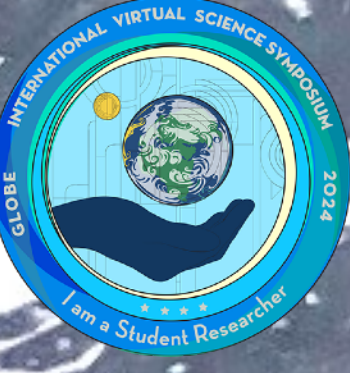
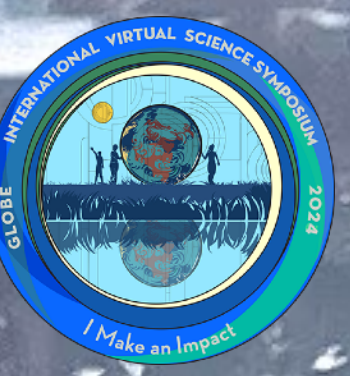


# Water Temperature and pH Measurements on Gulkana Glacier and Phelan Creek, Alaska

Teslin Brannan<sup>2,3</sup>



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 GLOBE Teacher: Christina Buffington<sup>4,5</sup>



## 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 CO<sub>2</sub>, raising water temperature and lowering pH
- Geologic formations, kinetic energy, and friction can affect water temperature and thus pH
- Gulkana Glacier, eastern Alaska Range, is classified as a '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

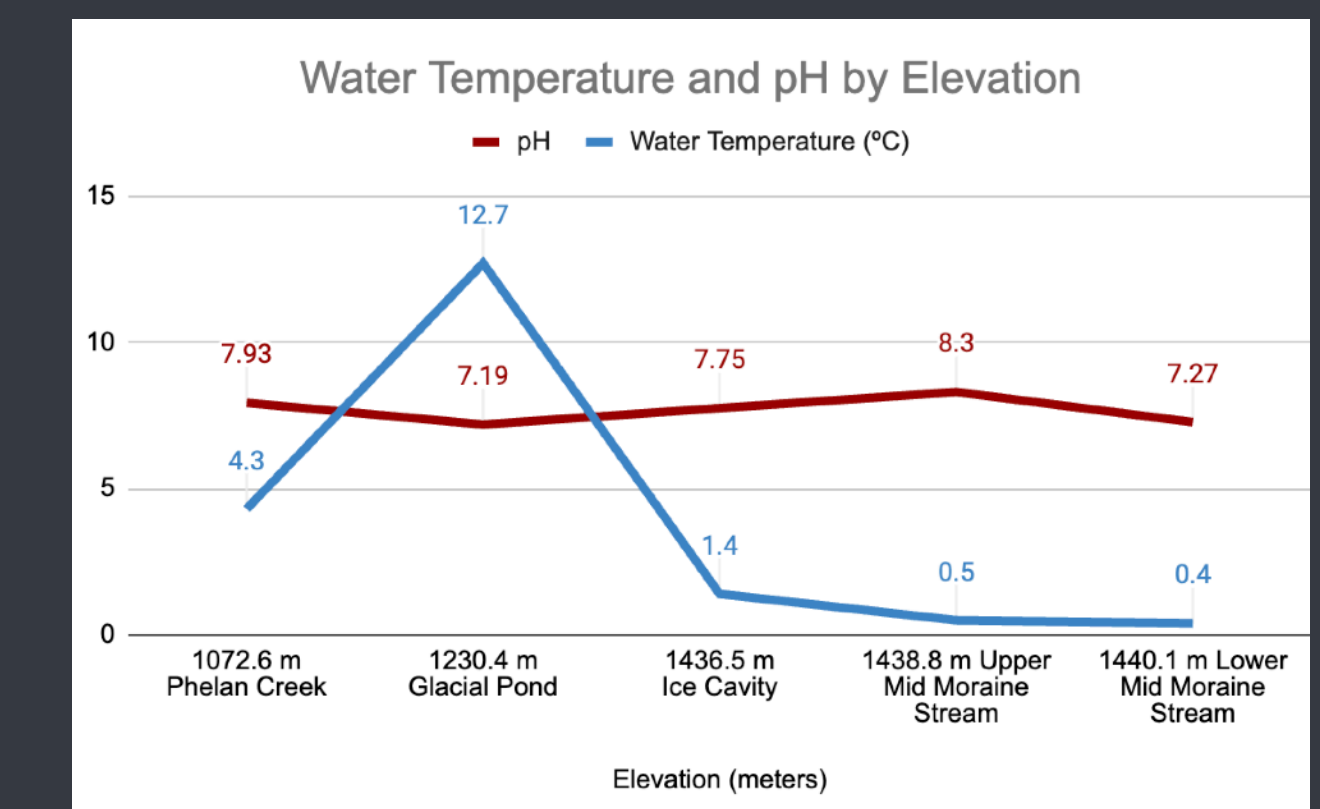
## Site Map



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



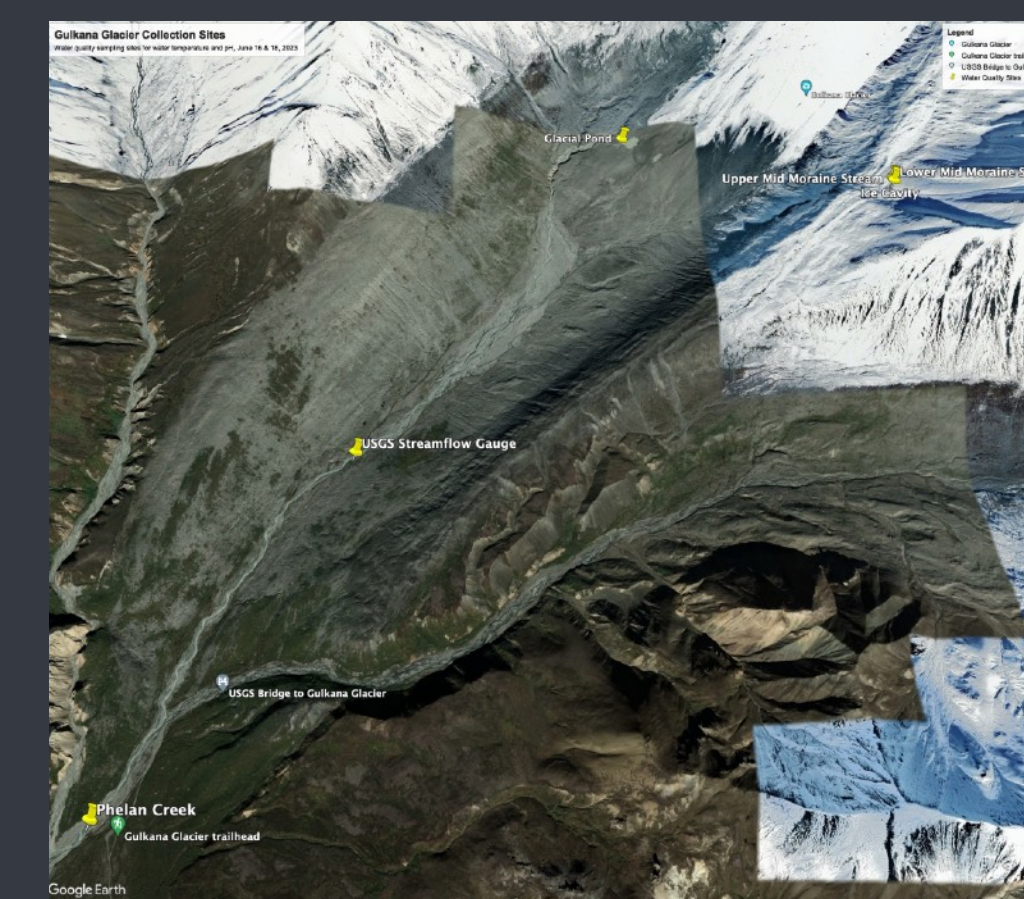
Hanna Meter probe at Ice Cavity site, photo credit - Girls on Ice Alaska



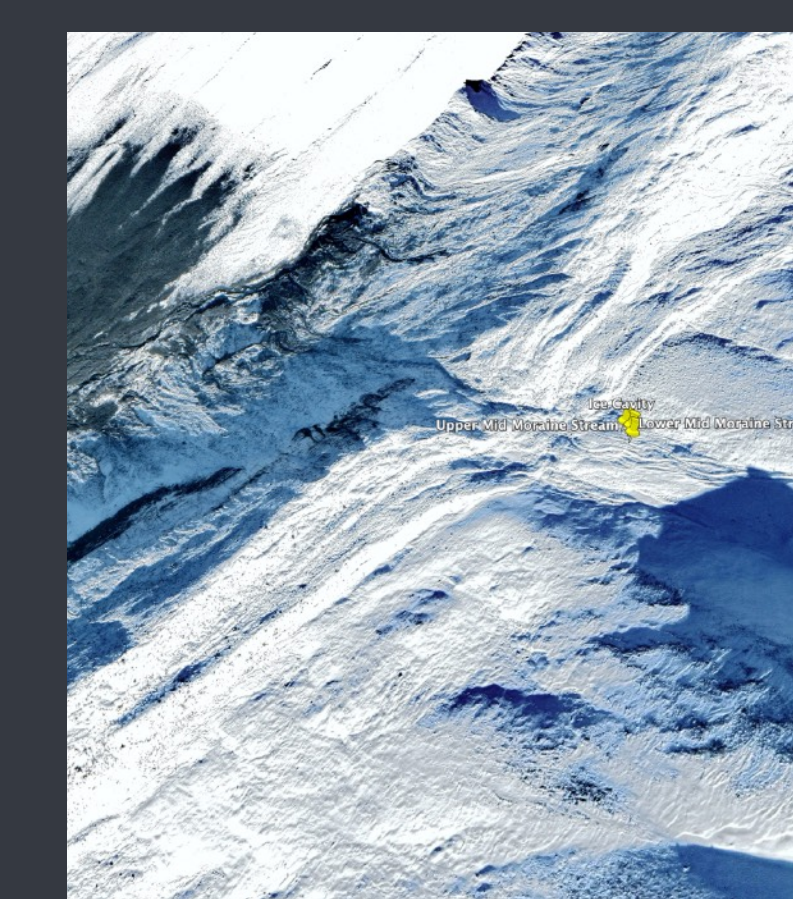
Recording data at the Lower Moraine Stream site, photo credit - Girls on Ice Alaska

## Research Methods

- Safe study sites were determined with assistance from glaciologist and mountain guide
- Locations marked using Garmin eTrex GPS unit
- Water temperature and pH measurements were collected with Hanna Meter probe following GLOBE Hydrosphere pH and water temperature protocols
- Electrical conductivity meter, salt, and buffering solutions, and GLOBE protocol field guides were not available
- Measurements 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 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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