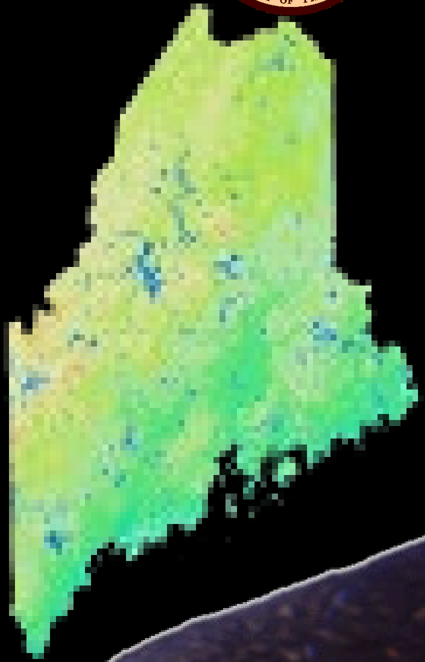
U.S. Fish and Wildlife Service

Logger Placement:

How do Lakes/Deadwaters Geomorphic features and Groundwater influence your data collection?



Maine Water Temperature Working Group May 7, 2020

Scott Craig *Certified Fisheries Professional*
Project Leader/ Fishery Biologist
Maine Fishery Resources Office
306 Hatchery Road
East Orland, Maine 04431
207 240-3172
http://www.fws.gov/northeast/mainefisheries/

Logger Placement is Critical for collecting unbiased-accurate Data

1) Sampling Considerations in Lotic systems with Lakes and Deadwaters.

2) Groundwater Temperatures in Maine (~7°C)

Cold in Summer, Warm in Winter!

3)

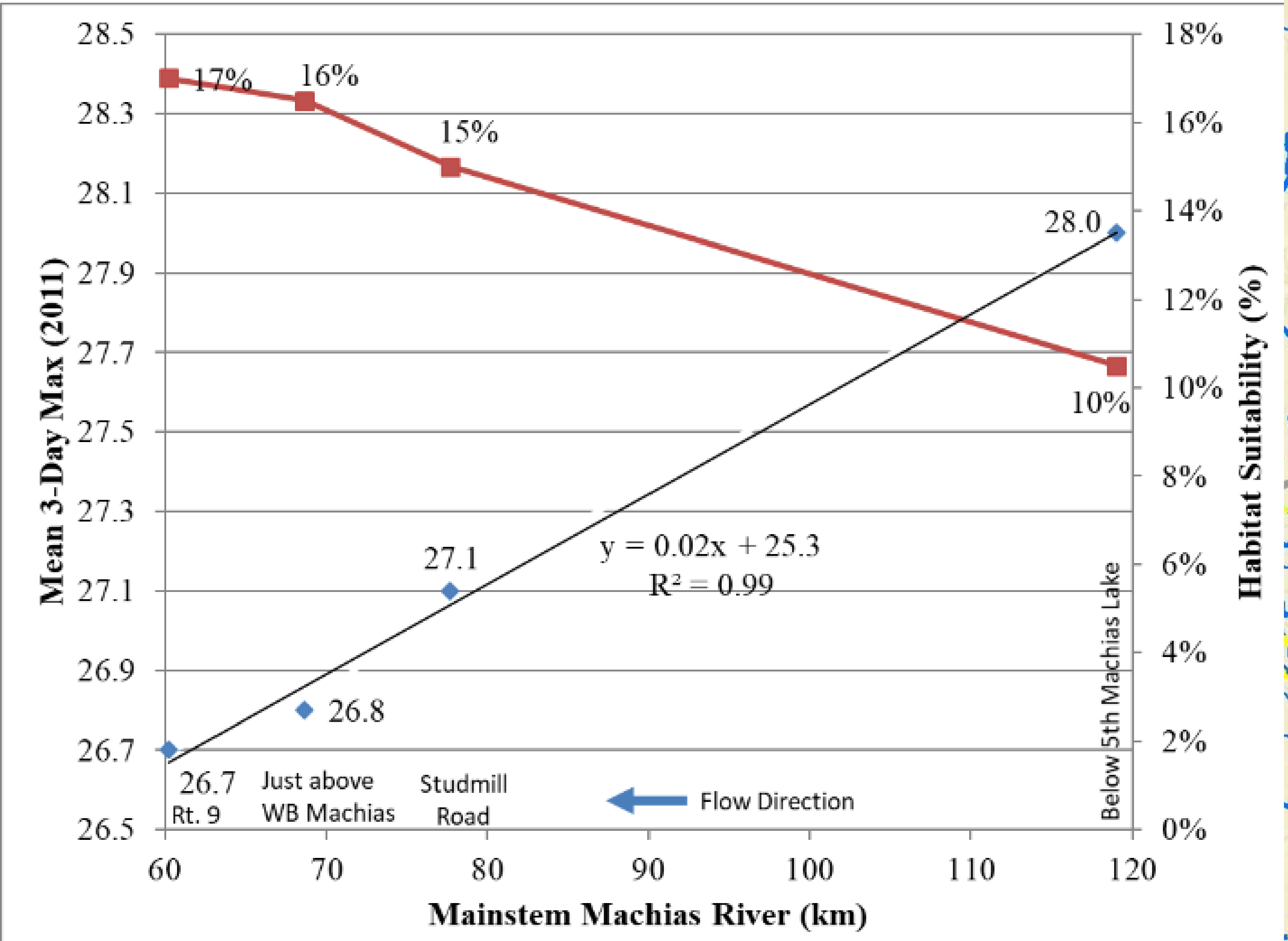
Tips to help you place and maintain logger's to help eliminate abnormally cold water inputs that may bias data by 5-20°C

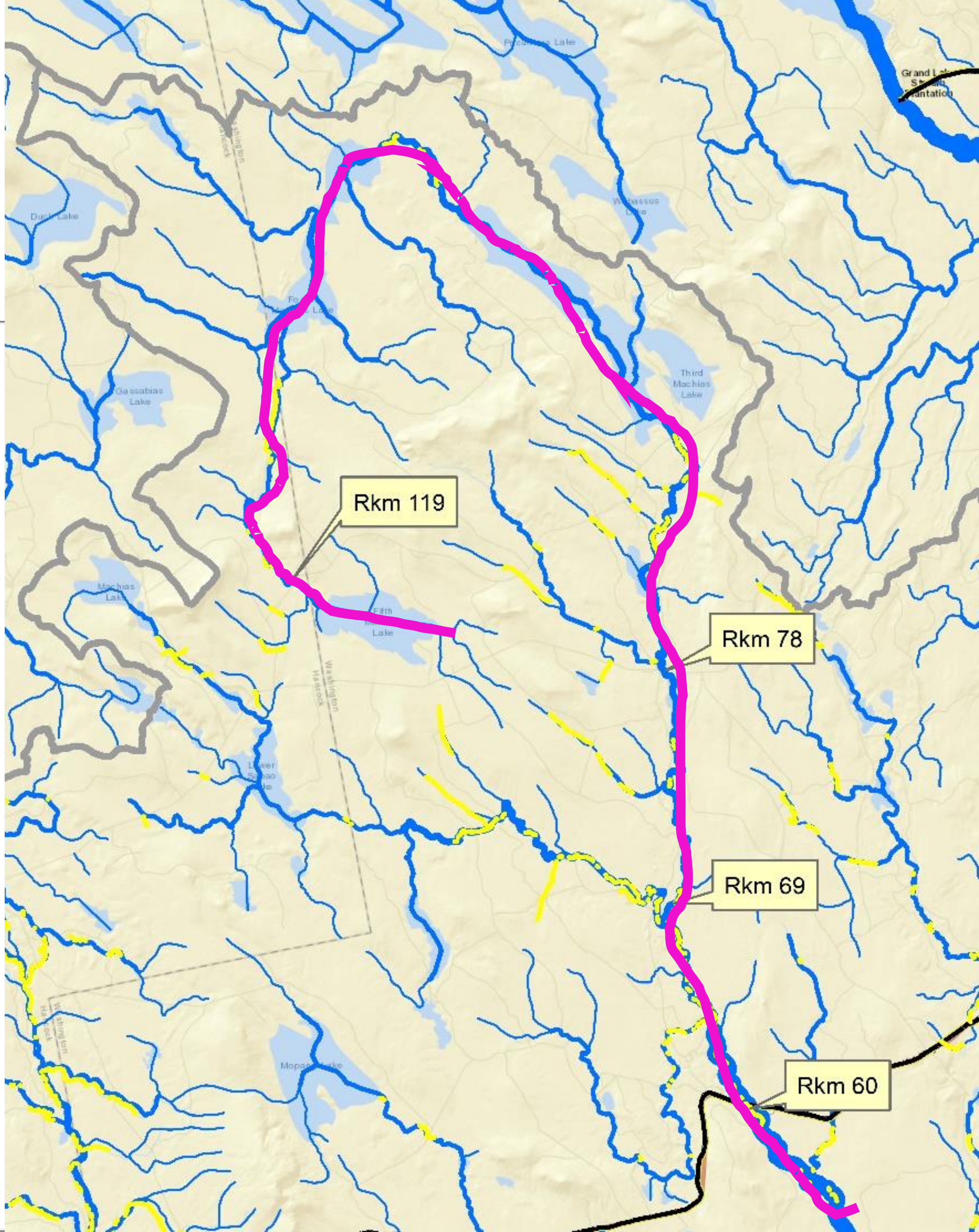
And/Or

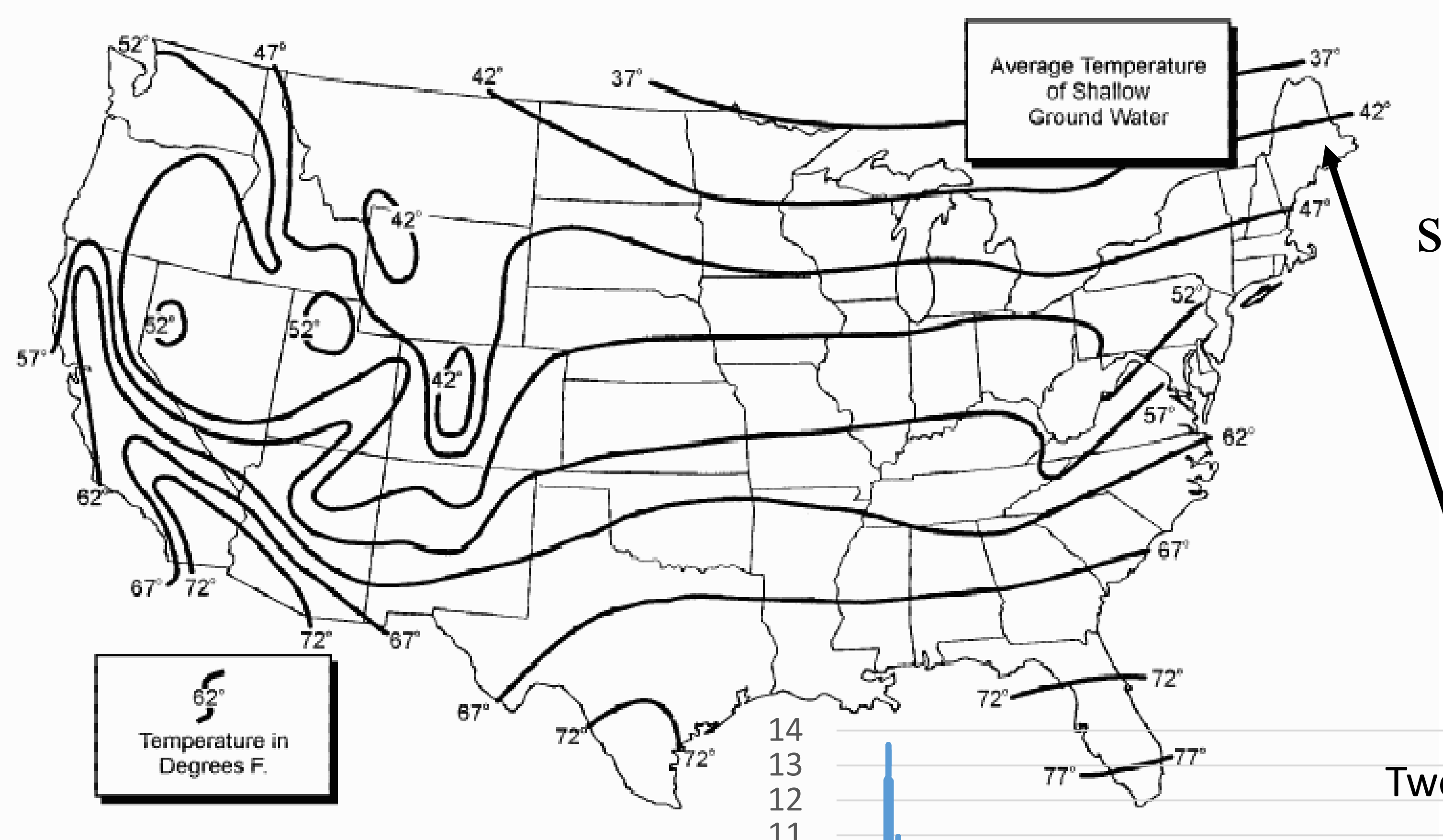
Where are likely places to find cold water inputs!!!

Considerations about Lakes and Deadwater's

Rivers normally warm when they go downstream???



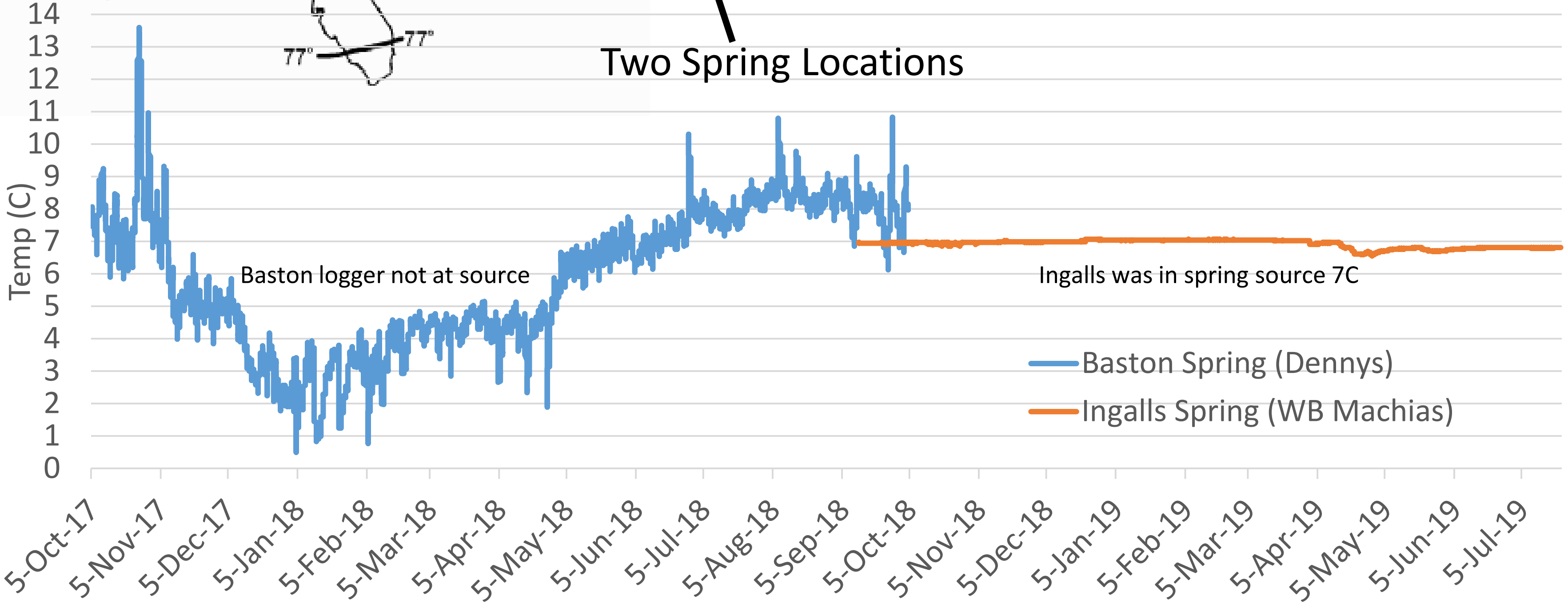




[USGS-EPA](https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/ex/jne_henrys_map.html) National map for shallow groundwater temperature 7.2 ºC (45 F).

https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/ex/jne_henrys_map.html

Groundwater in Maine



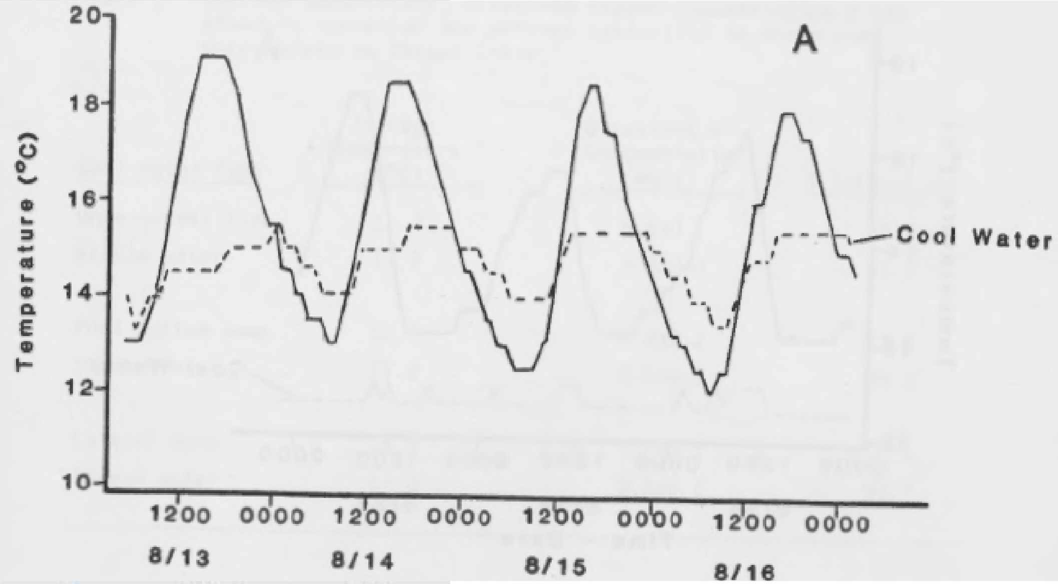
Oldie but Goodie from the 1980's

Characteristics and Frequency of Cool-water Areas in a Western Washington Stream

Robert E. Bilby

Centralia Research Center
Weyerhaeuser Company
Centralia, WA 98531

1984. J. of Freshwater Ecology 2(6):593-602.



Abstract

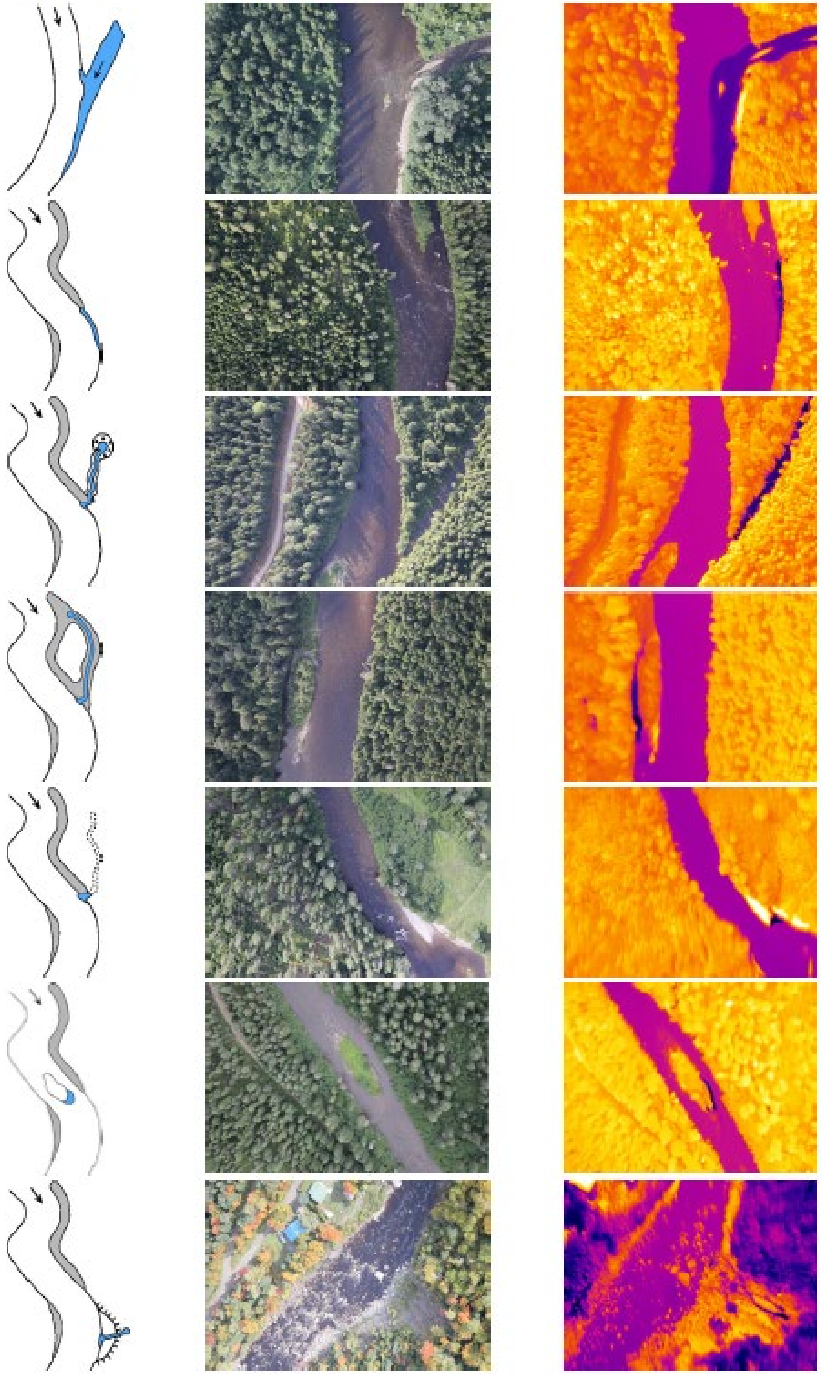
Four distinct types of cool-water areas were located during this mid-summer survey of Thrash Creek, Washington, a warm, fifth-order stream. These areas were termed lateral seeps, pool bottom seeps, cold tributary mouths and flow through the bed, depending upon the entry point and source of the cool water. These types differed with respect to average size, depth and location in the stream channel. Temperatures in the cool water areas averaged 4.7°C lower than ambient streamwater on warm afternoons. Thirty-nine such spots were found on a 3.5 km (2.2 mi) reach of the study stream. They accounted for 1.6% of the surface area and 2.9% of the water volume on this stretch of stream.

1) Lateral Seeps, 2) Pool Bottom Seeps, 3) Cold Tributary Mouths, 4) Flow Through Bed

Current Classification scheme for cold water inputs n=7

Dugdale, S., Bergeron, N., St-Hilaire, A. 2013. Temporal variability of thermal refuges and water temperature patterns in an Atlantic salmon river. Remote Sensing of Environment 136 (2013) 358–373

Thermal refuge	Reference	Schematic	Optical image example	TIR image example
Tributary confluence plume	Torgersen et al. (2012)			
Lateral seep	Bilby (1984) Ebersole et al. (2003a)			
Springbrook	Stanford and Ward (1993) Ebersole et al. (2003a)			
Cold side channel	Ebersole et al. (2003a) Stevens and DuPont (2011)			
Cold alcove	Ozaki (1988) Ebersole et al. (2003a)			
Hyporheic upwelling	Brunke and Gonser (1997) Poole and Berman (2001) Burkholder et al. (2008)			
Wall-base channel	Peterson and Reid (1984) Torgersen et al. (2012)			



Kurylyk, B., MacQuarrie K., Linnansaari T., Cunjak R. A, Curry R.A. 2014. Preserving, augmenting, and creating cold-water thermal refugia in rivers: concepts derived from research on the Miramichi River, New Brunswick (Canada). Ecohydrology. 14 p

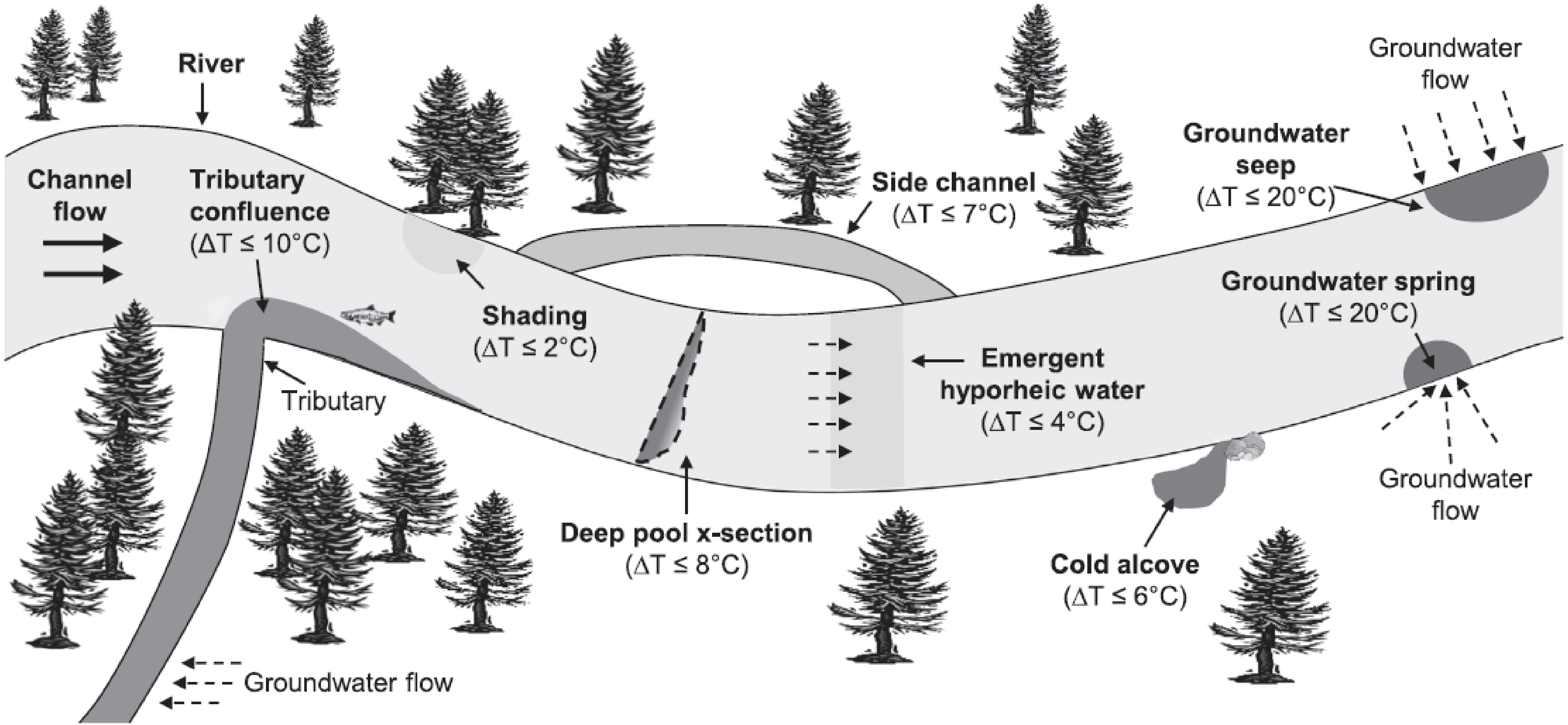
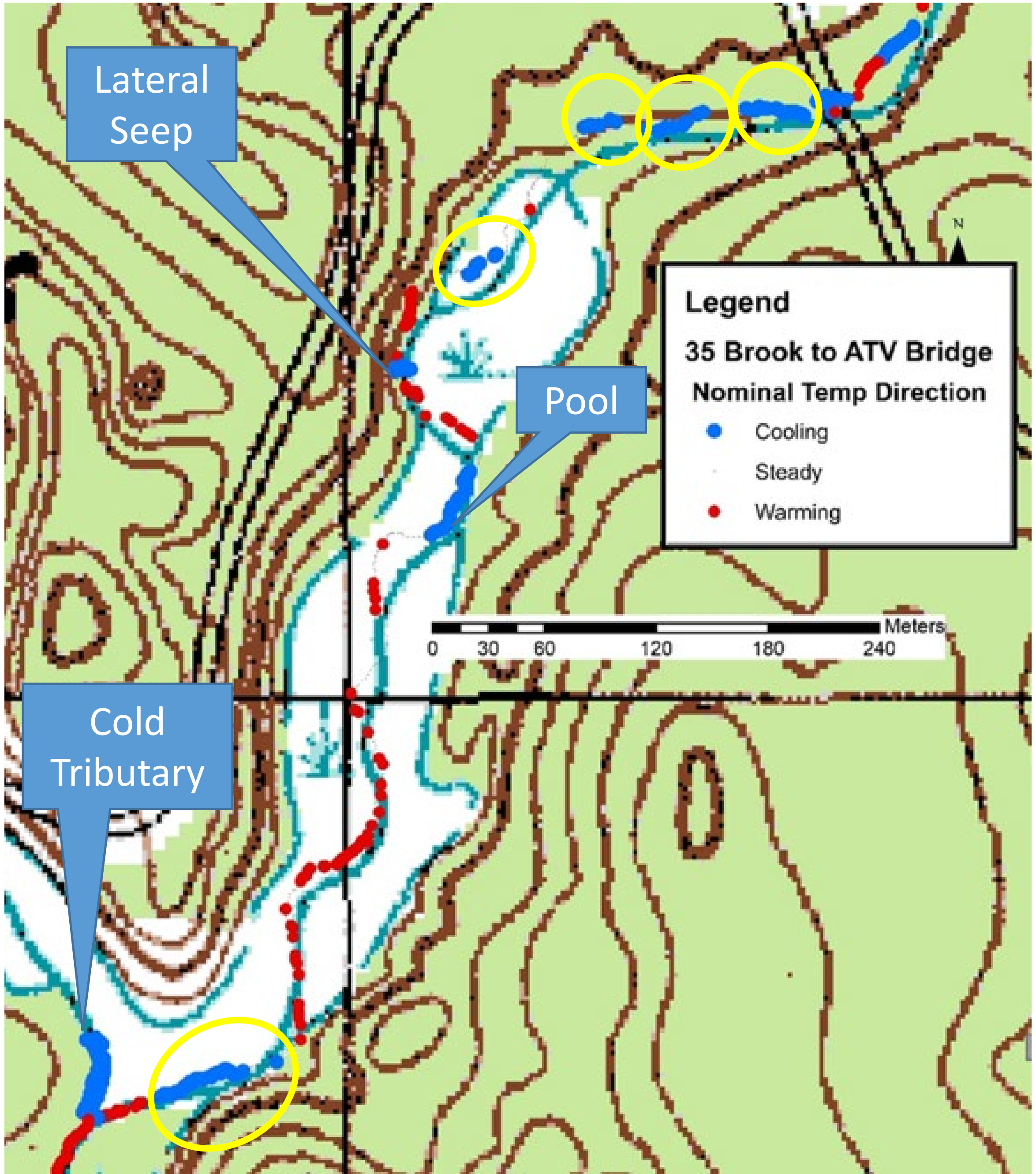
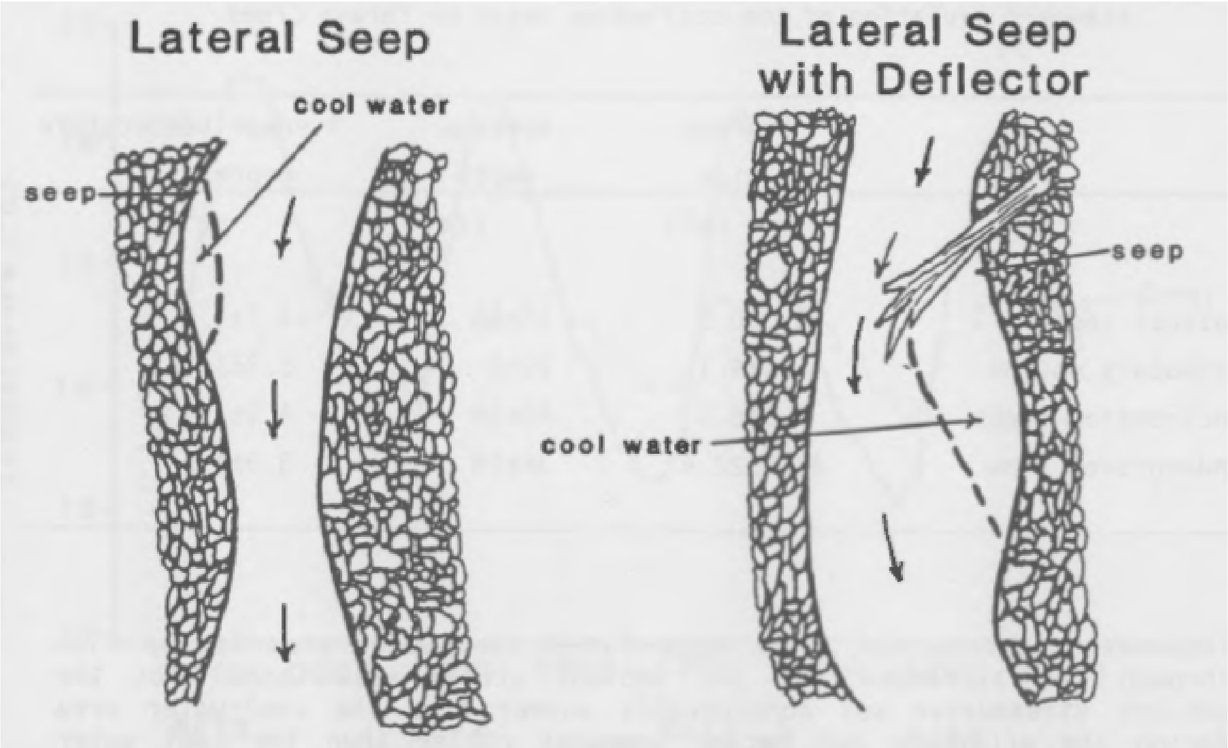


Figure 1. A conceptual overview of mechanisms that induce thermal diversity in rivers and create suitable thermal refugia. The estimated maximum temperature differences between a particular thermal anomaly and the ambient river temperature given in brackets are derived from other literature sources (Nielsen *et al.*, 1994; Ebersole *et al.*, 2003b) and extensive aerial infrared images and in-stream thermal surveys of the Little Southwest Miramichi River and other branches of the Miramichi River (e.g. Wilbur, 2012). Darker colors indicate colder water.

1) Lateral Seeps, 2) Pool Bottom Seeps, 3) Cold Tributary Mouths, 4) Flow Through Bed



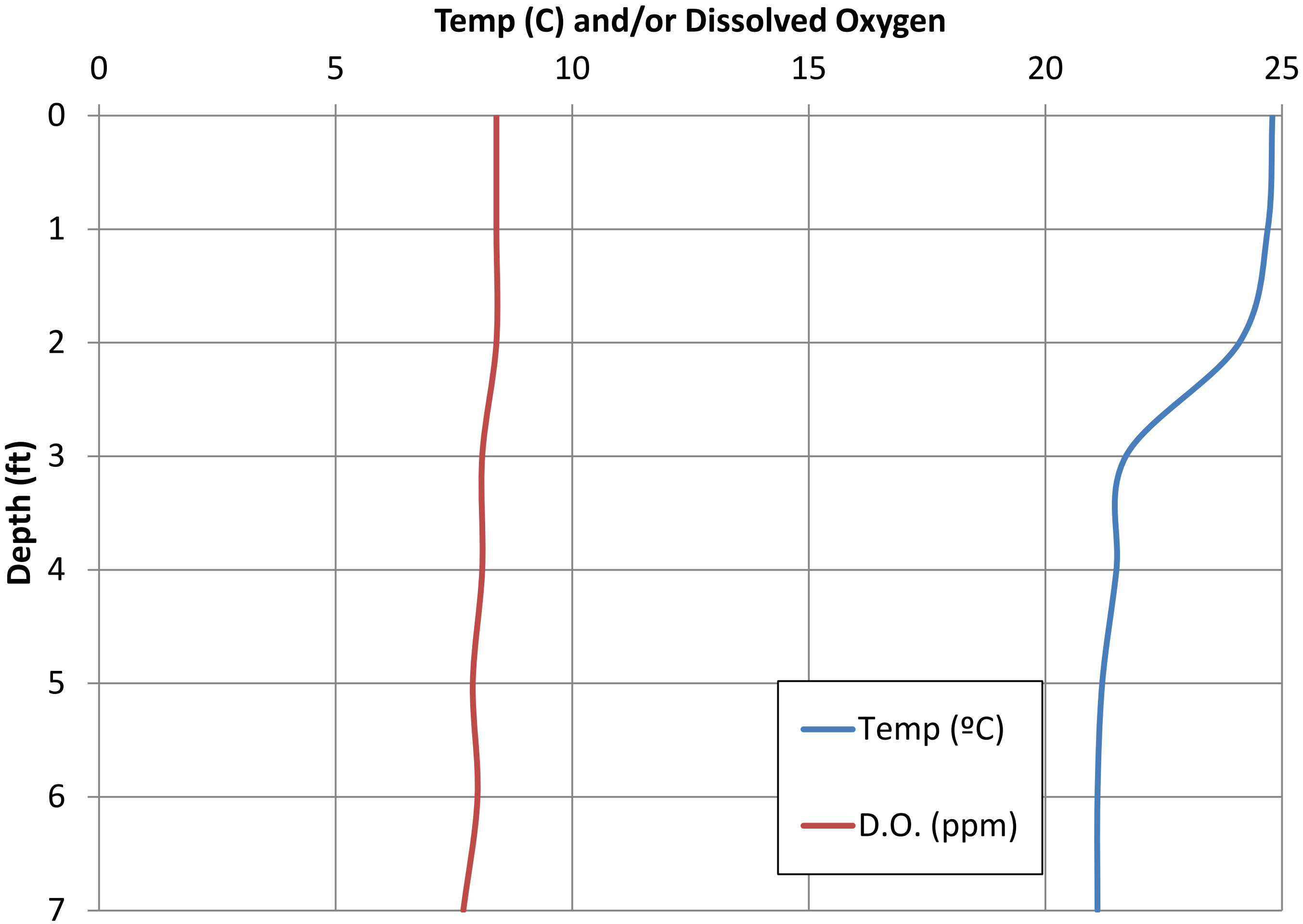


Cold water inflow associated with steep banks.

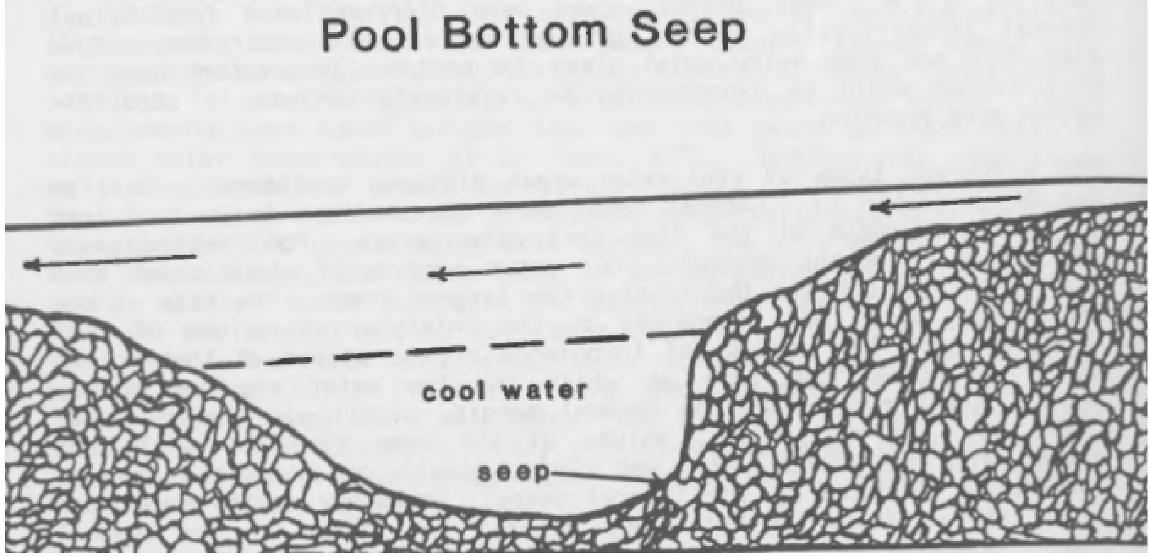
Look at Maine Surficial Geology layer for Eskers!

1) Lateral Seeps, 2) Pool Bottom Seeps, 3) Cold Tributary Mouths, 4) Flow Through Bed

7 ft deep pool below 28 Pond (Narraguagus R.)

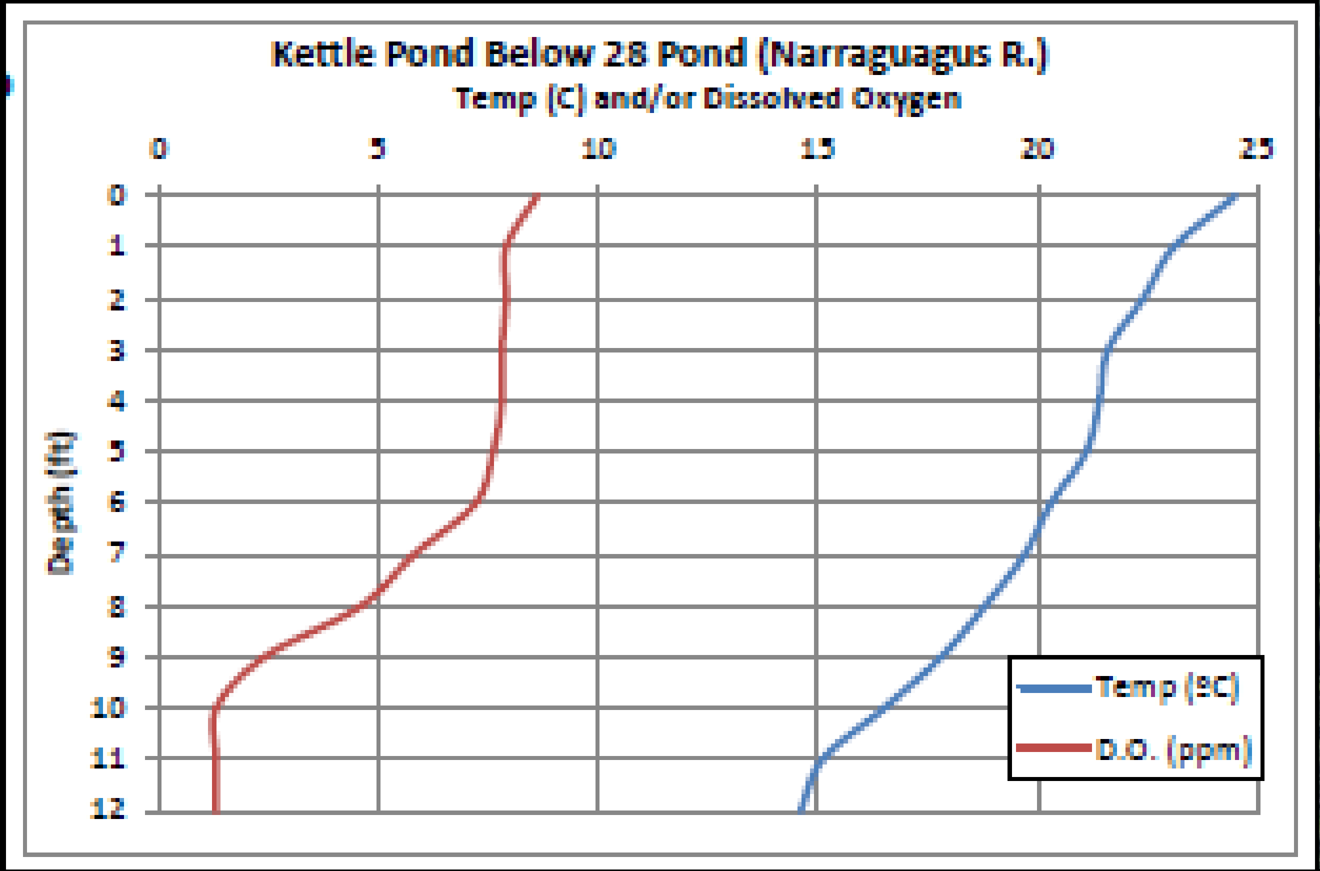


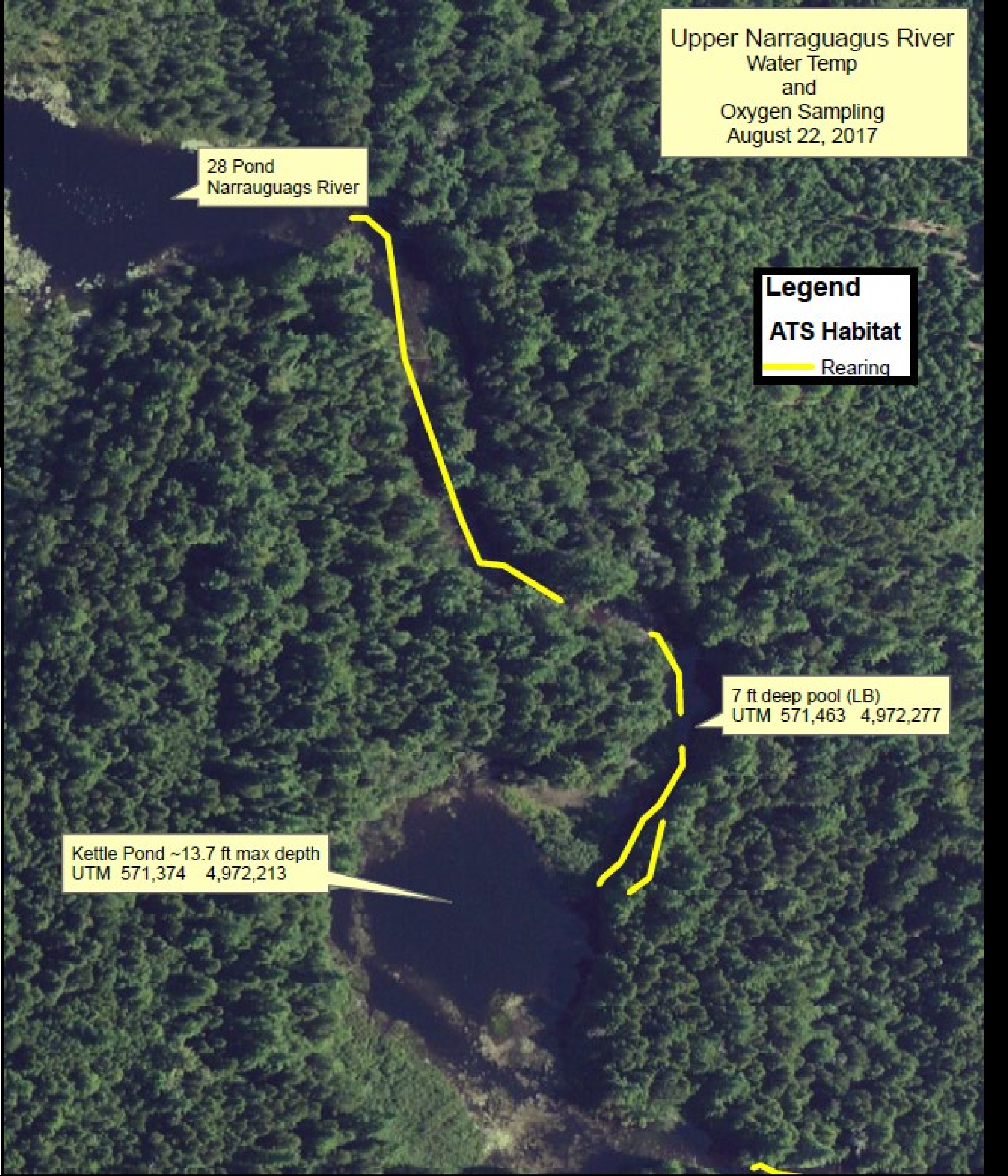
3.7 C cooler at Bottom!



As of most "Seeps"; Cooling effect more pronounced at low flows when mixing is reduced

Riverine Pools compared to Kettle Ponds





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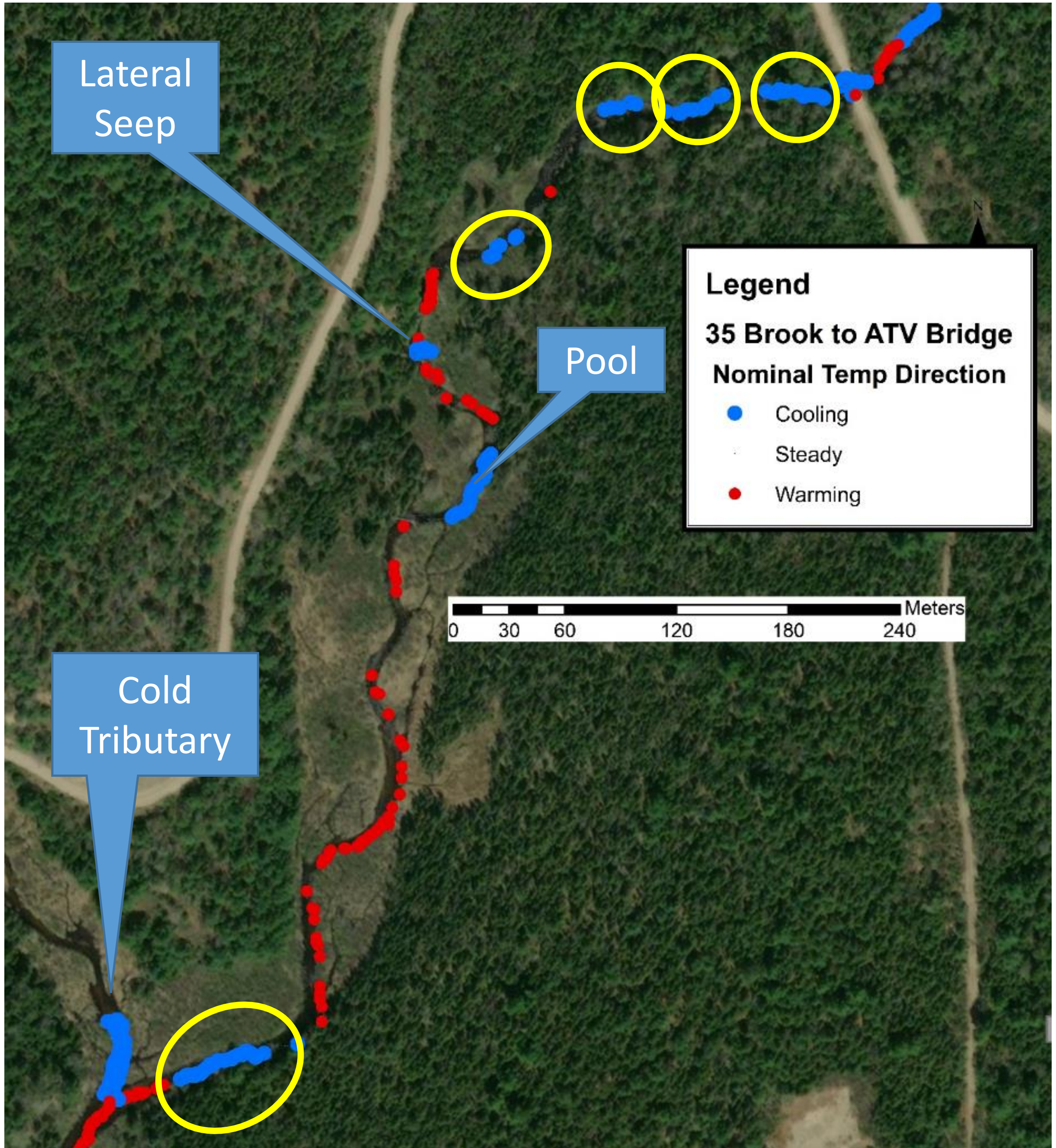
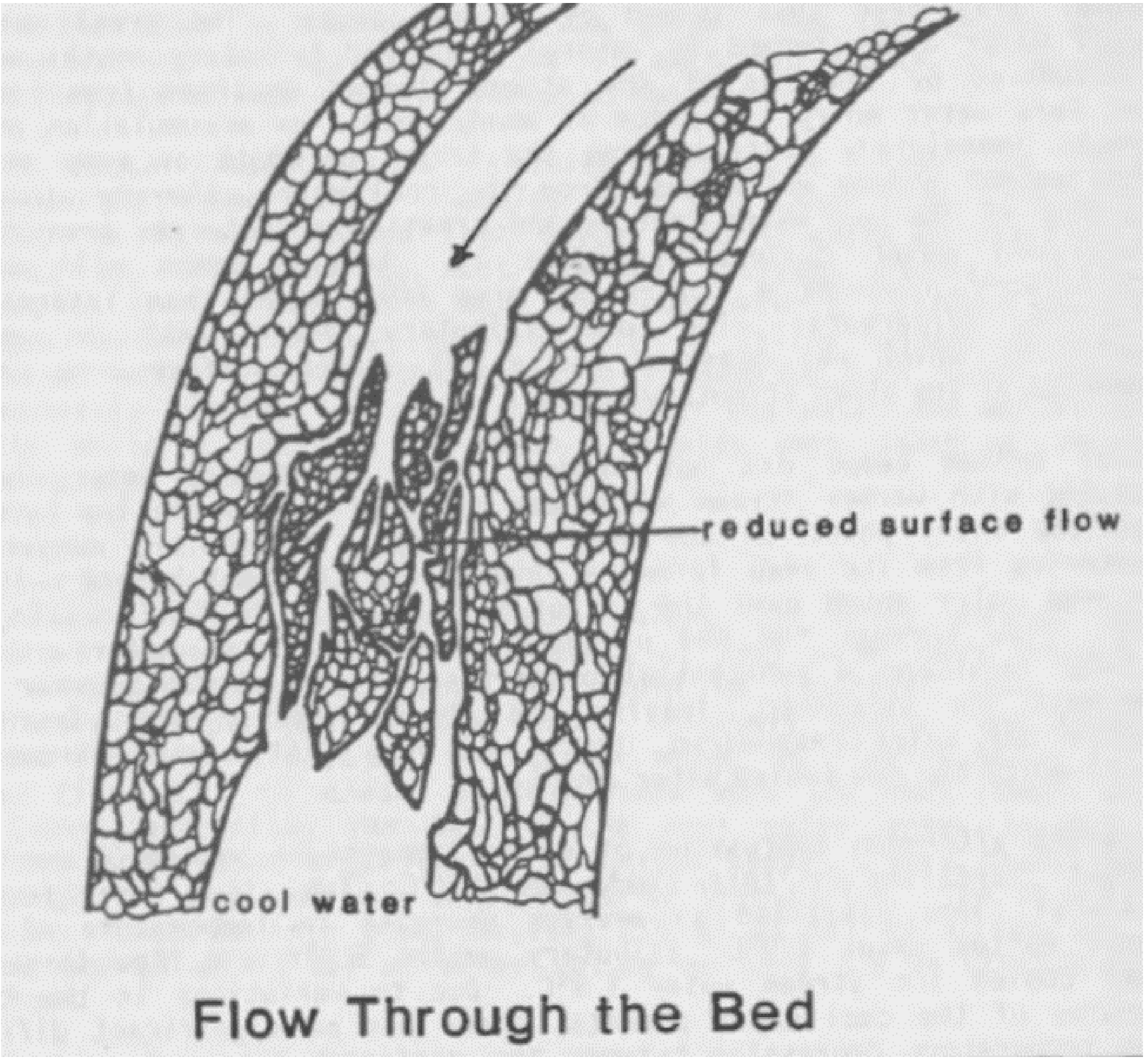


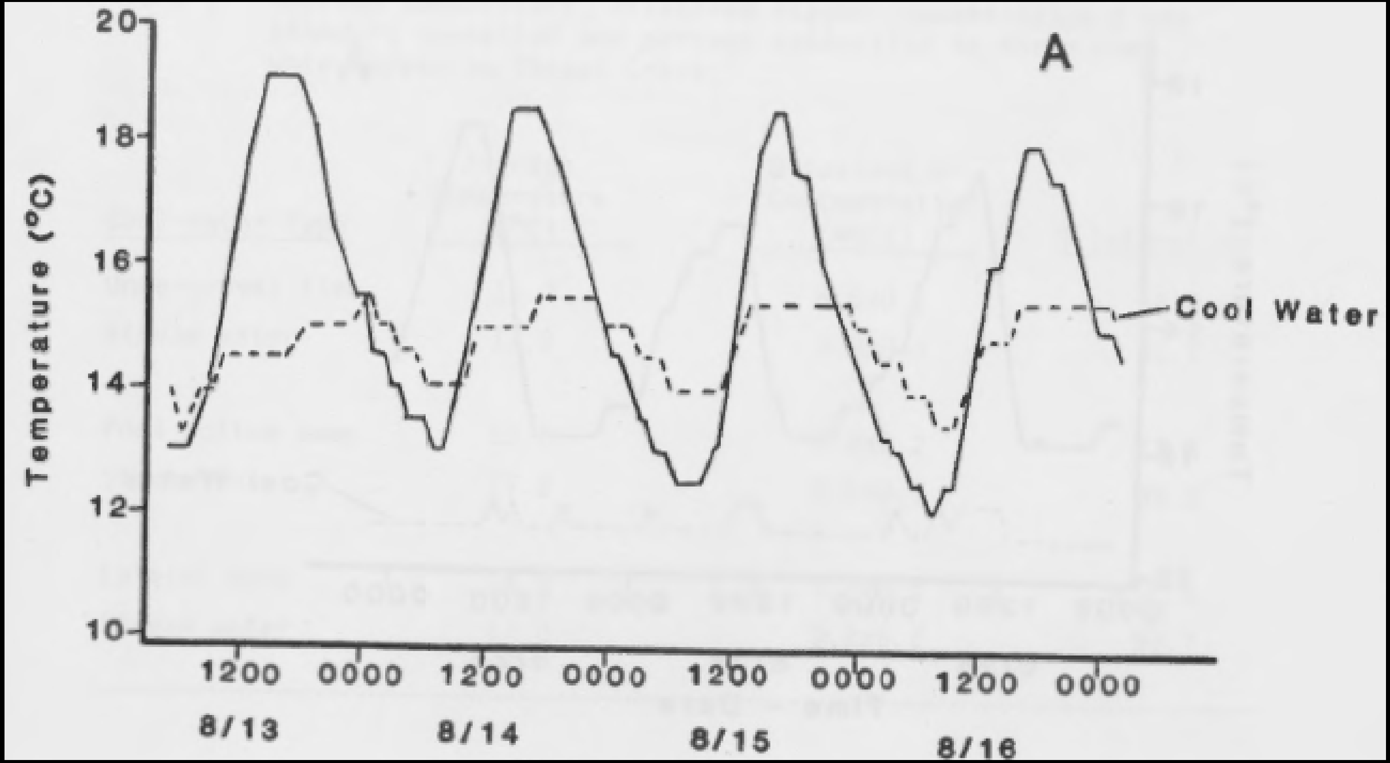


Lastly

Maintain Loggers so they do not interact with Hyporheic Flow

Easy solution:

Don't let your loggers become buried under sediments!



Literature Cited:

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EPA. 2016. Average Temperature of Shallow Ground Water. https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/ex/jne_henrys_map.html.

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Stanley, J. and J. Trial. 1995. Habitat Suitability Index Models: Nonmigratory Freshwater Life Stages of Atlantic Salmon. Washington D.C., U.S. Department of the Interior. National Biological Service: 20 p.