



Use of Selawik National Wildlife Refuge by Western Arctic Herd Caribou, 2009-2017

Natural Resource Report NPS/ARCN/NRR—2018/1681



ON THE COVER

Rousing caribou on their southward fall migration after a light snow, Selawik National Wildlife Refuge, October 2010.
Photograph by: Kyle Joly

Use of Selawik National Wildlife Refuge by Western Arctic Herd Caribou, 2009-2017

Natural Resource Report NPS/ARC/NRR—2018/1681

Kyle Joly and Matthew D. Cameron

Arctic Network Inventory and Monitoring Program
Gates of the Arctic National Park and Preserve
4175 Geist Road
Fairbanks, AK 99709

July 2018

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the [Arctic Inventory and Monitoring Network's Caribou Vital Signs webpage](#) and the [Natural Resource Publications Management website](#). If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Joly, K., and M. D. Cameron. 2018. Use of Selawik National Wildlife Refuge by Western Arctic Herd caribou, 2009-2017. Natural Resource Report NPS/ARC/NRR—2018/1681. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	viii
Tables.....	ix
Executive Summary	x
Acknowledgments.....	vii
Introduction.....	1
Methods.....	3
Seasonal Range Use	3
Results.....	4
All Data	4
Seasonal Range Use	6
Discussion	13
Literature Cited	14

Figures

	Page
Figure 1. Study area (20km buffer around Selawik National Wildlife Refuge, white line) and the range of the Western Arctic Herd.....	2
Figure 2. Histogram of the number of caribou GPS locations, by month, within the study area, 2009-2017.....	4
Figure 3. Histogram of the number of caribou GPS locations, by month, within the Selawik National Wildlife Refuge, 2009-2017.....	5
Figure 4. 2016-2017 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	6
Figure 5. 2015-2016 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	7
Figure 6. 2014-2015 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	7
Figure 7. 2013-2014 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	8
Figure 8. 2012-2013 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	8
Figure 9. 2011-2012 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	9
Figure 10. 2010-2011 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	9
Figure 11. 2010-2017 fall (August 27 to November 16) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	10
Figure 12. 2010-2017 winter (November 17 to March 21) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	11
Figure 13. 2010-2017 spring (March 22 to June 8) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou.	11
Figure 14. 2010-2017 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou.....	12

Tables

	Page
Table 1. Programmatic collar deployment overview.	3
Table 2. Number and relative percentage of Western Arctic Herd caribou collar relocations, September 2009 – August 2017, within Selawik National Wildlife Refuge and the entire study area.	5
Table 3. Annual (August 27 – June 8) range areas of Western Arctic Herd caribou (95% and 50% kernels).....	6
Table 4. Seasonal range areas of Western Arctic Herd caribou (95% and 50% kernels) for 2010-2017.....	10

Executive Summary

Caribou (*Rangifer tarandus*) have used the area which is now the Selawik National Wildlife Refuge for millennia. Historical accounts from local hunters indicate that the range of caribou has expanded and contracted over time, and as recently as the early 20th century caribou were not found as far south as the Selawik River (USFWS 2007). Since 2009, GPS collars have been deployed on adult female caribou in the Western Arctic Herd by an inter-agency coalition that includes the Alaska Department of Fish and Game, Bureau of Land Management, National Park Service, and the U.S. Fish and Wildlife Service. This report documents the use of the Refuge and surrounding area by Western Arctic Herd caribou for an 8-year period from September 2009 until August 2017. Caribou typically entered the Refuge in September or October on their southward fall migration and continued south and west to wintering areas beyond the Refuge's southern boundary. Use of the Refuge by wintering caribou was limited. During the study period, winter use areas were concentrated in the Nulato Hills and the Seward Peninsula. Caribou again crossed the Refuge on their northward spring migration, typically starting in early April. The first caribou groups arriving typically consisted of pregnant females. Non-pregnant females and males trailed behind and were found on the Refuge as late as early June. July was the only month during the study period for which no collared caribou were recorded on the Refuge. In fall, heaviest use was along a north-south corridor in the east-central portion of the Refuge. Higher concentrations of use during fall were also detected on the north side of Selawik Lake, perhaps because the large waterbody acted as an obstacle to the caribou's southward migration. In winter, heaviest use was in the Selawik Hills, adjacent to but primarily outside the Refuge boundary. Within the Refuge, the Kobuk River delta and the flats to the east of Selawik village received the most usage. In spring, caribou tended to migrate slightly further west than on their fall migration. Heaviest use on their northward migration was in the Selawik Hills and around Inland Lake. The Refuge remains an important migratory corridor for Western Arctic Herd caribou. Changes in the distribution of the herd and/or biophysical environment will likely need to occur before the Refuge becomes important winter range again (like it last was in the late 1970s).

Acknowledgments

Collar deployments are conducted collaboratively with the Alaska Department of Fish and Game (ADFG), Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), and high school students in the region. Monitoring a herd that ranges over a vast and remote landscape provides numerous challenges. We thank ADFG biologists Alex Hansen and Lincoln Parrett for their assistance and collaboration in fieldwork that improved our efficiency. We also thank Susan Georgette, Alex Hansen, Lincoln Parrett, and Eric Wald for reviewing drafts that improved this report.

Introduction

Selawik National Wildlife Refuge (henceforth, the Refuge) was designated, in part, by Congress in 1980 expressly to conserve Western Arctic Herd (WAH) caribou (*Rangifer tarandus*) and their habitats (ANILCA 1980). Moreover, Congress mandated that the Refuge participate in ecological studies and management of the herd. The herd ranges over all of northwest Alaska (Figure 1; Joly and Cameron 2017). The calving grounds are on the rolling hills of the Utukok uplands on the north side of the Brooks Range. After calving the herd typically moves to the southwest for insect relief in the Lisburne Hills. Once insect harassment abates, the herd scatters into small bands across the Brooks Range and the North Slope. In fall, caribou begin to aggregate and migrate south. Often, a majority of the herd will migrate through the Refuge on their way to their winter ranges in the Nulato Hills and on the Seward Peninsula. In April, caribou return from those winter ranges and cross the Refuge again on their northward spring migration back to the calving grounds.

WAH caribou are of great importance to people for both consumptive and non-consumptive purposes, and to the ecosystem as a whole. At an estimated population size of 260,000 animals in 2017 (ADFG 2017), the WAH is a significant ecological force in northwest Alaska and the largest caribou herd in the state. The heritage and traditions of Alaska Natives in approximately 40 subsistence-based communities in the region have been shaped by the availability of these caribou (Western Arctic Herd Working Group 2003), including those villages that are most closely linked to the Refuge such as Selawik, Noorvik, and Buckland. The presence and relative abundance of WAH caribou have substantial impacts on the populations of wolves, bears, and wolverines in the area. Caribou integrate regional environmental conditions in northwestern Alaska because of their migratory nature. They are considered good indicators of ecosystem condition because they consume lichens and fungi (which derive their nutrients from the atmosphere and thus are sensitive to pollutants) making them good bio-indicators of environmental toxins. Caribou may have substantial effects on plant and lichen communities and by extension to wildlife communities, either directly through browsing and grazing, or indirectly through biogeochemical cycling.

This report documents the use of the Refuge by WAH caribou from September 2009 through August 2017. We focus on the distribution of adult female caribou within the Refuge at both annual and seasonal time frames. Additional information about the National Park Service's monitoring of WAH can be found at <https://science.nature.nps.gov/im/units/arcn/vitalsign.cfm?vsid=19>.

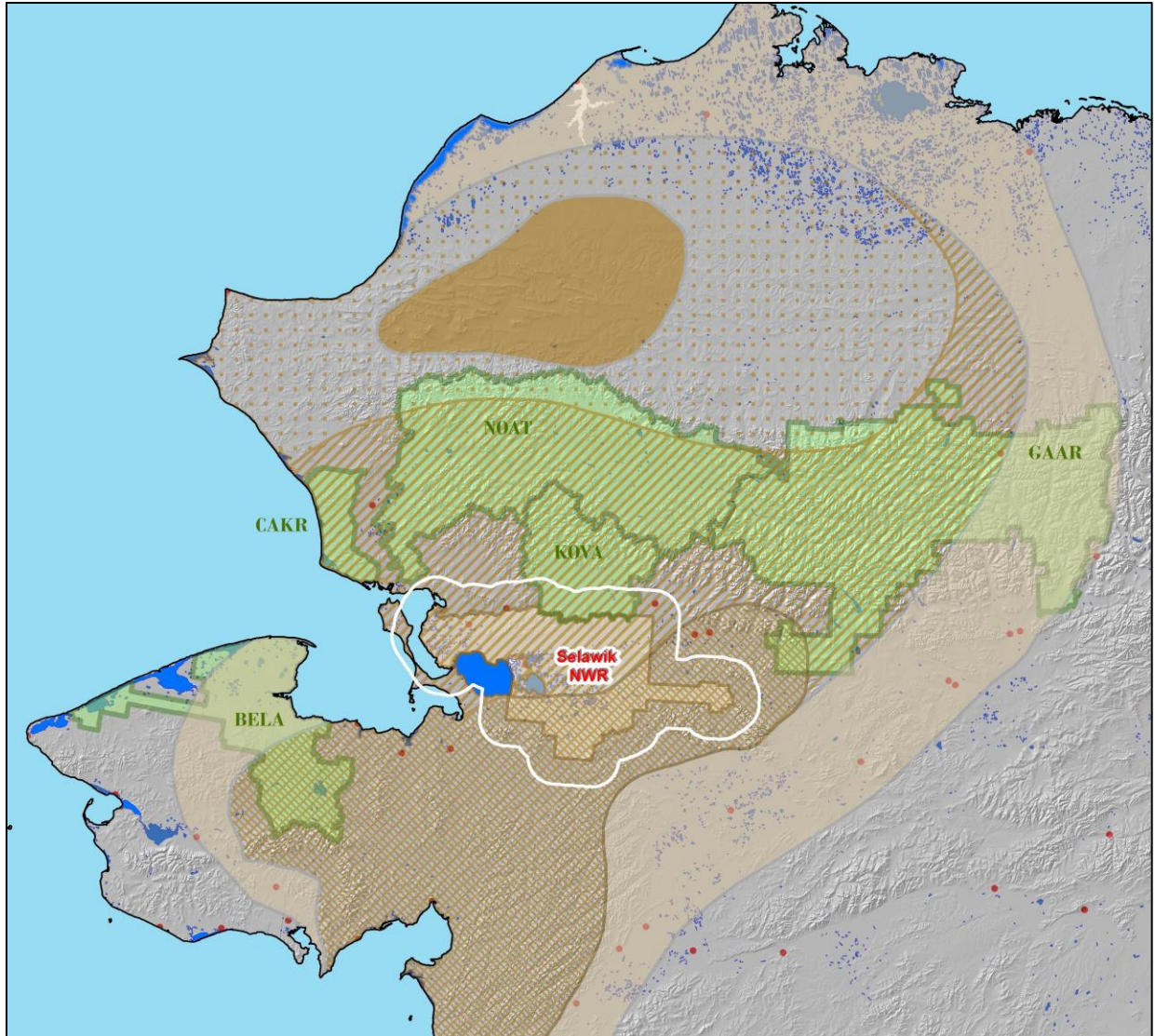


Figure 1. Study area (20km buffer around Selawik National Wildlife Refuge, white line) and the range of the Western Arctic Herd. Generalized range data courtesy of the Alaska Department of Fish and Game. Dark tan delineates calving area, stippled summer range, hatched migratory areas, cross-hatched core winter range and light tan is outer range. The red dots indicate villages and towns.

Methods

The methods used here are largely based on the NPS Arctic Network Inventory and Monitoring Program's Caribou Vital Sign Protocol (Joly et al. 2012, available at <http://science.nature.nps.gov/im/units/arcn/index.cfm?rq=12&vsid=19>). Information about the program, collar deployment, and range-wide distribution and movements can be found in Table 1 and NPS annual reports (e.g., Joly and Cameron 2017). All data here was based on adult female caribou instrumented with GPS collars that collect location every 8 hours. We provide information about the use of the Refuge using all GPS relocations within a 20 km buffer of the Refuge boundary. However, since all collars are deployed at a single location (Onion Portage) within Kobuk Valley National Park during the fall, the collars are not randomly distributed until the herd gathers on the calving ground the following summer (Joly et al. 2012). Therefore, when developing kernel distributions, we excluded data from the first fall and spring that the collar was deployed.

Seasonal Range Use

Both 50% and 95% utilization distribution kernels (Worton 1989) were produced using ArcGIS and ArcGIS tools developed by the NPS (see Joly et al. 2012). Kernels were developed for the year (August 27 – June 8; no caribou relocations occurred in the study area between June 9 and August 26 for any year) and for the following seasons: fall (day of year 239 [August 27 for non-leap years] to 320 [November 16]), winter (day 321 [November 17] to 80 [March 21]) and spring (day 81 [March 22] to 160 [June 9]). The seasons were determined based on the distribution of caribou within the 20 km buffer around the Refuge (Figure 2) and our knowledge of the ecology of caribou in the region. The Least Squares Cross Validation (LSCV) smoothing parameter (Worton 1989) was utilized for all kernels (Joly et al. 2012).

Table 1. Programmatic collar deployment overview. Number and survivorship (%) of GPS-satellite collars deployed on adult (>2 year old) female caribou at Onion Portage, Kobuk Valley National Park, number of collared caribou that appeared to be accompanied by a calf, and approximate number of GPS locations acquired. Captures were generally conducted in mid-September.

Monitoring Year	Collars Deployed	Survived 1st Year (%)	Died (%)	Collar Failures (%)	With Calf (%)	Active Collars at End of Year	Total GPS Locations
2016-2017	25	22 (88.0 %)	3 (12.0 %)	0 (0.0 %)	19 (76.0 %)	77	86,651
2015-2016	38	35 (92.1 %)	3 (7.9 %)	0 (0.0 %)	28 (73.7 %)	79	76,284
2014-2015	35	28 (80.0 %)	7 (20.0 %)	0 (0.0 %)	24 (68.6 %)	52	62,076
2013-2014	25	19 (76.0 %)	6 (24.0 %)	0 (0.0 %)	11 (44.0 %)	46	55,971
2012-2013	12	8 (66.7 %)	4 (33.3 %)	0 (0.0 %)	7 (58.3 %)	34	42,965
2011-2012	14	10 (71.4 %)	3 (21.4 %)	1 (7.1 %)	10 (71.4 %)	36	46,706
2010-2011	15	13 (86.7 %)	2 (13.3 %)	0 (0.0 %)	10 (66.7 %)	39	48,892
2009-2010	39	31 (79.5 %)	7 (17.9 %)	1 (2.6 %)	25 (64.1 %)	31	39,086
Total	203	–	–	–	–	–	458,631

Results

All Data

During the study period (September 2009 - August 2017), a total of 51,303 GPS locations from 202 different adult female caribou were collected within the study area (the 20 km buffer around the Refuge). While caribou were found inside the study area in every month except July, most of the usage took place during fall (33% in September and October combined) and spring (39% in April and May combined) migrations (Figure 2, Table 2). Lowest usage took place during June to August (< 1% combined).

Within the boundary of the Refuge itself, 23,967 locations from 200 caribou were collected. Thus, while about 99% of the caribou within the study area entered the Refuge, less than 47% of the GPS locations within the study area were within the boundary of the Refuge. While caribou were found inside the Refuge in every month except July, most of the usage took place during fall (36% in September and October combined) and spring (53% in April and May combined) migrations (Figure 3, Table 2). Lowest usage took place during June to August (< 1% combined).

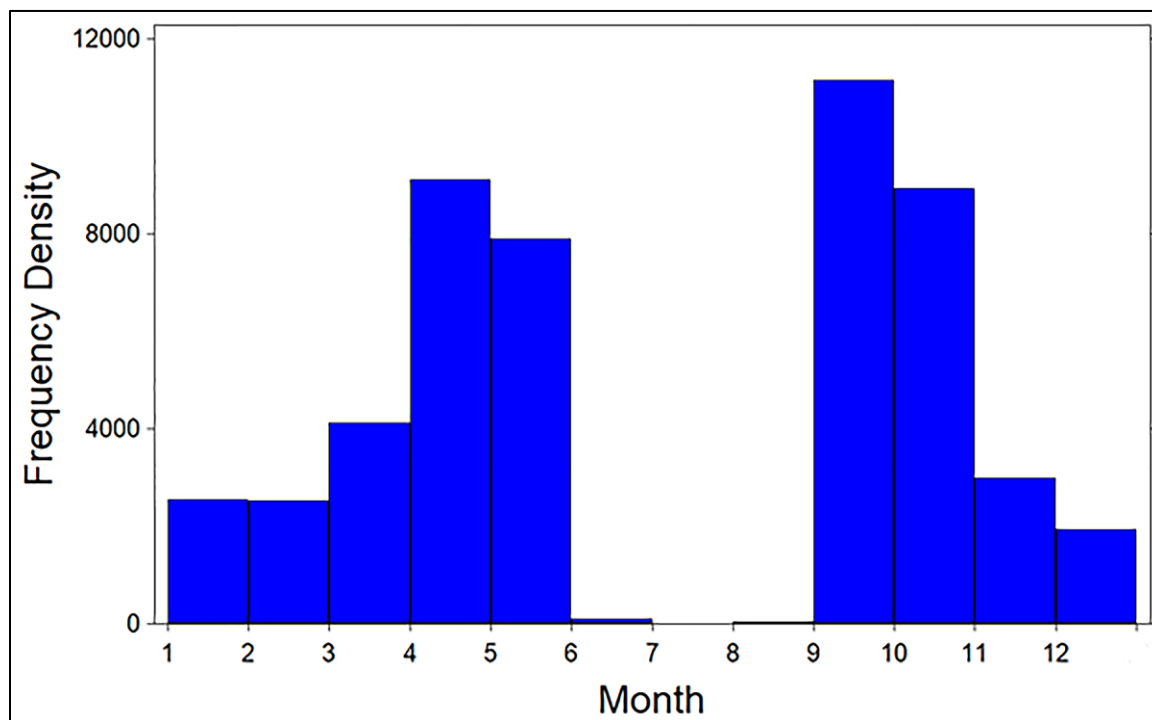


Figure 2. Histogram of the number of caribou GPS locations, by month, within the study area, 2009-2017.

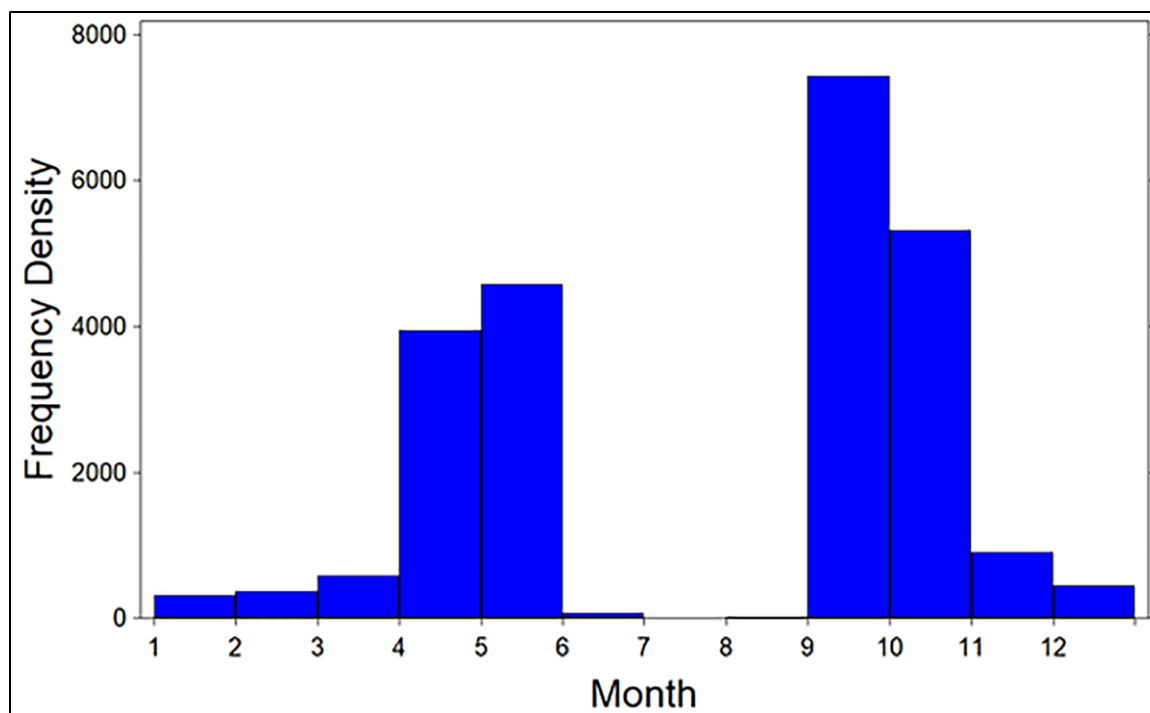


Figure 3. Histogram of the number of caribou GPS locations, by month, within the Selawik National Wildlife Refuge, 2009-2017.

Table 2. Number and relative percentage of Western Arctic Herd caribou collar relocations, September 2009 – August 2017, within Selawik National Wildlife Refuge and the entire study area.

Month/Season	Within Selawik		Entire Study Area	
	Locations	Percentage	Locations	Percentage
All months	23,967	100.0	51,303	100.0
January	310	1.3	2,536	4.9
February	370	1.5	2,527	4.9
March	582	2.4	4,124	8.0
April	3,945	16.5	9,102	17.7
May	4,573	19.1	7,894	15.4
June	67	0.3	96	0.2
July	0	0.0	0	0.0
August	15	0.1	33	0.1
September	7,434	31.0	11,145	21.7
October	5,320	22.2	8,923	17.4
November	906	3.8	2,989	5.8
December	445	1.9	1,934	3.8
Fall Migration	13,675	57.1	21,892	42.7
Winter	1707	7.1	10,856	21.2
Spring Migration	8,585	35.8	18,555	36.2

Seasonal Range Use

The 50% and 95% utilization distributions (kernels) for the study area are depicted for the annual (August 27 – June 8) range by year (2010-2017; Table 3; Figures 4-10). The 50% and 95% utilization distributions are also depicted for the fall, winter and spring seasons for all years combined (2010-2017; Table 4; Figures 11-13). Lastly, kernels for all seasons and years are depicted (Figure 14). The 50% kernels are also commonly referred to as “core areas”. Almost all areas of the Refuge were used by female caribou during the study period, but the headwaters of the Selawik River had the least usage.

Table 3. Annual (August 27 – June 8) range areas of Western Arctic Herd caribou (95% and 50% kernels).

Year	Sample Size	95% kernel area (km ²)	50% kernel area (km ²)
2016-2017	10	13216	505
2015-2016	32	19261	2092
2014-2015	35	18030	1462
2013-2014	28	16522	883
2012-2013	27	5752	217
2011-2012	19	17932	507
2010-2011	25	9689	380

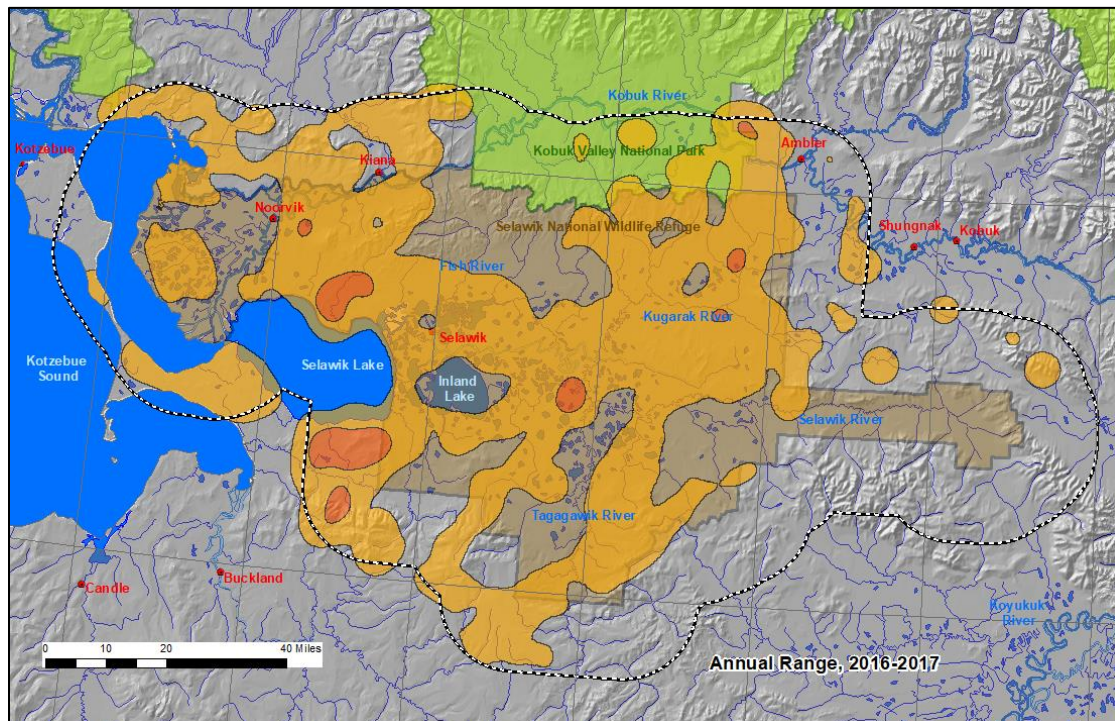


Figure 4. 2016-2017 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

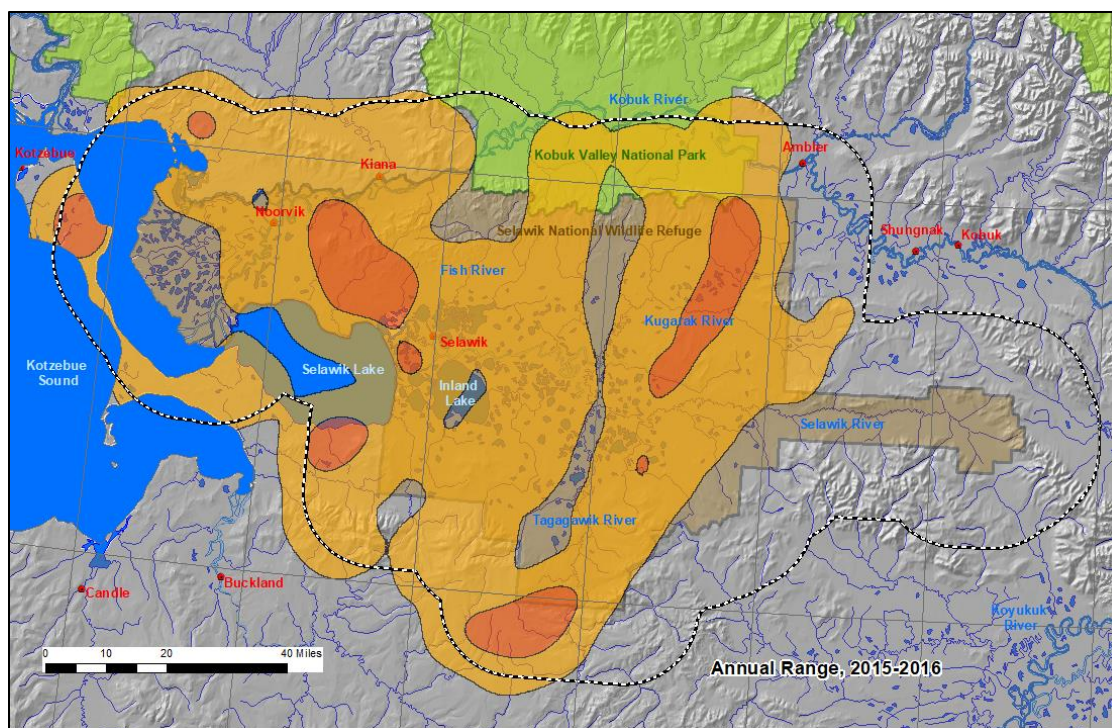


Figure 5. 2015-2016 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

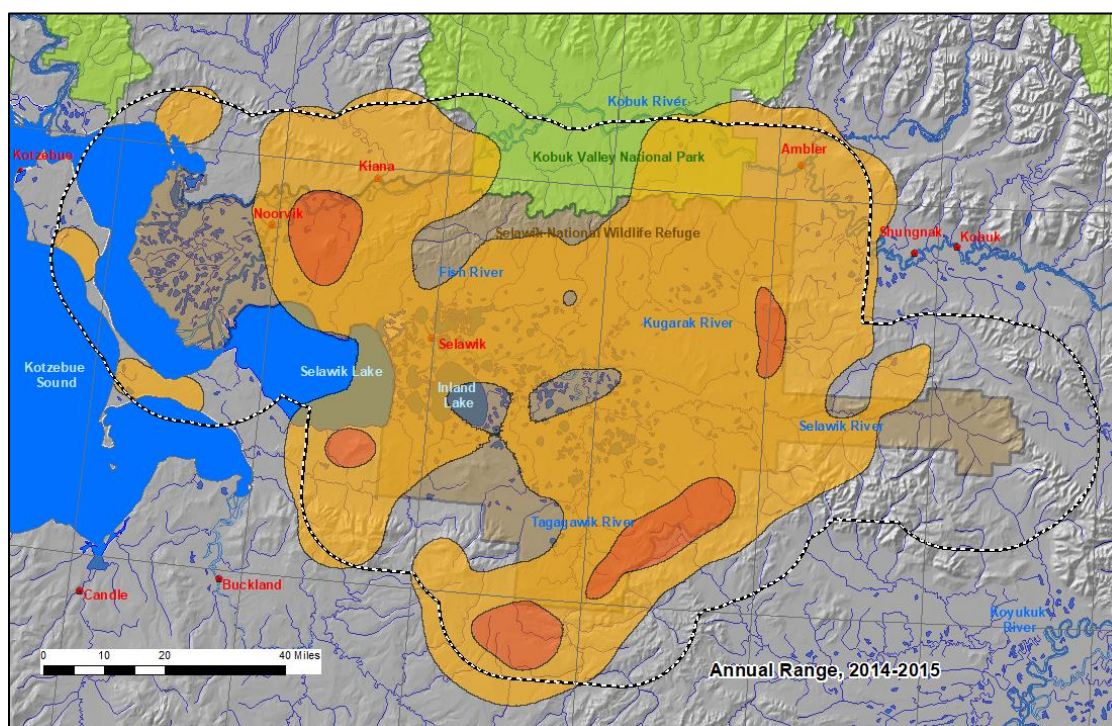


Figure 6. 2014-2015 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

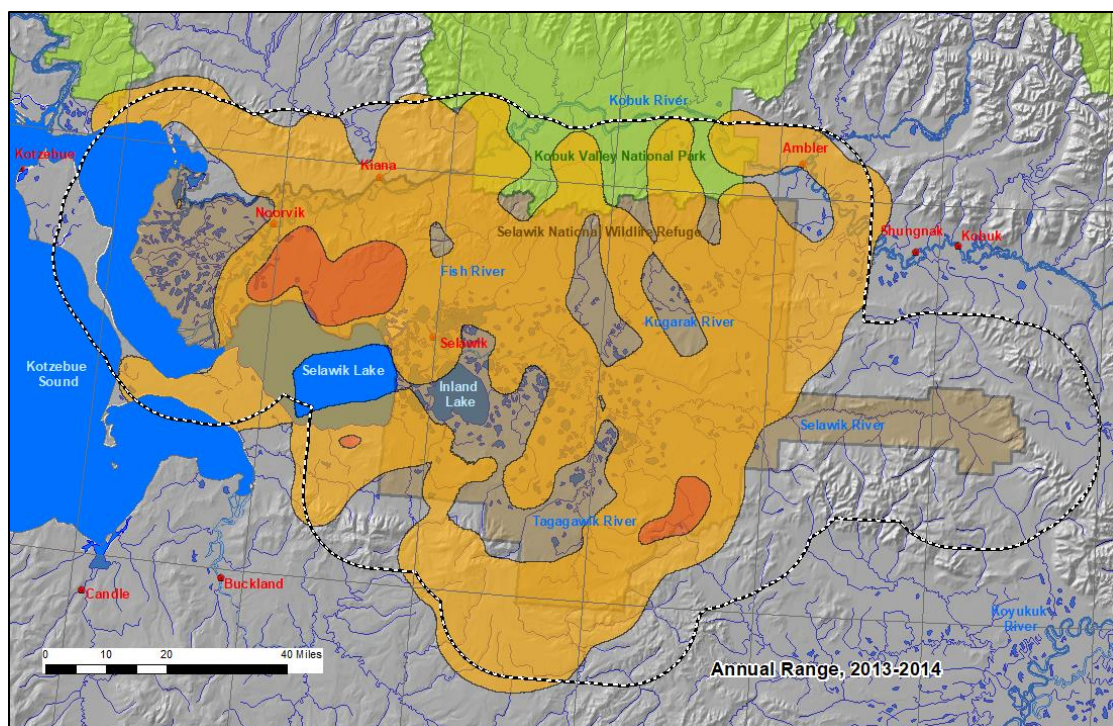


Figure 7. 2013-2014 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

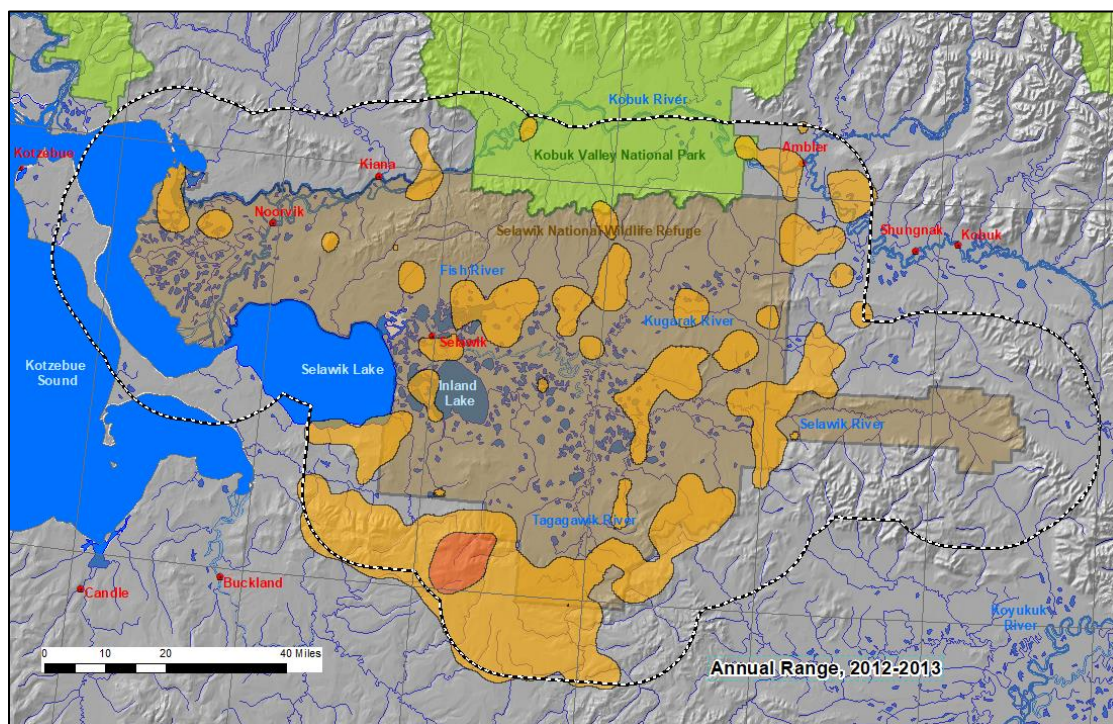


Figure 8. 2012-2013 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

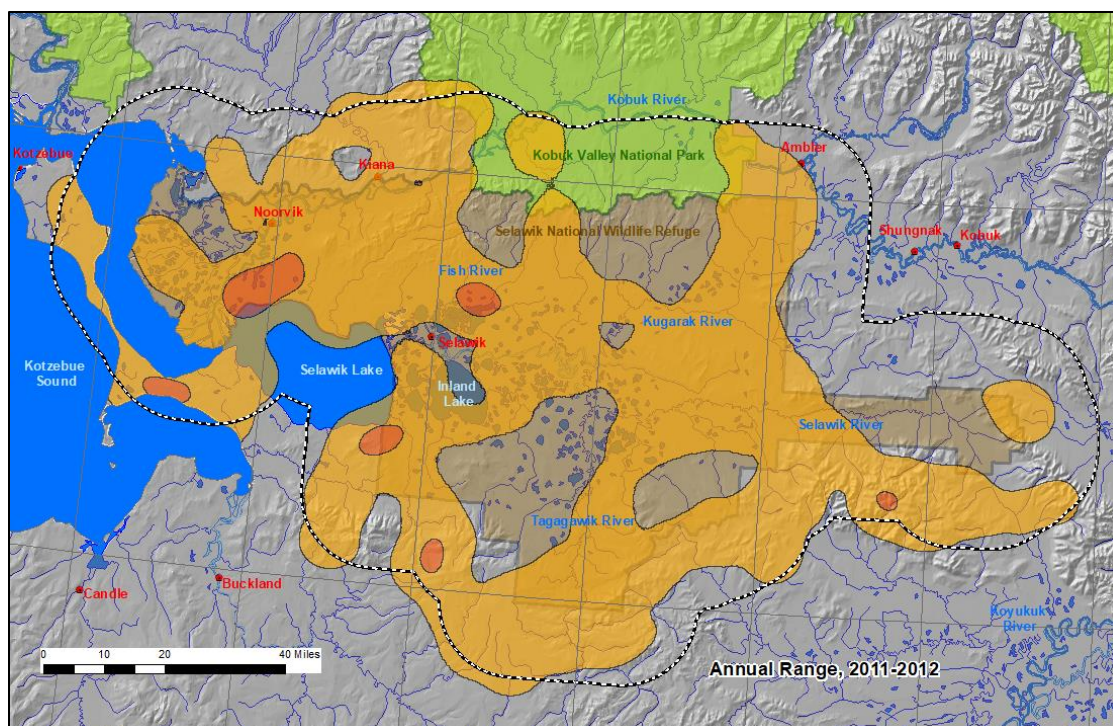


Figure 9. 2011-2012 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

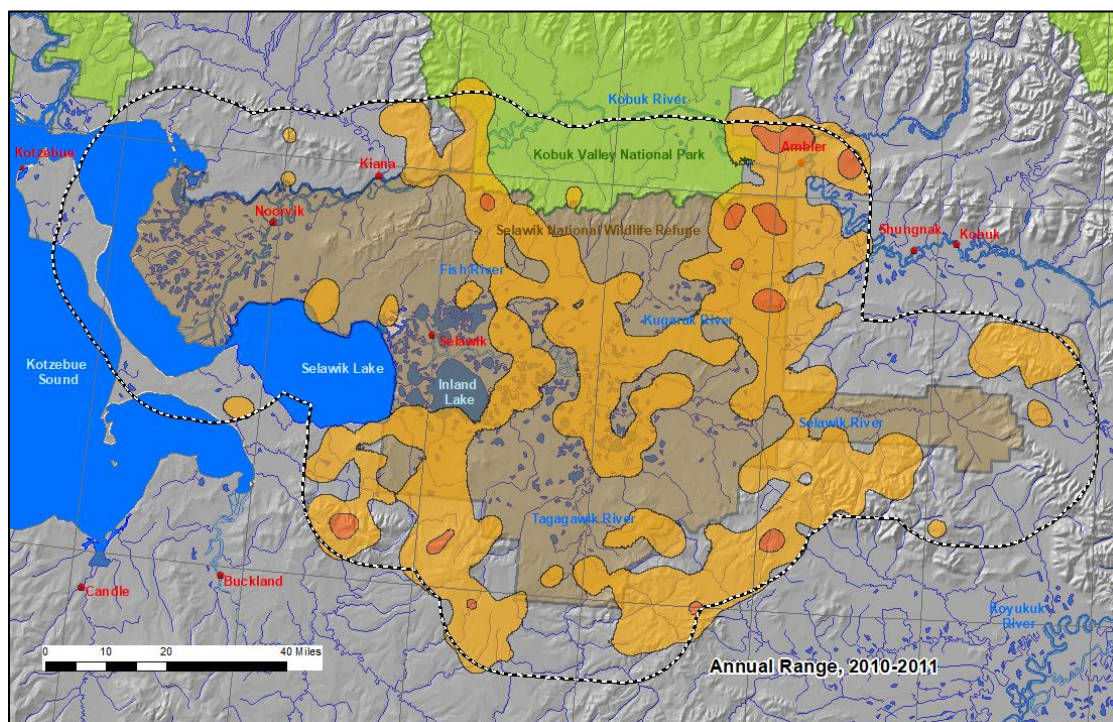


Figure 10. 2010-2011 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

Table 4. Seasonal range areas of Western Arctic Herd caribou (95% and 50% kernels) for 2010-2017. Fall was from August 27 to November 16, winter from November 17 to March 21, and spring from March 22 to June 9.

Season	Sample Size	95% kernel area (km ²)	50% kernel area (km ²)
Fall	129	18454	448
Winter	47	6615	312
Spring	101	8097	454

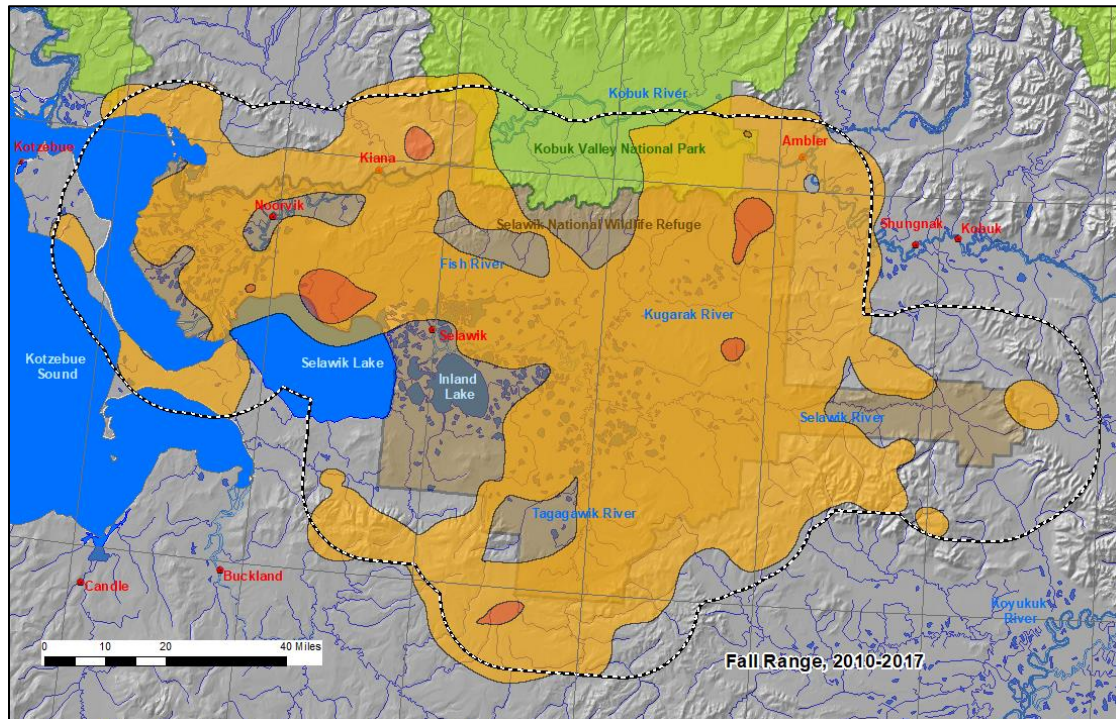


Figure 11. 2010-2017 fall (August 27 to November 16) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

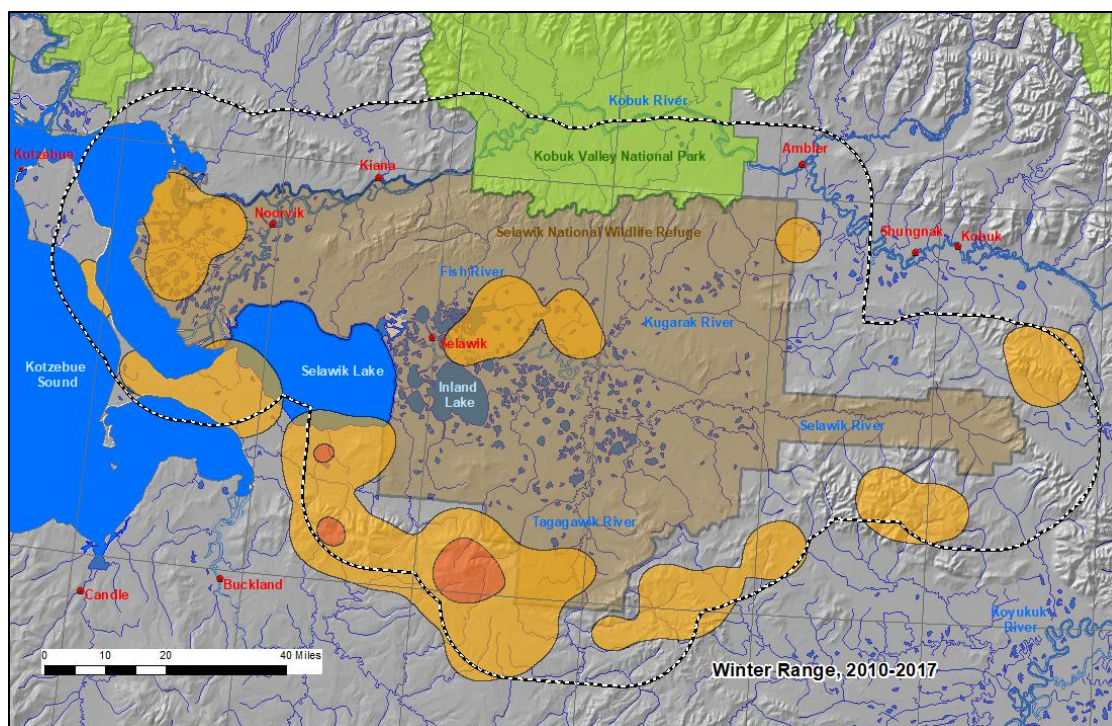


Figure 12. 2010-2017 winter (November 17 to March 21) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

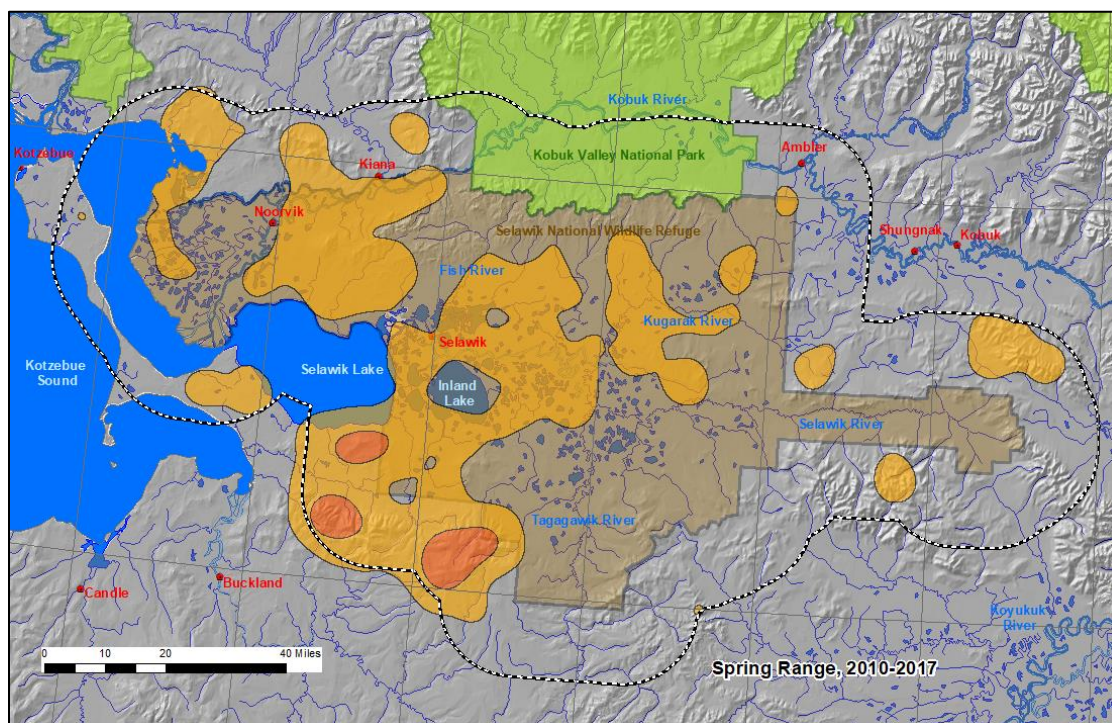


Figure 13. 2010-2017 spring (March 22 to June 8) range use of the Selawik National Wildlife Refuge by Western Arctic Herd caribou. Light orange depicts the 95% kernel and dark orange the 50% kernel.

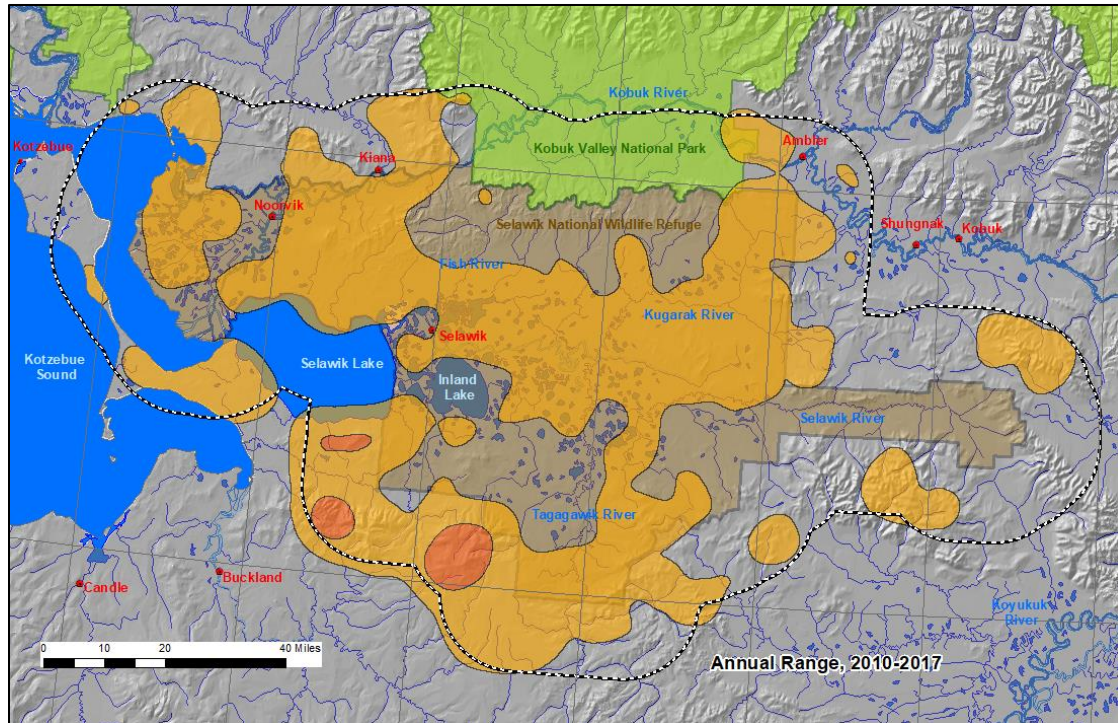


Figure 14. 2010-2017 annual (August 27 – June 8) use of Selawik National Wildlife Refuge by Western Arctic Herd caribou. The 95% kernel area was 13,590 km² and the 50% kernel was 397 km² ($n = 176$).

Discussion

The Refuge has been used by caribou for millennia (Guthrie and Matthews 1971). Historically, the range of caribou has expanded and contracted, and in some time periods the Refuge has been heavily used by caribou and in other periods caribou have been largely absent (USFWS 2007). GPS collars were deployed in the Western Arctic Herd for the first time in 2009, allowing for a detailed analysis of caribou use of the Refuge from 2009-2017.

During the study period, about 200 individual GPS-collared adult female caribou used the Refuge. They typically arrived in late August from the north during their fall migration to their winter ranges. Earlier migrants (those arriving in late August and early September) tended to use a north-south route in the east-central portion of the Refuge on their way to the upper Tagagawik River and the Selawik Hills. Caribou heading to the Tagagawik River often overwintered in the Nulato Hills, whereas those heading to the Selawik Hills often overwintered on the Seward Peninsula. An area along northern Selawik Lake showed high usage in the fall, which is likely due to the large water body acting as an obstacle for southbound caribou. Caribou migrating late in the fall (October-November) tended to use the west side (Kobuk Delta) of the Refuge and the Baldwin Peninsula.

Winter use of the Refuge by caribou was limited during the study period. Within the Refuge, greatest winter use was seen in the Kobuk Delta and on the flats east of Selawik village. Highest use during winter was in the Selawik Hills, south and west of the Refuge boundary. Less than 25% of the collared caribou that passed through the study area spent time there in the winter months. Lichen abundance in the herd's current winter range is 7 times greater than within the study area (Joly et al. 2010). Continued trampling and grazing by caribou on both their fall and spring migrations will likely continue to keep lichen abundance low in the study area unless the size of the herd, their distribution and movements, and/or some other biophysical conditions change. Until that time, we suspect that usage of the study area by large numbers of wintering caribou is unlikely.

Spring migration tended to be concentrated further west than the fall migration, perhaps because Selawik and Inland Lakes are typically frozen at this time and easier to cross than in the fall. Highest spring use was in the southwestern portion of the study area, including the Selawik Hills. With winter range use concentrated on the Seward Peninsula, many caribou use this corridor as a fairly direct route to the calving grounds in the Utukok uplands on the North Slope. WAH caribou continue to display some of the longest annual migrations of any terrestrial mammal in the world (see Fancy et al. 1989) and the Refuge remains an important migratory corridor for this herd.

Literature Cited

- Alaska National Interest Lands Conservation Act (ANILCA). 1980. PL 96-487, December 2, 1980.
- Fancy, S. G., L. F. Pank, K. R. Whitten, and W. L. Regelin. 1989. Seasonal movements of caribou in arctic Alaska as determined by satellite. *Canadian Journal of Zoology* 67:644-650.
- Guthrie, R. D. and J. V. Matthews. 1971. The Cape Deceit fauna – Early Pleistocene mammalian assemblage from the Alaskan Arctic. *Quaternary Research* 1: 474-510.
- Joly, K. and M. D. Cameron. 2017. Caribou vital sign annual report for the Arctic Network Inventory and Monitoring Program: September 2016-August 2017. Natural Resource Report NPS/ARC/NRR—2017/1570. National Park Service, Fort Collins, Colorado. 26 pp.
- Joly, K., F. S. Chapin III, and D. R. Klein. 2010. Winter habitat selection by caribou in relation to lichen abundance, wildfires, grazing and landscape characteristics in northwest Alaska. *Écoscience* 17 (3): 321-333.
- Joly, K., S. D. Miller, and B. S. Shults. 2012. Caribou monitoring protocol for the Arctic Network Inventory and Monitoring Program. Natural Resource Report NPS/ARC/NRR—2012/564. National Park Service, Fort Collins, Colorado. 99pp.
- USFWS. 2007. Uqausriptigun: In our own words. Selawik elders speak about caribou, reindeer and life as they knew it. Kotzebue, Alaska. 50 pp.
- Western Arctic Caribou Herd Working Group. 2003. Western Arctic Caribou Herd Cooperative Management Plan. 33 pp. <http://westernarcticcaribou.org/the-group/management-plan/>.
- Worton, B.J. 1989. Kernel methods for estimating the utilization distribution in home-range studies. *Ecology* 70:164-168.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 953/146878, July 2018

National Park Service
U.S. Department of the Interior



[Natural Resource Stewardship and Science](#)

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525