Southeast Alaska Network

Glacier Bay NP & Pres. Klondike Gold Rush NHP Sitka NHP

Climate Change Resource Brief

Lewis Sharman of Glacier Bay National Park and Preserve (GLBA) prepares to collect a vertical profile of physical oceanographic conditions at a station in Glacier Bay proper.

Climate Change and Southeast Alaska

Global climate change is expected to manifest in Southeast Alaska as warmer, wetter conditions. This region is largely defined by water – delivered, transported, and residing as humidity, mist, rain, snow, glaciers, icefields, icebergs, rivers, estuaries, bays, and the open ocean. Changes in the amount, timing and form of water delivered to SEAN parks will drive both dramatic and subtle patterns and processes in plants, wildlife, and landform. The SEAN comprises three parks: Glacier Bay National Park and Preserve (GLBA), Klondike Gold Rush National Historical Park (KLGO), and Sitka National Historical Park (SITK).

Glaciers

Sensitive to seasonal variation in temperature and precipitation, glaciers are excellent indicators of regional and global climate. More than 50 glaciers cover 1,375 square miles in GLBA – fully 27% of the park. Glaciers continue to shape the park's dramatic scenery, topography, and landforms while providing billions of gallons of freshwater to a pristine glacial fjord ecosystem. Even seemingly subtle changes in glacial dynamics can have far-reaching consequences, through changes in hydrology and runoff patterns, degree of ocean stratification, carbon delivery, and capacity of the system to buffer against ocean acidification. In coordination with the approaches of other Alaska Networks, SEAN will initiate area and surface elevation monitoring for selected index glaciers in 2010.

Johns Hopkins Inlet in the upper west arm of Glacier Bay.

Water Quality and Quantity

Freshwater systems within the national parks of SEAN support a wide variety of aquatic life, including robust populations of all five Pacific salmon species. Continuous monitoring of physical characteristics and stream discharge occurs in surface waters of all network parks. The four core water quality parameters being monitored are dissolved oxygen, pH, specific conductance and temperature. In KLGO, we will also monitor turbidity in the Taiya River, a glacier-fed river where sediment loads and temperature are expected to change with warmer, wetter conditions. SEAN will be adding a freshwater contaminants monitoring program to complement our marine and airborne contaminants programs in all three parks. As valuable indicators of freshwater ecosystem condition, macroinvertebrates will be sampled in SITK where residential development in the Indian River watershed continues to increase.

Pink salmon return to spawn in the Indian River at Sitka National Historical Park (SITK).

Physical Oceanography

Along with weather, glaciers, and landform, ocean waters drive ecosystems and dynamics of many biological communities in Southeast Alaska, from primary producers to apex predators. A number of other SEAN Vital Signs (e.g., Marine Predators, Kittlitz's Murrelets, Humpback Whales) are themselves directly or indirectly influenced by oceanography. By collecting vertical water column profiles throughout the year, we can detect changes that may influence the condition of many resources throughout the park. Oceanographic monitoring improves our understanding of the Southeast Alaska marine system, linkages between atmospheric and oceanic systems, and implications of climate change in high-latitude marine systems.

Reid Glacier, Glacier Bay National Park and Preserve.

Ocean Acidification

The world's oceans act as a vast buffer against global climate change, absorbing and storing approximately 1/3 of annual anthropogenic carbon dioxide emissions. But this ecological function comes at a risk; the process by which oceans absorb CO_2 also produces carbonic acid. The result is that ocean surface water is, on average, 30 percent more acidic than records dating to 25 million years. Though these changes are well documented and not much debated, the impacts of increased acidity on marine calcifying organisms – the very foundation of marine food webs – are not well understood. Scientists are concerned that increased acidity will result in reduced productivity of these calcifying organisms, with profound impacts up the food chain. SEAN is developing a project to better understand ocean pH dynamics, the degree of acidity, and potential impacts on the incredibly productive waters of Glacier Bay proper.

Populations of apex predators, including threatened Steller sea lions, endangered humpback whales, killer whales, sea otters, and seabirds may be severely impacted if increased ocean acidity disrupts marine food webs.

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