Cold Water Stream Habitat in Connecticut

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Connecticut Department of Energy and Environmental Protection
Presentation Outline

Part 1

Identified fish species and summer temperatures that are indicative of cold water stream habitat

Part 2

Use this study to mine datasets to identify cold water habitat everywhere we have measurements
Deriving Water Temperature Categories

Continuous Temperature Loggers

Fish Community Surveys
Deriving Water Temperature Categories

160 Sites

Fish community/water temperature

# Temperature Bins for CT using Threshold Indicator Taxa Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Maximum Daily Temp °C</th>
<th>July Mean Temp °C</th>
<th>June-Aug Temp °C</th>
<th>Indicator Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>&lt; 22.40</td>
<td>&lt; 18.45</td>
<td>&lt; 18.29</td>
<td>Slimy sculpin, Brook trout</td>
</tr>
<tr>
<td>Cool</td>
<td>22.40-26.30</td>
<td>18.45-22.30</td>
<td>18.29-21.70</td>
<td>None</td>
</tr>
<tr>
<td>Warm</td>
<td>&gt;26.30</td>
<td>&gt;22.30</td>
<td>&gt;21.70</td>
<td>Cutlip minnow, Smallmouth bass, Rock bass, Brown bullhead, Redbreast sunfish, Yellow bullhead</td>
</tr>
</tbody>
</table>

Any Stream Temperature Will Do

Fish/100 M

June-August Mean Water Temperature (Celsius)

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Warm Water Species

June-August Mean Water Temperature (Celsius)

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Tweeners

June-August Mean Water Temperature (Celsius)

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Cold Water Species

June-August Mean Water Temperature (Celsius)

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Stream Temperature Distribution

- WARM: 16%
- COLD: 16%
- COOL: 68%

Stream Temperature Category:
- COLD
- COOL
- WARM
......“Brook Trout can be viewed as a sentinel species for small, healthy, least disturbed streams in Connecticut because they are the most important indicator fish species ...”

### Analysis Methods

#### Always Cold N = 115

| Station_Name          | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 99 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Valley Brook         | 153| NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 77 | 161| 77 | 122| 59 | 176| 43 | 130| 122| 97 | 37 |
| Mott Hill Brook      | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 141| NA | 64 | 40 | 29 | 121| 141| NA | 121| 141| NA | NA |
| Rugg Brook           | 164| NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 42 | NA | NA | NA | 27 | NA | 18 | NA | 12 | NA | NA |

#### Not Always Cold N = 159

| Station_Name          | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 99 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Spruce Brook         | NA | NA | NA | 35 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 5  | NA | NA | 0  | NA | NA | NA | NA | 0  | NA | NA | 0  |
| Patton Brook         | NA | NA | 0  | 46 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0  | NA | NA | 0  | NA | NA | NA | NA | 0  | NA | NA | 0  |
| Eagleville Brook     | NA | NA | 0  | 46 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0  | NA | NA | 0  | NA | NA | NA | NA | 0  | NA | NA | 0  |
| PENDLETON HILL BROOK | 31 | NA | 6  | 4  | 9  | 9  | 10 | 11 | NA | NA | NA | NA | NA | NA | NA |
| Anguilla Brook       | NA | NA | 20 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ballymahack Brook    | NA | NA | 185| NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fulling Mill Brook   | NA | NA | 185| NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fulling Mill Brook   | NA | NA | 185| NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hemp Swamp Brook     | NA | NA | 72 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Kahn Brook           | NA | NA | 1  | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nonewaug River       | NA | NA | 8  | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

- > 10 cold water fish/100m
- < 10 cold water fish/100m
- No cold water fish
Mapping Methods

**Water Temperature** - streams with an average summer water temperature of < 18.29 °C

The map can be updated periodically as new data are collected.

**Fish Community** - streams with a density of at least 10 cold-water fish individuals per 100-meter stream reach.

- **Brook Trout**
- **Slimy Sculpin**

*P. Zaidel photo*
Fish Community Samples

Cold Water Fish Samples
Years 1988 - 2018
Temperature Loggers

Cold Water Temperature Sites
Years 2002 - 2018
Connecticut Cold Water Habitat

~4000 Stream Miles
~ 1600 Square Miles

https://ctdeepwatermonitoring.github.io/ColdWaterHab/
About the map

Several native aquatic species in Connecticut such as wild brook trout (*Salvelinus fontinalis*) and slimy sculpin (*Cottus cognatus*) are dependent on cold water habitat in Connecticut rivers and streams. These species require specific temperatures for survival, growth and reproduction. Habitat for cold water species is under threat in the Connecticut due to stream flow and temperature modification caused by altered land use, fragmented populations from dams and culverts, climate change and introduction of exotic species (ADD REFS). Depletion of cold water habitat could constrain populations to smaller and more fragmentated waters resulting in population shifts and reductions of species.

We developed a map to help identify this critical habitat to inform decisions on land use management by stakeholders.

Data analysis

The map above displays cold water habitat as the watershed upstream of sites identified with cold water. Cold water sites were identified as streams with an average water temperature of less than 18.29 degree C from June through August (Beauchene et al 2014) or streams with a density of at least 10 cold-water fish individuals per 100-meter stream reach. Samples were collected by the CT DEEP Monitoring and Assessment Program and Inland Fisheries Program from 1988 - 2018. The map will be update periodically as new data is collected.

References

Mike Beauchene, Mary Becker, Christopher J. Bellucci, Neal Hagstrom & Yoichiro Kanno (2014) Summer Thermal Thresholds of Fish Community Transitions in Connecticut Streams, North American Journal of Fisheries Management, 34:1, 119-
Data

Sample collection data:
Sample Data collected and processed as of the map date: Sample Data (csv)

Maps for download:
High res map for download: 8000px Map (png)
Low res map for download: 1200px Map (png)

Spatial Data:
Cold water sites as of map date: Site Data (geojson)
Cold water supporting watershed as of map date: Watershed Area (geojson)

Map Development Repository:
https://github.com/marybecker/ColdWaterHab

https://ctdeepwaterwatermonitoring.github.io/ColdWaterHab/
Summary

• Brook trout and slimy sculpin are important cold water indicator species in CT. This work has been peer reviewed and published in the scientific literature.

• Watersheds that have thriving populations of brook trout and slimy sculpin can be used to highlight areas of the state that have cold water habitat.

• Summer water temperature measurement also can be used to highlight cold water habitat.

• ~ 4,000 miles of cold water stream habitat identified. Map uses only information measured in the field by DEEP biologists and trained volunteer groups with data quality assured by DEEP. No modeling is used in this map.
61% of fish community samples taken at T1 had a cold water community present at T2, 20 or more years later.

Declines in cold water fish density has occurred over time.
What is causing change at some site?

Landscape Changes?  Geological of the Site?  Climate Change?

https://marybecker.github.io/BioVariability/
Utility of Cold Water Mapping

- State and local environmental reviews
- Land acquisition
- State Wildlife Action Plan
- Trend Monitoring
- Research opportunities
- Others? – Audience participation time!
Questions and Feedback

Thanks to all the dedicated staff in the Fisheries Division, Water Monitoring, and Volunteers for many years of diligent data collection and management.

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