Batten Kill Summer Temperature Monitoring

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Background

Water temperature is one of the most important environmental factors determining the suitability of aquatic habitat for fish. As so-called cold-blooded organisms, whose internal body temperature is influenced by that of their surrounding environment, the metabolic activity of fish is directly affected by ambient temperature. Consequently, water temperature at any given time has a direct bearing on fish activity, growth, health, and survival. Elliott (1981) described the temperature requirements of brown trout which have been applied to this study. The temperature tolerance range for brown trout is 0-24.7°C (32-76.5°F). The upper value is the upper incipient lethal temperature (UILT), or the upper temperature at which 50% mortality is observed for a given acclimation temperature. Instantaneous death occurs at maximum lethal temperature (MLT) ranging from 25.6-29.7°C (78.1-85.5°F) depending on acclimation temperature. The preferred thermal range for brown trout is 4-19°C (39.2-66.2°F).

Study Objectives

- Monitor summer water temperatures at several locations along the length of the Batten Kill main stem.
- Examine the range, magnitude, and duration of summer temperatures in the Batten Kill and determine whether temperature regimes limit the habitat suitability and survival of brown trout.

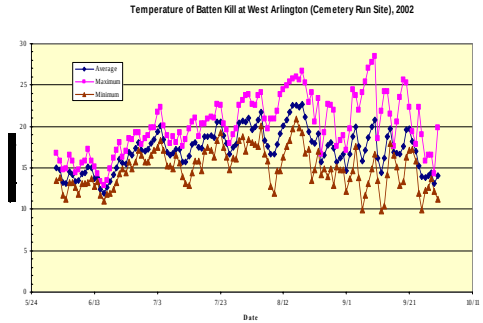
Study Methods

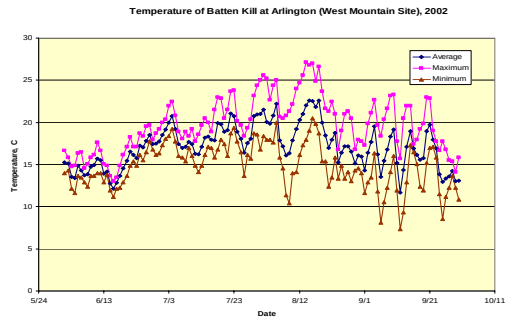
Temperature data loggers were placed in the Batten Kill at four locations: West Arlington, Arlington, Manchester WWTP, East Dorset. Stream temperatures were also monitored in the Green River and other Batten Kill tributaries. Loggers continuously recorded hourly water temperatures throughout the summer seasons of 2001 and 2002 from June 1-September 30. At the end of each period, the loggers were retrieved and the stored hourly temperature measurements were downloaded into a computerized database and analyzed.

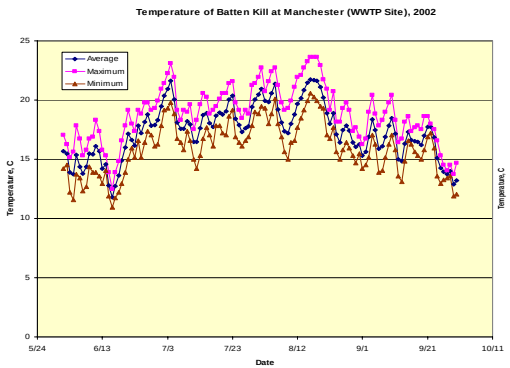
Results

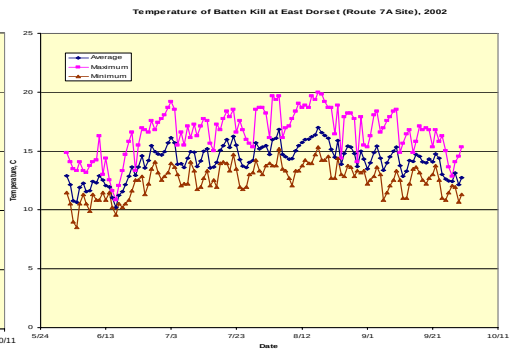
- According to Vermont precipitation records maintained by the National Climatic Data Center (http://lwf.ncdc.noaa.gov/oa/ncdc.html), the summers of June-August 2001 and 2002 ranked, respectively, 5th and 78th driest on record since 1895.
- Average summer air temperature for both years ranked 71st warmest over the 111-year period of record. The average temperature for September 2002 ranked 103rd versus 62nd for 2001.
- During the summers of 2001 and 2002, the Batten Kill main stem experienced water temperature regimes that were largely conducive to brown trout survival, i.e. 99% or more of the time.
- The West Arlington monitoring site experienced the most alarming thermal regime with episodes exceeding the UILT during both 2001 and 2002 seasons. In 2002, river temperatures at the Arlington site also exceeded the UILT. Both sites recorded temperatures exceeding the MTL in 2002.
- Temperatures exceeding the UILT were not recorded at the other monitoring sites on the main stem or in the Green River.

		Preferred		Upper Tolerance		≥ 24.7°C UILT		≥ 25.6°C MLT	
	Monitoring location	**#h**	**%**	**# h**	**%**	**# h**	**%**	**# h**	**%**
2001	West Arlington	2154	73.6	767	26.2	7	0.2	0	0
	Arlington	2302	78.7	625	21.3	0	0	0	0
	Manchester	2348	80.2	579	19.8	0	0	0	0
	East Dorset	2916	99.6	11	0.4	0	0	0	0
	Green River	2709	92.6	218	7.4	0	0	0	0
2002	West Arlington	2115	72.2	772	26.4	36	1.2	15	0.5
	Arlington	2184	74.6	699	23.9	45	1.5	20	0.7
	Manchester	2195	75.0	733	25.0	0	0	0	0
	East Dorset	2904	99.2	24	0.8	0	0	0	0
	Green River	2663	90.9	265	9.0	0	0	0	0









Conclusion

- With exception of the lowermost river, the thermal regime of the Batten Kill main stem is clearly suitable for brown trout survival.
- Even though the lower river does experience excessively warm temperatures at times during the summer season which may stress trout and cause health problems, including mortality, temperature alone does not explain similar trends of reduced brown trout abundance observed at the other Batten Kill population monitoring sites.
- The ability of fish to acclimate to increasing water temperatures and relocate temporarily to cool water refugia, such as groundwater and tributary inflows, enables trout to weather periods of unsuitable temperatures.

Acknowledgements

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References

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