Wolf Management Report and Plan, Game Management Unit 13:

Report Period 1 July 2010–30 June 2015, and

Plan Period 1 July 2015–30 June 2020

Heidi L. Hatcher

2018

Alaska Department of Fish and Game Division of Wildlife Conservation

Wolf Management Report and Plan, Game Management Unit 13:

Report Period 1 July 2010–30 June 2015, and

Plan Period 1 July 2015–30 June 2020

PREPARED BY:

Heidi L. Hatcher
Wildlife Biologist II

APPROVED BY:

Todd A. Rinaldi
Management Coordinator

REVIEWED BY:

W. Frank Robbins
Wildlife Biologist III

Michael R. Guttery
Biometrician II

Alaska Department of Fish and Game
Division of Wildlife Conservation
PO Box 115526
Juneau, AK 99811-5526

Funding for survey and inventory project 14.0 was provided through the Federal Aid in Wildlife Restoration grant program. 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.

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 area, 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 website.

This species management report and plan was reviewed and approved for publication by Todd A. Rinaldi, Region IV Management Coordinator for the Division of Wildlife Conservation, Palmer.

Species management reports and plans are available via the Alaska Department of Fish and Game's website (www.adfg.alaska.gov) or by contacting Alaska Department of Fish and Game, Division of Wildlife Conservation, PO Box 115526, Juneau, AK 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).

This document, published as a PDF only, should be cited as follows:

Hatcher, H. L. 2018. Wolf management report and plan, Game Management Unit 13: Report period 1 July 2010–30 June 2015, and plan period 1 July 2015–30 June 2020. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2018-26, Juneau.

Cover photo: Wolf on ridgeline in Unit 13. ©2018 ADF&G. Photo by Gerald Lee.

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 wolf (*Canis lupus*) in Unit 13 for the previous 5 regulatory years (RY; RY10–RY14) and plans for survey and inventory management activities in the 5 years following the end of that period (RY15–RY19). A regulatory year begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). 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 them of wildlife management activities. In 2016 the Alaska Department of Fish and Game's (ADF&G) Division of Wildlife Conservation (DWC) launched this 5-year report to more efficiently report on trends and describe potential changes in data collection activities over the next 5 years. It replaces the wolf management reports of survey and inventory activities that were previously produced every 3 years and supersedes the 1976 draft Alaska wildlife management plans (ADF&G 1976).

I. RY10–RY14 Management Report

Management Area

Unit 13 (60,549 km^2; 23,378 mi^2), Southcentral Alaska, consists of that area west of the east bank of the Copper River and drained by all tributaries into the west bank of the Copper River from Miles Glacier and including the Slana River drainages north of Suslota Creek; the drainages into the Delta River upstream from Falls Creek and Black Rapids Glacier; the drainages into the Nenana River upstream from the southeast corner of Denali National Park; the drainage into the Susitna River upstream from its junction with the Chulitna River; the drainage into the east bank of the Chulitna River upstream to its confluence with the Tokositna River; the drainages of the Chulitna River (south of Denali National Park) upstream from its confluence with the Tokositna River; the drainages into the north bank of the Tokositna River upstream to the base of the Tokositna Glacier; the drainages into the Tokositna Glacier; the drainages into the east bank of the Susitna River between its confluences with the Talkeetna and Chulitna Rivers; the drainages into the north and east bank of the Talkeetna River, including the Talkeetna River to its confluence with Clear Creek, the eastside drainages of a line up the south bank of Clear Creek to the first unnamed creek on the south, then up that unnamed creek to Lake 4408, along the northeast shore of Lake 4408, then southeast in a straight line to the northernmost fork of the Chickaloon River; the drainages into the east bank of the Chickaloon River below the line from Lake 4408; the drainages of the Matanuska River above its confluence with the Chickaloon River (Figure 1).

Unit 13 includes portions of 3 of Alaska's 32 ecoregions: the Alaska Range, the Chugach–St. Elias Mountains, and the Copper River Basin (ADF&G [n.d.]). Maps for Unit 13 boundaries and special management areas are found at http://www.adfg.alaska.gov/index.cfm?adfg=maps.main.

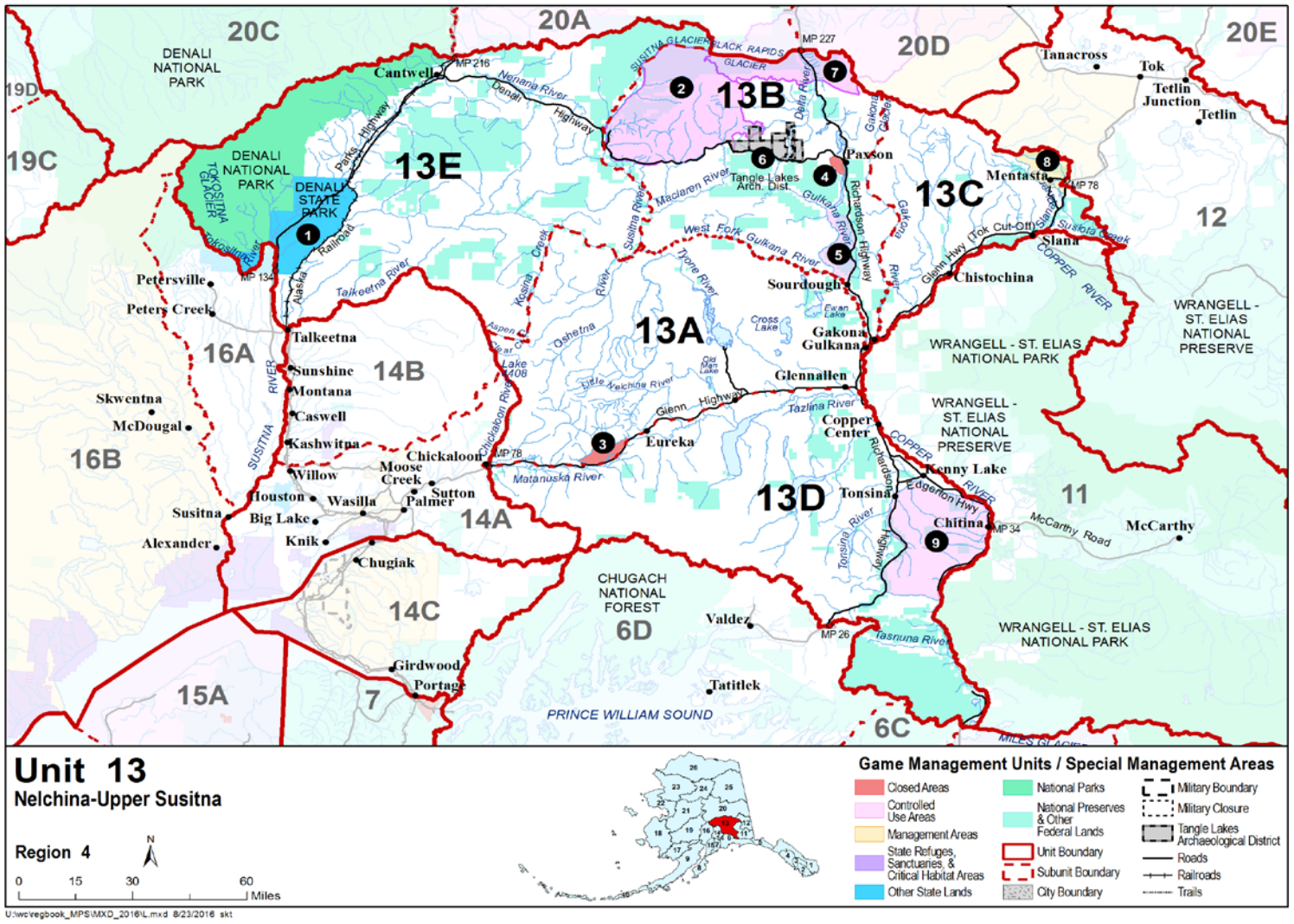

Figure 1. Game Management Unit 13, Southcentral Alaska.

Summary of Status, Trend, Management Activities, and History of Wolves in Unit 13

Wolf abundance in Unit 13 was low from the early 1900s until the early 1930s, reflecting correspondingly low prey densities (Skoog 1968). Wolf numbers increased after this period, until the implementation of predator control by the U.S. Fish and Wildlife Service between 1948 and 1953 (Ballard et al. 1987). Based on estimates in Rausch (1967), as few as 12 wolves may have remained in the unit in 1954. Following cessation of federal wolf control in 1959, wolf numbers increased. A population of 350–450 wolves was estimated in 1965 and fall population estimates in subsequent years exceeded 300 wolves through the early 1970s (Ballard et al. 1987). Increased harvest pressure reduced the population through the mid-1970s to an average of 275 wolves during the fall. Fall wolf numbers oscillated between 200 and 370 wolves over the next decade, during which time the ungulate populations began to increase.

Before RY88 same-day-airborne (SDA) land-and-shoot was allowed under general trapping regulations and was a common method for taking wolves in Unit 13. Land-and-shoot has been specifically differentiated from ground-shooting in the sealing process only since RY86; therefore, the specific impacts of the land-and-shoot method were not monitored prior to RY86. When land-and-shoot was discontinued in RY88, the Unit 13 wolf population increased, despite consistent harvest pressure. The moose (*Alces alces*) population soon began to decline due to harsh winters with deep snow (1988–1994) and increased wolf predation. During fall 1999 and 2000, unitwide wolf estimates peaked at more than 500 wolves (>8 wolves/1,000 km^2; >21 wolves/1,000 mi^2) and were the highest in more than 25 years.

In January 2000, a wolf control plan was initiated under intensive management (IM) to benefit the moose population, though land-and-shoot harvest was not allowed until January 2004 (RY03) when the current management objectives were instituted. Aerial shooting of wolves was allowed under wolf control permit conditions starting in RY06. The Unit 13 wolf population has since declined, and has been maintained at or near objective levels since spring 2006.

Management Direction

Wolves in Unit 13 are currently managed to reduce predation on ungulate populations by maximizing public wolf harvest when wolf numbers are within or above the population objective. Wolves are recognized as an integral part of the ecosystem throughout Unit 13 and are managed also to ensure that harvest by humans does not eliminate the species from the management area. Human uses of wolves in Unit 13 include hunting and trapping (for personal or commercial use of hides), photography, viewing, and scientific research (ADF&G 2002).

EXISTING WILDLIFE MANAGEMENT PLANS

- Direction, goals, and guidelines on wolves from *Alaska Wildlife Management Plans: Southcentral Alaska* (ADF&G 1976) have been utilized by the department over the years to provide guidance when informing the Alaska Board of Game.

- *Operational Plan for Intensive Management of Moose in Unit 13 during Regulatory Years 2016–2021* (ADF&G, *In prep*). This operational plan outlines the implementation of the IM plan in regulation (5 AAC 92.121).

GOALS

- Ensure enough wolves remain within Unit 13 to contribute to the health of the ecosystem while providing for the broadest possible range of human uses.
- Determine wolf population estimates for subunits annually or semi-annually.
- Achieve adequate harvest to maintain wolf population numbers within management objectives.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The Unit 13 wolf population has a positive customary and traditional use determination. The unitwide amount reasonably necessary for subsistence is 8–24 wolves.

Intensive Management

The Unit 13 wolf predation control area is established in 5 AAC 92.121. Intensive Management Plan V. Wolf control is authorized in this plan for the intensive management of moose.

MANAGEMENT OBJECTIVE

- Achieve and maintain a unitwide spring (posthunting and trapping season) population of 135–165 wolves in Unit 13 (2.2–2.7 wolves/1,000 km^2; 5.8–7.1 wolves/1,000 mi^2).

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Estimate spring wolf abundance using anecdotal staff and pilot observations, public reports, and harvest data–sealing records.

Data Needs

In order to administer the IM plan for Unit 13, an estimate of the spring (posthunting/trapping season) wolf abundance for Unit 13 is necessary to determine if wolf control will be warranted for the following hunting–trapping season.

Methods

After the first sufficient snow cover we contact area pilots, trappers, and individuals known to spend a significant amount of time in the field, and request that they report any wolf sightings or fresh tracks that are observed throughout the winter. Observations by members of the public are

recorded, as are sightings by staff during annual moose surveys. Data are categorized by type (actual wolf sightings or tracks), pack size, individual pelt colors, geographic location, date, and name of observer. Observations are then plotted using mapping software in an attempt to identify individual wolf packs and to consolidate multiple observations of any single pack.

At the end of winter and the conclusion of hunting–trapping season, a review of wolf sealing data is conducted. Data captured on harvest sealing records, including harvest location and estimated pack size, are compared to individual packs identified previously. If it is suspected that harvested wolves correspond to previously identified packs, the harvested wolves are subtracted from the members of the observed pack. Wolf packs identified through sealing records, but not documented through earlier observations or not subsequently harvested, are added as new observations. The final comprehensive observations, minus harvest, are used to estimate the spring wolf population for each subunit.

Results and Discussion

During this reporting period, spring minimum wolf population estimates averaged 131 wolves (2.2 wolves/1,000 km^2; 5.6 wolves/1,000 mi^2) (Table 1; R. K. Schwanke, Wildlife Biologist, ADF&G, memorandums for Unit 13 wolf population estimates, 2012 and 2013, Glennallen). During RY14, minimum wolf count (MWC; Gardner and Pamperin 2014) surveys were conducted in Units 13D and 13E. In Unit 13D, 10 wolf groups and 28 wolves were observed, while in Unit 13E 6 wolf groups and 27 wolves were observed. These observations contributed greatly to the accuracy of the spring wolf population estimate for Unit 13. Per the Unit 13 IM plan, aerial wolf control was suspended during RY12 as a result of the RY11 spring wolf estimate being below the objective. A spring wolf estimate was not determined for RY13. Aerial wolf control was suspended for RY14.

Recommendations for Activity 1.1

Modify: Conduct MWC surveys throughout Unit 13 to provide a minimum annual baseline with which observations and sealing records can be related. This will improve the accuracy of the annual wolf population estimate and provide sufficient information to determine if the wolf population is likely to be above, below, or within the Unit 13 population objective (135–165 wolves).

Table 1. Unit 13 fall and spring wolf population estimates, Southcentral Alaska, regulatory years[a] 2010–2014.

Regulatory	Population estimate[b]		
year	Fall[c]	Spring[d]	Packs
2010	314	146	57
2011	204	104	40
2012	266	191	50
2013	320		
2014		84	20–30

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010 = 1 July 2010–30 June 2011.
[b] Population estimates are derived through incidental observations, anecdotal reports, sealing records, and minimum counts when available.
[c] Fall estimate = pretrapping season population.
[d] Spring estimate = posttrapping season population.

2. Mortality–Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor harvest through sealing records.

Data Needs

Wolf harvest data are necessary to annually assess trends in harvest, corroborate anecdotal or incidental observations or survey results, and ensure that the population is not being harvested in excess of sustained yield and harvest objectives.

Methods

Harvested wolves are required to be sealed in Unit 13. Through this process, the data collected for each wolf harvested includes name of harvester, location of kill, method of take, month of take, method of transportation, sex of the wolf, color of the pelt, and estimated number of wolves in the pack. These data are entered and stored in databases accessible through ADF&G's Wildlife Information Network (WinfoNet), from which the data can be queried and analyzed when needed. Harvest is reported by regulatory year.

While some wolf harvest may go unreported, Alaska wolves cannot be sold commercially nor professionally tanned without being sealed. Unreported harvest of wolves in Unit 13 is suspected to be minimal.

Season and Bag Limit

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Unit 13		
Hunting: 10 wolves per day.	10 Aug–30 Apr	10 Aug–30 Apr
Trapping: No limit.	15 Oct–30 Apr	15 Oct–30 Apr

Steel traps and snares smaller than $^{3}/_{32}$-inch diameter may not be used from 15 October–9 November, or 1–30 April. During active predation control years, control permits are issued to pilots and gunners in November or December depending on snow conditions and completion of annual moose surveys by department staff. There are no bag limits. Predation control permits are valid through 30 April.

Under federal subsistence hunting regulations, federally qualified subsistence users (residents of Units 6, 9, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, Chickaloon, and Unimak Island) can harvest a limit of 10 wolves on federal lands in Unit 13 between 10 August and 30 April. These users can also trap an unlimited number of wolves on federal lands between 10 November and 31 March.

Results and Discussion

Harvest by Hunters–Trappers

Hunters and trappers reported harvesting 50–159 wolves annually (average of 93 wolves annually) in Unit 13 during RY10–RY14 (Table 2). This is down from the average of 109 wolves harvested annually during RY05–RY09, largely due to 2 years of suspended aerial wolf control during this reporting period. The average of 32 successful wolf harvesters in Unit 13 during RY10–RY14 was also down from the average of 45 successful harvesters during RY05–RY09, presumably for the same reason.

Table 2. Unit 13 wolf harvest, Southcentral Alaska, regulatory years[a] 2010–2014.

	Reported harvest				Method of take				
Regulatory year	M	F	Unk	Total	Trap/ snare	Shot	SDA[b]	Unk	Successful harvesters
2010	84	72	3	159	46	10	103	0	40
2011	48	43	0	91	16	35	40	0	22
2012	24	34	1	59	37	21	0	1	37
2013	54	47	1	102	26	16	60	0	34
2014	26	26	1	53	33	18	0	2	29

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010 = 1 July 2010–30 June 2011.
[b] Same-day-airborne (SDA) refers to land-and-shoot or aerial shooting.

Harvest Chronology

Wolf harvest in Unit 13 generally occurs throughout the open season with high variability based on annual climatological conditions that affect the timing of freeze-up and snow conditions (Table 3). Above average harvest occurred early in the season in RY14, presumably due to incidental take of wolves during moose and caribou (*Rangifer tarandus*) hunting excursions, and in response to the suspension of aerial wolf control, which generally results in higher percent of harvest occurring January–March.

Transport Methods

During years with active aerial wolf control permits, airplanes are generally the most utilized transport method for successful wolf harvest, followed closely by snowmachines (Table 4). Snowmachines are the most common method of transportation when aerial wolf control is inactive or suspended.

Other Mortality

Ballard et al. (1987) estimated natural mortality rates for radiocollared wolves in a portion of Unit 13. They attributed 11% of annual mortality to intraspecific strife and an additional 9% to accidents, injuries, starvation, and drowning. Ballard attributed the remaining 80% to harvest by humans.

Table 3. Unit 13 wolf harvest percent chronology by month, Southcentral Alaska, regulatory years[a] 2010–2014.

Regulatory year	Harvest percent chronology by month							*n*
	Aug–Oct	Nov	Dec	Jan	Feb	Mar	Apr	
2010	5	3	18	42	17	11	4	159
2011	2	1	10	23	13	44	7	91
2012	8	10	17	24	15	9	17	59
2013	9	3	5	28	34	17	4	102
2014	17	4	19	21	21	9	9	53

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010 = 1 July 2010–30 June 2011.

Table 4. Unit 13 wolf harvest percent by transport method, Southcentral Alaska, regulatory years[a] 2010–2014.

Regulatory year	Harvest percent by transport method								*n*
	Airplane	Dogsled, Skis, Snowshoes	Boat	ATV[b]	Snowmachine	ORV[c]	Highway vehicle	Unk	
2010	77	1	0	2	18	1	1	0	159
2011	45	1	0	0	48	2	3	0	91
2012	14	8	0	2	69	0	7	0	59
2013	68	6	0	1	23	1	1	0	102
2014	13	2	0	12	63	0	10	0	53

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010 = 1 July 2010–30 June 2011.
[b] ATV = all-terrain vehicles.
[c] ORV = off-road vehicles.

Alaska Board of Game Actions and Emergency Orders

There were no Alaska Board of Game actions or emergency orders for wolves in Unit 13 during this reporting period.

Recommendations for Activity 2.1

Continue.

3. Habitat Assessment–Enhancement

None.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

- Wolf sealing/harvest data are stored on an internal server (http://winfonet.alaska.gov/index.cfm).
- Wolf survey information is stored electronically on the Glennallen Shared Drive (O:\DWC\BGDIF\Fur\Core Fur Files\Wolf) and published in species wildlife management reports. These reports are available online at: http://www.adfg.alaska.gov/index.cfm?adfg=librarypublications.wildlifemanagement.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

Fluctuations in wolf abundance in Unit 13 are primarily a function of the annual implementation or suspension of aerial wolf control. Given this situation, wolves in Unit 13 are managed within an adaptive framework that requires annual review to maintain a reasonable balance within a highly dynamic system. Aerial wolf control is utilized to successfully achieve low wolf densities in an effort to lessen predation on Unit 13 ungulate populations. When wolf estimates drop below objective levels, aerial wolf control is suspended to allow wolf numbers to rise and prevent wolf densities from dropping below sustainable levels. Wolf population estimates and harvest rates during this reporting period, with aerial wolf control suspended in RY12, reinstated in RY13, and suspended in RY14, indicate that the adaptive management framework for wolves in Unit 13 is a successful tool for maintaining low wolf densities while providing for multiple user groups and ensuring the continuation of wolf presence within the unit. This adaptive strategy should be continued, with improved wolf population estimates through the implementation of annual minimum wolf counts.

To improve public participation and support of effective wolf management in the state of Alaska, it is necessary to increase awareness and understanding of the uses, conservation, and management of wolves, their prey, and their habitat. Management goals and objectives should be modified to support this endeavor.

II. Project Review and RY15–RY19 Plan

Review of Management Direction

MANAGEMENT DIRECTION

The existing management direction and goals for Unit 13 remain appropriate within the context of IM, statewide goals (ADF&G 2002), sustained yield, and species conservation. There is no evidence that the long-term sustainability of wolves in Unit 13 will be compromised by the current management direction or goals.

GOALS

To acknowledge the importance of public awareness and understandings of wolves within the context of wildlife management and healthy ecosystems in Unit 13, the following goal will be included with the existing management goals:

- Increase public awareness and understanding of uses, conservation, and management of wolves, their prey, and habitat in Alaska.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

No change recommended.

Intensive Management

No change recommended.

MANAGEMENT OBJECTIVE

- Achieve and maintain a spring (posthunting and trapping season) population of 135–165 wolves in Unit 13 (2.2–2.7 wolves/1,000 km^2; 5.8–7.1 wolves/1,000 mi^2).

Maintain this management objective while IM of moose is in effect for Unit 13. The current adaptive management framework has demonstrated success in reducing wolf population numbers to within or below this objective, which maintains adequate resiliency for wolf populations to rebound and exceed objective levels before intensive harvest resumes.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct MWC surveys to determine the minimum number of wolves in each subunit of Unit 13.

Data Needs

An MWC is necessary for each subunit to create an annual baseline for winter wolf counts. With the addition of harvest data and public observations (activity 1.2), an MWC provides sufficient information to estimate if spring wolf numbers are above, below, or within management objectives. This information is necessary to determine if predation control will be implemented for the following winter, without the added resources required for a more statistically rigorous sample unit probability estimator (Becker et al. 1998, 2004) or intensive aerial wolf survey (Gardner and Pamperin 2014).

Methods

MWC surveys, described by Gardner and Pamperin (2014), will be conducted in Unit 13 (Appendix). If resources allow, MWC surveys will be conducted in each subunit of Unit 13 annually or semi-annually. Annual MWC surveys will be scheduled with priority for completion in Units 13A, 13B, and 13E, with Units 13C and 13D to follow if weather and resources allow.

ACTIVITY 1.2. Using survey results, anecdotal observations, and harvest–sealing data, to develop a posttrapping–hunting season wolf population estimate.

Data Needs

An estimate of the posthunting–posttrapping season wolf population for Unit 13 in relation to the population objectives is necessary to determine if wolf control will be active the following season.

Methods

MWC survey results will be used in conjunction with reported observations as well as sealing data to refine information collected during the MWC surveys, and to remove any wolves subsequently harvested throughout the season. Analysis of observations and sealing data will be conducted as previously described.

2. Mortality–Harvest Monitoring

ACTIVITY 2.1 Monitor harvest through sealing records.

Data Needs

Wolf harvest data are necessary to annually assess trends in harvest, corroborate anecdotal or incidental observations or survey results, and ensure that the population is not being harvested in excess of sustained yield or IM objectives. This requires data associated with fur sealing and

stored in databases accessible through the WinfoNet server, including pack size, location of harvest, and hunter–trapper effort.

Methods

Harvested wolves will continue to be sealed, and sealing information will be entered and stored in databases accessible through WinfoNet. Sealing data will be queried and analyzed annually, or more frequently as needed.

3. Habitat Assessment–Enhancement

None.

4. Public Awareness and Understanding of Wolves, their Prey, and Habitat.

ACTIVITY 4.1. Engage in public interface and outreach.

Methods

Attend local advisory council meetings, when staffing and resources allow, to provide information on the biology, ecology, and management of wolves and their prey when questions, concerns, or misinformation arise. Engage in outreach opportunities with local agencies, organizations, and school groups to increase youth exposure to information on wolves, predator–prey ecology, and wildlife management in Alaska.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

- Wolf sealing–harvest data are stored on an internal server (http://winfonet.alaska.gov/index.cfm).
- Wolf survey information is stored electronically on the Glennallen Shared Drive (O:\DWC\BGDIF\Fur\Core Fur Files\Wolf) and published in species wildlife management reports. These reports are available online at http://www.adfg.alaska.gov/index.cfm?adfg=librarypublications.wildlifemanagement.

Agreements

None.

Permitting

None.

References Cited

ADF&G (Alaska Department of Fish and Game). [n.d.]. Alaska's 32 ecoregions [web page]. Division of Wildlife Conservation, Juneau. http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions (Accessed 4 April 2018).

ADF&G (Alaska Department of Fish and Game). *In prep*. Operational plan for intensive management of moose in Unit 13 during regulatory years 2016–2021. Division of Wildlife Conservation, Juneau.

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

ADF&G (Alaska Department of Fish and Game). 2002. Strategic plan. Division of Wildlife Conservation. Juneau. http://www.adfg.alaska.gov/static/research/plans/pdfs/strategic_plan_wc_2002.pdf (Accessed 4 April 2018).

Ballard, W. B., J. S. Whitman, and C. L. Gardner. 1987. Ecology of an exploited wolf population in South-central Alaska. Wildlife Monographs 98.

Becker, E. F., H. N. Golden, and C. L. Gardner. 2004. Using probability sampling of animal tracks in snow to estimate population size. Pages 248–270 [*In*] W. L. Thompson, editor. Sampling Rare or Elusive Species: Concepts, Designs, and Techniques for Estimating Population Parameters. Island Press, Washington, D.C.

Becker, E. F., M. A. Spindler, and T. O. Osborne. 1998. A population estimator based on network sampling of tracks in the snow. Journal of Wildlife Management 62(3):968–977.

Gardner, C. L., and N. J. Pamperin. 2014. Intensive aerial wolf survey operations manual for Interior Alaska. Alaska Department of Fish and Game, Wildlife Special Publication ADF&G/DWC/WSP-2014-01, Juneau.

Rausch, R. A. 1967. Some aspects of the population ecology of wolves, Alaska. American Zoologist 7(2):253–265.

Skoog, R. O. 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Doctoral dissertation, University of California, Berkeley.

♦ ♦ ♦

Appendix. Wolf census form.

APPENDIX A.
WOLF CENSUS FORM

Date _____ *GMU* _____ *Aircraft Hours* _____

Pilot _____ Observer _____

Snow Age	Snow Cover	Light Type	Light Intensity	Predominant Habitat in SU	Survey Rating
1. 1-2 days 2. 3-4 days 3. 5-6 days 4. 7+ days	1. Complete 2. Some low veg showing 3. Bare ground showing	1. Bright 2. Flat	1. High 2. Medium 3. Low	1. OPEN lower elev.shrubs/wetland 2. DECIDUOUS FOREST birch, aspen 3. MIXED FOREST 4. OPEN CONIFEROUS FOREST 5. DENSE CONIFEROUS FOREST 6. SUB-ALPINE SHRUB 7. BURN	A. Excellent B. Good C. Fair D. Poor

PACK INFORMATION

Ref. No.	SU track 1st spotted	Time 1st spotted	SUs containing tracks	SU w/ wolves	Time tracking ended	Pack size	Wolf colors	In/ Out	Comments/Pack Waypoint
1									
2									
3									


ALASKA
DEPARTMENT OF FISH AND GAME