iButton Temperature Data from 40 Aquatic Plots

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Thermocron iButton data loggers were installed on July 19, 2021, in 30 thaw ponds in the NIRPO and Jorgenson Field Sites, Prudhoe Bay, Alaska, and programmed to record temperature in degrees Celsius every hour. They were retrieved on August 23, 2021.

Sensors were installed in the following locations in each pond:

- Water surface
- Above the moss layer
- At the sediment surface.

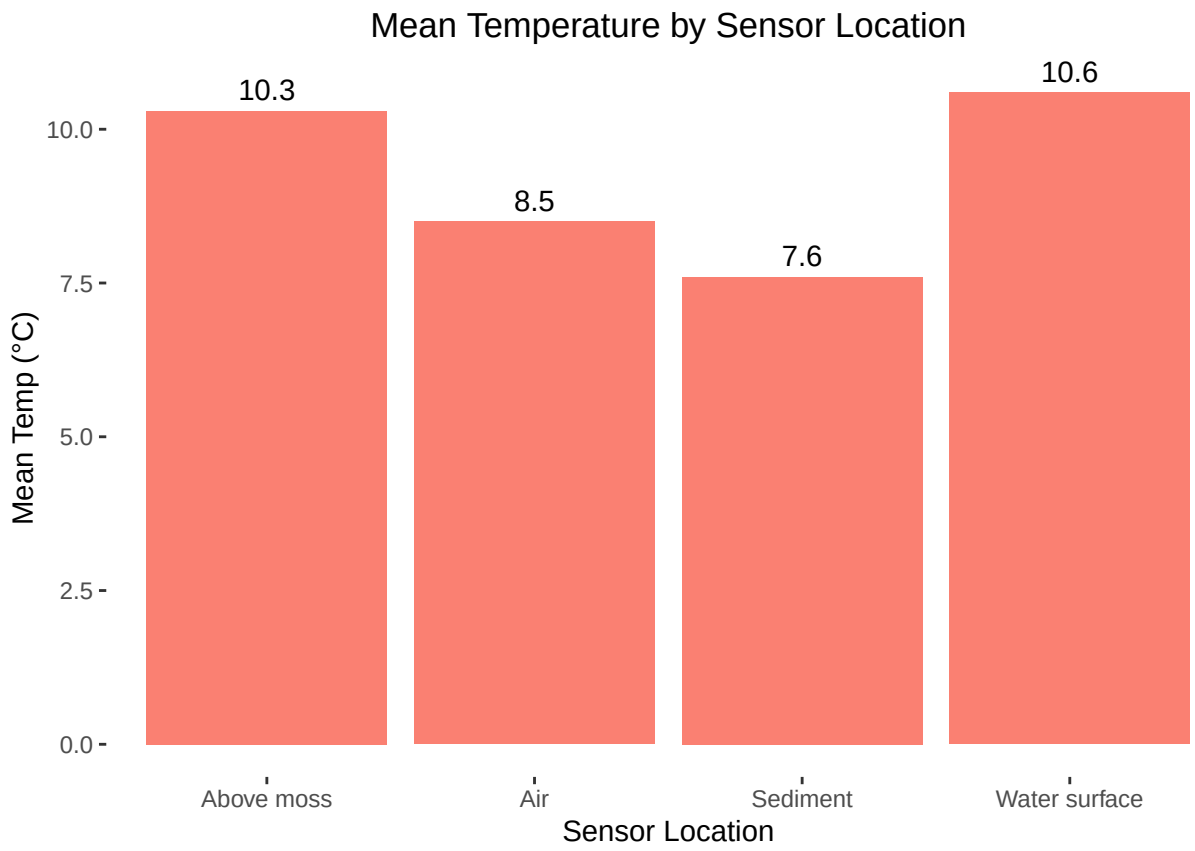
Two additional sensors were installed to record air temperature at each site (NIRPO and Jorgenson), and one sensor was installed at the water surface in a lake at the Jorgenson site.

Raw Data (99,720 rows)

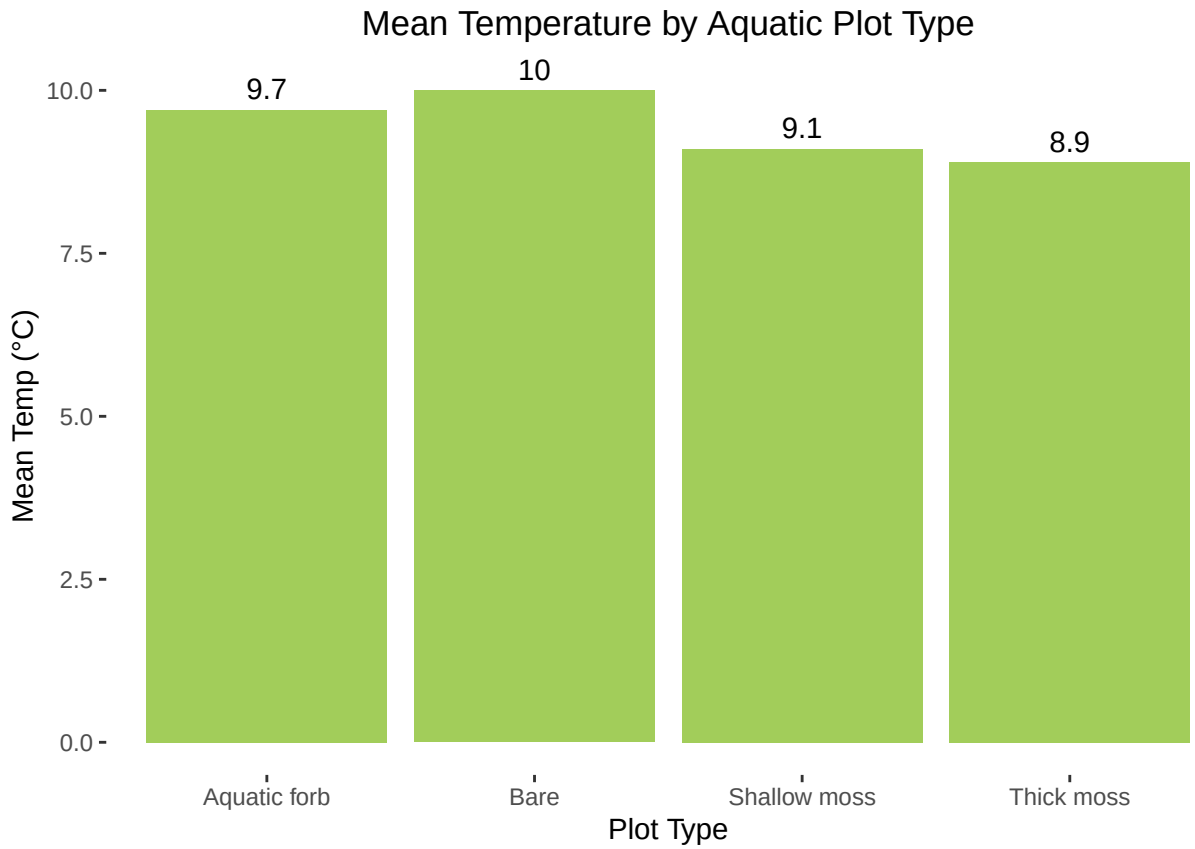
Date	Time	iBtn ID	Temp (°C)	Plot ID	Sensor Type	Plot Type
2021-07-19	6:00:00 PM	1	20.5	21A-01	Aquatic forb	Water surface
2021-07-19	6:00:00 PM	2	20.5	21A-01	Aquatic forb	Above moss
2021-07-19	6:00:00 PM	4	13.0	21A-01	Aquatic forb	Sediment
2021-07-19	6:00:00 PM	5	21.5	21A-02	Thick moss	Water surface
2021-07-19	6:00:00 PM	6	21.5	21A-02	Thick moss	Above moss
2021-07-19	6:00:00 PM	9	8.5	21A-02	Thick moss	Sediment

Average Daily Temperature calculated (4320 rows)

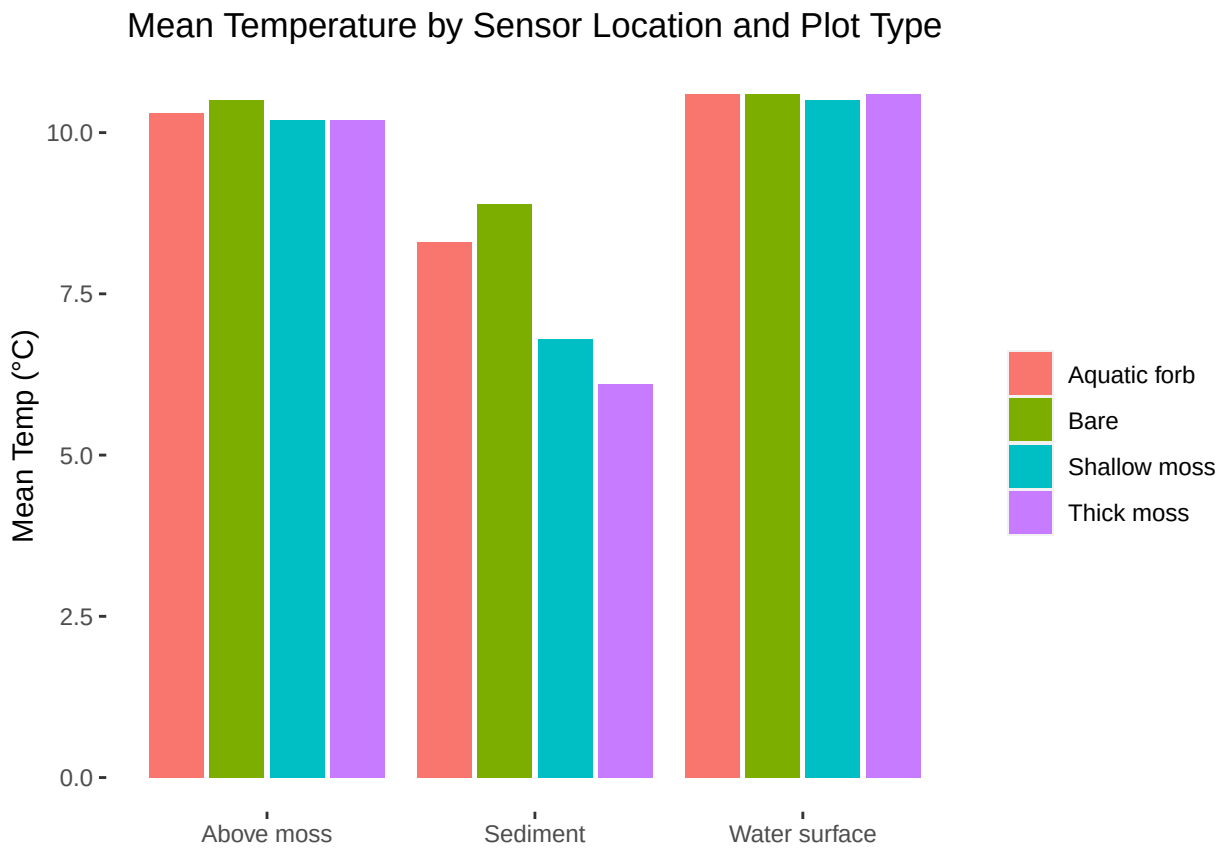
Date	iBtn ID	Plot ID	Sensor Type	Plot Type	Avg Daily Temp (°C)
2021-07-19	1	21A-01	Water surface	Aquatic forb	20.1
2021-07-19	10	21A-03	Sediment	Aquatic forb	8.8
2021-07-19	101	21A-20	Sediment	Lake	15.7
2021-07-19	103	21A-21	Water surface	Thick moss	20.5
2021-07-19	105	21A-21	Above moss	Thick moss	20.8
2021-07-19	108	21A-21	Sediment	Thick moss	7.2



Sensor Type	Mean Temp (°C)
Above moss	10.3
Air	8.5
Sediment	7.6
Water surface	10.6

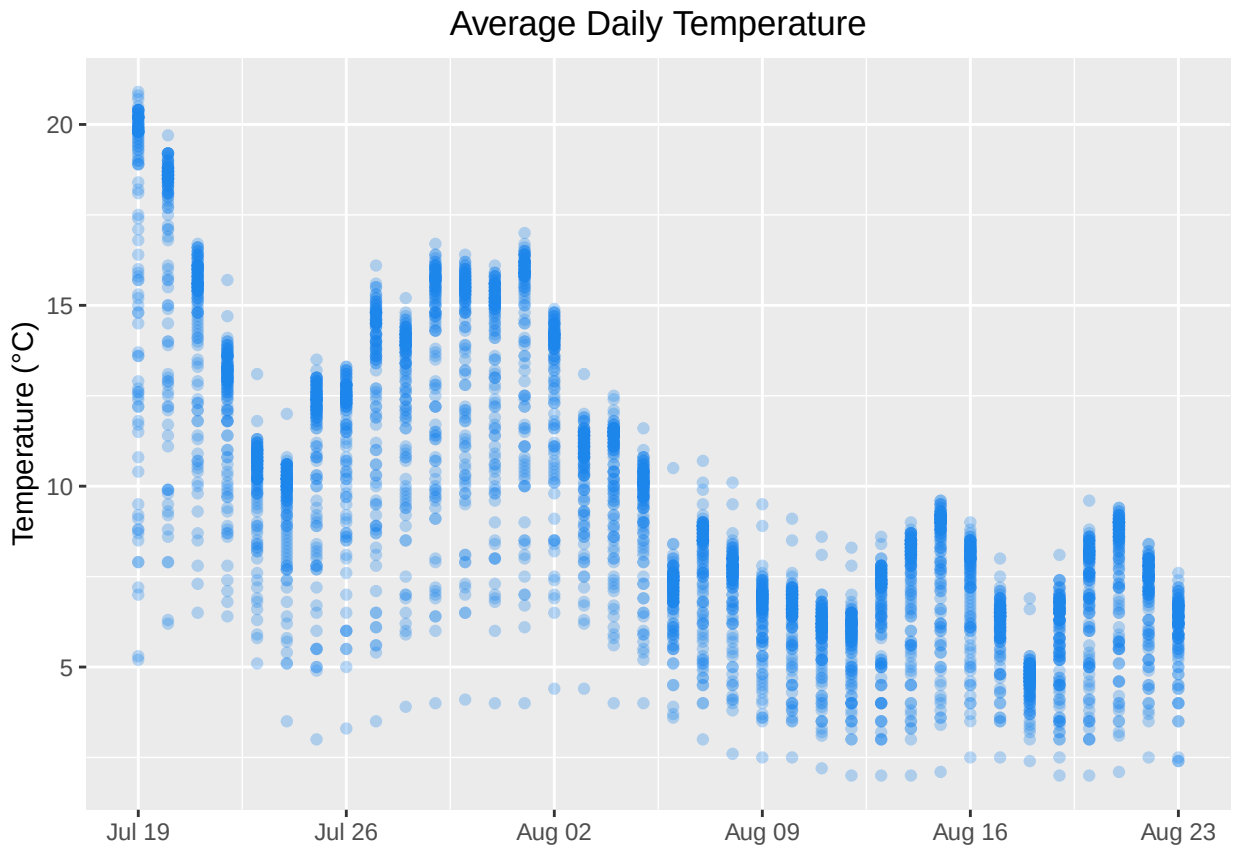


Plot Type	Mean Temp (°C)
Aquatic forb	9.7
Bare	10.0
Shallow moss	9.1
Thick moss	8.9

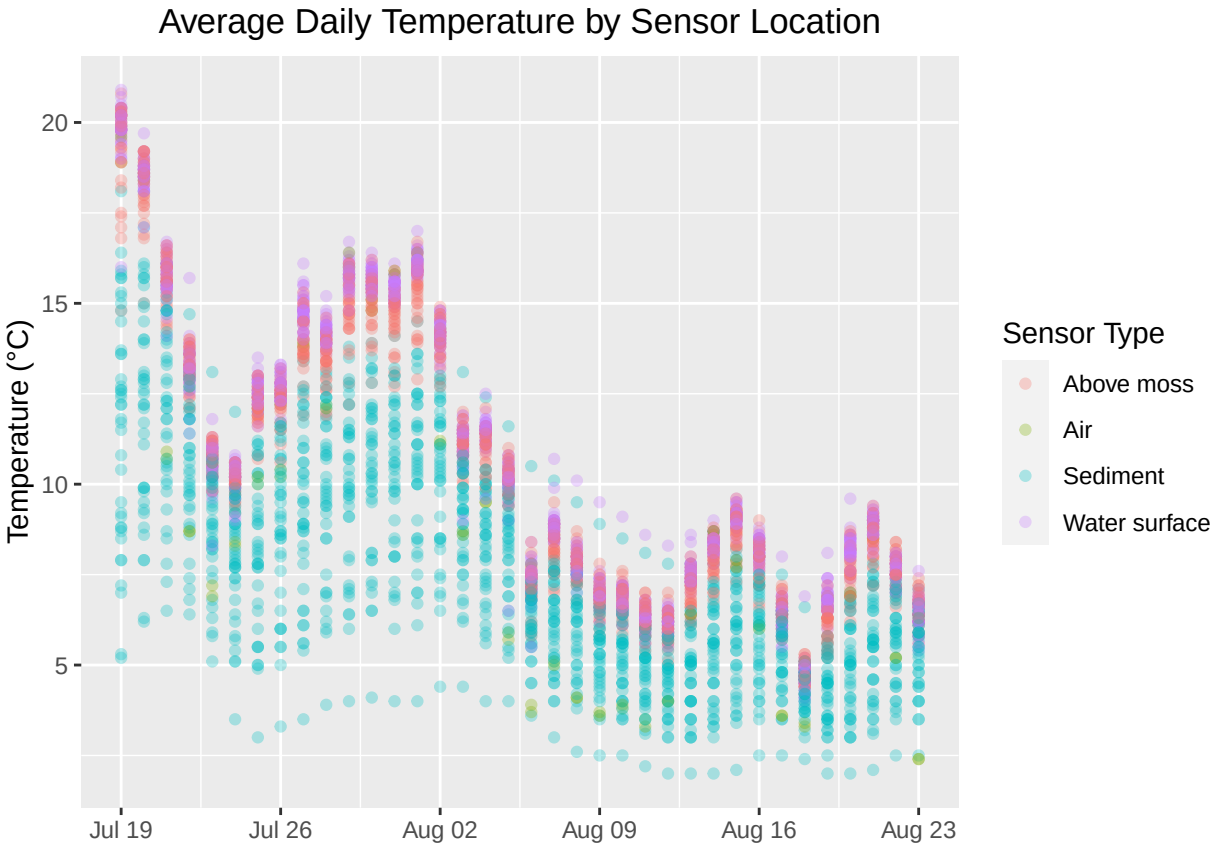


Sensor Type	Plot Type	Mean Temp (°C)
Above moss	Aquatic forb	10.3
Above moss	Bare	10.5
Above moss	Shallow moss	10.2
Above moss	Thick moss	10.2
Sediment	Aquatic forb	8.3
Sediment	Bare	8.9
Sediment	Shallow moss	6.8
Sediment	Thick moss	6.1
Water surface	Aquatic forb	10.6
Water surface	Bare	10.6
Water surface	Shallow moss	10.5
Water surface	Thick moss	10.6
### Let's look a	t the data in m	ore detail.

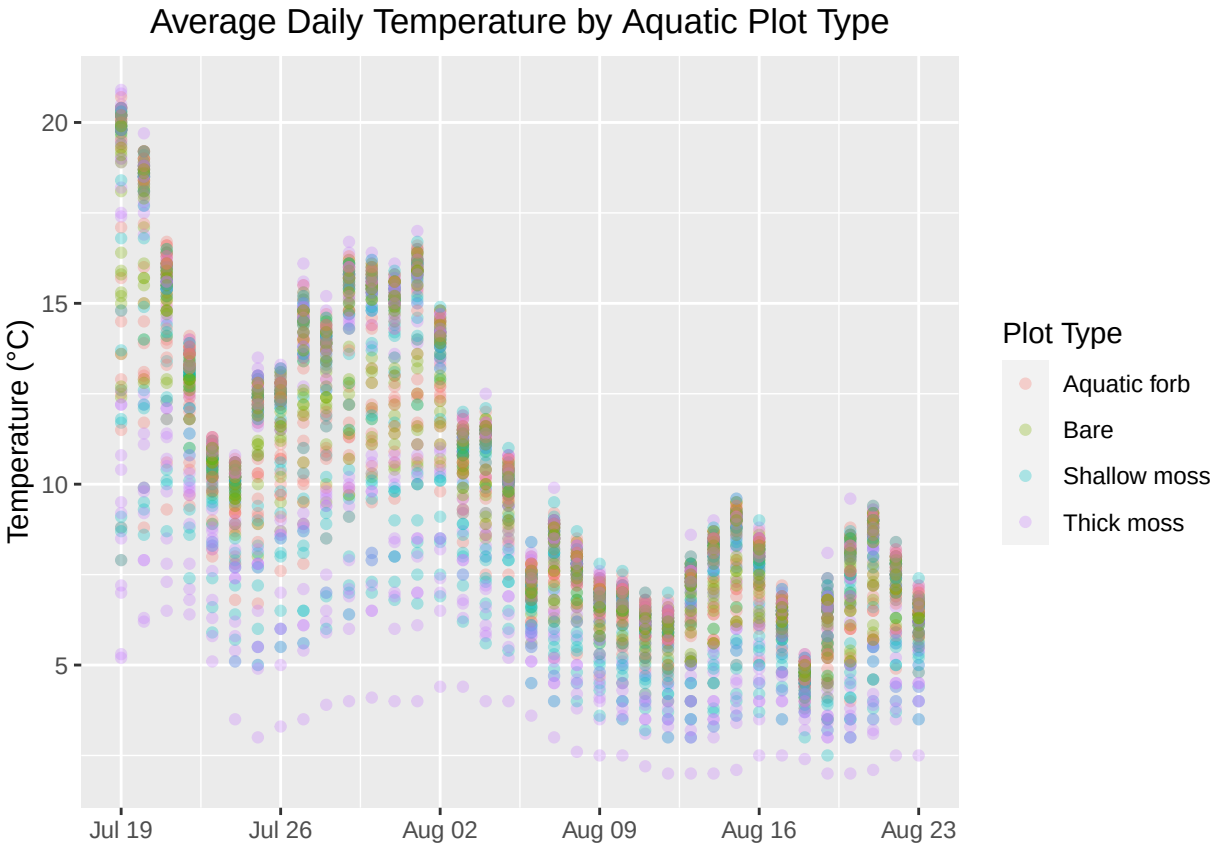
Here is a plot of the average daily temperature of each iButton from July 19 to August 23.

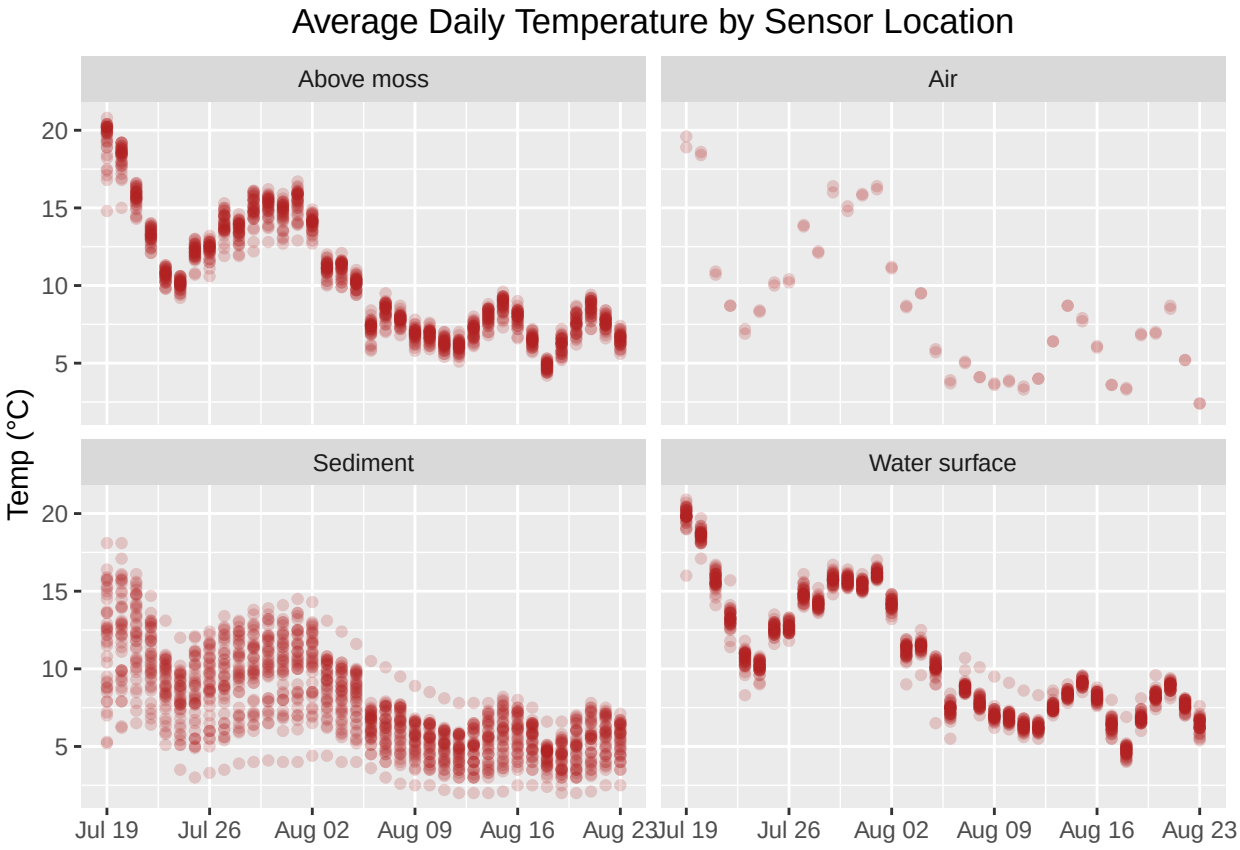


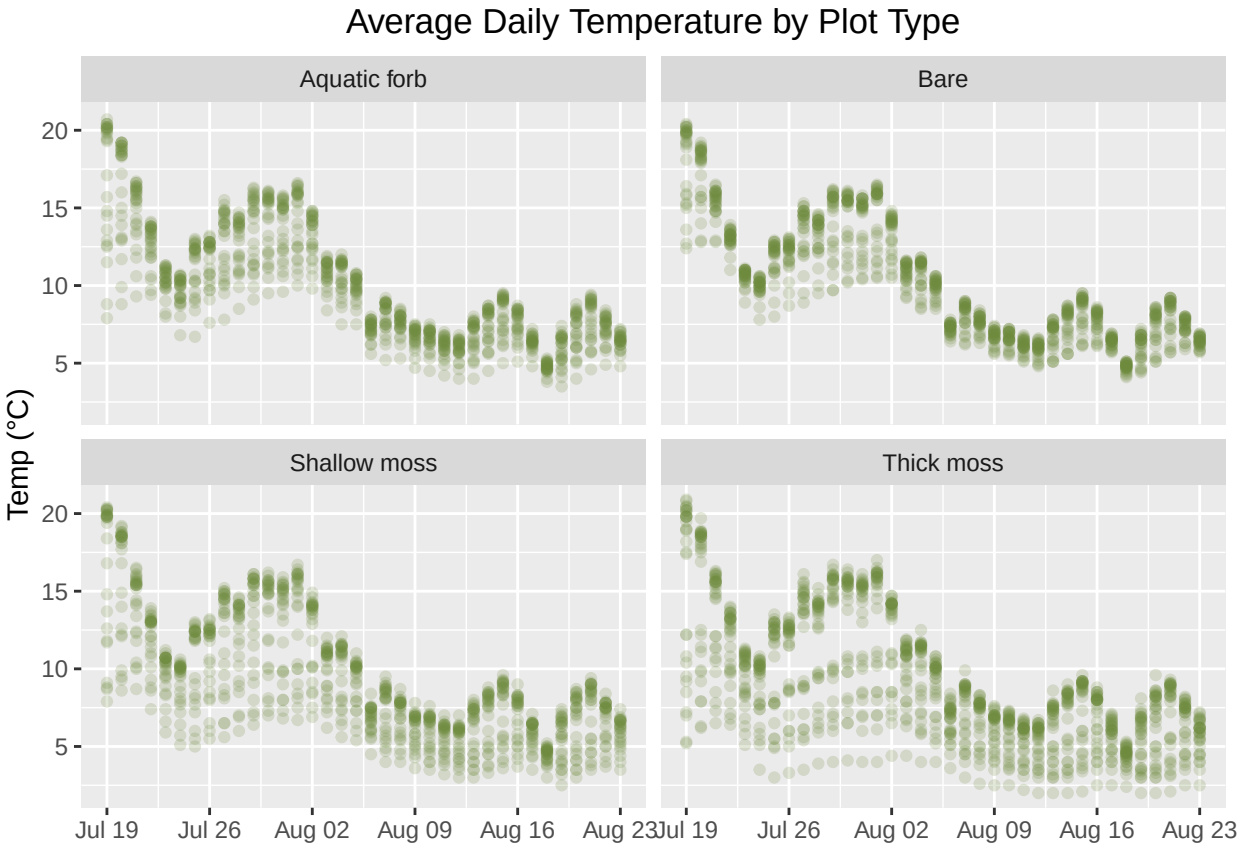
Now we can look at the same data but colored to indicated the location of the temperature sensor: At water surface, sediment surface, or below the water surface, but above the vegetation layer. Two sensors were also placed above the ground to record the ambient air temperature at each site.



This time we'll look at the dominant type of aquatic vegetation in the 1-m plot. For example, here the plot shows the average daily temperature data for each sensor location (water surface, sediment surface, above moss layer) in thick moss plots as purple markers. Based onthe previous plot we can assume the coldest temperatures in thick moss plots come from the sensors at the sediment surface, and the warmest temperatures are from the water surface.

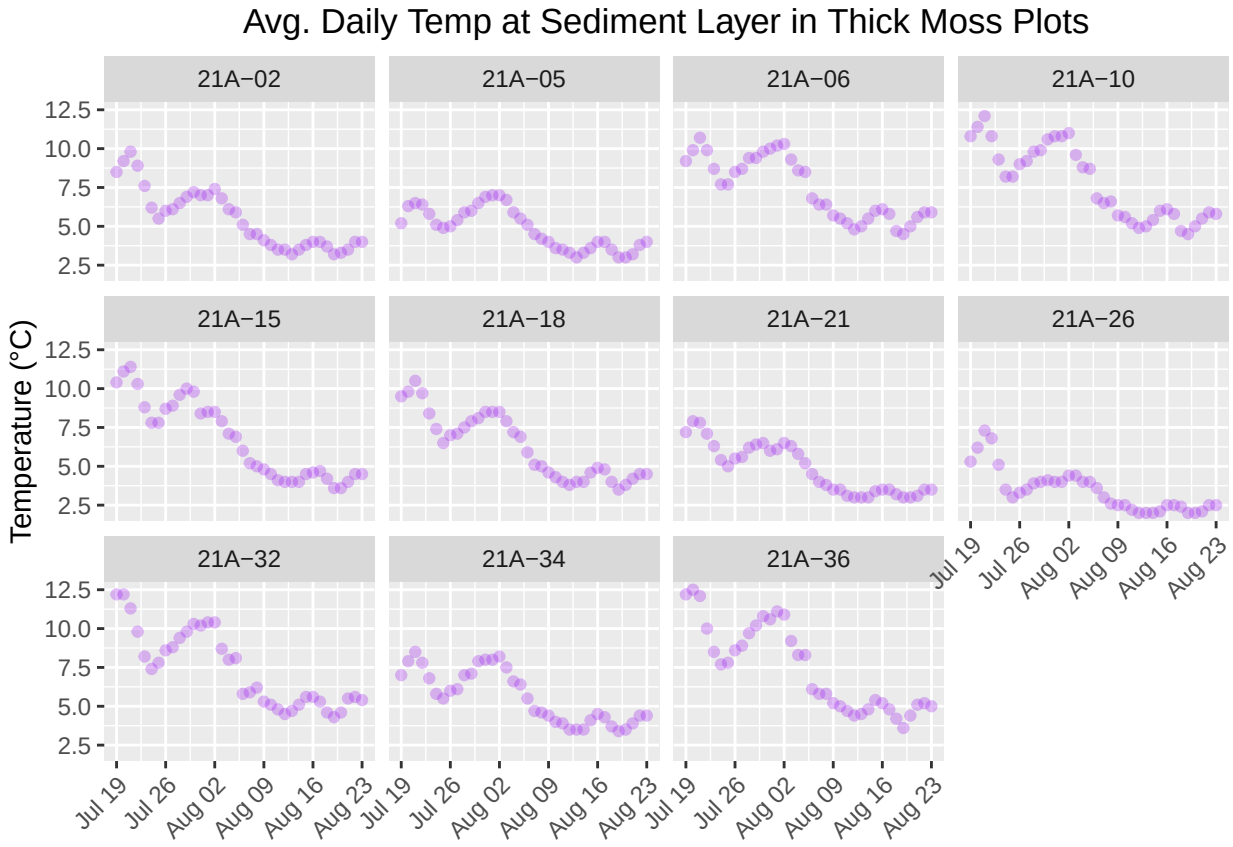

Average Daily Temperature by Aquatic Plot Type
Temperature (°C)
20
15
10
5
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Plot Type
Aquatic forb
Bare
Shallow moss
Thick moss


Average Daily Temperature by Sensor Location
Above moss
Air
Sediment
Water surface
Temp (°C)
20
15
10
5
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23

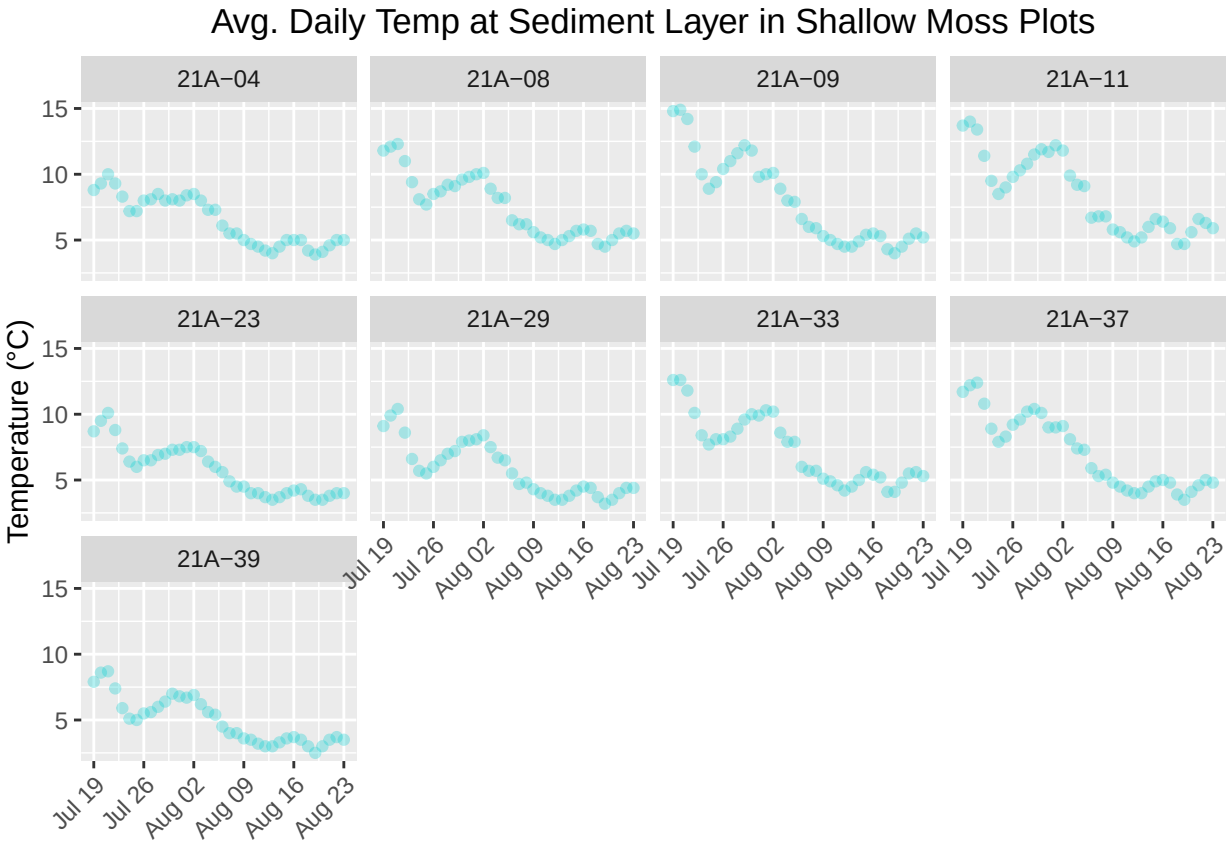


What's going on at the sediment surface?

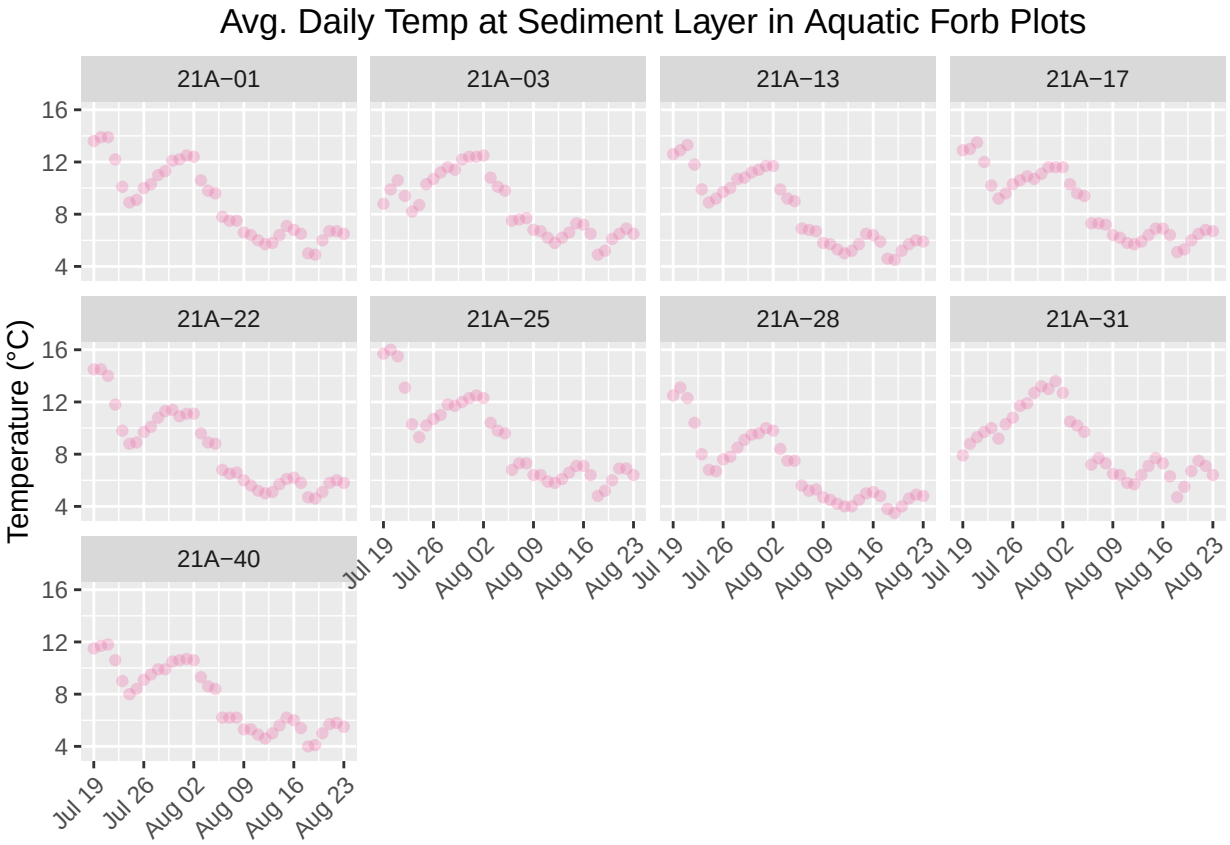
Let's take a closer look at the differences in temperature at the sediment surface by plot type. As we've seen the coldest temperatures are at the pond bottoms are in plots characterized by thick moss.



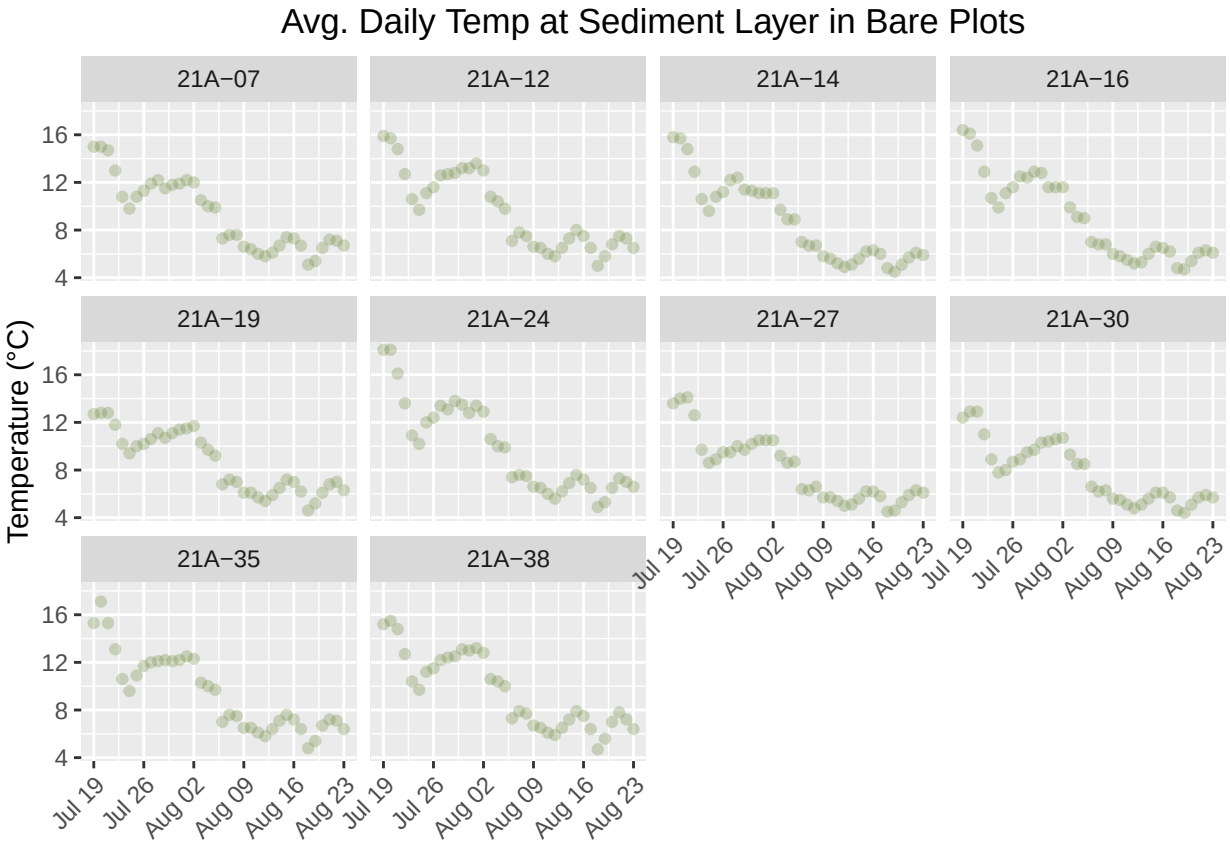
Followed by shallow moss. . .



And aquatic forb plots...



Finally, we observe the warmest temperatures at the pond bottom (sediment surface location) in plots without significant vegetation of any type (bare plots).


Avg. Daily Temp at Sediment Layer in Bare Plots
21A−07
21A−12
21A−14
21A−16
21A−19
21A−24
21A−27
21A−30
21A−35
21A−38
Temperature (°C)
16
12
8
4
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23