How do Different Riparian Factors Affect the Stream Temperature in Copeland Creek?

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Introduction

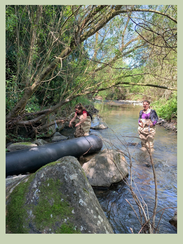
Endangered Pacific salmonid fishes require specific temperature regimes, generally within a range of 11.8ºC-14.6ºC, in order to survive, grow, and reproduce. Various factors that may influence stream temperature dynamics include water velocity, water depth, and degree of canopy coverage. In order to investigate which of these factors control diurnal stream temperature fluctuations, we placed Thermochron iButton temperature sensors in eight locations along Copeland Creek at Sonoma State University. We selected areas that varied in velocity, depth, and canopy cover. These findings will help determine if Copeland Creek could potentially be a suitable habitat for salmonid fishes.

Materials & Methods

•Programmed eight Thermochron iButtons to record temperatures every 30 minutes
•Each iButton was waterproofed and glued onto a paint stick with silicone sealant
•Each paint stick was reinforced with duct tape and connected to a Kevlar string
•We chose eight different locations along Copeland Creek that were varying in depth, canopy cover, and velocity to place the sensors
•We wedged the paint sticks into the streambed and tied the Kevlar string to a branch near each spot as an anchor
•After 48 hours, we collected the sensors and analyzed the data

This map of Sonoma State University shows the location of where we placed the sensors

iButton sensors glued onto paint sticks with silicone sealant and reinforced with duct tape


Images of us placing the sensors in Copeland Creek

Results

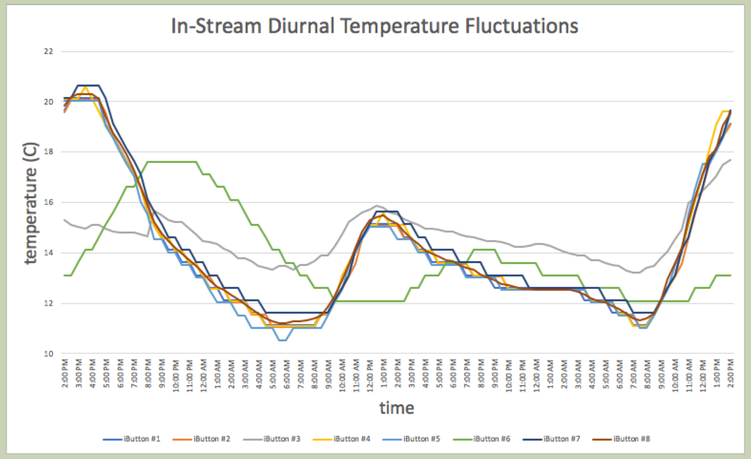


Figure 1. The diurnal stream temperature fluctuations at eight different locations along Copeland Creek over a span of 48 hours

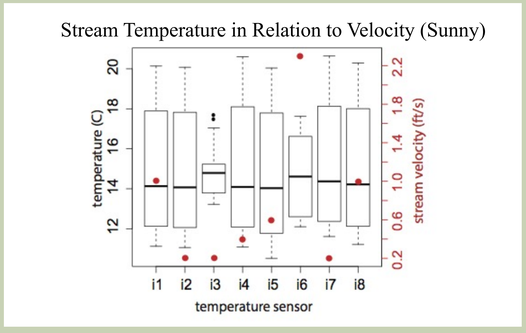


Figure 2. The temperature range at each location on the sunny day and the respective velocity of each location

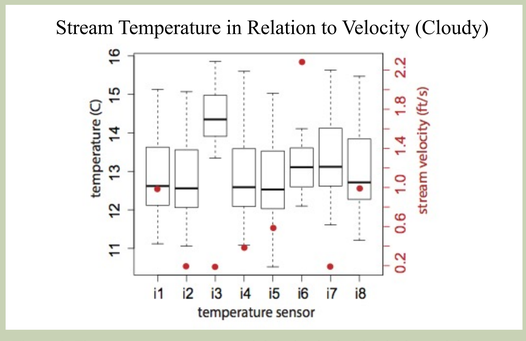


Figure 3. The temperature range at each location on the cloudy day and the respective velocity of each location

Conclusion

- Canopy cover has no measurable effect on diurnal stream temperature fluctuations
- Varying degrees of canopy cover and depth do not seem to influence stream temperatures, at least in the narrow ranges we tested
- Stream temperature is extremely sensitive to cloud cover
- High current velocity causes an apparent delay in diurnal temperature cycle
- The sensor placed in a high velocity setting did not reach nearly as high of temperatures as the rest
- Drainage culverts dampen diurnal temperature fluctuations
- The sensor near the culvert was the only one that did not seem to be affected by the cloudy day
- Pacific salmonid fishes require specific temperature regimes, generally within a range of 11.8ºC-14.6ºC
- The maximum temperature reached in our study was approximately 20ºC and the minimum was approximately 11ºC
- Possible solutions to make Copeland Creek a more suitable environment for Pacific Salmon:
  - Remove/relocate culverts from the creek
  - Possibly engineering the channel to run faster

Acknowledgments

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References

Broadmeadow, S., Jones, J., Langford, T., Shaw, P. and Nisbet, T. (2011). The influence of riparian shade on lowland stream water temperatures in southern England and their viability for brown trout. *River Research and Applications*, 27(2), pp.226-237.

Imholt et al., 2013 C. Imholt, C. Soulsby, I.A. Malcolm, C.N. Gibbins. Influence of contrasting riparian forest cover on stream temperature dynamics in salmonid spawning and nursery streams Ecohydrology, 6 (2013), pp. 380-392, 10.1002/eco.1291.

Mills, T. J., Bratovich, P., Olson, D., Pitts, A., Atherstone, M., Niggemeyer, A., …Ellrott, B. (2004). *MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR FEATHER RIVER FISH SPECIES* (pp. 1-24) (United States of America, The Resources Agency, Department of Water Resources).

Roth, T., Westhoff, M., Huwald, H., Huff, J., Rubin, J., Barrenetxea, G., Vetterli, M., Parriaux, A., Selker, J. and Parlange, M. (2010). Stream Temperature Response to Three Riparian Vegetation Scenarios by Use of a Distributed Temperature Validated Model. *Environmental Science & Technology*, 44(6), pp.2072-2078.