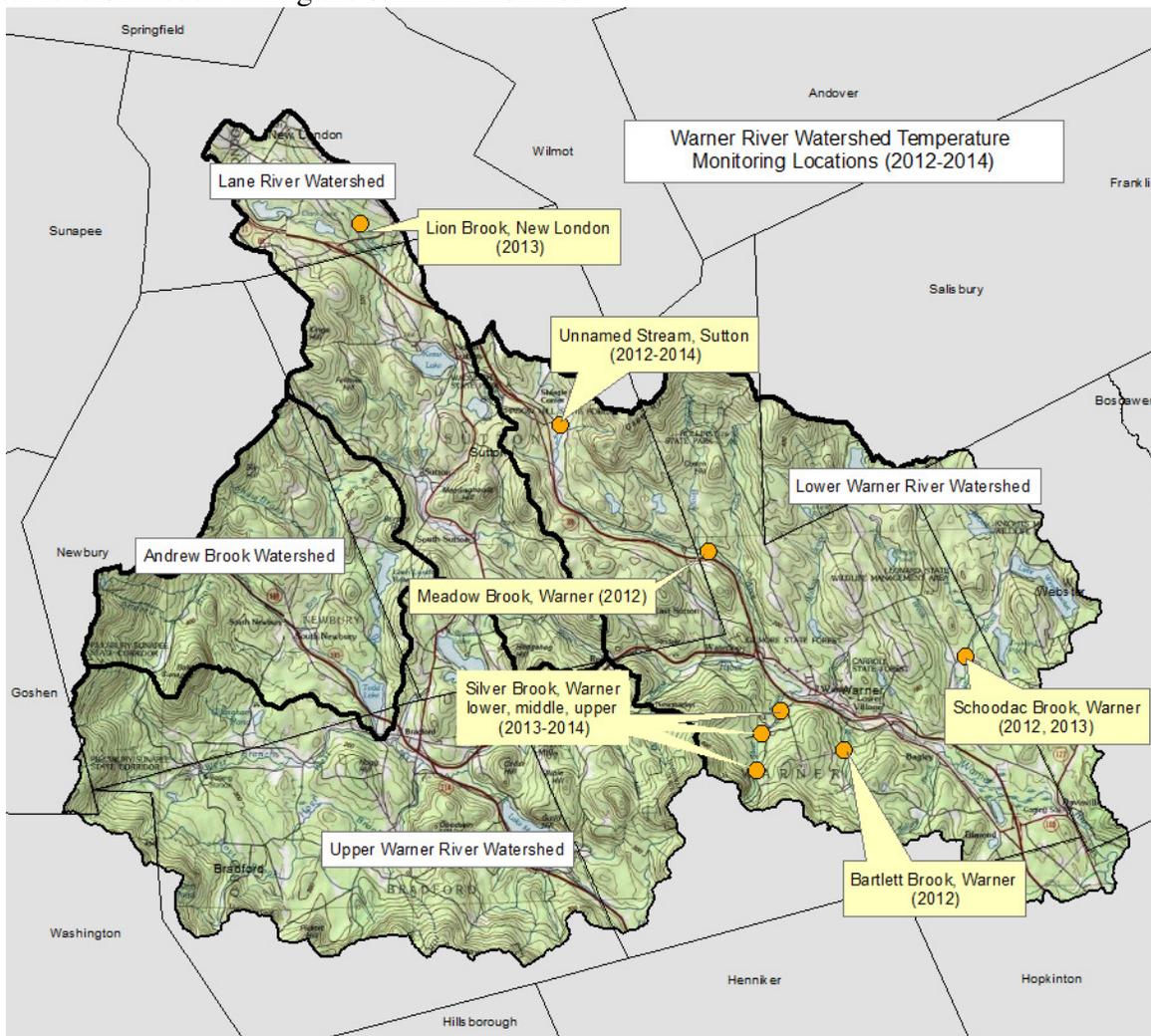


Hourly Water Temperature Monitoring

Hourly water temperature was monitored at select locations within tributaries to the Lower Warner and Lane River watersheds (2012-2014). *Optic StowAway* thermographs (Onset Computer Corp[®]) were deployed in areas to develop a better understanding of stream temperatures throughout summer months. Thermographs were programmed to record temperature values at hour intervals. The units were housed in a protective case made of 1.5 in. diameter PVC pipe, capped on both ends and drilled with 1/4 in. diameter holes to allow water to flow through. The cases were attached to cement blocks with steel cable and placed behind large boulders to afford protection from heavy stream flows and from human disturbance. The thermographs recording water temperatures were placed in deep pools to prevent exposure as water levels receded during the summer months.



This information can be a useful tool to help identify locations having the potential to support wild brook trout, areas available for summertime thermal refuge, and areas with water temperatures that would likely preclude wild brook trout from being present during the summer. Water temperature monitoring can also be used as a surrogate to evaluate effects of stormwater runoff by observing the rates of change in stream temperatures after rain events.

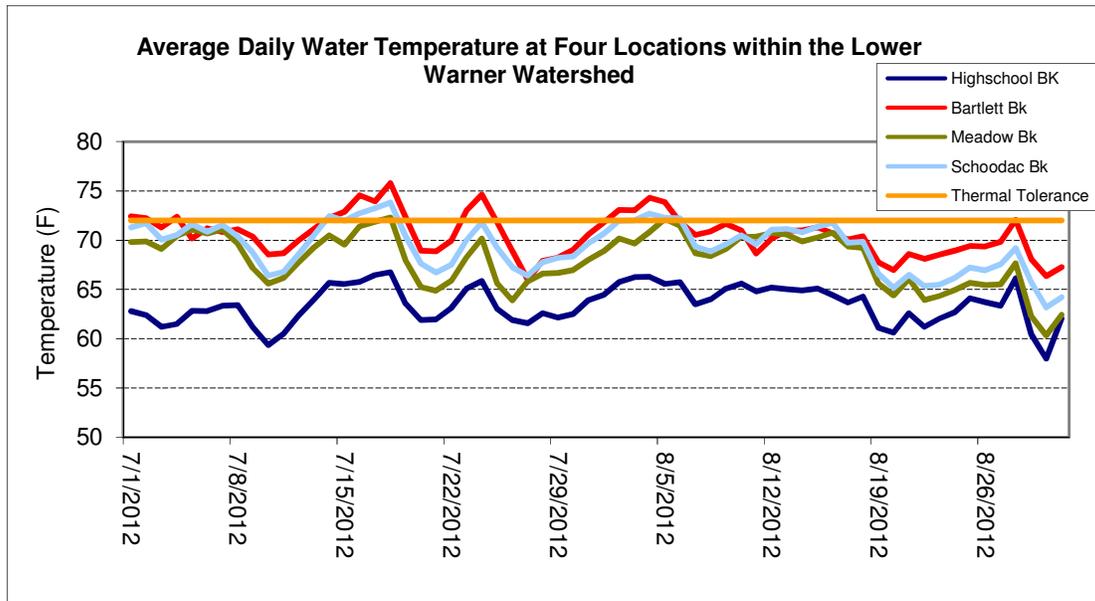
2012 Stream Temperature Monitoring

In 2012, four water temperature thermographs were deployed in tributaries to the Lower Warner River watershed in Bartlett Brook (Warner), Meadow Brook (Sutton), Schoodac Brook (Warner), and the unnamed stream near the Kearsarge Regional High School (Sutton). All four tributaries displayed mean monthly water temperature for July and August below 72°F in 2012. Every location except the unnamed stream near the Kearsarge Regional High School experienced periods of water temperatures exceeding 72°F during the two months. Bartlett Brook exceeded the 72°F temperature threshold most frequently of the four monitoring locations and also had the greatest mean monthly water temperatures for July and August. Mean monthly water temperatures and the number of days were water temperatures exceed 72°F for the four monitoring locations can be found in the table below.

Three monitoring locations exhibited mean July temperatures greater than 67°F in 2012. These conditions may have precluded the ability for the young-of-the-year brook trout found in June to survive until water temperatures began to reside in the fall. This illustrates the importance of habitat connectivity and the need to ensure riparian canopy offer as much shading as possible. If brook trout are unable to migrate to more desirable locations because of perched crossings and impoundments, they may not survive the summer.

The Mean Value of July and August Combined Water Temperature (MJAWT), Mean Value of July Water Temperatures (MJWT), Mean Value of August Water Temperature (MAWT), standard deviation, ranges, and number of days where water temperature exceeded 72°F in tributaries to the Warner River in 2012.

Site Name	MJAWT (SD) Range	MJWT (SD) Range	# Days >72°F	
			July	August
High School Bk	63.5 (±2.6) 52.3-70.0	63.1 (±2.4) 55.9-70.0	0	0
Bartlett Bk	70.6 (±3.4) 61.5-79.1	71.0 (±3.5) 63.4-79.1	27	26
Meadow Bk	68.4 (±3.2) 56.9-75.0	68.4 (±2.9) 61.2-75.0	11	11
Schoodac Bk	69.3 (±2.8) 60.6-75.8	69.8 (±2.5) 63.8-75.5	16	11



2013 Stream Temperature Monitoring

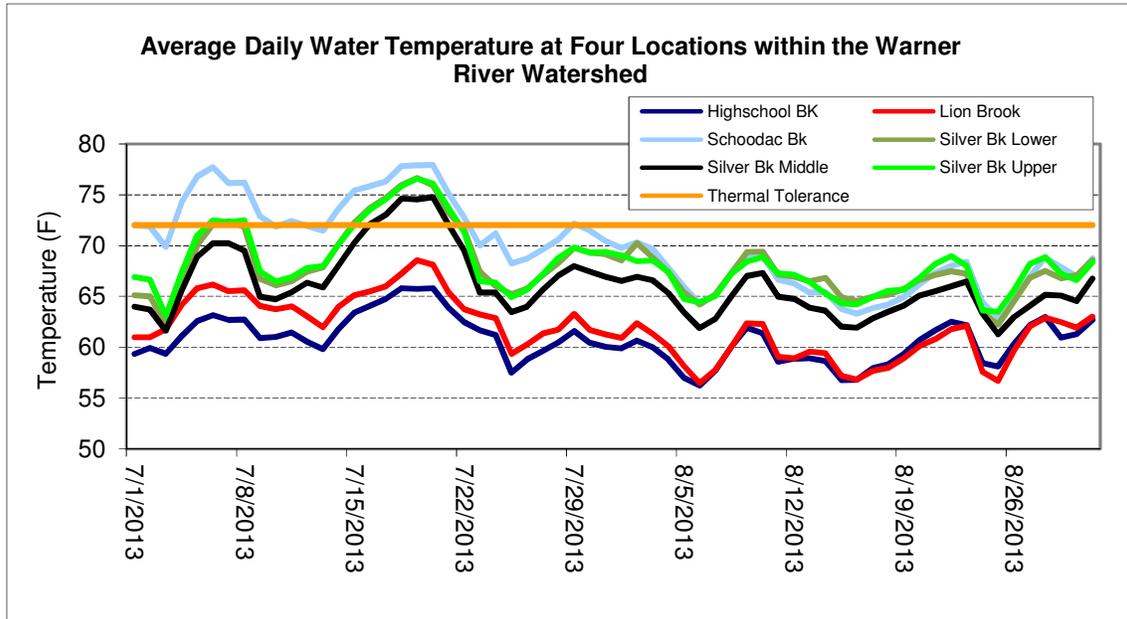
In 2013, water temperature thermographs were deployed in Lion Brook (New London, Lane River Watershed), the unnamed stream near the Kearsarge Regional High School (Sutton, Lower Warner River Watershed), and three locations within Silver Brook (Warner, Lower Warner River Watershed). With the exception of Schoodac Brook, all other locations displayed mean monthly water temperature for July and August below 72°F in 2013. The mean water temperature at the Schoodac Brook monitoring location was 73.2°F and 66.6°F during the months of July and August, respectively. Every location except the unnamed stream near the Kearsarge Regional High School and Lion Brook experienced periods of water temperatures exceeding 72°F during the two months. Schoodac Brook exceeded the 72°F temperature threshold most frequently and also had the greatest mean monthly water temperatures for July and August. Mean monthly water temperatures and the number of days were water temperatures exceed 72°F for the six monitoring locations can be found in the table below.

Three monitoring locations exhibited mean July temperatures greater than 67°F in 2013. These conditions may have precluded the ability for the young-of-the-year brook trout found in June to survive until water temperatures began to reside in the fall. This illustrates the importance of habitat connectivity and the need to ensure riparian canopy offer as much shading as possible. If brook trout are unable to migrate to more desirable locations because of perched crossings and impoundments, they may not survive the summer.

The summer water temperature regime observed at Silver Brook in 2013 shows promise for the possibility of reintroducing wild brook trout to an area where no wild brook trout were found. In 2012, a section above Mink Hill Lane in Warner was electrofished with no wild brook trout being found. In 2013, a lower and upper section of the stream was electrofished and the presence of wild brook trout was confirmed. No wild brook trout were found again after electrofishing the middle section of Silver Brook in 2013. Temperature monitoring indicates the middle section provides more favorable conditions for wild brook trout. Currently, several barriers preclude the species from accessing the middle portion of Silver Brook. Two dams, Silver Lake, and a perched crossing on Mink Hill Lane prevent wild brook trout from moving upstream into the section and several wetland complexes and beaver dams likely discourage downstream movement.

The Mean Value of July and August Combined Water Temperature (MJAWT), Mean Value of July Water Temperatures (MJWT), Mean Value of August Water Temperature (MAWT), standard deviation, ranges, and number of days where water temperature exceeded 72°F in tributaries to the Warner River in 2013.

Site Name	MJAWT (SD) Range	MJWT (SD) Range	# Days	MAWT (SD) Range	# Days
			>72°F		>72°F
			July		August
High School Bk	60.7 (+2.5) 53.6-67.7	61.7 (+2.3) 55.6-67.7	0	59.7 (+2.3) 53.6-64.9	0
Schoodac Bk	69.9 (+4.4) 60.5-80.5	73.2 (+3.2) 66.0-80.5	29	66.6 (+2.6) 60.5-72.9	1
Lion Bk	61.9 (+3.1) 54.2-71.2	63.8 (+2.6) 57.3-71.2	0	60.0 (+2.3) 54.2-64.2	0
Silver Bk lower	68.0 (+3.6) 59.6-79.7	69.4 (+4.0) 60.3-79.7	13	66.6 (+3.2) 59.6-73.1	1
Silver Bk middle	66.2 (+3.4) 59.2-77.1	67.9 (+3.8) 59.2-77.1	8	64.5 (+1.9) 59.6-69.2	0
Silver Bk upper	68.2 (+3.4) 59.3-79.4	69.7 (+3.8) 59.3-79.4	13	66.7 (+2.1) 61.6-71.1	0



2014 Stream Temperature Monitoring

In 2014, water temperature thermographs were deployed in the unnamed stream near the Kearsarge Regional High School (Sutton, Lower Warner River Watershed), and three locations within Silver Brook (Warner, Lower Warner River Watershed). All locations displayed mean monthly water temperature for July and August below 72°F in 2014. The lower section of Silver Brook not only exceeded the 72°F temperature threshold most frequently but also had the greatest mean monthly water temperatures for July and August. The middle and upper sections of Silver Brook exceeded 72°F in July 8 and 9 days, respectively but did not exceed 72°F in August. The unnamed stream near the Kearsarge Regional High School did not experience periods of water temperatures exceeding 72°F during the two months. Mean monthly water temperatures and the number of days were water temperatures exceed 72°F for the four monitoring locations in 2014 can be found in the table below.

The summer water temperature regime observed at Silver Brook in 2013 shows promise for the possibility of reintroducing wild brook trout to an area where no wild brook trout were found. In 2012, a section above Mink Hill Lane in Warner was electrofished with no wild brook trout being found. In 2013, a lower and upper section of the stream was electrofished and the presence of wild brook trout was confirmed. No wild brook trout were found again after electrofishing the middle section of Silver Brook in 2013. Temperature monitoring indicates the middle section provides more favorable conditions for wild brook trout. The collected data in 2014 reinforces that the middle section of Silver Brook (above Mink Hill Ln) may be a good candidate to consider reintroducing wild brook trout from a nearby source to this area.

The Mean Value of July and August Combined Water Temperature (MJAWT), Mean Value of July Water Temperatures (MJWT), Mean Value of August Water Temperature (MAWT), standard deviation, ranges, and number of days where water temperature exceeded 72°F in tributaries to the Warner River in 2014.

Site Name	MJAWT (SD) Range	MJWT (SD) Range	# Days >72°F July	MAWT (SD) Range	# Days >72°F August
High School Bk	59.8 (+2.4) 54.0-67.2	60.8 (+2.3) 55.9-67.2	0	58.9 (+2.1) 54.0-63.5	0
Silver Bk lower	67.9 (+3.5) 60.4-75.9	70.0 (+2.9) 62.9-75.9	23	65.8 (+2.7) 60.4-72.4	2
Silver Bk middle	66.0 (+3.2) 58.8-75.1	67.6 (+2.9) 60.9-75.1	8	64.5 (+2.7) 58.8-69.8	0
Silver Bk upper	66.1 (+3.3) 58.4-73.9	67.6 (+3.0) 60.4-73.9	9	64.5 (+2.9) 58.4-70.2	0

