



# Resource Management 2022



The coastal wolf research team scans a beach at Katmai Bay for wolf sign. Find out more on page 3. *NPS L. Law*

National Park staff working in Katmai National Park and Preserve, Aniakchak National Monument and Preserve, and the Alagnak Wild River spend time in the field to study, inventory, and monitor cultural and natural resources.

The cultural resource program involves archeology and anthropology and focuses on the history of human occupation in the region. The natural resource program studies biological and physical resources, such as wildlife, fish, plants, wilderness, and backcountry resources.

We continue to follow all federal guidelines during the COVID-19 pandemic. Some research efforts were limited in 2021 and may continue to be affected in 2022.

Look for project and research updates on our website ([www.nps.gov/katm](http://www.nps.gov/katm)), Facebook page, and through the explore.org Katmai bear cams.

## Research Permits

In addition to work conducted by NPS staff, external researchers come to the parklands to conduct a wide array of studies. The diversity of work helps to answer local management questions as well as those of greater interest to science. The parks are a vibrant, living laboratory.

## Brooks River Bear Monitoring Results

For over 20 years, park biologists have monitored the number of bears feeding at Brooks River during the salmon run. Due to the high concentration of bears observable at Brooks River, this location offers a unique and effective opportunity to view and count bears without using invasive and costly techniques such as tagging or collaring. Individual bears can be recognized using physical and behavioral characteristics. With this information, the park can monitor the number of bears using the river each season and how that number has changed through time.

Recently, biologists started using these data in a mark recapture framework. Since cause and time of death for an individual bear is often unknown, the sighting histories of individual bears were used to estimate annual survival probability of different age and sex groups within the local Brooks River bear population. Repeated counts of individual bears using Brooks River are also being used to estimate annual bear abundance and productivity. Results from this analysis were completed in 2021 by biologist Leslie Skora as

part of her master’s thesis work. The mark recapture analysis showed little variation in annual survival of young (subadult) and adult bears from 2000–2017 (Figure 1). Annual survival of spring cubs showed some years with lower survival around the same time sockeye salmon escapement was low (Figure 2).

Results from the count data analysis showed that annual abundance of bears using Brooks River has fluctuated over the years (Figure 3). Annual abundance of breeding females with cubs showed a positive relationship with sockeye salmon escapement meaning sows with cubs were more likely to use Brooks River when sockeye salmon escapement was high. This use pattern based on salmon escapement made it difficult to assess changes in productivity including whether increased salmon escapement led to more cubs being produced the following year. Future research may be able to tease apart the changing use patterns from changes in the annual number of cubs produced.

More results from Leslie Skora’s thesis, titled “Population Dynamics of Brown Bears Along Brooks River in Katmai National Park, Alaska,” can be found on ProQuest (ID number: 2572593208).



Brooks River monitoring data indicated sows with cubs were more likely to use Brooks River when sockeye salmon escapement was high. NPS L. Law

Figure 3 (right): Annual counts of bears along Brooks River and annual sockeye salmon escapement for the Naknek River drainage, AK, 2000–2018.

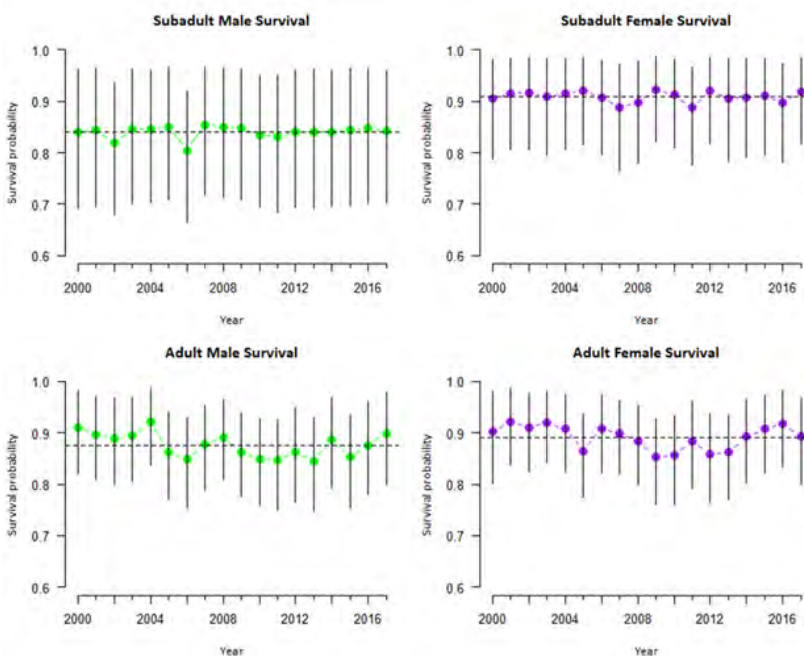


Figure 1 (above): Individual bear identification histories were used in a capture-recapture framework to estimate annual survival (2000–2017) of Brooks River bears according to different age and sex groups.

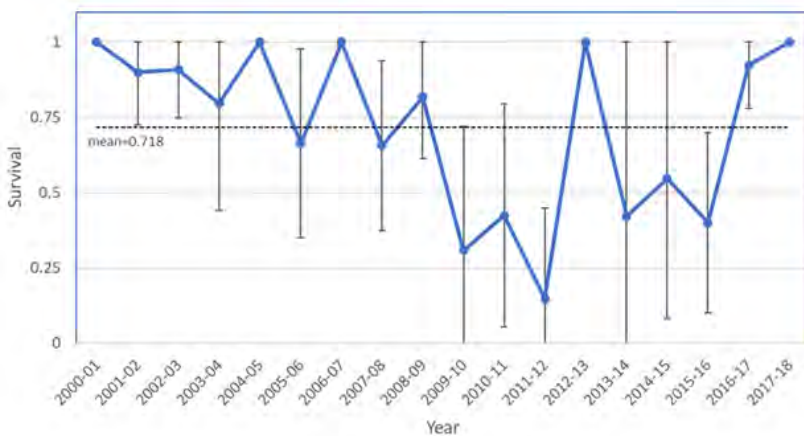
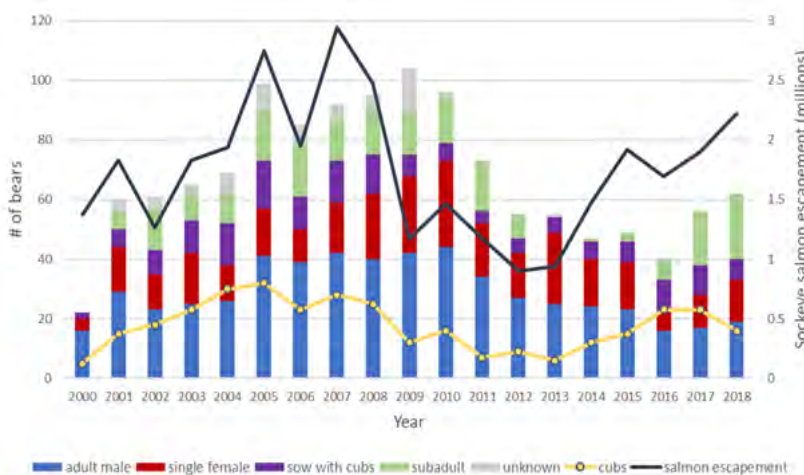


Figure 2 (above) : Mean survival (dotted line), annual survival (blue) for Brooks River spring cubs (2000–2017) based on when they were first counted during July monitoring to when they were next seen during their second year.



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## Willow Ptarmigan Pilot Study-update

Ptarmigan are an important subsistence species on the Alaska Peninsula; however, there is limited data on how their population and density has changed over time. Ptarmigan numbers can fluctuate greatly between years and are known to be cyclical in many Arctic populations.

This research was developed in response to community observations and concerns over ptarmigan abundance. Funding has been provided through Subsistence Advisory Council funds. Our objectives are to conduct a series of line transect surveys for willow ptarmigan within Katmai National Park and Preserve and Aniakchak National Preserve. This project will support the establishment of survey transects and acquisition of baseline data (surveys to be conducted spring of 2021 and 2022) that may be used for future survey efforts. Results may be compared with survey efforts from Becharof National Wildlife Refuge and provide a more complete picture of changes in ptarmigan populations on the Alaska Peninsula.

During 2021, we established 12 4-kilometer transects surveyed in eight locations between May 5 and June 2, 2021. These transects were conducted in Naknek/King Salmon, Katmai National Park (Contact Creek and Mt. Dumpling), Katmai National Preserve (Kukaklek Lake and Nanuktuk Creek), and Aniakchak National Preserve (Cinder Creek and Albert Johnson Creek). Surveys were conducted following methods of previously conducted transect surveys for ptarmigan on the Alaska Peninsula (Savage 2015, Welfelt & Pepin 2015).

We counted an average of 28.8 ptarmigan across all transects ( $n=11$ ) ( $st.dev=36.1$ ) in Katmai and Aniakchak. In comparison, Becharof Refuge surveys from 2015 averaged 5.1 ptarmigan across 21 transects ( $st.dev: 6.0$ ) (Welfelt & Pepin 2015). Given that ptarmigan populations are cyclical, our preliminary results suggest that ptarmigan may be in an upswing in their cycle. We plan to conduct a second year of surveys in Katmai and Aniakchak in 2022.



**A male willow ptarmigan in spring plumage.**

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## Katmai Coastal Wolf Project



**A wolf checks out a trail camera on the Katmai coast. Cameras, in combination with hair snares allow us to confirm if a wolf visited the site and collect hair samples.**

This summer, the Katmai Coastal Wolf Project field crew conducted a large-scale non-invasive sampling effort to study the foraging ecology and population distribution of wolves living in the park's coastal regions. Over the course of the summer, we surveyed six different areas on the Katmai coast: Kamishak Bay, Cape Douglas, Swikshak, Hallo Bay, Dakavak Bay, and Katmai Bay. The central goal of our sampling was to collect scat samples from coastal wolves, from which we can garner information about individual wolf diets by using a technique called DNA metabarcoding. Metabarcoding allows us

identify individual prey species in wolf scats by reading their DNA sequences. We also set up "hair snare" stations to attract wolves and capture tufts of their fur for use in additional genetic analyses. By examining and comparing the genetic variation in wolf DNA from each hair sample or scats, we will be able to identify individual wolves and obtain a minimum population estimate for wolves living in our study areas. In addition to these non-invasive genetic sampling techniques, we also installed several automatic digital cameras along beaches and animal trails to capture wolf activity. These installments included five "bear-proof" camera tripods housed in sturdy aluminum boxes to capture potential wolf predation on marine mammals at key sites along the coast.

Our sampling efforts were very successful and resulted in the collection of around 800 wolf scat samples in addition to several hair samples and countless photos and videos of coastal wolves across all sites. Overall, non-invasive genetic sampling has proven to be a highly effective tool for reconstructing coastal wolf diet and identifying individuals. Analysis of wolf prey items in scats is still ongoing, but our initial results demonstrate very extensive utilization of marine prey items by wolves. So far, we have detected in wolf scats: sea otter, harbor seal, bald eagle, brown bear, salmon, arctic ground squirrel, starry flounder, softshell clams, blue mussels, and even feather duster worms. These results are exciting because they demonstrate that the wolf is not necessarily an obligate predator of ungulates such as moose and deer, as is the common perception. At a minimum, six distinct wolf packs reside on the Katmai coast despite a low density of moose, and their reliance on marine food sources constitutes a unique and important relationship between terrestrial and marine systems. We will continue some field work in 2022 to fill in gaps between sampling locations and continue with lab work and analyses.

## A Genetic Analysis of Katmai's Brown Bears

Katmai is home to one of the densest and most well-known populations of brown bears on the planet, but our understanding of the population connectivity is limited. The Aleutian mountain range bisects the park and reduced food resources in the mountains may limit movement and restrict gene flow. In 2016, park biologists began a study that used genetics to shed light on gene flow throughout the Katmai Park and Preserve. Biologists analyzed samples collected across the landscape to examine gene flow and determine if bears are consistently crossing the mountain range between the coast and interior regions. Data collection was completed for this project in 2019 and the past two years we have been extracting the DNA and conducting analysis.

By comparing different sampling sites throughout the park and preserve we found evidence of a distinct population structure between the bears on the Pacific coast of the park and those on the Bristol Bay side of the Aleutian Range. This demonstrates that there is some level of genetic isolation between the bears in these areas of the park. Additionally, we found evidence of a recent bottleneck in the brown bear population in Katmai. While we cannot determine the cause with any certainty from these data, the timing suggests that this bottleneck may have been the result



**Brown bear DNA from bears at Brooks Camp was compared to DNA from bears on the Katmai Coast.**

of the 1912 eruption of the Novarupta volcano, which created the Valley of Ten Thousand Smokes. This is supported by contemporary reports that described bears blinded by falling ash and a significant reduction in salmon productivity along the Aleutian Peninsula in the ten years after the eruption. Finally, we were interested in comparing the rates of genetic diversity at Brooks Camp compared to other areas of the Park and Preserve as well as to data collected ten years previously. We documented no reduction in genetic diversity in either comparison.

## Wildlife Aerial Surveys



**Caribou in Katmai NP&P. NPS W. Artz**

Katmai's vast road-less wilderness and often inclement weather makes accessing areas of the park difficult for biologists trying to monitor wildlife populations. Aerial surveys provide a way to access this landscape and study some of Katmai's keystone species. Bears, bald eagles, and moose are all surveyed at locations and times when their concentrations are known to be high. Surveys are flown in small 2 seat aircraft at low levels off the ground. Both pilot and observer work together to spot and record the number of a wildlife species gathered at a location.

Bald eagles are surveyed during the spring to better understand nest occupancy and reproductive success. Bald eagles are important indicators of

freshwater and marine ecosystems because their survival and productivity are dependent on high quality freshwater and marine food sources. Katmai resumed bald eagle surveys in 2021 after a break in 2020 due to Covid. Trends are monitored at the regional level incorporating data from other parks in southwest Alaska.

Counts of bears and cubs during the summer allow the park to monitor the bear population and look for factors that might be affecting it. The sedge meadow and stream surveys that Katmai conducts not only help to understand bear numbers and productivity but salmon run timing and abundance as well. Similar to last year, counts of bears during 2021 continue to be high showing increased use of salmon streams and sedge meadows.

Moose counts of bulls, cows, and calves are conducted during early winter to monitor trends in the moose population and look for environmental factors that might be affecting the population. During 2021, surveys were completed in the Branch River and Park border trend areas. We observed 75 bulls:100 cows (Branch River) and 63 bulls:100 cows (Park border) in these areas with 7 calves:100 cows and 25 calves:100 cows. These numbers are within a typical range for unit 9C.

### Caribou surveys

In winter 2021, Katmai began conducting aerial caribou surveys along the northern border of Katmai Preserve. This project is supported through Subsistence Advisory Council funds. The goal is to better understand caribou abundance in this area and possible subsistence opportunities.

Counts during 2021 were around 300 caribou in the Katmai Preserve including lands to the north and east. Aerial surveys will continue during 2022 and may help guide future research of caribou in this area.

## Katmai and Savonoski Village Remote Sensing and Archeological Survey



University of Alaska Anchorage. Archives & Manuscripts Dept.

**Photo Credit:**

taken during National Geographic Society expedition to Katmai area. 1918. University of Alaska Anchorage. Consortium Library. Archives & Special Collections. 3211 Providence Dr. Anchorage, AK 99508, 1-907-786-1849.

## West Naknek-American Creek Archeological Survey

West Naknek-American Creek Archeological Survey with archeologist Sam Coffman (UAF-Museum of the North) will continue the inventory of the Lake Kukaklek-American Creek drainage of Katmai National Park. Last year survey efforts included West Naknek Lake, Iliuk Arm, and Lake Brooks. The study will provide the park management NHPA section 110 inventory data on the condition of newly discovered and previously identified archeological sites. The methodological intent is to identify ancient and historic travel and trade routes across Katmai's glaciated landforms. The multi-year project employs a new predictive site model developed by Coffman and Katmai park staff, and incorporates guidance on ancestral site locations from the Council of Katmai Descendants. *For more information, contact Linda Chisholm (907-469-0322, or linda\_chisholm@nps.gov).*

Laura Stelson (Penn State, PhD. candidate) will continue archeological survey and remote sensing methodology as part of her dissertation fieldwork focused on material culture evidence for cultural resiliency among ancestral and historic Sugpiat-Alutiit villages of the Katmai interior and Pacific coastline. Stelson is partnering with the National Geographic Society Field Assistant Program, the Cultural Resources Diversity Internship Program, the Council of Katmai Descendants, and the Native Village of Perryville to provide Perryville School students an immersive culture camp opportunity and distance learning experience using park archival materials and local oral histories. *For more information, contact Linda Chisholm (907-469-0322, or linda\_chisholm@nps.gov).*

Partnering with Elders Project, 2021 Update  
Although the 2021 Cultural Resources field season was canceled due to the Perryville earthquake, Park Archeologists Christina (Crissy) Phillips and Laura Stelson continued to work on community and elders' projects with the Native Village of Perryville and the Igiugig Village Council. The latter project helped produce a series of Elder's knowledge cards based on Igiugig's recent Ethnobotany book, designed by LaRece Construction. *For more information, contact Linda Chisholm (907-469-0322, or linda\_chisholm@nps.gov).*



Fossil leaf from dinosaur-bearing Chignik Formation. This fossil leaf is related to modern trees like Hickories. As these modern trees live in milder, lower latitude climates today, this suggests the dinosaurs of Aniakchak lived in a milder climate some 70 million years ago.

## The Dinosaurs of Aniakchak National Monument

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After a pandemic-driven pause, we continued the documentation of dinosaurs in the coastal outcrop of the Cretaceous Chignik Formation in Aniakchak National Monument and Preserve in 2021. The Chignik Formation is approximately 70 million years old, which makes these rocks approximately the same age as the dinosaur-bearing rocks we find in Denali National Park and Preserve. And it is this connection in time that makes the work in Aniakchak not only important for the park, but also important because of the broader, regional perspective gained in learning about an ancient terrestrial high-latitude ecosystem, an ecosystem that was much milder in

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climate than what is experienced in these parks today.

We have now recorded over 100 track sites of fossil animals in Aniakchak, all within the Chignik Formation (see Fiorillo et al., 2018, 2019: <https://www.nps.gov/articles/aps-17-1-3.htm>, <https://doi.org/10.1371/journal.pone.0223471>) making this one of the most important dinosaur localities in the entire Alaska Region. While most of the footprints can be attributed to plant-eating duck-billed dinosaurs, ranging from very young to fully mature individuals, other tracks found can be attributed to armored dinosaurs, meat-eating dinosaurs, and two kinds of fossil birds. The larger bird tracks are like the tracks we previously described from Denali National Park, *Magnoavipes denaliensis*, a crane-sized bird, while the smaller bird tracks belong to a bird about the size of a modern Willet. The track size of the predatory dinosaur found in Aniakchak National Monument suggests a body size approximately 6-7 m long, about the size of *Nanuqsaurus*, the tyrannosaurid known from bones from the North Slope.

We hope to continue the work this summer (2022) with additional reconnaissance of rock exposures, examining the rich fossil plant record as well as the fossil soils. After the big earthquake in the region in 2021, it is particularly important to revisit the coastal exposure to determine what remains of our previous work, as well as what new opportunities for new discovery that may now exist. Details from my team's work will provide a much better understanding of the environments, and the climate, in which these dinosaurs lived during a much warmer world.

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## Paleontological Resource Focused Condition Assessment

Over the summer of 2021, paleontologists from the NPS Alaska regional office and University of Alaska Museum of the North conducted fieldwork along the coast of Katmai as part of the Paleontological Resource Focused Condition Assessment project. We explored and documented fossil localities in order to better understand the risks coastal fossils face. Fossils found during the fieldwork included marine invertebrates such as ammonites, bivalves, and belemnites that were alive between 160 and 66 million years ago.

One rock formation we are particularly interested in is the Naknek Formation, a Jurassic-aged rock unit that is widespread across Katmai and the entire Alaska Peninsula. The formation has yielded theropod dinosaur tracks south of Katmai near Chignik Bay and a possible dinosaur bone within the park. Based on these past findings, our goal was to explore the Naknek Formation in two parts of the park to potentially discover new, previously unrecognized fossils. At the first locality, we found many marine invertebrate fossils but no indications that the rocks contained dinosaur tracks or bones. Due to weather delays, we were unable to visit the other locality this summer, but it remains of interest for future research. A report summarizing these findings, as well as more information about Katmai's fossils, is currently in review.



Photo of bivalves from the Naknek Formation. They make look similar to modern mussels, but these *Buchia* were alive over 150 million years ago! NPS M. Harrington

## Other Natural Resources Projects

### • Marine debris and seabird mortality

In collaboration with the National Oceanic and Atmospheric Administration (NOAA) and the Coastal Observation and Seabird Survey Team (COASST) we continue to monitor debris accumulation and seabird die-offs.

### • Bat Monitoring

The park continues to monitor bats in coastal and interior areas using acoustic monitors

### • Invasive Plant Management

We treated invasive plants with the help of an SCA crew in the Brooks Camp Area, Furie's Cabin, and other backcountry areas and will continue to do so in 2022.

### • Timelapse Photography Project

We will begin analysis on additional data from cameras set up near salt marsh and salmon streams to better understand bear activity patterns.



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