ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

Alaska Department of Fish and Game
Wildlife Restoration Grant

GRANT NUMBER: AKW-B-R1-2020

PROJECT NUMBER: 14.32

PROJECT TITLE: Predation patterns and foraging ecology of wolves in Southeast Alaska

PERIOD OF PERFORMANCE: July 1, 2019 - June 30, 2021

PERFORMANCE YEAR: July 1, 2019 - June 30, 2020; year 1 of a 2-year grant

REPORT DUE DATE: Submit to FAC August 28, 2020

PRINCIPAL INVESTIGATOR: Gretchen Roffler

COOPERATORS: National Genomics Center for Wildlife and Fish Conservation, Dr. Taal Levi (Oregon State University)

Authorities: 2 CFR 200.328
2 CFR 200.301
50 CFR 80.90

I. PROGRESS ON PROJECT OBJECTIVES DURING PERFORMANCE YEAR

OBJECTIVE 1: Live-capture, radio collar, and monitor wolves.

ACCOMPLISHMENTS: During FY 2020 we captured and instrumented 4 wolves. One male pup was captured via helicopter darting in Berners Bay, and 3 adult wolves (2 males and 1 female) were captured with foot hold traps on Revilla Island (1 male in Shelter Cove, and 1 male and 1 female near Ketchikan Lakes).

OBJECTIVE 2: Investigate kill sites.

ACCOMPLISHMENTS: We visited clusters of GPS wolf locations during late summer (15 August – 15 September), 2019 in Berners Bay and the Gustavus study areas, and late winter (15 February – 15 March), 2020 in Berners Bay and Revilla Island. Wolf 201901 (female) dispersed from the Gustavus area to the Chilkat Peninsula in January 2020 and was harvested in early February, therefore we only investigated late summer GPS clusters

for this wolf pack. Wolf 201902 was captured during fall 2019, thus the first kill site investigation period was late winter 2020.

We visited 41 of the 43 clusters in the Berners Bay study area during the late summer 2019 predation rate investigation period. All transportation to the sites was conducted by Hughes 500 helicopter. Six of the Berners Bay wolf clusters had evidence of predation and were classified as kill sites (1 moose adult female, 1 moose male yearling, 2 adult female mountain goats, and 2 mountain goat kids). We visited 36 of the 46 clusters in the Gustavus study area during the late summer 2019 predation rate investigation period. Transportation to the sites was conducted mainly on foot from the Gustavus road system. Seven clusters were aligned along the length of the Bartlett River, and we used 2 helicopter landings (one drop-off and one pick-up on the same day) to access these sites. Two clusters were in the Beardsley Islands and were accessed by kayak. Nine of the clusters had evidence of predation and were classified as kills sites (1 moose calf, 1 adult moose, and 7 sites with 1 – 27 salmon carcasses). Two of the clusters were scavenging sites (an adult moose carcass, and one site near a Gustavus residence where the wolf had handled human garbage).

We visited 57 of 67 clusters in the Berners Bay study area during the late winter 2020 predation rate investigation period. We found evidence of predation at 10 of the clusters, thus these were classified as kill sites. The prey species at the kill sites consisted of 2 moose bulls, 1 moose female yearling, 1 moose (unknown age and sex), 2 adult female goats, 1 female goat (unknown age), and 2 beaver. We also found evidence of scavenging at 4 of the clusters. All transportation to the kill sites was conducted by Hughes 500 helicopter.

We visited 46 of 54 clusters in the Revilla study area during the late winter 2020 predation rate investigation period. We found evidence of predation at 5 of the clusters, thus these were classified as kill sites. The prey species at the kill sites consisted of 5 deer (1 adult male, 1 adult female, and 3 unknown age). We also found evidence of scavenging at 1 of the clusters (adult female black bear). Transportation to the kill sites was by a combination of skiff, hiking, and Hughes 500 helicopter.

OBJECTIVE 3: Determine predation patterns during late summer and late winter.

ACCOMPLISHMENTS: No work was completed on this objective during the reporting period. This objective will be accomplished at the end of the project once all field data are collected.

OBJECTIVE 4: Determine minimum counts of wolves.

ACCOMPLISHMENTS: We conducted radiotelemetry flights to track the collared wolves approximately every 6 weeks. Aerial observations were only marginally successful during the reporting period due to difficulties spotting the marked individuals in dense forest cover. Using successful aerial observations, ground observations and camera data, we determined the minimum count of the Berners Bay pack was 6 (1 adult collared female, 2 subadults (born spring 2018), and 3 pups (born spring 2019). The minimum count of the Shelter Cove pack was 2 (2 adults), and the Ketchikan Lakes wolf pack minimum count is currently unknown as these wolves were captured at the very end of the reporting period, and we have not had sufficient time to conduct telemetry flights to track these individuals. Aerial observations of the Gustavus wolf pack only produced one visual of 2 wolves, but camera data documented 12 wolves during winter 2020.

OBJECTIVE 5: Assess spatial distribution and movement patterns of radiocollared wolves.

ACCOMPLISHMENTS: We downloaded GPS locations of wolves and archived the data in a data base. We evaluated wolf home range distribution and movement patterns to determine pack home range boundaries, potential denning locations, and dispersal events of GPS collared wolves.

OBJECTIVE 6: Characterize variation in Southeast Alaskan wolf diets.

ACCOMPLISHMENTS: During the reporting period we collected 296 scats from GMUs 1A, 1C, 1D, 2, and 4 (Pleasant Island). Samples were stored frozen until shipment to Oregon State University for analysis.

We received results from the wolf scat analyses during January 2020. Of the 157 samples analyzed, 139 provided successful DNA amplification results of prey taxa (88.5%). Two of the scat samples presumed to originate from wolves were identified molecularly as originating from black bear (*Ursus americanus*), 1 scat from brown bear (*Ursus arctos*), and 10 scats from coyote (*Canis latrans*). Because coyote and wolf scats may be difficult to distinguish in the field, and the 12s vertebrate mitochondrial gene used to identify prey species in wolf scats does not distinguish between the originating canid species, we performed an additional assay to identify scats from coyotes vs. wolves. At the time of this report, results from 139 samples are pending final analyses.

We shipped 195 wolf samples from GMUs 1A, 1B, 1C, 1D, 2, 3, 4 (Pleasant Island), and 5 for stable isotope analyses to the Alaska Stable Isotope Facility. These samples consisted of 121 hair samples, 70 muscle tissue samples, and 3 vibrissae sample. We also

collected samples from wolf prey species (Steller sea lion: n = 12, sea otter: n = 1) and sent them to the Alaska Stable Isotope Facility. We expect to receive δ13 C and δ15 N results from these samples by September 2020.

OBJECTIVE 7: Describe genetic relationships and structure of Southeast Alaskan wolves.

ACCOMPLISHMENTS: We developed and used a custom hybridization-based capture to generate 37,082 neutral, genome-wide single nucleotide polymorphism (SNP) genotypes and over 500,000 SNP genotype likelihoods. We genotyped 58 wolves at these SNPs on Prince of Wales Island (POW) and adjacent areas in Southeast Alaska and conducted analyses of genomic inbreeding, population structure, and detection of recent immigrants.

Currently, 443 muscle tissue samples and 68 hair samples from wolves from across Southeast Alaska and the Yukon Territory have been sequenced at the 37,082 SNPs. The remaining 106 hair samples will be sequenced in FY2021, as will all library preparation and bioinformatics to prepare the genomic data for regional structure analyses.

OBJECTIVE 8: Data synthesis and preparation of publications

ACCOMPLISHMENTS: Analyses of regional differences in wolf diets using metabarcoding of fecal DNA date were completed and a manuscript prepared and submitted to a peer-reviewed journal (this manuscript was accepted in August 2020). A manuscript describing the comparison of identifying wolf prey species using mechanical sorting and metabarcoding of amplified target DNA sequences was prepared and submitted to a peer-reviewed journal in February 2020. Katherine Zarn, University of Montana MS student defended her thesis “Genomic Inference of Inbreeding in Alexander Archipelago Wolves (*Canis lupus ligoni*) on Prince of Wales Island, Southeast Alaska” in December 2019, and manuscript preparation is underway. Analyses of wolf stable isotope data for identifying major prey species by region have been conducted, and preliminary results are available.

II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

Since initiation of this project during Spring 2018, 9 wolves from 4 packs have been instrumented with GPS collars and fieldwork for 4 predation rate estimation periods have been completed. FY2020 was year 2 in a 5-year project.

We have completed the first step of quantifying geographic variability in wolf diets across Southeast Alaska, using DNA metabarcoding of prey remains in 860 wolf scats collected during 2010–2018 across 12 mainland and island study sites. DNA metabarcoding achieved fine taxonomic resolution of prey remains and identified 55 diet items representing species from 42 genera and 29 families, many previously undetected in coastal wolf diets. Overall, ungulates made up the largest proportion of wolf diets but were also most variable between study sites. On most islands, Sitka black-tailed deer were the most consumed ungulate species, whereas moose

and mountain goats contributed more to mainland wolf diets. Across all study sites combined, beaver, marine mammals, and black bears were important alternate prey. We also determined that degraded scats produced reliable data for diet analysis. DNA metabarcoding presents a viable tool for rapid characterization of trophic interactions needed to assess the conservation status of wildlife populations such as the Southeast Alaskan wolves.

We have also completed the first step in characterizing and understanding genomic structure and characteristics in Southeast Alaskan wolves. We quantified inbreeding in 58 wolves on POW and adjacent areas in Southeast Alaska examining runs of homozygosity. The custom hybridization-based capture method provided increased resolution regarding regional genomic structure, and detection of recent migrants among management units. Wolves on POW had more long runs of homozygosity, indicating more frequent mating between individuals with recent common ancestors, likely due to smaller recent historical population size on POW. No recent emigrants from POW to surrounding regions were detected using Admixture analysis. One of the 16 wolves sampled on POW was a recent immigrant or a relative of a recent immigrant from the genetic cluster made up of wolves from GMU 1A and GMU 3. This result indicates that wolves can move between adjacent areas and POW; however, the frequency of these immigration events is unknown. Wolf populations on POW and adjacent regions are genetically differentiated, indicating gene flow does not occur at a sufficient rate to maintain population connectivity or mitigate inbreeding on POW.

III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

This project was underspent partially due to the inability to conduct fieldwork activities during Spring 2020 because of COVID-19, resulting in unspent funds in lines 2000 (travel), 3000

(contractual, including helicopter flights), and 4000 (supplies) to support field work. The WBI position (PCN 11-2224) was not filled until June 1, 2020 resulting in unspent funds in line 1000.

IV. PUBLICATIONS

A media piece (radio and website) was released on 27 April 2018 describing some results from this project:

https://www.ktoo.org/2018/04/27/wolves-are-eating-sea-otters-near-gustavus-what-does-that-mean-for-the-deer/

McAllister, A. February 2019. Deciphering the 'kill site': investigating wolf kill sites in Southeast. Alaska Fish and Wildlife News:

http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=902

McAllister, A. February 2019. Gustavus wolves set sights on new quarry: Sea otters prove to be a large portion of diet. Alaska Fish and Wildlife News:

http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=901

Roffler, G. 2019. Seasonal predation patterns of coastal wolves. Glacier Bay National Park and Preserve research highlight:

https://www.nps.gov/articles/seasonal-predation-patterns-of-coastal-wolves.htm

Zarn, K.E., 2019. Genomic Inference of Inbreeding in Alexander Archipelago Wolves (*Canis lupus ligoni*) on Prince of Wales Island, Southeast Alaska. MS thesis, University of Montana, Wildlife Biology Program.

Roffler, G.H., Allen, J.M., Massey A.L., Levi, T. 2020. Regional metabarcoding of fecal DNA shows that dietary diversification in wolves substitutes for ungulates in an island archipelago. Accepted at Ecosphere 4 August, 2020.

Massey, A., G.H. Roffler, T. Vermeul, J. Allen, and T. Levi. 2020. Comparison of mechanical sorting and DNA metabarcoding for diet analysis with degraded wolf scats. In review at Ecosphere.

V. RECOMMENDATIONS FOR THIS PROJECT

This project has provided valuable results for understanding variation in wolf diets and seasonal predation patterns. This project should continue for a minimum of 3 years as planned in order to achieve sufficient data for analyses.

Prepared by: Gretchen Roffler, Wildlife Biologist III

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