



Water Quality 2020

Water quality is an important and sensitive indicator of aquatic and terrestrial ecosystem health. Monitoring river conditions helps scientists and park managers detect environmental patterns driven by human activity, climate change and watershed dynamics, then use that information to make better-informed decisions. The Southeast Alaska Inventory & Monitoring Network (SEAN) has prioritized continuous water quality monitoring in Glacier Bay National Park and Preserve since 2010. Data collected thus far suggest good river health with rare exceedances of Alaska Department of Environmental Conservation (ADEC) water quality standards.

Methods

This research program (1) tracks hourly conditions at a single fixed site in the park from early spring to late fall, (2) examines seasonal and interannual variability, and (3) evaluates observations against state standards indicating optimal or hazardous conditions for fishes. Continuously collected data include:

- **Water temperature (°C)** reflects air temperature patterns and snow or glacial melt.
- **Dissolved oxygen concentration (mg/L)** quantifies microscopic oxygen bubbles essential to aquatic organisms. Mainly regulated by temperature, oxygen fluctuations can also be caused by enhanced biological respiration or decomposition and water aeration.
- **pH** is a unitless measure indicating relative acidity or alkalinity. The chemistry of local rocks, soils, and rain impact observed pH levels.
- **Specific conductance (mS/cm)** describes the ability of water to conduct an electrical current. In Southeast Alaska, higher values represent groundwater influence and lower values reflect rain and snow runoff.

During the ice-free season, water quality sondes sampled the river hourly at a fixed location. Once a month, park staff visited the site to check sensor calibrations, download data, and resolve any problems; this monitoring project would not be possible without their dedication and assistance. In Glacier Bay, sensors were not submerged for a brief interval in early July with minimal data loss. SEAN's certified annual

water quality data are publicly available, as is the peer-reviewed protocol guiding this monitoring program.

2020 Southeast Alaska Weather

With a robust winter snowpack and frequent precipitation, the start of 2020 definitively concluded the past several years' drought. Rainfall totals throughout Southeast Alaska were well above average from June through August. Early fall experienced a welcome drier interval; several more intense precipitation events occurred at year's end. In contrast, temperatures remained close to normal in 2020, with greatest variability from the long-term record in May and November.

Results

Glacier Bay National Park and Preserve has more than 300 streams flowing over 3,380 km through a diversity of glacially shaped landscapes. The SEAN monitors the Salmon River, whose watershed primarily drains Excursion Ridge to the east and features mature wetlands and forests. This system is strongly groundwater influenced, reflecting greater storage capacity in wetlands and the local aquifer. The sonde is located at river km 9.0, just upstream from the park boundary. Since 2014, a USGS streamflow gage has operated about one km downstream; no significant tributaries exist between the two stations. The Salmon River is home to many productive anadromous fish populations. Although their life histories vary, especially with respect to spawning location and amount of time spent in the stream, all are vulnerable to environmental shifts due to climate

processes. Tracking temporal changes in water temperature and flow patterns is an established focus for Glacier Bay National Park and Preserve.

2020 Observations

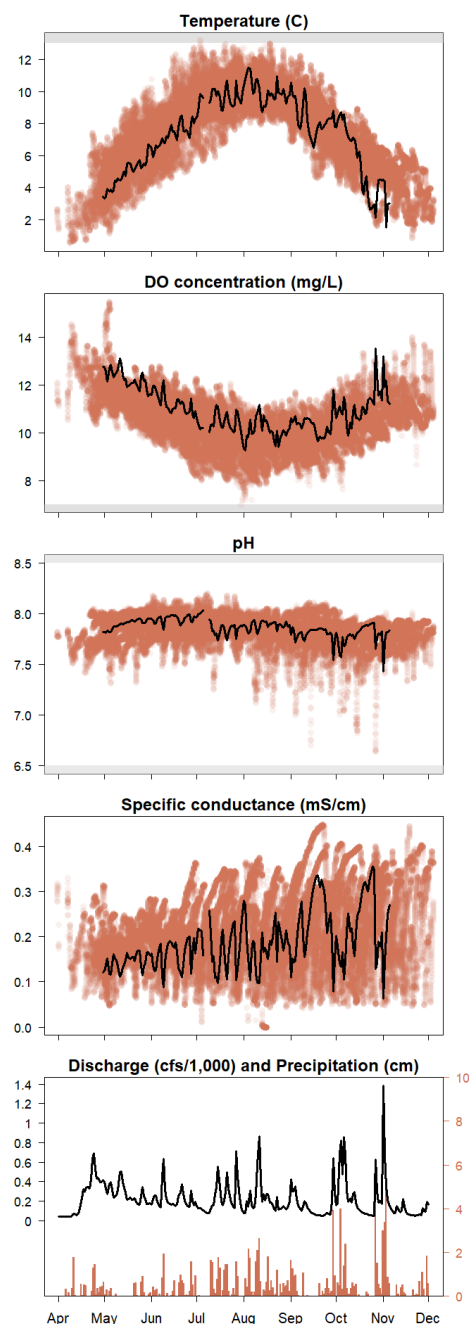
- Water temperatures, cooler than normal, followed the expected seasonal pattern. Mean temperature 1 May - 31 October was below the 2010-2019 mean by -0.35°C . Peak summer conditions exceeded the 13°C ADEC standard for five hours in early August.
- Dissolved oxygen varied minimally in 2020, remaining at the upper edge of the long-term record and always suitable for fish habitat.
- pH was stable throughout all months. Minor drops in pH occurred during two fall storms; values were consistently well within ADEC thresholds.
- Specific conductance fluctuated far less than typical during spring and summer, reflecting frequent precipitation that enhanced surface runoff inputs and stabilized conductance values. Variability through the full historic range resumed in the fall, with episodic rainfall (low specific conductance) alternating with groundwater influence (high conductance).
- Discharge was well above normal during spring and summer, followed by isolated autumn storms. At the Salmon River gaging station, 2020 set record maximum discharge levels in February, April, May, June, and December, plus reached a near-record high for annual mean streamflow.

Salmon River freshwater data summary, 2020.

Parameter	Mean	Min	Max
Temperature ($^{\circ}\text{C}$)	7.47	0.54	13.16
DO concentration (mg/L)	10.97	9.00	14.77
pH	7.86	7.11	8.07
Specific conductance (mS/cm)	0.19	0.01	0.37
Discharge (cfs)	229.02	49.89	1,385.90



Salmon River monitoring site, Glacier Bay National Park and Preserve.



Daily mean water quality parameters for the Salmon River in 2020 (black lines) relative to the hourly measurements prior to 2020 (pink points). Bottom panel shows daily mean discharge rates (black lines) from the nearby stream gage and precipitation (pink bars) from the closest weather station. Shaded regions denote ADEC thresholds for unsuitable fish habitat for temperature (above 13°C), dissolved oxygen (below 7 mg/L), and pH (below 6.5 or above 8.5).

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Southeast Alaska Inventory & Monitoring Network
<https://www.nps.gov/im/sean/streamflow.htm>