



Resource Management 2016



NPS/S Backensto

US Fish and Wildlife Service Biologist Robb Kaler surveyed approximately 12 miles of Katmai's beaches for seabird carcasses as part of an effort to investigate the extent and magnitude of the common murre die-off during a coastal survey in March. To learn more about this project, see page 7.

Each summer, 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. Summer is the time to do it: rivers are flowing, wildlife is active and study sites are accessible. With more than 4.73 million acres between the three park units, this is a busy time of year.

Resource Management falls under three main groups: cultural resources, natural resources, and inventory & monitoring. The cultural resource program focuses on the human history of this region, including archeology and anthropology. The natural resource program studies biological and physical resources, such as wildlife, fish, plants, wilderness, and backcountry resources. The third group, inventory and monitoring, is part of a National Park Service effort to understand the status of the park's significant natural resources. The Southwest Alaska Network (SWAN) Inventory and Monitoring Program cooperates with the park to conduct various surveys to understand how park resources may change over time.

2016 marks the 100th year anniversary of the National Park Service. Throughout this field season, look for project and research updates on our website (www.nps.gov/katm), Facebook page, and through the explore.org Katmai bear cams. We hope that you enjoy reading about the many projects occurring in these remarkable parklands. See you in the field!

Research Permits

In addition to work conducted by NPS staff, external researchers come to conduct studies. Some of the projects being studied include investigations of the ongoing volcanism in the area, climate, wildlife ecology, and contaminant accumulation. 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.

2016
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Geophysical Survey (GPR)



NPS/JL Chisholm

Rob Jacob and Tommy Urban at Overlook cabins with 1000MHz GPR.

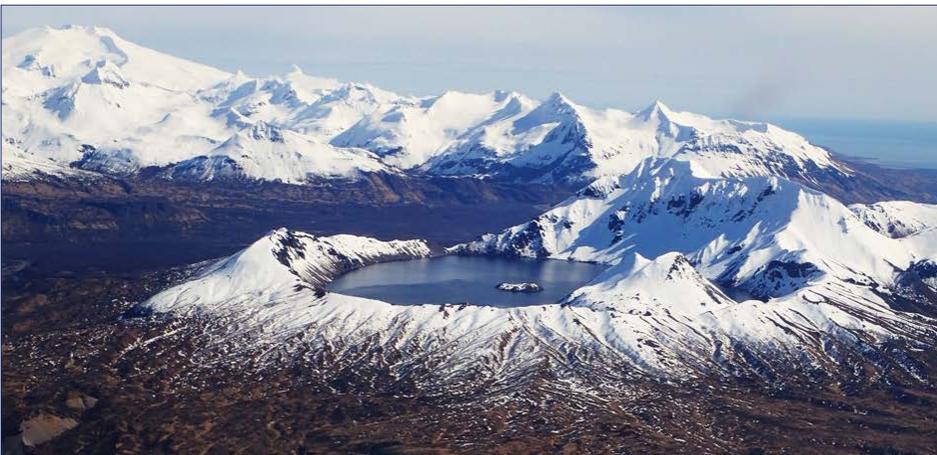
2016 marks the second year of collaborative geophysical survey work between the Katmai Cultural Resource Program and CESU researcher Dr. Tommy Urban (Cornell University, Tree Ring Laboratory). In 2015, Urban and his colleague Dr. Rob Jacob (Bucknell University, Department of Geology and Environmental Geosciences) joined Katmai archeologists Dale Vinson and Linda Chisholm to assess the complex matrix of subsurface cultural resources and facilities infrastructure at Brooks Camp. Gates of the Arctic archeologist Jillian Richie lent her

expertise in prepping the survey grids for the several types of instruments used to identify subsurface anomalies. These include a 250MHz and 1GHz ground-penetrating radar (GPR); a multi-frequency electromagnetometer (EM), and a G-858 cesium-vapor magnetometer (MAG). Each of these tools provides archeologists with a unique window into deeply-buried house depressions and associated features that are not obvious from the ground surface.

Brooks Camp is located within the boundaries of the Brooks River Archeological District (XMK-050) and the Brooks River Archeological District National Historic Landmark (XMK-0204). This District includes at least one thousand known cultural depressions that span over four thousand years of human habitation along the current and former terraces lining the Brooks River. By the mid-twentieth century, the Brooks River supported a fly-in fishing lodge and a popular bear-viewing operation that installed several dozen buildings and maintenance assets to support a

growing number of visitors and staff. Not surprisingly, this juxtaposition of irreplaceable cultural resources with modern construction and utility corridors presents continuous challenges for Park management and resource protection. The GPR instruments identified collapsed timbers and hearths within several depressions, include two very large features that may have served as community meeting houses or ceremonial lodges. The GPR images also illustrated utility lines and trenches previously unknown to cultural resource managers which coincide with other sensitive resources around the visitor cabins and the concessioner lodge. The EM and MAG instruments identified several electrical and magnetic anomalies that also suggested the presence of hearth features and activity areas that may be related to food processing or working skins and hides into useable materials. Chemical analyses of soil samples as well as carbon dating results are pending.

Savonoski Drainage Archeological Survey



NPS/JL Chisholm

View of Kaguyak Crater during a pre-season aerial survey.

2016 marks the first year of a three-year survey of the Savonoski and Ninagiak River drainages. Archeologists will traverse areas of high probability for short-term camps and village sites along river corridors that likely supported the historically-documented travel between Katmai Coast villages like Kaguyak-Douglas and those found within the lower Savonoski drainage.

Tribal Consultation

The Cultural Resource Program is currently working with Alaska Region Cultural Resources and Alaska Native Liaison personnel to create a robust protocol for appropriate Government-to-Government and Section 106 Compliance National Historic Preservation Act (NHPA) tribal consultation. Through this process, the Park will identify and contact federally-recognized Tribes, Village Councils, Regional Councils and Affiliated Parties who should be engaged in meaningful consultation prior to any Park projects or management decisions that potentially affect cultural practices, resources, or access to traditionally important lands.

Bear Foraging Strategies Along the Katmai Coast

This summer, wildlife biologists will continue behavioral observations of coastal bears and the collaring and sample collection from a small number of bears as part of the Changing Tides project. In 2015, nine bears were fitted with GPS collars to evaluate their use of coastal habitats. In general, the bears were found to occupy relatively small areas, staying within about 3.5 miles of the coast, and traveled between 5 to 22 miles along the coast over the entire observed active season (based on data from three collars; late May to early October). Some bears did occasionally make longer forays inland or even onto islands. In a comparison of weight gain before and after salmon are available to bears, researchers found that bears were able to gain 1.9 pounds per day before salmon (based on data collected from six bears) and 1.4 pounds per day during the salmon season (based on two individuals), suggesting that early season food resources, such as clams and vegetation can have a significant effect on weight-gain.

During the GPS collar removal last fall, one bear was found near the partial remains of several harbor seals. Although bears have been well documented scavenging on marine mammal carcasses, little is known about bear predation on marine mammals. This spring, time-lapse and motion activated cameras were installed overlooking a couple marine mammal haul-out areas where bear predation of seals and sea otters has been suspected. This project, along with the ongoing work through the Changing Tides project, will provide insight into bear foraging strategies.



NPS/K Chritz



NPS/J Walton

Washington State University graduate student Joy Erlenbach observes bears foraging in the intertidal zone at Hallo Bay (top). USGS Biologist Dan Monson installs time-lapse cameras at a marine mammal haul-out site (bottom).

A Genomic Perspective on Katmai's Brown Bears



J Nourrot

A sow and her cub play on the Valley Road at Brooks Camp. Genetic analysis will allow us to create a pedigree of Brooks Camp bears, and see how they connect with bears throughout the Park and Preserve.

Katmai is home to one of the most widely viewed populations of brown bears on the planet. But where do the bears go when we cannot see them? In 2016, park biologists

will initiate a study to use genomics to shed light on gene flow throughout the Park and Preserve. This information will help to illuminate movement patterns of bears and understand how bears are connected across the park. By collecting samples from along the coast and at various locations in the interior of the park, biologists will be able to analyze gene flow and determine if bears are crossing the mountain range that traverses the park between the coast to interior regions. Coastal samples will be collected as a part of the Changing Tides project, while interior samples will be collected via hair snares at multiple locations and biopsy darts at Brooks Camp. The use of biopsy darts at Brooks Camp will allow researchers to visually identify bears as they are sampled. With this information they will be able to construct a pedigree of the local population and evaluate the level of inbreeding in the Brooks bears. The information gained from this study will provide valuable information regarding the genetic health of the population and help inform management decisions impacting these amazing animals.

Invasive Plant Management



NPS/A Kosakowski

Student Conservation Association intern Melissa Armstrong prepares to survey for invasive plants on Mink Island in Amalik Bay.

Alaska's national parks are home to complex native communities of plants and animals that have developed over millions of years. The delicate natural balance within these communities is threatened by the influx of invasive plants, which are considered the second greatest threat to biodiversity after habitat loss. Invasive plants display rapid growth, spread with little or no human assistance, and are expensive to remove and difficult to control once established. They threaten the genetic integrity of native flora through hybridization, can out-compete native plant species for limited resources, and can change the structure and function of ecosystems.

Since 2005, Katmai's Exotic Plant Management Team (EPMT) has documented 14 non-native species on park lands with more inventoried nearby that could spread into the park. Most of the species are restricted to heavily visited areas such as Brooks Camp and Fure's Cabin; our ongoing priority is to prevent the spread of those invasives into more remote areas of the park. Each year we strive to survey new remote locations and revisit old ones to ensure that our natural areas, including coastal fjords, glacial valleys, tundra, and boreal forests, remain pristine. In addition to terrestrial surveys, we have now added aquatic surveys to our list of priorities due to the discovery of *Elodea* in Lake Hood, a hub of float plane traffic into the park. By teaming up with the Southwest Alaska Network's aquatic hydrologists, we have been able to survey many lakes and rivers in Katmai and we continue to make education a priority. *Elodea* in Katmai could have devastating effects; it has been shown to simplify aquatic communities, alter nutrient cycles and degrade salmon spawning habitats. This makes early detection and rapid response crucial in the event *Elodea* is discovered in the park's waters.

Prevention and education continue to be top priorities for the EPMT. Some preventive measures include signage

and boot brushes, inspection of heavy equipment used for maintenance at Brooks Camp, and revegetation plans following new construction. We also maintain and develop new educational materials for the park staff and its commercial service operators, and create programming for the King Salmon Visitor Center and the Fish and Wildlife Services's science camp. Outreach is also conducted through social media, local radio stations and newsletters.

The majority of national parks in Alaska contain healthy, intact native ecosystems with very low levels of infestation by invasive plants and Katmai is no exception. We will continue to educate, survey, monitor and control in order to maintain this distinction.

For further information on invasives in Katmai National Park and Preserve, or to report a suspicious terrestrial or aquatic species, please contact the Exotic Plant Management Team at 907-246-2156. Identification materials for both native and non-native species are available upon request to help visitors identify species in the field.



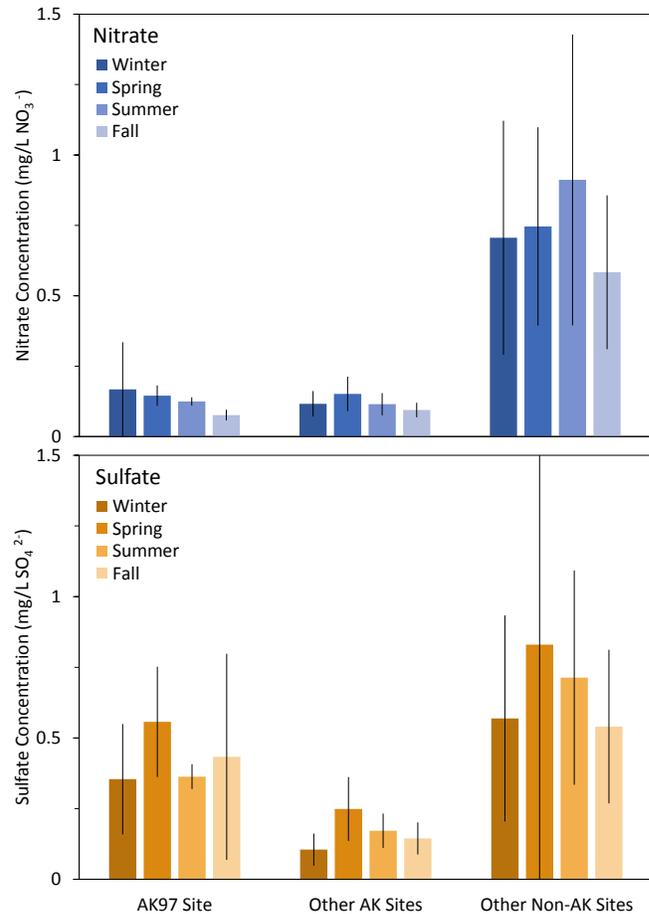
NPS/J Tourville

Capsella bursa-pastoris (shepherd's purse) on the spit at Brooks Camp.

Air Quality Monitoring

Atmospheric deposition is the process by which airborne pollutants, such as nitrate and sulfate, reach the earth. Deposition consists of both wet and dry components. Wet deposition occurs when pollutants are transferred to the ground, usually by rain and snow but also by fog and mist. Wet deposition has been monitored in North America since 1978 by the National Atmospheric Deposition Program's National Trends Network (NTN). The network currently includes 261 active monitoring sites, one of which is operated jointly by the Southwest Alaska Network and Katmai National Park and Preserve. This site (known as AK97) is located in King Salmon, Alaska, and is one of only five active NTN sites in the state. Recent average nitrate concentrations at AK97 are comparable to those at other Alaska sites, and lower than averages elsewhere on the continent (top right graph). Average sulfate concentrations at AK97 are more variable, and tend to be intermediate between those at Alaska and non-Alaska sites (bottom right graph).

Arctic and subarctic ecosystems are particularly sensitive to the deposition of excess nitrogen and sulfur. Effects include the disruption of ecosystem processes and the alteration of species composition and abundance. Although concentrations of nitrate and sulfate are relatively low at most sites in Alaska where monitoring occurs, atmospheric pathways capable of transporting pollution to the northwest coast of North America are worth noting. As the global human population grows, so does the likelihood that Alaska air quality will be impaired by increasing emissions from other continents.



Seasonal average concentrations of the two common pollutants for the years 2011-2014.

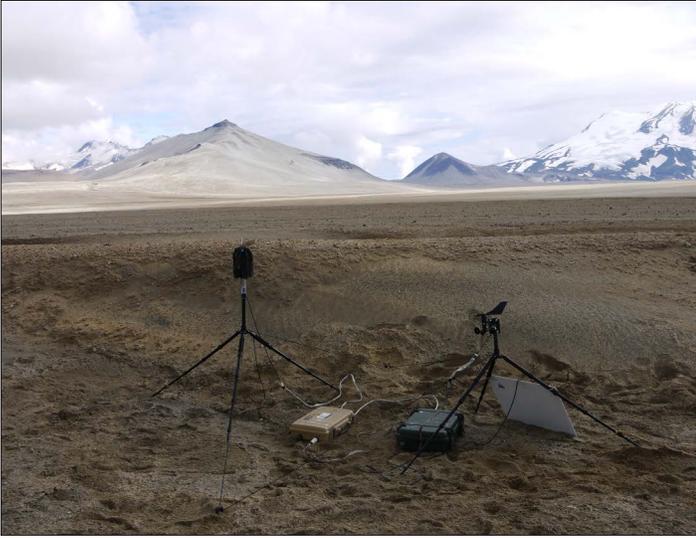
Baseline Monitoring of Alpine Vegetation in Katmai



NPS scientists survey a long-term vegetation alpine monitoring site near Hammersly Lake in Katmai NPP. Several alpine areas in Katmai NPP will be surveyed in 2016, including sites near Pfaff Peak, Mirror Lake, Hammersly Lake, and Wolverine Lake.

The alpine environment is the product of extreme natural conditions, including high winds, low temperatures, scouring and burial by snow and ice, and a short growing season. Adaptations of species to these conditions, such as low stature, determinant growth cycles, and specific leaf morphology, can result in tight relationships between species persistence and environmental processes. Vegetation studies across Alaska, including at Katmai National Park, have shown that plant species diversity in alpine environments can often be much larger than diversity in adjacent lowlands. Alpine areas are also known to support a much higher number of Alaska-Yukon endemics, and amphi-Beringian or circumpolar species. Changing environmental conditions that are expected to affect alpine plant communities include a warming climate and increasing climate variability, encroachment of shrubs and trees into tundra areas, shifting atmospheric chemistry and pollutant loads, and increasing variability in plant pathogens and pests. An important priority for the Southwest Alaska Network is to monitor Katmai's alpine environment for change that could alter certain vital ecosystem functions.

Soundscape



NPS/D Betchkal

Sound equipment was installed in the Valley of Ten Thousand Smokes in late July, 2015.

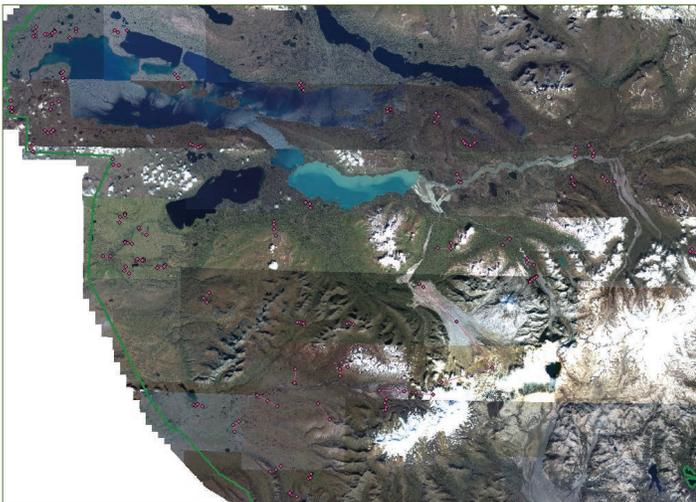
The sounds around us can have a powerful impact on our emotions and enhance our experiences. At Katmai National Park and Preserve, natural sounds such as the call of American Robins or Greater Yellowlegs can signify the beginning of Spring. The purring sound of nursing bear cubs can delight visitors at Brooks Camp; whereas the sound

of an animal sniffing around outside a tent at Hallo Bay can make for a fitful night's sleep for the campers. Natural sounds are an important component of the natural world and the park service strives to protect these resources.

Last summer, Katmai National Park, in cooperation with the NPS Natural Sounds department, began a three-year soundscape inventory throughout the park's wilderness. Each year, sound recording equipment is installed at several backcountry locations where it records continuously for a month. During 2015, the first year of this study, three sites were surveyed, each with varying degrees of visitation. The frequency and amplitude of anthropogenic sounds are of particular interest in this study, as they can impact the natural soundscape, which can affect wilderness character and visitor's experience.

Last summer, equipment was installed at Swikshak Lagoon, Pfaff Mine and in the Valley of Ten Thousand Smokes. This summer, sound equipment will be installed at Cape Douglas, Hallo Bay, and Katmai Bay on the coast, as well as at American Creek, Jo Jo Lake and on Naknek Lake in the park's interior. For more information on natural sounds research in the National Park Service go to: <http://www.nature.nps.gov/sound/index.cfm>

Soil Inventory



Potential soil inventory survey locations (in pink) for 2016.

This summer, the Alaska Inventory and Monitoring Program will be working with ABR, Inc.—Environmental Research & Services (ABR) to conduct a soils inventory of Katmai National Park & Preserve. The objective of the inventory is to gain a better understanding of how soils contribute to the richness and character of the park by identifying soil types and describing their distribution.

Why study soils? On various scales, soil influences ecological processes that modify and drive vegetation patterns, regional hydrology, nutrient dynamics, habitat development, and landscape evolution. Through its structure, texture, and permeability, soil influences vegetation and succession processes and provides a way for nutrients to be recycled. Such processes create the complex and diverse landscapes that are protected in the Park.

This project will provide a baseline dataset that can be used to inform a variety of future research and monitoring studies. Information from this survey will improve the park's general understanding of how soils influence park ecological processes. The project will require two seasons to complete the systematic examination, description, classification, and mapping work. Field work will primarily be accomplished using helicopters to access field sites. To identify and classify soils, the crews will study five soil-forming factors - climate, topographic relief, biological activity, time, and parent material. Using soil samples taken along predetermined transects, soil scientists will describe the current physical and chemical properties of soil horizons, such as soil color, texture, structure, and soil pH. Data will also be collected for vegetation, landforms, and surface hydrology.

Coastal Survey Reveals Evidence of Common Murre Die-Off

In response to the yearlong widespread common murre die off along the Pacific Coast, including the northern Gulf of Alaska, the Southwest Alaska Network led a field investigation in March along the Katmai Coast to survey live marine birds found in the nearshore habitat as well as to survey beaches for dead common murres. A crew from NPS, USFWS and USGS launched from Homer aboard the M/V Island C and headed to the park's coastline to conduct skiff-based marine bird and mammal surveys and beach-based carcass surveys.

Surveyors found evidence of the die off everywhere they looked, from Sukoi Bay on the north side of Cape Douglas, south along the coast to Hallo Bay, Swikshak Bay, Kukak Bay, Amalik Bay and Geographic Harbor.

Crews searched 19 segments of beaches (a combined total of approximately 12 linear miles) and two offshore islands. They counted over 2000 seabird carcasses (1,988 murres, 16 crested auklets, 2 least auklets, 1 marbled murrelet, 1 glaucous-winged gull, 2 black-legged kittiwakes, 2 cormorants, and 23 unidentified small alcids). Nearly all carcasses were estimated to be on the beach for over 1.5 months, heavily scavenged, and found further inland on the beaches. Two fresh carcasses were sent to USGS National Wildlife Health Center. Preliminary results indicate that both birds were emaciated. Routine cultures are pending.



NPS/E Kunisch

Unusually high numbers of common murres were counted during the 2016 winter survey.

In addition to fresh carcasses, 100 wings were collected and will be analyzed for nutritional stress analysis at UAF. The highest density of observed carcasses was at the head of Kukak Bay; over 500 in about a half-mile stretch of beach in a wrack line at the upland edge of a tidal estuary.

Kukak Bay is also where observers estimated thousands of live murres were congregated as well as more than a dozen Humpback whales and hundreds of Steller sea lions, suggesting abundant prey availability in the area. ADF&G has been monitoring herring biomass in Kukak Bay since 2008 and while biomass is variable year to year, 2015 was the highest ADF&G has recorded (ADF&G per comm.).

Though the search effort was substantial, total carcasses counted during this survey likely represents only a fraction of dead murres in the area; winds and currents may have moved the carcasses, and beach deposition may have buried others.

Interestingly, there seems to be to a big change in live common murre distribution this year in Katmai. Repeating nearshore transects surveyed by the NPS Southwest Alaska Network in previous years, observers recorded 634 live common murres on 21 transects this March compared to zero birds in March of 2009 and 14 birds in March of 2012. Transects that common murres were observed on this year varied from protected bays to exposed coastlines, so there seemed to be no particular habitat type they were associated with. Another surprise was the unseasonably warm weather. This year there was snow only on the mountain peaks and almost no ice on the water with the exception of thin ice in Hidden Harbor, compared to other years with snow to the water line and ice-filled bays.

While we don't know what the long-term effects of this die-off may be, NPS will conduct further surveys this summer and continue to collaborate with other agencies and partners to understand causes and effects of this anomalous event.



NPS/J Walton

SWAN ecologist Heather Coletti removes a wing from one of the nearly 2000 common murre carcasses found during beach surveys. One hundred wings were collected for future analysis of nutritional stress.

2015 Marine Debris Cleanup



NPS/K Nicolato

Biological Science Technician Bob Peterson loads marine debris onto the M/V Island C's landing craft. Trash from Katmai was incorporated into a larger Gulf of AK marine debris removal effort led by the Gulf of AK Keepers (www.goak.org) and was transported to Seattle, WA by barge for recycling and disposal through Waste Management.

Last summer, Katmai National Park was involved in a multi-park marine debris cleanup and outreach project. Staff and volunteers from Katmai NP, Kenai Fjords NP, Wrangell St. Elias NP, Bering Land Bridge NPr and Cape Krusenstern NM cleaned nearly 50 miles of NPS coastline and removed 11.9 tons of debris. Katmai's contribution to this effort was the removal of 5.5 tons of debris from over 16 miles of coastline from Sukoi Bay to Hallo Bay. Of the

debris collected in KATM, 68% was hard plastics, 20% were ropes and nets and 7% was foam (styrofoam type plastics). The remaining 5% of the trash was a mixture of metal, rubber and other materials. This project not only removed trash that could potentially harm wildlife, it also improved the visitor experience and the wilderness character of the beautiful Katmai Coast.

The Alaska SeaLife Center, a key partner in the project, compiled and analyzed the data from all parks. There was a distinct difference in debris density between the Gulf of Alaska parks (Katmai, Kenai Fjords and Wrangell St. Elias) and the Western Arctic park units (Bering Land Bridge and Cape Krusenstern). Significantly higher debris loads were found within the Gulf of Alaska parks, particularly for plastics and foam. Currents, vessel traffic and the presence and duration of sea ice in the Bering Sea likely play a significant role in these differences; however changes in climate, particularly decreasing sea ice leading to increases in vessel traffic, will likely lead to higher debris loads in the Western Arctic area in the future. Marine debris is an ongoing issue in coastal areas throughout the world. Education and outreach are critical to drawing attention to this global issue.



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Seabird Colony Inventory

Each spring, a variety of seabirds return to Katmai to breed. Coastal cliffs and nearshore islands are important breeding areas for a variety of seabirds including black-legged kittiwakes, horned puffins, tufted puffins, pigeon guillemots, glaucous-winged gulls and cormorants. This summer, a seabird colony inventory will be conducted along the Katmai Coast.

The purpose of the inventory is to update existing information of known colonies, and to identify and document any new or previously undocumented colonies. Marine mammal haul-outs will also be recorded. Surveys will be conducted by boat, and both individual birds and nests will be counted. The data collected will be incorporated into the seabird database managed by the US Fish and Wildlife Service.



USFWS/K Payne

Glaucous-winged gulls are a common sight along the Katmai Coast.

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