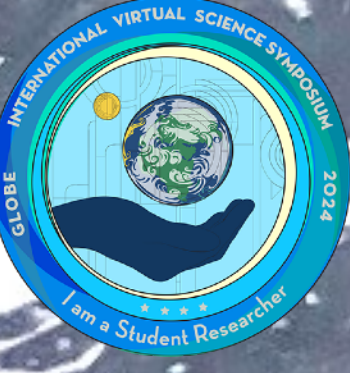
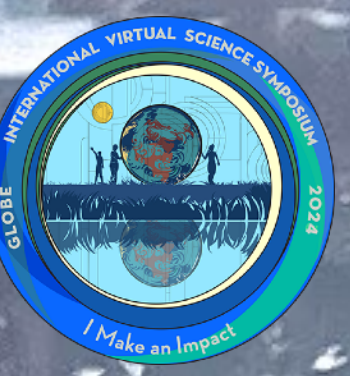


Water Temperature and pH Measurements on Gulkana Glacier and Phelan Creek, Alaska

Teslin Brannan^{2,3}



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GLOBE Teacher: Christina Buffington^{4,5}



Introduction and Literature Review

- Glaciers are melting rapidly worldwide
- Measuring pH in glacial meltwaters is challenging due to cold, slow response time of probes, and remote field sites
- pH levels usually decrease with an increase in temperature
- Glacial meltwater exposed to the atmosphere for extended periods of time absorbs CO₂, raising water temperature and lowering pH
- Geologic formations, kinetic energy, and friction can affect water temperature and thus pH
- Gulkana Glacier, eastern Alaska Range, classified as a world climate "reference glacier" due to location and long-term data

- Stream flow (1966-present) and atmospheric (1986-present) data are available for the Gulkana Glacier and Phelan Creek area, but no data on pH or water temperatures were found
- Basal meltwater from Gulkana Glacier recharges the aquifer that fills the spring-fed Delta Clearwater River
- Delta Clearwater River is the largest producer of Coho Salmon in the Yukon River Drainage
- Coho Salmon prefer water temps >15°C and pH between 7-8
- As part of the Inspiring Girls* Expedition: Girls* on Ice Alaska, three high school students conducted GLOBE Hydrosphere protocols on glacial meltwater at five locations on or related to the Gulkana Glacier

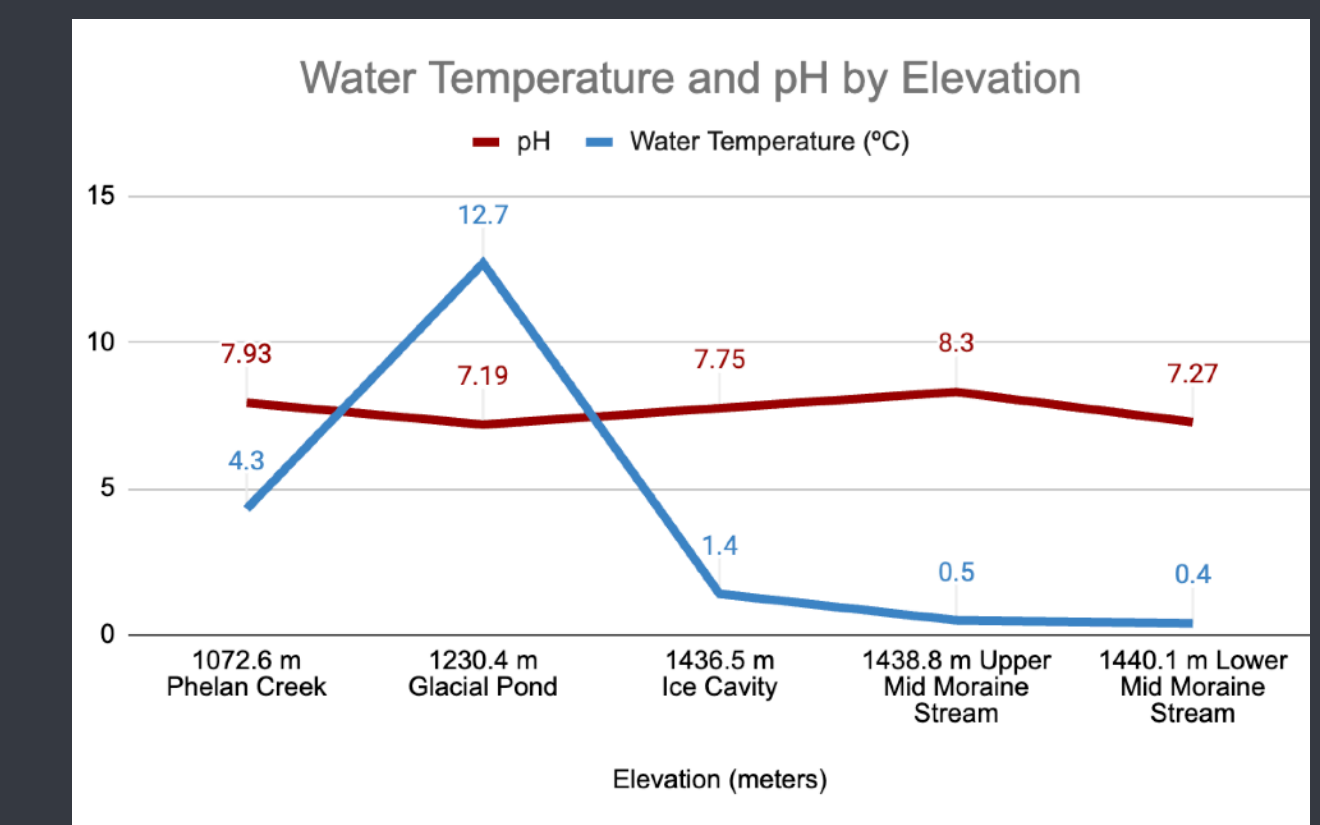
Site Map



Watershed from Gulkana Glacier to Phelan Creek to Delta River (Google Earth)

Results

- The highest temperature also measured the lowest pH
- Highest elevations recorded the lowest temperatures
- Standing water recorded highest temperature and lowest pH



Research Questions

- Question 1:** How does the physical location of the water sample collected at Gulkana Glacier affect pH?
- Question 2:** How does the physical location of the water sample collected at Gulkana Glacier affect water temperature?



Water quality testing at the Lower Moraine Stream site, photo credit - Girls* on Ice Alaska



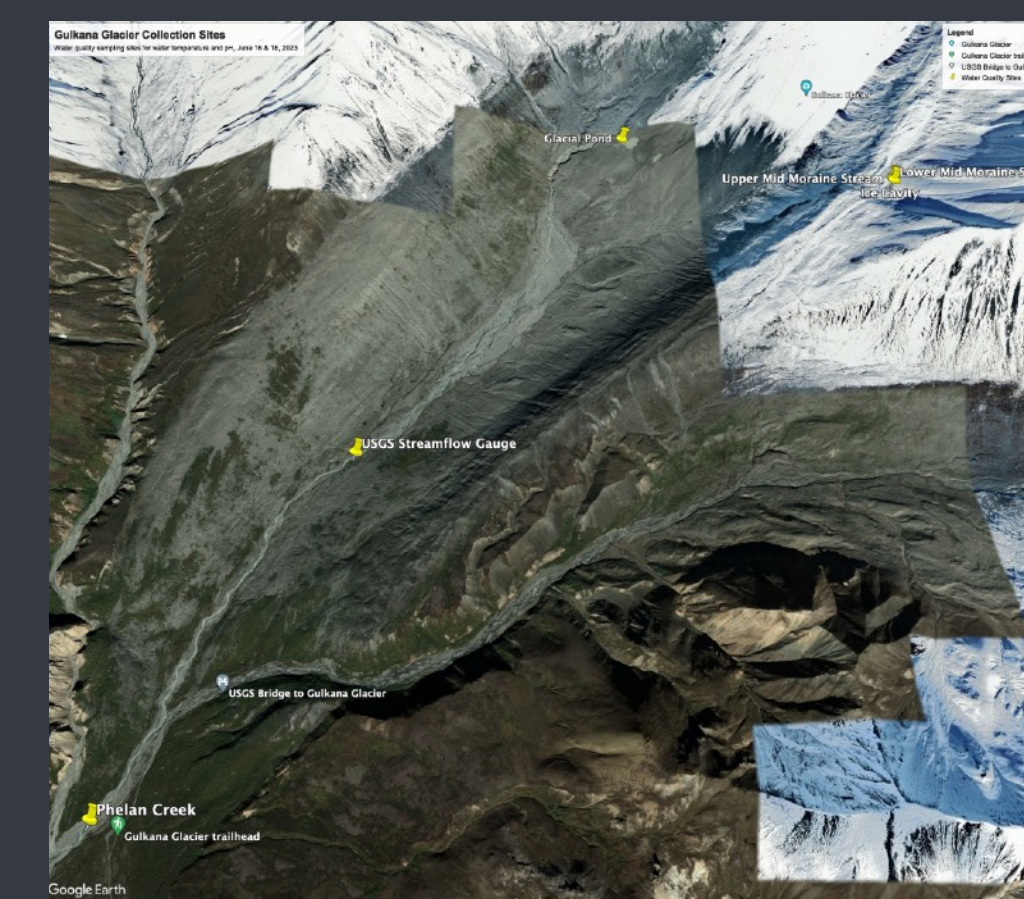
Hanna Meter probe at Ice Cavity site, photo credit - Girls* on Ice Alaska



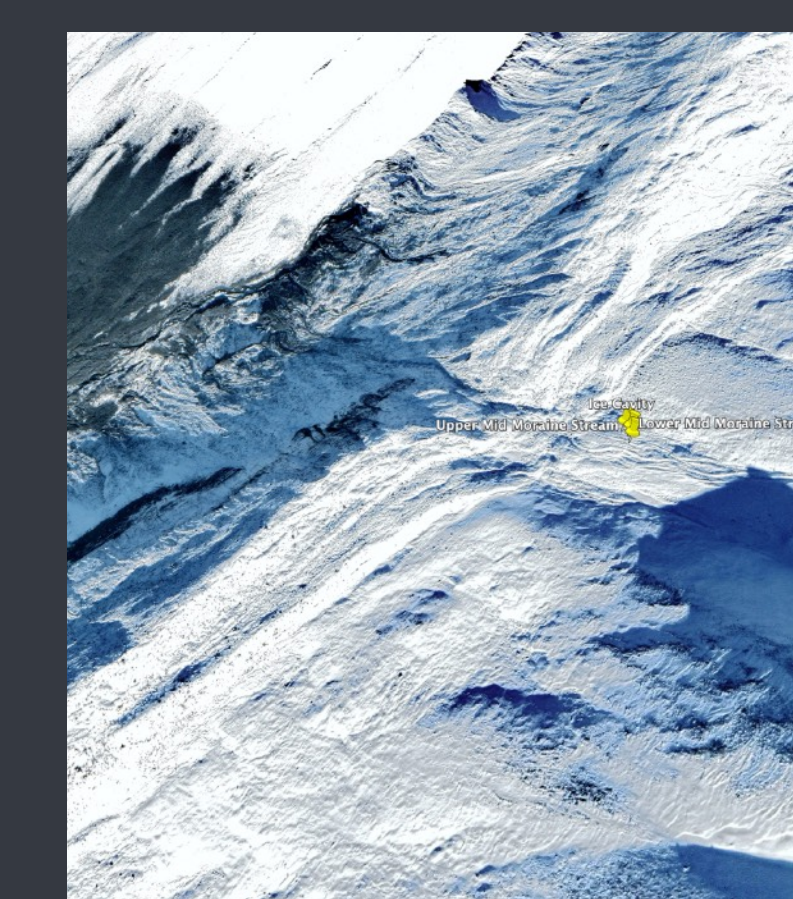
Recording data at the Lower Moraine Stream site, photo credit - Girls* on Ice Alaska

Research Methods

- Safe study sites were determined with assistance from expedition glaciologist and mountain guide
- Locations marked using Garmin eTrex GPS unit
- Water temperature and pH measurements were collected with a Hanna Meter probe following GLOBE Hydrosphere pH and water temperature protocols
- Electrical conductivity meter, salt, buffering solutions, and GLOBE protocol field guides were not available on site
- Measurements were recorded once numbers on probe stabilized, cold delayed response time



Water quality collection sites and other features (Google Earth Pro)



Three highest elevation collection sites (Google Earth Pro)

Conclusion

- The physical location (elevation, ice formation, type of sediment/rock) of the collected water sample affected pH and water temperature
- Downstream flow and aquifer recharge for local salmon habitat is mostly within preferred pH salmon range, 7-8
- Additional research is needed for water temperature and pH with possible additions of turbidity, DO, and conductivity
- Partnering with Inspiring Girls* Expeditions to conduct structured GLOBE studies would decrease the errors and provide missing data

Keywords: Gulkana Glacier, Water Temperature, pH

This study was conducted on Ahtna Nenn', the traditional lands of the Ahtna people, at C'ulc'ena' Luu,' 'cutting stream glacier,' also known in English as Gulkana Glacier (Pittas, 2023).

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