



Resource Management 2021



Fireweed blooms at Hallo Bay in Katmai National Park. NPS K. Griffin

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.

The COVID-19 pandemic has affected our ability to complete scheduled field work in 2020 and may continue to impact research efforts in 2021.

Look for project and research updates on our website (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.

Wilderness Visitor Study: Understanding Visitors' Desired Social and Natural Conditions- Project Update

Researchers from Clemson and Kansas State Universities sought to provide insight into the backcountry and wilderness experiences of visitors to Katmai National Park and Preserve (KATM). This was a two-phase project, with research taking place during both the 2018 and 2019 summer seasons, aiming to provide an enhanced level of detail regarding the characteristics that compose KATM-based visitor experiences and the immersive opportunities that are provided through this dynamic landscape. As a result of the increasing popularity of KATM's natural resources and unique visitor experiences, visitation has continued to rise. Park managers are tasked with understanding the impacts of such visitation and developing optimal, effective management strategies as they continuously strive to maintain a balance between visitor needs and the environment. To aid in this endeavor, university researchers employed a two-phase process, with the assistance of park managers, to investigate visitor's perceptions of their experiences.

Wilderness Visitor Study cont.

The data collected from this research not only provides foundational details in comprehending the ideal visitor experience but offers integral information for management decisions as well, through the gained understanding of visitor viewpoints and actions.

Both phases of this research used a quantitative questionnaire to evaluate the preferences of visitors concerning their backcountry and wilderness experiences in KATM. For the 2018 summer season, questionnaires asked about any important aspects of the visitor experience. These results guided questions asked during the 2019 summer season regarding the experienced and expected quality of such experiential aspects. Based on the expansive backcountry and wilderness contexts within KATM, researchers spent time in varying locations to contact visitors and gain a representative reflection of the ongoing visitation experiences and resulting visitor perceptions.

Six indicators, or aspects important to experience quality, were chosen to represent a visit to KATM. These included the individual distance to a focal bear, the amount of anthropogenic sound heard per hour, the number of other groups within view, the number of other groups encountered per day, the number of fish caught per day with previous scarring, and the number of bears viewed per hour. While preferences and experienced conditions varied across user groups and locations visited, the majority of visitors reported conditions at or exceeding their expectations. Researchers conducted additional analyses to help understand use and preferences at KATM. One such analysis involved the development of utilization distributions, a 3-dimensional map of the intensity of visitor use across the park. The final report is in the review process.



Utilization distribution for all summer visits in 2017 containing a green (lowest degree of visitor use) to red scale (highest degree of visitor use).



Visitors at Hallo Bay engaging in the varied and available wildlife-based opportunities within Katmai National Park and Preserve.

Wildlife Aerial Surveys



Covid mitigation plans enabled observers to continue some of our aerial surveys like on salmon stream surveys for bears pictured below.



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.

The pandemic of 2020 created challenges for the continued monitoring of Katmai's keystone species. Maintaining the health and safety of staff and the community was a top priority. Through additional planning by staff and the support of community available Covid-19 testing, much of the aerial survey data were still collected this year.

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. Due to the pandemic, bald eagle surveys were not conducted during 2020. Katmai plans to resume bald eagle surveys in 2021 using newly developed Covid-19 mitigation protocols.

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 not only help to understand salmon run timing and abundance, but also indicate bear numbers and productivity. In 2020, sedge meadow surveys were conducted with pilot and no observer.

Wildlife Surveys cont.

Although changing to a single observer can affect the number of bears seen, the use of satellite phones allowed the pilot to call in observations to biologists who could record the data. Counts of bears congregating on salmon spawning streams and sedge meadows were somewhat higher than previous years which could indicate abundant food resources and potentially a growing population.

Moose counts of bulls, cows, and calves are conducted during the winter to monitor the moose population and look for environmental factors that might be affecting the population. During 2020, moose surveys were completed with both pilot and observer. Surveys were completed in the Branch River and Angle/Takayof trend areas. An average of 67 bulls:100 cows and 25 calves:100 cows were seen which is close to the 5-year average for these trend areas.

In 2021, Katmai plans to incorporate a caribou survey along the northern border of Katmai Preserve. The survey will be supported through Subsistence Advisory Council funds and help Resource Advisory Councils and the park better understand and manage caribou in Game Unit 9.

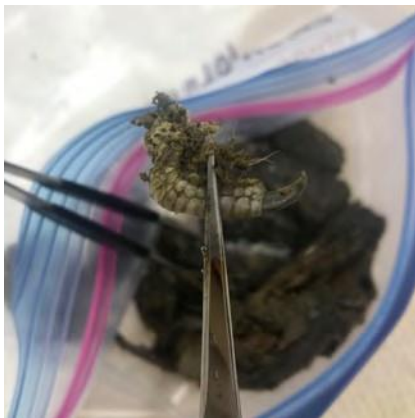
Willow Ptarmigan Pilot Study

In spring 2021 we will begin a 2-year willow ptarmigan study in Katmai National Park and Preserve and Aniakchak National Monument and Preserve. The project will be supported through Subsistence Advisory Council funds and help Resource Advisory Councils and park management of ptarmigan populations in Game Unit 9. 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 are known to be cyclical in many areas in the Arctic and their numbers can fluctuate greatly between years. Our pilot study will establish transect surveys that will allow us to determine a baseline density estimate of ptarmigan in these areas and add to existing knowledge from ptarmigan data collected in Becharof National Wildlife Refuge.



Ptarmigan in Aniakchak National Preserve
Photo: C. Ricks

Katmai coastal wolf project



Prey remains from wolf scat are processed in a lab. A process called metabarcoding extracts regions of DNA researchers can sequence to identify prey consumed.



In 2020, we continued our non-invasive pilot project to study Katmai's enigmatic coastal wolf population. In conjunction with other survey efforts we collected scat from coastal and interior areas of the park and tested hair sampling techniques near Fures cabin. We will continue and expand upon these sampling efforts through 2023, with a focus on investigating the unique foraging ecology of wolves on the Katmai coast. We will significantly increase the number and coverage of trail cameras along the shoreline and up coastal streams where wolves are suspected of fishing the salmon run. For this summer, our intention is to extensively search several coastal regions for the scats of wolves and other cryptic carnivores.

The scat and hair samples we collect will be analyzed at Oregon State University to characterize the role of wolves as generalist carnivores in Katmai's nearshore community. In the laboratory, we will employ both DNA metabarcoding of prey in wolf scats and stable isotope analysis of hair and tissue samples to reconstruct the short- and long-term diets of individual wolves. The metabarcoding process involves extracting and amplifying specific regions of genomic DNA, then sequencing these segments with a machine that can differentiate DNA molecules. The result of this analysis is a reconstruction of every prey species that a wolf has consumed over the past few days. Complementarily, stable isotope analysis will provide us with a more general overview of the contribution of marine vs. terrestrial prey items to a wolf's diet over the course of many months. We will obtain genotypes (individual wolf identities) from these samples using single-nucleotide polymorphisms (SNPs), which represent genetic variation within a species through collective single-unit differences in DNA strands. These multiple data streams from the laboratory and field will help us piece together the complex and fascinating puzzle of coastal wolf ecology in Katmai.

Changing Tides Project

The Changing Tides project in Katmai was designed to investigate the link between nearshore and terrestrial ecosystems, specifically coastal brown bears and intertidal invertebrates. The project's graduate student, Joy Erlenbach, defended her PhD in 2020 from data collected in Katmai 2015-2017. The study investigated in part, to what degree female bears along the coast consume non-salmon marine resources like clams, flounder, sea otter, and seals. Study findings indicated these resources did not show up in substantial portions in bears' dietary estimates. Erlenbach also found that the proportion of salmon in coastal female bear diets and the number of observable bears at Hallo Bay have decreased by around 50% over the last 17-27 years (Figure 1). Erlenbach stressed the potential importance of considering how bears in similar areas (such as within Katmai National Park) might be experiencing different nutritional stresses depending on the status of the salmon species or stocks that are available to them (such as bears on the coast with the primary species [pink and chum salmon] exhibiting low abundance versus bears on the interior with the primary species available [sockeye salmon] exhibiting record high abundance; Figure 1).

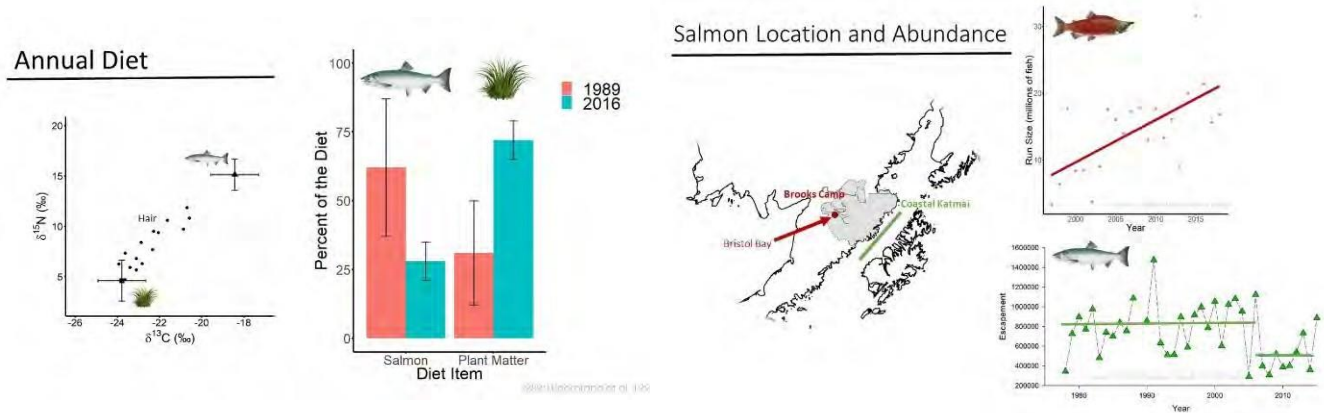


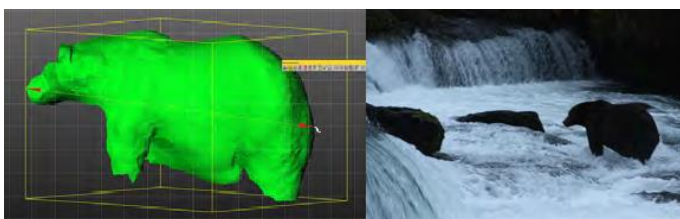
Figure 1. The carbon and nitrogen stable isotope values of bear hair, in relation to potential diet items (plant matter and salmon). Hair is grown approximately May-September and therefore represents approximately the annual diet. Annual diet estimates from the bear hair (1989 in red, 2015-2017 in teal), showing much lower salmon consumption during this study (2015-2017), and trends in salmon abundance (pinks and chums) for coastal bears during the 1989 study and during our study (green), versus sockeye salmon abundance for interior (Brooks camp and other) bears (red).

Further work needs to be done to determine whether the large decrease in salmon consumption seen during the Changing Tides study was a transient response to low salmon abundance during the study or a signature of a more long-term trend. Regardless, the finding seems to indicate that bears' diets can significantly change in what appears to be a response to low salmon abundance. Another finding in Erlenbach's study showed that as salmon consumption decreased over the last 27 years, plant matter consumption increased, with densities of bears on salt marshes in Katmai being 43 times higher than the average density of bears in the park, and often exceeding the densities of bears found at the mouths of coastal salmon streams. The high densities of bears on salt marshes may be an indicator of resource quality. The combination of protein in sedges and high digestible carbohydrate in goose tongue vegetation in salt marshes can lead to high caloric intake when the two are consumed together. All bears gained weight early in the season consuming primarily vegetation, suggesting that plant resources can be important for bears to meet their nutritional needs. Plant matter resources may act as an important buffer resource if other food items (including salmon) decline.

Finally, Erlenbach's research resulted in improvements to methods currently used to estimate diets of wild bears. Erlenbach's dissertation titled "Nutritional and Landscape Ecology of Brown Bears (*Ursus arctos*)" can be found online through ProQuest (ID 2453710130). Erlenbach continues to work on coastal bear research as the bear biologist for the Kodiak National Wildlife refuge just across the Shelikof strait from Katmai.

Bear Scanning: A Non-invasive Tool

A high-precision terrestrial lidar scanner was used to create a three-dimensional model of bears used to estimate volume. Bear 747 came in at the largest volume of all the competitors at an estimated 22.6 cubic feet—a little larger than an extra-large-capacity chest freezer or the equivalent of 80 bowling balls!



In 2018, Alaska regional GIS specialist Joel Cusick devised a method of laser scanning to non-invasively measure the volume of the portly participants of Fat Bear Week. He returned this year, armed with knowledge gained and the patience to wait for a bear waiting for a fish. Terrestrial LiDAR Scanning is used almost exclusively in civil engineering fields to scan interiors of buildings, so putting it to the test on live animals is new. Right now, we can use this to determine the volume of a bear as well as length, height, and girth. As we learn more, this could open other potential applications, perhaps even to monitor the overall health of these, and other, animals in the wild. More information about Fat Bear Week can be found at <https://explore.org/fat-bear-week>

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.

Laura Stelson (Penn State) proposes an archeological survey employing remote sensing methodology as part of her dissertation fieldwork focused on cultural resiliency among ancestral and historic Sugpiat-Alutiit villages of the Katmai parkland interior and Pacific coastline. Stelson is also partnering with 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).

West Naknek-American Creek Archeological Survey

Sam Coffman (UAF-Museum of the North) is proposing to conduct an archeological inventory of the West Naknek Lake and American Creek areas of Katmai National Park, to include Lake Coville, Lake Grosvenor, Naknek Lake including the Iliuk Arm, and Lake Brooks. The study will provide NHPA section 110 inventory data for these areas of the park. The purpose is to identify archeological sites and features in the park interior, especially in regard to travel and trade across ancient glaciated landforms. The multi-year project employs a newly developed predictive site model and guidance from the Council of Katmai Descendants. For more information, contact Linda Chisholm (907-469-0322, or linda_chisholm@nps.gov).

Partnering with Elders Project, 2020 Update

Although the 2020 Cultural Resources field season was canceled due to COVID-19, 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).

Other Natural Resources Program Updates

• 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 completed marine debris surveys on beaches at Dakavak Bay and Hallo Bay. We surveyed for seabird carcasses on our beaches at Hallo Bay and in our local community at Naknek Beach.

• Brooks River Bear Monitoring

Biologists continue to track individual bear use of Brooks River. The more than 20-year dataset is being used to estimate annual survival of different age and sex groups within the local Brooks River bear population. Results from the study are expected in 2021.

• Backcountry Impacts Monitoring

Park staff continued the collection of field data, including photos and GPS locations, to document human impacts (evidence of camping, campfires, etc.) in the backcountry. This is part of a long-term effort to monitor backcountry conditions. In 2020 field work focused on the north arm of Naknek Lake.

• Bat Monitoring

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

• Invasive Plant Management

We treated invasive plants in the Brooks Camp Area and Fures Cabin and plan on having a larger crew to help with invasive plant control in 2021.

• **Brown bear research report available online:**

Spatio-temporal distribution of coastal brown bears and visitors in Katmai National Park, Alaska
<https://irma.nps.gov/DataStore/Reference/Profile/2283864>

Additional External Agency and Researcher Projects

Water Quality Study of the Alagnak Wild River

Adventure Scientists - a not for profit group, intends to deploy volunteer scientists to access the Alagnak and Nonvianuk Rivers by pack raft or kayak and will be using field instruments to record dissolved oxygen, pH, temperature, and conductivity of the waters. In addition, they will be collecting grab samples which will be laboratory analyzed to detect dissolved nitrogen, nitrates, ammonium, phosphorus and organophosphate, sodium, sulphates and metals. This data will be used to update the water quality information for the Alagnak River and is being conducted in conjunction with similar studies occurring across the National Wild and Scenic River System.

Water Quality Study of the Aniakchak Wild River

Adventure Scientists - a not for profit group, intends to deploy volunteer scientists to access the Aniakchak River by pack raft or kayak and will be using field instruments to record dissolved oxygen, pH, temperature, and conductivity of the waters. In addition, they will be collecting grab samples which will be laboratory analyzed to detect dissolved nitrogen, nitrates, ammonium, phosphorus and organophosphate, sodium, sulphates and metals. This data will be used to update the water quality information for the Aniakchak River and is being conducted in conjunction with similar studies occurring across the National Wild and Scenic River System.

The Brown Bear Viewing Experience at Brooks River

Michael Fitz from Explore.org is proposing to conduct a visitor use survey at Brooks Camp to determine the visitor experience at this location in the park as it relates to their prior experiences with the Brooks Camp web camera system operated by Explore.org. The team would be on site in the Brooks River area and would be intercepting visitors aged 18+ with a series of questions related to their previous history with the web camera system and their experiences on the ground at Brooks Camp.

Geophysical Imaging of the Magmatic Plumbing of the Katmai Volcanic Group

Paul Bedrosian with USGS and in collaboration with AVO would embark on a multiyear project to measure the magma chamber located beneath the Katmai Volcanic Group. This project would entail the team setting up a series of approximately 120 ground sensors that would take electromagnetic readings of the group beneath the sensors. The sensors would be buried into the ground to ensure good contact with the measurable area and to reduce the amount of atmospheric interference with the sensors. This study would be a first of its kind for Katmai and would further expand the scientific understanding of this volcanic area.

Geologic Investigation of Mt. Douglas and Fourpeaked Mountain Volcanoes

Tim Orr with the USGS is proposing to conduct a project studying Fourpeaked Mountain and Mt. Douglas volcanoes located at the northeast corner of Katmai National Park. The team will have several study areas around these volcanoes examining the exposed rock edifices to collect rock samples, a tephra study along the adjacent riverbanks and gullies and all sides of the volcanoes, and a lahar and pyroclastic flow study focusing on all major drainages near these mountains to evaluate flowage deposits in terms of size, extent, and character. All laboratory analysis will be performed and administered by the USGS in Anchorage and collected samples will be temporarily curated and archived at the USGS Alaska Tephra Laboratory and data center in Anchorage Alaska.



We will continue to collect timelapse photography data at sedge and intertidal areas to better understand bear and visitor activity patterns.



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**Katmai National Park & Preserve
Aniakchak National Monument & Preserve
Alagnak Wild River**
P.O. Box 7
King Salmon, AK 99613

Phone
(907) 246-3305

Web
Katmai NP&P: www.nps.gov/katm
Aniakchak NM&P: www.nps.gov/ania
Alagnak WR: www.nps.gov/alag

Contributors and Photo Credits:
Kelsey Griffin, Leslie Skora, Alyssa Reischauer, Linda Chisholm, Brian Smith, Joy Erlenbach, Ellen Dymit, Kansas State University, Clemson University

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