554	108	0	662	1053
2019	1–7	75	253	0	328	604	179	1	784	1112
2016	2–3	45	109	0	154	335	98	0	433	587
2017	2–3	49	158	0	207	369	157	0	526	733
2018	2–3	49	119	0	168	337	62	0	399	567
2019	2–3	32	129	0	161	350	89	0	439	600
2020	2–3	21	113	0	134	150	10	0	160	294

Table 1. Tok management area Dall sheep composition counts from aerial surveys, summer 2016–2020, Alaska.

^a Full curl or larger.
^b Greater than ¹/₄-curl but less than full curl.

 $^{\rm c}$ Ewe classification also includes yearlings of both sexes and rams of 1/4-curl or less.

		Legal rams:	Sublegal rams:	Total rams:	Lambs:	Lambs
Year	Survey units	100 ewes ^a	100 ewes	100 ewes	100 ewes	% of total
2016	1–7	16	42	48	31	16
2017	1–7	18	45	63	42	20
2018	1–7	21	50	71	19	10
2019	1–7	12	42	54	30	16
2020	2–3	14	75	89	7	3

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^a Ewe classification also includes yearlings of both sexes and rams of ¹/₄-curl or less.

Year	Survey units	< 1/2 curl	≥1/2 – <3/4 curl	≥3/4 – <full curl<="" th=""><th>≥Full curl</th><th>Total rams observed</th></full>	≥Full curl	Total rams observed
2016	1–7	8%	25%	39%	28%	330
2017	1–7	15%	27%	29%	28%	405
2018	1–7	17%	26%	27%	30%	391
2019	1–7	20%	30%	27%	23%	328
2020	2–3	16%	37%	31%	16%	134

Table 3. Tok management area Dall sheep observed ram composition (by degree of horn curl) as estimated during aerial surveys, 2016–2020.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor and analyze harvest data (Objectives M1-M4).

Data Needs

Harvest data are necessary to determine whether trophy management objectives are achieved.

Methods

Annual harvest was estimated from mandatory harvest report cards and through the mandatory horn sealing process. If timely harvest reports are not received, hunters receive up to 2 reminder letters, an e-mail (if an e-mail address was provided by the hunter), and in some situations, a telephone call. Successful hunters are required to have the horns sealed within 30 days of the date of kill at an ADF&G office. During the sealing process, a uniquely numbered aluminum plug is placed in the horn, the sheep's age is determined, a broken determination is made (both, 1, or neither horns broken), and measurements are taken (including total length and base circumference). Additional horn measurements were collected from rams that were harvested during RY16–RY18 and sealed in Anchorage, Fairbanks, or Palmer as part of a statewide research project assessing horn morphometrics (Wendling et al. 2019). Except for this research project, no other formal analyses were conducted on the horn data that was collected during the sealing process.

Season and Bag Limit

The sheep hunting season for resident and nonresident hunters during RY16–RY20 was 10–25 August for DS102 and 26 August–20 September for DS103. In addition, 1 Alaska Governor's TMA Dall sheep permit was auctioned annually to raise funds for wildlife research and management in Alaska (1 additional Alaska Governor's TMA permit was given out for RY20), and the season for this permit was 10 August–20 September. The bag limit for all TMA permits was 1 legal ram every 4 years; legal rams are those with a full-curl or larger horn, or with both horns broken (broomed), or at least 8-years old.

Harvest by Hunters-Trappers

Total reported annual harvest during RY16–RY20 averaged 40 rams per year (range 27–56; Table 4), which is greater than the previous 5-year average annual harvest of 23 rams per year, but similar to the RY06–RY10 average of 39 rams per year. The management objective to harvest 30–45 rams per year was met or exceeded during RY17–RY19 and was not met during RY16 and RY20. This management objective was not met in RY16, mostly due to the lower number of permits issued (61 total), while during RY20 it was not met mostly due to low success rates. Conversely, the management objective was exceeded in RY18 mostly due to high success rates. The harvest of 56 rams in RY18 and 27 rams in RY20 was the highest and lowest harvest recorded, respectively, during years in which 100–102 permits were issued. The average annual harvest was similar between the DS102 (19 rams/year) and DS103 (20 rams/year) hunts.

Table 4. Tok management area (TMA) harvest of Dall sheep rams, regulatory years 2016–2020, Alaska.

						Mean			
	Regulatory	Permits	%	%	Total	horn			Mean
Hunt no.	year	issued	hunted	successful	harvest	length ^a	<i>n</i> ≥4	0″ (%) ^b	age
DS102	2016	30	87	65	17	36.0	1	(6)	8.2
	2017	40	83	67	22	37.4	5	(23)	9.0
	2018	50	88	61	27	37.3	5	(19)	9.1
	2019	50	92	41	19	37.1	3	(16)	9.2
	2020	50	84	24	10	36.1	1	(10)	8.8
DS103	2016	30	77	39	9	37.0	2	(22)	7.8
	2017	40	85	50	17	37.7	3	(18)	9.3
	2018	50	86	65	28	37.2	3	(11)	8.9
	2019	50	86	65	28	36.7	5	(18)	9.7
	2020	50	82	39	16	35.3	2	(13)	7.9
All	2016	61	82	54	27	36.6	4	(15)	8.1
TMA	2017	81	84	59	40	37.6	8	(20)	9.1
permits	2018	101	87	64	56	37.3	8	(14)	9.1
combined	2019	101	89	53	48	37.0	9	(19)	9.5
	2020	102	83	32	27	35.7	3	(11)	8.3

^a Mean horn length reported in inches.

^b Number of rams harvested with horn length greater than or equal to 40" in length.

^c DS102, DS103, SS101, and SS102.

Annual mean horn length during RY16–RY20 was 36.8 inches (range 35.7–37.6; Table 4). The management objective for a mean horn size of >36 inches was met each year except RY20. One contributing factor as to why the management objective was not met in RY20 could be due to the reduction in the sheep population, including the number of legal rams, between RY19–RY20. This reduction could have resulted in hunters being less selective when harvesting rams and/or resulted in fewer larger rams in the population available for harvest, both of which could have contributed to the reduction in the average horn size. Average horn size was slightly higher in the DS102 hunt (36.9 inches) compared to the DS103 hunt (36.8 inches) while the governor's tag

permits had the highest average horn size (39.5 inches). Mean horn size during RY17 (37.6 inches) was the largest observed in the last 30 years.

The annual proportion of rams with horns \geq 40 inches averaged 16% (range 11–20%, Table 4) during RY16–RY20, and the management objective to maintain at least 7% rams with 40-inch or greater horns in the harvest was met during each year. The proportion of harvested rams with horns \geq 40 inches in RY17 was the second highest observed in the last 30 years, and the 5-year average proportion was the highest recorded during the last 30 years.

The annual mean age of harvested rams during RY16–RY20 was 8.8 years (range 8.1–9.5; Table 4), and the management objective for a mean age of >8 years was met every year. The average age of 9.5 years in RY19 was the highest average age since RY08. The proportion of 7-to-8-year-old rams in the harvest decreased from 34% during RY16–RY18 to 20% in RY20, while the proportion of rams 5-to-6-years old increased from 4% during RY16–RY18 to 30% in RY20. This change in the composition of the harvest is likely a reflection of the poor lamb cohorts during 2012–2013 (rams born during these years would have been 7-to-8-years old in RY20).

Permit Hunts

During RY16–RY20, an average of 5,242 and 3,097 applications were submitted annually for DS102 and DS103 permits, respectively. Beginning in RY17, hunters could submit up to 6 applications for the same species, and these 6 applications could be submitted for the same or different hunts. As a result, the number of applications approximately doubled in RY17 compared to RY16. The annual chance of being drawn for DS102 and DS103 hunts during RY16–RY20 ranged from 0.8–0.9% and 1.3–1.7%, respectively. Since RY14, ADF&G has used a systematic method that was developed in conjunction with the Upper Tanana Fortymile Advisory Committee to aid in determining the number of permits to award based on survey and harvest data (Fig. 2). The goals of this approach are to allow for maximum participation in the TMA hunt while simultaneously achieving management objectives. The matrix draws on survey results from SUs 1–4; however, since only SUs 2 and 3 were completed during the 2020 survey, the portion of the matrix related to the survey results were altered to be applicable to only these 2 SUs for determining the RY21 permit numbers.

Hunter Residency and Success

Mean annual success rate during RY16–RY20 was 52%, which is higher than the RY11–RY15 average annual success rate of 41%. The RY18 success rate of 64% was the highest reported success rate during the past 30 years. Mean success rates were identical between the DS102 and DS103 hunts.

Harvest Chronology

Similar to prior reporting periods, most (68%) of the harvest for both the DS102 and DS103 hunts during RY16–RY20 occurred during the first week of the open season.

Transport Methods

Similar to prior reporting periods, the type of transportation used by most successful hunters during RY16–RY20 was airplanes (72%), followed by a combination of highway vehicles and walking in on foot (10%) or 4-wheelers (8%).

Other Mortality

A local pilot observed a dead ram that was mostly intact on 29 July 2019 in upper Station Creek and ADF&G retrieved the ram via helicopter later that day. The ram, which was partially scavenged by the time it was retrieved, was sent to Dr. Kimberlee Beckman in Fairbanks for a necropsy. She determined that the cause of death was likely due to pneumonia (necropsy report #2019-122, unpublished report obtained from Dr. Kimberlee Beckman, Alaska Department of Fish and Game, Fairbanks, Alaska).

Alaska Board of Game Actions and Emergency Orders

During RY16–RY20, the Alaska Board of Game did not take any actions effecting the TMA nor did ADF&G issue any emergency orders effecting the TMA.

Recommendations for Activity 2.1.

Continue the systematic approach to determine the number of permits to be awarded (Fig. 2) but modify the matrix so the portion based on the survey results is applicable to whichever areas are surveyed during any given year.

ACTIVITY 2.2. Monitor disease prevalence (Goal G1).

Data Needs

Prior to this reporting period, no disease monitoring has been conducted within the TMA since 1990. It is important to establish (or reestablish) a baseline presence-absence of pathogens to increase the chances of detecting a change in pathogen presence in the future (Wild Sheep Working Group 2017).

Methods

Nasal swabs were collected from most rams harvested within the TMA during RY17–RY19 as part of a statewide *Mycoplasma ovipneumoniae* (*M. ovi*) bacterium surveillance effort led by the ADF&G Wildlife Health and Disease Surveillance Program. Furthermore, an experimental sampling protocol was attempted in RY17 that utilized samples collected by hunters. Sampling kits were distributed to 30 hunters who voluntarily agreed to collect a variety of samples if they were successful in harvesting a ram. The requested samples included a section of lower leg bone (body condition), feces (parasite load), muscle (DNA), blood (disease screening), and liver (trace minerals and contaminants).

Results and Discussion

Preliminary results of the statewide *M. ovi* surveillance effort can be found in ADF&G (2020a and 2020b).

Although some hunters turned in samples as part of the volunteer sampling process during RY17, little usable data was obtained from the samples due to how the samples were handled in the field.

Recommendations for Activity 2.2.

Disease sampling for TMA sheep will be based upon recommendations from the ADF&G Wildlife Health and Disease Surveillance Program. Tok ADF&G staff will continue to investigate reports of dead sheep observed within the TMA and will make every effort possible to investigate and collect samples from these sheep in a timely manner.

Discontinue obtaining samples from hunter-harvested rams in the field, unless the protocol can be altered to increase the chances of obtaining useable samples.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor habitat use (Goal G1).

Data Needs

Changes in habitat could lead to changes in sheep distribution; however, little is known about the sheep habitat within the TMA. The only study conducted specifically on sheep habitat within the TMA was within the Sheep Creek and Robertson River drainages in the late 1970s (Winters 1980). This study investigated TMA sheep summer habitat, including food utilization and nutritional quality.

Methods

The sheep habitat plots included in Winters (1980) were digitized into ArcGIS based upon the map included in his thesis. I assessed several of these plots on 3 August 2017 and recorded the general habitat types at each plot and took pictures in the 4 cardinal directions. Other than my visit to these plots, no other sheep habitat work was completed during RY16–RY20.

Results and Discussion

On 3 August 2017, I visited plots 1, 4–7, B, D, H, and J. I did not find any visible markers when visiting these sites, so there was no way to assess how close the visited locations were to the Winters (1980) plots. The vegetation at these sites included shrubs (i.e., alder, willow, and dwarf birch species), graminoids, and forbs. I uploaded the pictures I took at the plots along with my associated notes into the DWC Wildlife Information Network (WinfoNet) database.

Recommendations for Activity 3.1.

Discontinue. Future sheep habitat monitoring within the TMA should be based upon management needs and should be guided by consultation with biometric and research staff.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Inadequate funding resulted in smaller areas surveyed during RY20 compared to previous years. Given the high demand from hunters, the unique qualities of this hunt area, and the direct application of survey results to determining permit numbers, full survey funding should be

pursued for the next reporting period. The lack of full survey funding will likely result in a conservative approach to determining permit numbers.

Data Recording and Archiving

- All electronic files such as survey memos, reports, survey data, and maps are located on the Tok server (S:\Wells\Sheep\TMA Sheep and S:\Wells\MAPS\TMA Sheep). All hard copy data sheets, paper files, etc. are found in the file cabinet in the conference room in the Tok office.
- Electronic copies of survey memos, survey data, and maps are stored in the WinfoNet data archive. Project Title: Tok Sheep. Primary Region: Region III.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

Minimum count and composition surveys during RY16–RY20 suggest that the TMA sheep population decreased during this reporting period, mostly during winter 2019–2020. Although similar changes in the population have been observed in past years, such as the decrease that was observed following the severe winter of 2012–2013, the number of sheep observed in RY20 was the lowest since surveys began in 2002. Although data was not collected specifically to address contributing factors to the decline, it is likely that weather was a primary contributing factor. In conjunction with the decrease in the TMA sheep population, the proportion of rams judged to be full-curl or larger also decreased during this reporting period. Under the assumption that rams typically become full-curl at 8-years of age, legal ram numbers are likely to remain below average during 2021–2022 based upon the lower-than-average number of observed lambs and lamb-to-ewe ratios during 2012–2014. Similarly, legal ram numbers could dip again around 2028 given the low lamb numbers observed during 2020.

The TMA management objectives were achieved in most years during RY16–RY20. The management objective related to average horn size was met each year except RY20, when a reduced sheep population (including legal ram numbers) was a likely contributing factor to the failure to meet the objective. The management objectives related to the average age and proportion of rams with horns \geq 40 inches were met during all 5 years. Last, the management objective to harvest 30–45 rams per year was not met in RY16 or RY20. Although this objective might have been met in RY16 if the number of permits had been increased, an increased harvest likely would have decreased the likelihood of achieving the trophy horn management objectives after RY16. In RY20, the reduced sheep population likely contributed to low hunter success rates, and the combination of these factors contributed to the failure to meet this objective despite the high number of permits issued that year. The primary management action for achieving the

TMA management objectives is to alter the number of drawing permits. The systematic approach that was used during RY16–RY20 to guide how many permits to award should be continued and should help in achieving management objectives during RY21–RY24.

II. Project Review and RY21–RY25 Plan

Review of Management Direction

MANAGEMENT DIRECTION

Unless directed otherwise by the Board of Game or public stakeholders, the RY16–RY20 management direction and goals for the TMA will remain unchanged for RY21–RY25.

GOALS

- G1. Maintain a harvestable population of Dall sheep fluctuating within historical limits of abundance and the carrying capacity of their habitat.
- G2. Provide for the opportunity to be selective in hunting and to hunt large-horned sheep.
- G3. Provide the opportunity to hunt sheep under aesthetically pleasing and uncrowded conditions.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The TMA sheep population has a negative customary and traditional use finding, as determined by the Board of Game.

Intensive Management

The TMA sheep population has not been identified as an intensive management population by the Board of Game.

MANAGEMENT OBJECTIVES

M1. Maintain an annual average horn size of >36 inches on harvested rams. This objective will be considered met if the average annual horn size, as measured during the mandatory sealing process, exceeds 36 inches.

The management action taken related to this objective will be to alter the number of permits awarded in subsequent years, based on the 2-year average horn size (Fig. 3).

M2. Maintain an annual average age of >8 years for harvested rams. This objective will be considered met if the average annual age, as determined during the mandatory sealing process, exceeds 8 years.

Due to the full-curl harvest strategy used in the TMA, which restricts harvest to mature rams, this objective has historically been met and no management action beyond maintaining the full-curl harvest strategy has been necessary. However, if the objective is not met in the future, permit numbers could be altered to help achieve the objective.

M3. Maintain at least 7% rams with ≥40 inches horns in the annual harvest. This objective will be considered met if the annual proportion of rams with horns ≥40 inches, as measured during the mandatory sealing process, exceeds 7% of the total harvest.

The management action taken related to this objective will be to alter the number of permits that are awarded. This will be based upon the 2-year proportion of rams with horns \geq 40 inches (Fig. 3).

M4. Using a full-curl harvest strategy, maintain an annual harvest of 30–45 rams. This objective will be considered met if the annual harvest, as determined through the mandatory reporting and sealing process, is within 30–45 rams.

This objective is secondary to objectives M1–M3. Permit numbers are altered largely with the intent to meet objectives M1 and M3 (Fig. 3), which means that at lower permit numbers (e.g., 60) the harvest will likely be lower than 30 rams. However, at the higher permit numbers (80 and above), this harvest objective is achievable and reflects the general intent of TMA management to allow for the harvest of 30–45 rams annually.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct population abundance (minimum count) and composition surveys (Goal G1).

Data Needs

No change from the prior reporting period. Minimum count population data and composition estimates will be used to 1) assist in determining the number of permits to award, 2) inform the public of population status and trends, and 3) for general long-term monitoring of the population.

Methods

Aerial survey methods will be the same as those described in the report section for RY16–RY20. Although the goal will be to complete SUs 1–7 annually, budget constraints may not allow for this during each year. Therefore, if the entire area is not completed, the secondary goal will be to complete SUs 1–4, while the tertiary goal (if funds are not available for SUs 1–4) will be to complete SUs 2–3.



Figure 3. Updated permit matrix for determining the number of sheep draw permits to issue annually within the Tok Management Area, Alaska. The updated permit matrix will be used beginning in regulatory year 2021.

^a 20% less than the long-term (defined as all years since 2002, excluding the current survey year) average number of sheep observed.

 $^{\rm b}$ 40% greater than the long-term average number of sheep observed.

2. Mortality-Harvest Monitoring

Activity 2.1. Monitor and analyze harvest data (Objectives M1–M4).

Data Needs

No change from the prior reporting period. Harvest data are necessary to assess whether the trophy harvest management objectives are achieved.

Methods

No change from the prior reporting period, except small changes will be made to the permit matrix. Given the difficulties in planning long-term surveys in relation to budgetary and other constraints, the permit matrix will be altered to reflect a 20% reduction (or a 40% increase for the last section of the matrix) of whichever area is surveyed compared to the long-term average (Fig. 3) as opposed to the set number that was based on SUs 1–4 in the previous matrix (Fig. 2). This will allow the permit matrix to be used regardless of the area surveyed, provided the area surveyed is a part of the SUs previously surveyed and is representative of the area as a whole. The upper bounds of the survey-related portion of the matrix is a greater difference from the long-term average compared to the lower bounds because a large number of sheep on the landscape will likely be needed to effectively spread hunter effort temporally and spatially to meet the management goal of providing the opportunity to hunt sheep under aesthetically pleasing and uncrowded conditions. Conversely, the lower bound is a smaller difference from the long-term average to be more conservative in reacting to potentially large reductions in the TMA sheep population. The remainder of the matrix remains unchanged.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

No change from the prior reporting period; full survey funding should be pursued for future reporting periods.

Data Recording and Archiving

RECORDING

- Dall sheep survey form (Appendix A)
- ArcGIS version 10.6 (store and analyze spatial data)

ARCHIVING

- Harvest data will be stored on an internal database housed on the Wildlife Information Network (WinfoNet) server and archived in WinfoNet under *Harvest Information*.
- All electronic files such as survey memos, reports, survey data, and maps will be located on the Tok server (S:\Wells\Sheep\TMA Sheep and S:\Wells\MAPS\TMA Sheep). All hard copy data sheets, paper files, etc. will be stored in the file cabinet in the conference room in the Tok office.

• electronic copies of survey memos, survey data, and maps will also be stored in the WinfoNet data archive. Project Title: Tok Sheep. Primary Region: Region III.

Agreements

None.

Permitting

None.

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Appendix A. Aerial Dall sheep survey form for surveys conducted within the Tok Management Area, Interior Alaska, during 2016–2020.

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