INFLUENCE OF GROUNDWATER ON STREAM FLOW IN SALMON-BEARING STREAMS

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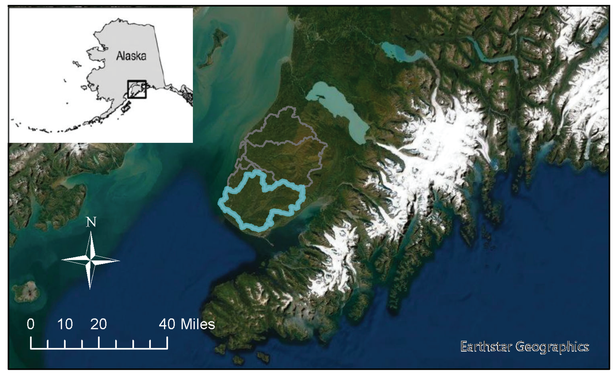
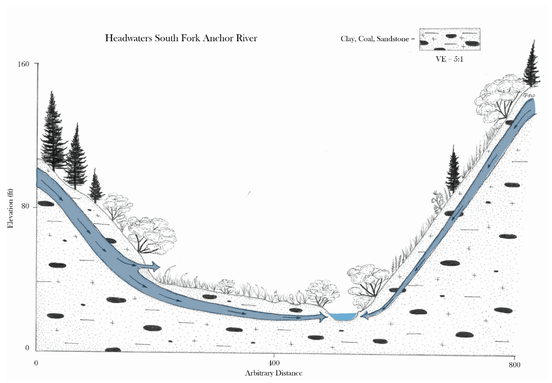
ERG Website

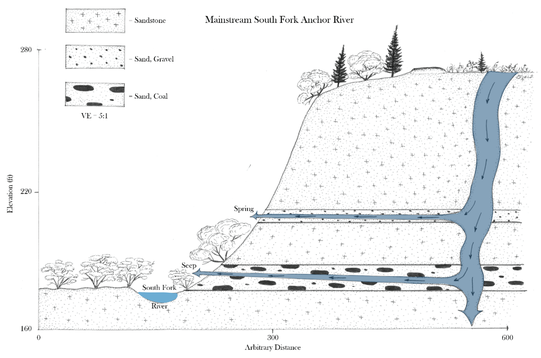


Modified from Callahan et al. (2015)

Groundwater resources are balanced between salmon-bearing streams and adjacent human users. These groundwater resources are limited and risk further depletion due to rapid population growth and regional climatic drying trends.

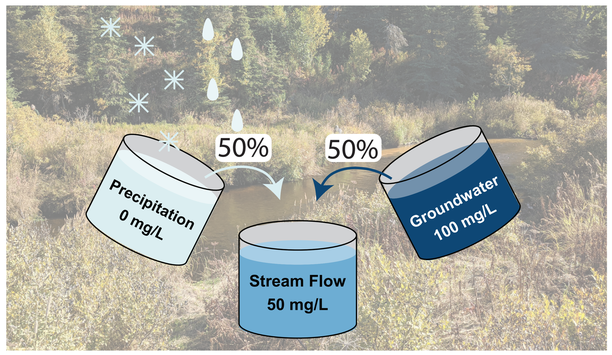


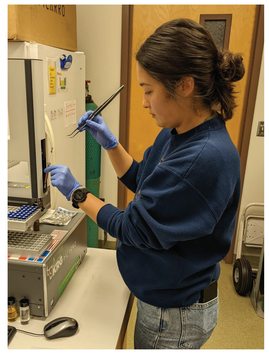
Groundwater discharge modulates stream flow, temperature, and nutrient concentrations.



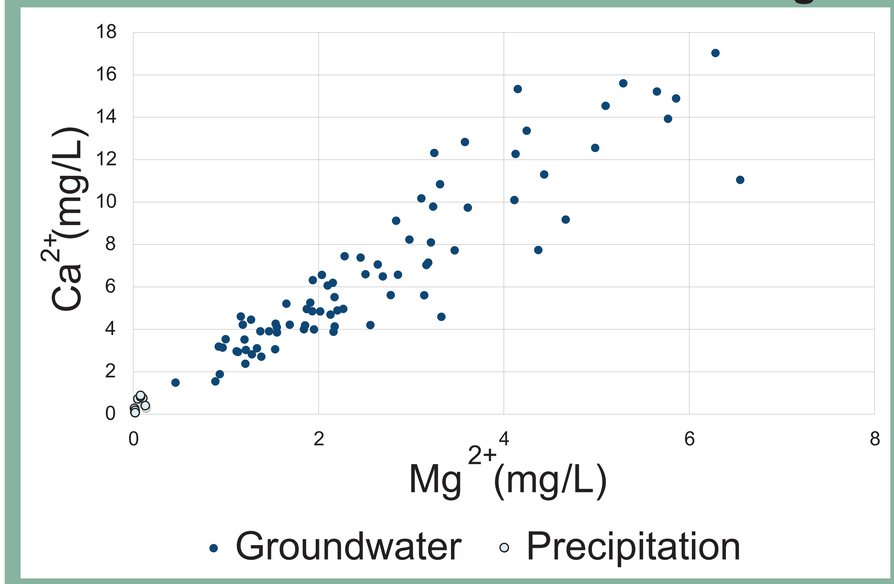
Modified from Gerlach et al. (2021) Illustrations drawn by Conrad Field from field sketches and notes prepared by Mark Rains.

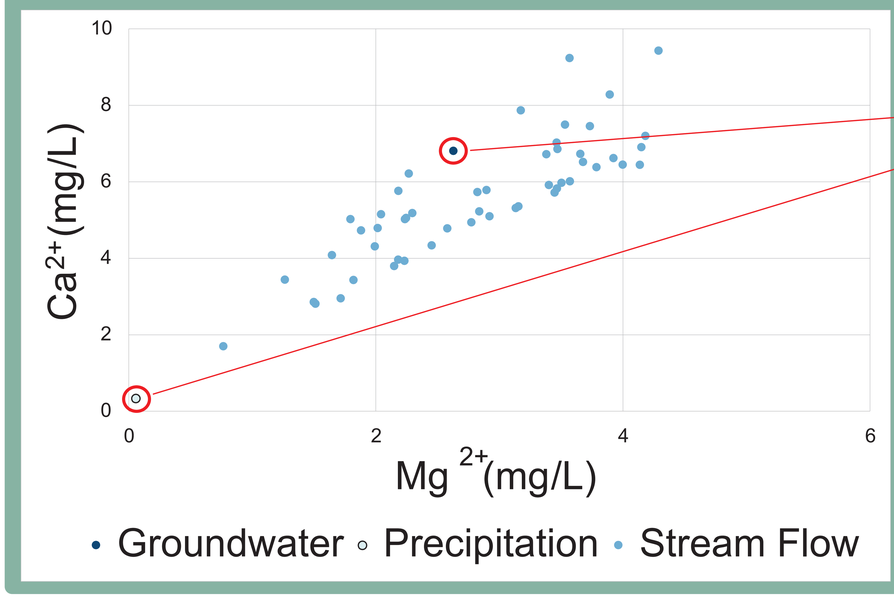
What are the relative contributions of groundwater and precipitation to stream flow?





Two-End Mass Balance Mixing Model





Groundwater concentrations are variable.

Take the average precipitation and groundwater concentrations and make these the two end-members.

Groundwater and precipitation end-members.

$$Mg_L = Mg_{PR} \cdot (x) + Mg_{GW} \cdot (1 - x)$$

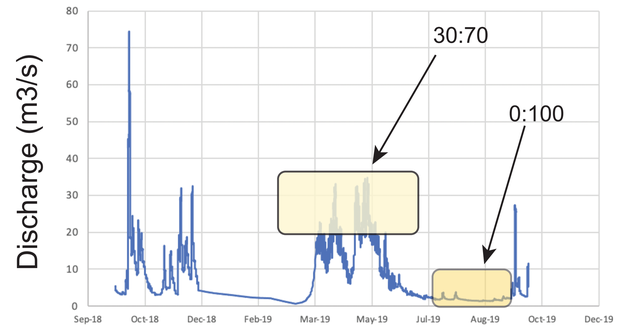
Mg_L is local stream flow

Mg_{PR} is precipitation

Mg_{GW} is groundwater

Date	Precipitation Contribution	Groundwater Contribution
April 27, 2021	23%	77%
May 4, 2021	26%	74%
May 11, 2021	37%	63%
May 18, 2021	38%	52%
June 8, 2021	10%	90%
July 7, 2021	15%	85%
July 27, 2021	0%	100%
August 26, 2021	4%	96%
September 17, 2021	0%	100%
September 23, 2021	0%	100%

Anchor River Hydrograph Oct 2018 - Sept 2019



Conclusion:

Groundwater is the major contributor to stream flow in the Kenai Peninsula Lowlands, Alaska. Our results indicate that water-supply wells draw from many of these same groundwater resources. Further planned development in the area could result in further reduction of groundwater resources and eventually stream flow. These results have implications for water resource management and for the salmon-dependent Kenai Peninsula Lowlands economy.

Next Steps:

Use chemical fingerprints to infer the geologic history of different types of groundwater.

Three-end member mass balance mixing model to determine the contributions of shallow-hillslope groundwater and deep-aquifer groundwater.

References: Callahan, M.K. et al. (2015) Controls on temperature in Salmonid-bearing headwater streams in two common hydrogeologic settings, Kenai peninsula, Alaska: Journal of the American Water Resources Association, v. 51, p. 84–98.; Callahan, M.K. et al. (2017) Nitrogen subsidies from hillslope alder stands to streamside wetlands and headwater streams, Kenai peninsula, Alaska: Journal of the American Water Resources Association, v. 53, p. 478–492.; Gerlach, M.E. et al. (2021) Using remote sensing and machine learning to locate groundwater discharge to salmon-bearing streams: Remote sensing, v. 14, p. 63.

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