Southwest Alaska Network Inventory and Monitoring Program
National Park Service

Midwinter Notes 2008

Serving the Alagnak, Aniakchak, Katmai, Kenai Fjords, and Lake Clark units of the National Park Service

The SWAN completed biological inventories in 2007, and is now in the process of developing Protocols and Standard Operating Procedures (SOPs) to monitor a suite of vital signs (V.S.) in six project areas. The 2008 edition of the Midwinter Notes presents a synopsis of project updates and plans for 2008. Not all vital signs are presented here. Additional information related to SWAN projects and vital signs is available on the Internet: http://science.nature.nps.gov/im/units/swan/

Biological Inventories

Biological inventories have been completed in the SWAN park units for:

amphibians; invertebrates;
freshwater fish; birds;
mammals and vascular plants.

The only amphibian known to occur in SWAN parks is the wood frog. Biologists confirmed the presence of several previously undocumented bird species that were thought to reside in SWAN parks. Vascular plant inventories led to range extensions for several plant species. The results of these inventories are summarized in reports that are available for viewing and downloading at: http://science.nature.nps.gov/im/units/swan/index.cfm?theme=inventory_species

Human Activities

V.S. Rationale - Air quality in SWAN parks is considered pristine by national standards, but airborne pollutants associated with increasing global and regional industrialization, and increased particulate loads associated with wildfire and volcanic activity, have the potential to affect climatic conditions and ecological processes in the Network.

- SWAN is taking steps to establish a National Atmospheric Deposition Program (NADP) site to monitor wet deposition in SWAN parks. Due to the power and sampling requirements, King Salmon holds the most promise.
- The NADP is a long-term program that has been monitoring a suite of chemical parameters for over 20 years. Collection sites are located throughout the U.S. and many are in national parks, including Denali NPP. The NADP web site posts maps of wet deposition trends across the U.S. (http://nadp.sws.uiuc.edu/)

NADP Aerochem wet deposition collector and electronic rain gage in Denali NPP. This station has been in operation since 1980.

SWAN staff retrieving Lake Clark temperature array in October 2007. A temperature array will be deployed in Naknek Lake in 2008.

Freshwater Flow Systems

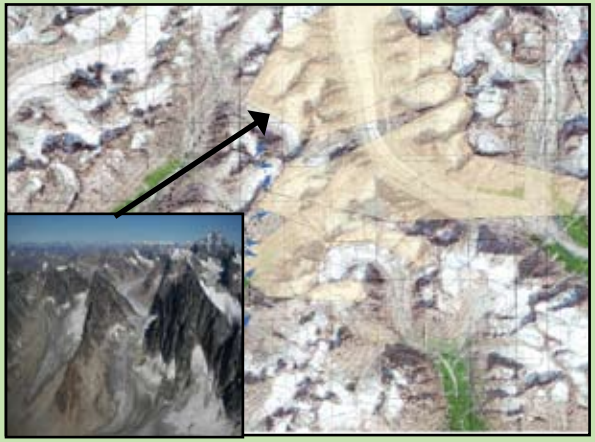
V.S. Rationale - The SWAN parks contain some of the largest and most pristine freshwater resources in the national park system. These include Naknek Lake and Lake Clark, numerous multi-lake systems, and thousands of miles of rivers, including five designated "Wild Rivers"—and largely unexploited resident lake fish populations.

- Outflows at Naknek Lake, Lake Brooks (KATM), Lower Twin and Telaquana Lakes (LACL) are currently instrumented with level loggers, which will allow SWAN staff to monitor lake level fluctuations over time.
- Temperature data from the Lake Clark temperature array were collected for water year 2007 (10/1/06-9/30/07). This vertical array will show trends in ice cover formation and break-up, and thermocline development, two processes that directly influence lake productivity.

Landscape Dynamics & Terrestrial Vegetation

V.S. Rationale - Glacier Extent Mapping – Glaciers are a significant landscape feature in SWAN parks, but they have been in widespread retreat and thinning since the end of the Little Ice Age (1900). Although this ice loss has occurred at varying rates over time, it is generally understood to have increased in the last few decades. This variation in glacial coverage is responsible for landscape change within these parks.

- GIS data sets are being developed for the LACL & KATM glacier photo series taken in 2007. The resulting GIS coverage will identify the image location and a corresponding map area that defines the view captured by the image. Stayed tuned for a GIS coverage update!
- This photo series will assist in the interpretation of Landsat images used to analyze glacial extent, especially for areas in which glacier ice is obscured by shadows, debris, or clouds.
- Glacial extent has decreased in both KATM and KEFJ over the period of 1986-2000 by approximately 1.6%, and 7.7%, respectively. Mapping is currently underway for LACL.



GIS coverage showing map area linked to an image from the glacier photo series. Additional attribute data (glacier name, watershed, etc.) are stored in a linked table.

Upper: Salt marshes provide critical habitat for bears in SWAN parks.
Middle: Measuring species cover in a beach berm community, Silver Salmon Creek (LACL).
Lower: Characterizing the soil profile in a beach rye meadow.

V.S. Rationale - Sensitive Vegetation Communities– Salt marshes have been identified as a sensitive vegetation type in the SWAN. These areas provide critical bear habitat where the bears graze on sedges and other salt marsh vegetation. Changes in sea level, storm surges and sediment loading related to climate change may alter these important salt marsh communities.

- Long-term monitoring transects were established at two salt marsh sites in LACL. Measurements were collected for species cover, soil pH and salinity in brackish meadows, and water level and temperature in tidal channels.
- Additional monitoring transects will be established in Swikshak and Hallo Bays (KATM) in 2008.

V.S.Rationale-Terrestrial Vegetation–Lowshrub/dwarf shrub plant communities include high densities of lichen, which provide critical habitat for wildlife in LACL and KATM. These lichen-rich communities provide forage and habitat for a number of species, including caribou, bears, ground squirrels and birds. This vegetation type is characteristic of interior areas throughout LACL and KATM, and is one of several vegetation types that will be monitored in the SWAN.

- Long-term plots were established at ten sites in LACL in 2007 to monitor plant species distribution and frequency over time. The project will expand to include interior sites in KATM in 2009.
- These plots will be re-sampled every 5-10 years to track changes in species composition in these low shrub communities.

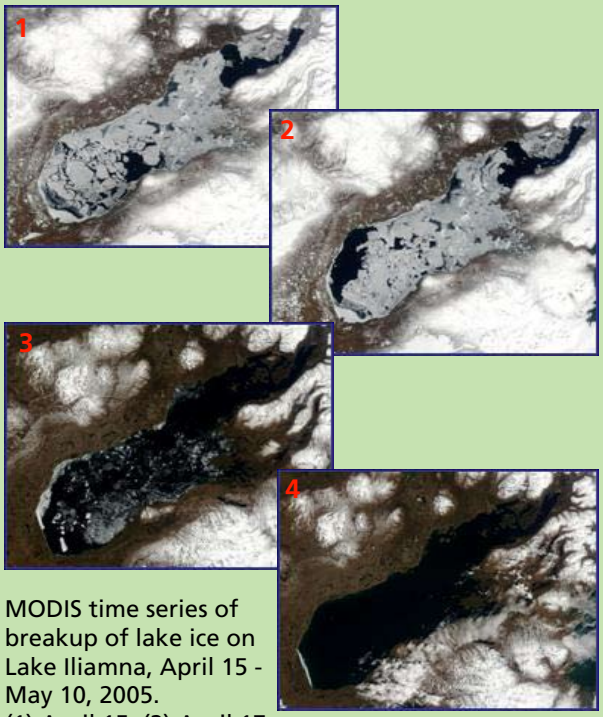
Lower: Vegetation transect from plot established in the Caribou Lakes area (LACL).
Upper: Plant species composition and frequency data are collected from nested quadrats ranging in size from 0.25 m^2 to 4.0 m^2.

Drying ponds and increasing shrub cover are two examples of change occurring on the SWAN landscape.

Landscape Dynamics & Terrestrial Vegetation

V.S. Rationale - Landscape Processes - The SWAN is monitoring the timing of freeze-up and break-up of large lakes, snowpack formation and snowmelt, and vegetation green-up and senescence as part of the vital sign Landscape Processes. The primary tool to monitor these events is multispectral satellite data currently acquired by the MODIS satellites.

- Analysis of MODIS data enables SWAN ecologists to detect anomalies in snow and ice cover, such as we saw in the winter of 2002-03 when the snowpack was very thin and large lakes remained ice free.
- Imagery to date (2000 – 2007) indicates that establishment of lake ice is highly variable, and is linked to the onset of fall freeze-up. Vegetation growth patterns appear less variable.



MODIS time series of breakup of lake ice on Lake Iliamna, April 15 - May 10, 2005.
(1) April 15; (2) April 17; (3) May 8; (4) May 10.

Weather & Climate

V.S. Rationale - Climate is a basic driver of all ecological systems. Global climate models predict that climate change and variability will be most severe at high latitudes, and there are many indications that environmental conditions are already changing in these regions.

- In 2008, seven weather stations are scheduled to be deployed throughout the SWAN parks: KATM - 3, LACL - 3, and KEFJ – 1
- The Harding Icefield weather station (KEFJ) has been in operation for the last 3 years. To date, average temperature ranges between 24.3 and 28.5 °F. A high of 71.7 °F was recorded in 2005 and a low of -21.4 °F was recorded in 2007.
- Near real-time weather observations for the Harding Icefield weather station can be viewed at: http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?akAHAR

Left: Detailed map location of a proposed weather station site at Coville Lake in KATM.
Right: Aerial view of Coville site looking southwest.

Right: Detailed map location of a proposed weather station site on Fire Cove in KEFJ.
Lower: Looking south across the Fire Cove site.

Terrestrial Animals

V.S. Rationale - Brown bears are an integral part of SWAN parks. They play important ecological roles as top predators by influencing population dynamics of other species and serving as means of nutrient transfer from spawning salmon to the terrestrial system. SWAN parks support high densities of brown bears; estimated densities of brown bears along the KATM coastline are among the highest reported in North America.

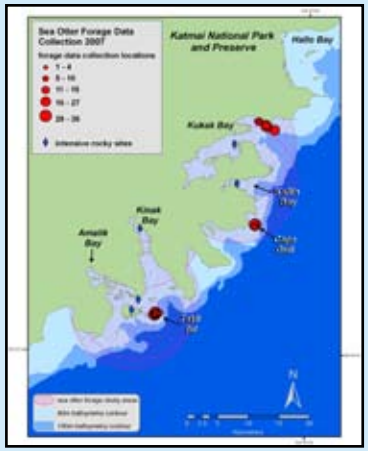
- The protocol to monitor the brown bear population and distribution in SWAN parks is based on aerial techniques developed by the Alaska Department of Fish & Game.
- Simulations have been run to estimate the sampling frequency (i.e., annually, every 5, 7, and 10 years) required to detect changes in bear populations over time.

Brown bears feeding on salmon at Brooks Falls (KATM). The bears concentrate in large numbers along rivers where salmon are abundant.

Marine Nearshore

V.S. Rationale- The marine coastline of the SWAN spans 1,900 km in the Northern Gulf of Alaska and contains almost one-third of the marine coastline in the national park system. The intertidal and subtidal areas of the nearshore habitat are some of the most productive in the Gulf of Alaska and are highly susceptible to anthropogenic disturbances. Nearshore habitats provide important feeding grounds for larger animals such as sea otters and brown bears and provide nurseries for marine organisms. The marine nearshore project comprises a suite of six vital signs: kelps and seagrasses, marine water quality, intertidal invertebrates, marine birds, black oystercatchers, and sea otters.

- Two years of nearshore vital signs monitoring data have been collected in KATM (2006 and 2007). Monitoring was initiated in KEFJ in 2007.
- Annual monitoring is expected to continue for the first five years of the project to estimate the natural range of variability for the six vital signs.
- Early findings for marine birds, black oystercatcher (BLOY) and sea otters are presented based on 2007 data except where noted.



Locations of sea otter observations where dietary and behavioral data were collected.

Biologists recording sea otter foraging behavior.

Sea otter feeding on a clam.

Black oystercatcher surveys were conducted on six transects in KATM and five transects in KEFJ. Nests were found to be more abundant in KATM. Based on sampled areas, this may be due to the increased availability preferred of BLOY habitat in KATM. Eggs and chicks were observed in the active nest sites in both parks. Half of the active nests observed in 2006 were active in 2007 in KATM. Nesting data are presented below.

	KATM	KEFJ
Active	22	6
Failed	4	1
Inactive	6	unkn

Upper: Black oystercatcher nest with chick and egg.
Lower: Black oystercatcher family - adult with two chicks.

Sea otter density and distribution were estimated from the marine bird and mammal surveys. Researchers used spotting scopes to record foraging behavior of sea otters, including predominant prey items and foraging success rates across dives. Teeth from sea otter carcasses were collected during beach surveys for laboratory analysis to estimate age at death, which will be used to estimate the population structure. Data are summarized in the table below.

	KATM	KEFJ
Predominant prey	clams	mussels
Predominant age class at death	juvenile (2006 data)	unknown
Dive success rate	87%	91%

Marine bird and mammal surveys were conducted by boat along 181 km in KATM and 185 km of shoreline in KEFJ representing 27% and 20%, respectively, of shoreline in each park. Nearshore surveys recorded all bird and mammal observations within 200 m of the shoreline, whereas pelagic surveys recorded observations >200 m offshore. The table below lists the major bird species recorded during these surveys, by highest to lowest abundance.

	KATM	KEFJ
Nearshore	Glaucous-winged gull Black-legged kittiwake	Glaucous-winged gull Tufted puffin Black-legged kittiwake
Reliant on Nearshore	Harlequin duck Surf scoter Common merganser Red-breasted merganser	Harlequin duck Surf scoter Common merganser
Pelagic	Black-legged kittiwake Glaucous-winged gull	Not conducted

Education and Outreach Products

- Commercial Operator visitor use data are available on the NPS intranet: http://165.83.62.205/EC/visitor_use_intra/index.cfm
- Other visitor use data available on the NPS intranet at: http://www1.nrintra.nps.gov/im/units/swan/monitor/vs/human_activities/visitor_use.cfm
- A 22 minute DVD entitled *Exploring the Biological Diversity of National Parks in Southwest Alaska* is now available for distribution. The DVD features the SWAN and its role in long-term vital signs monitoring.
- Additional outreach materials (SWAN brochure, photo galleries, posters, field guides, etc.) are available at: http://science.nature.nps.gov/im/units/swan/index.cfm?theme=education_outreach

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U.S. Department of Interior

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