Alagnak *Aniakchak* *Katmai* *Kenai Fjords* *Lake Clark*

2015 Field Season Highlights

Changing Tides: Assessing Bivalve Health

Collaborators from the SWAN, USGS, and the Alaska Sea Life Center (ASLC), collected intertidal bivalves at eight locations along the Lake Clark and Katmai coastlines this summer as part of a Changing Tides project. Several of the bivalve species targeted have been identified as forage for bears and other carnivores in the nearshore. Species collected for this project included, but were not limited to, the Pacific blue mussel (*Mytilus trossulus*), Pacific razor clam (*Siliqua patula*), and the butter clam (*Saxidmous gigatea*). Razor clams were sampled at Kashvik Bay and Swikshak (Katmai), and Silver Salmon Creek, Chinitna Bay, and Tuxedni Bay (Lake Clark). Additional collections are planned for Hallo Bay in 2016. Mussels were sampled at SWAN monitoring sites at Kukak Bay, Kaflia Bay, and Takli Island (Katami).

NPS/Jim Pfeffenberger, OASLC

Dan Esler (USGS) samples soft sediment in KEFJ to assess bivalve density and species composition, June 2015.

Specimens were kept alive in small aquarium-like containers and returned to the ASLC to measure condition and performance metrics, including feeding rates, byssal thread production, and calorie content. Protein markers (P450 enzyme, heat shock protein), cellular response (hemocyte counts), and genetic markers will be used to measure physiological responses to heat shock, pH, and metabolic and disease states. These measurements will allow us to compare the health of the clam or mussel populations at different sites, assess their responses and sensitivity to environmental stressors (changes in temperature, pH, contaminant levels), and their energetic value as bear prey. Analysis will be on-going this year, and collections made again next year.

Measuring Mercury in Aquatic Environments

Mercury, in its methylated form, is a potent neurotoxin that bioaccumulates in aquatic and terrestrial food webs. This year, the NPS Air Resources Division completed its fourth season of studying the utility of dragonfly larvae as indicators of mercury status. The study is a collaborative effort between the NPS, USGS, University of Maine, and hundreds of citizen scientists nationwide. More than 55 park units, including Katmai and Lake Clark, participated in 2015.

Dragonfly larvae were selected for study over other aquatic insects because they tend to live longer and eat higher in the food chain, accumulating more mercury over time. They are also preferred food sources for many types of fish, some of which are subsequently eaten by humans. Preliminary results from 2014 indicate that the average mercury level in Katmai dragonfly larvae from two sites near Brooks Camp (109.3 ± 5.6 ng/g) was lower than the study-wide average (141.1 ± 2.5 ng/g).

NPS/Evan Booher

Tim Shepherd collects dragonfly larvae from the Beaver Pond near Brooks Camp, Katmai.

NPS/Amy Miller

NPS/Tom Weber

View of extensive spruce woodlands near the mouth of Upper Tazimina Lake, Lake Clark (left). SWAN biologist James Walton measures shrub height and cover in the understory of a spruce woodland (right) near Caribou Lakes, Lake Clark.

Spruce Thrives Near Western Treeline

White spruce (*Picea glauca*) woodlands and open forest are major vegetation types in Lake Clark and Katmai. Stand structure and environmental data from long-term monitoring sites in the SWAN are being used to explore the conditions influencing spruce growth, establishment, and new recruitment along temperature and precipitation gradients. In 2015, we sampled 49 woodland sites across the two parks, collecting tree cores for estimation of tree age, and seedling counts for an estimate of seedling abundance across the landscape. Tree-ring data show that warming since the 1980s has resulted in greater growth rates at all sites, but particularly at sites in Katmai, near western treeline. Warmer temperatures also appear to be supporting new establishment, as indicated by high seedling counts near the western forest margin.

New Lichen Discoveries in Kenai Fjords

Lichens form diverse communities and are good subjects for monitoring due to their environmental sensitivity. In July 2015, cooperators from Oregon State University, University of Bergen (Norway), University of Hamburg (Germany), the Bureau of Land Management, and the National Park Service conducted the first-known, comprehensive lichen inventory of Kenai Fjords. The five-member team collected lichens in the old-growth forests, riparian areas, and rocky shorelines of Nuka Bay and McCarty Fjord, Harris Bay and Granite Passage, Aialik Bay, and in the alpine near Exit Glacier. Already one species new to North America has been identified: *Ephebe multispora*, a dark filamentous species found growing on seepage boulders in Coleman Bay. Previously it was known only from Greenland and northern Sweden. Stay tuned, as we expect more exciting discoveries to come out of Kenai Fjords!

NPS/James Walton

Dr. Matthias Schultz, University of Hamburg -Germany, collects lichens in Aialik Bay.

Climate Station Maintenance and Upgrades

SWAN physical scientists and a soil scientist from the Natural Resources Conservation Service visited twelve SWAN climate stations in Lake Clark, Kenai Fjords, and Katmai to perform regular maintenance, conduct soils surveys, and install additional sensors for monitoring soil temperature and soil moisture. Four stations with vulnerable wind sensors were fitted with a second heavy-duty wind sensor to increase their reliability and reduce data loss and downtime. Once integrated with the RAWS real-time reporting system, these upgrades will provide important data streams on current aviation conditions, weather, and fire conditions to park staff and the public.

2015 Field Season By the Numbers

730,338
Adult sockeye salmon seen passing the counting tower near the Lake Clark outlet in 2015

372,363
Average number of adult sockeye salmon passing the counting tower annually from 2000-2014

17,356
Bivalves measured from intertidal soft sediment sites

6,873
2015 estimated sea otter population in Katmai

250
Sea otter foraging bouts with an approximate average of 8 dives for each bout

69
Maximum water temperature in degrees Farenheight at the Lake Brooks outlet in 2015, recorded at 5 pm on August 2

40
Mean average temperature in degrees Farenheight for King Salmon's 2015 water year (October-September); 5 degrees higher than the 30-year normal, and the hottest year on record

NPS/Peter Kirchner

Coville, one of four weather stations collecting soil moisture and temperature measurements.