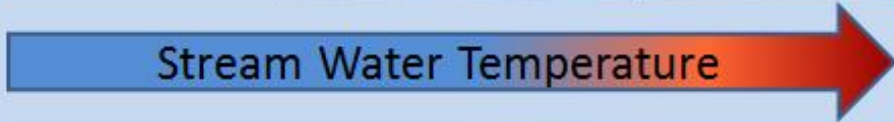
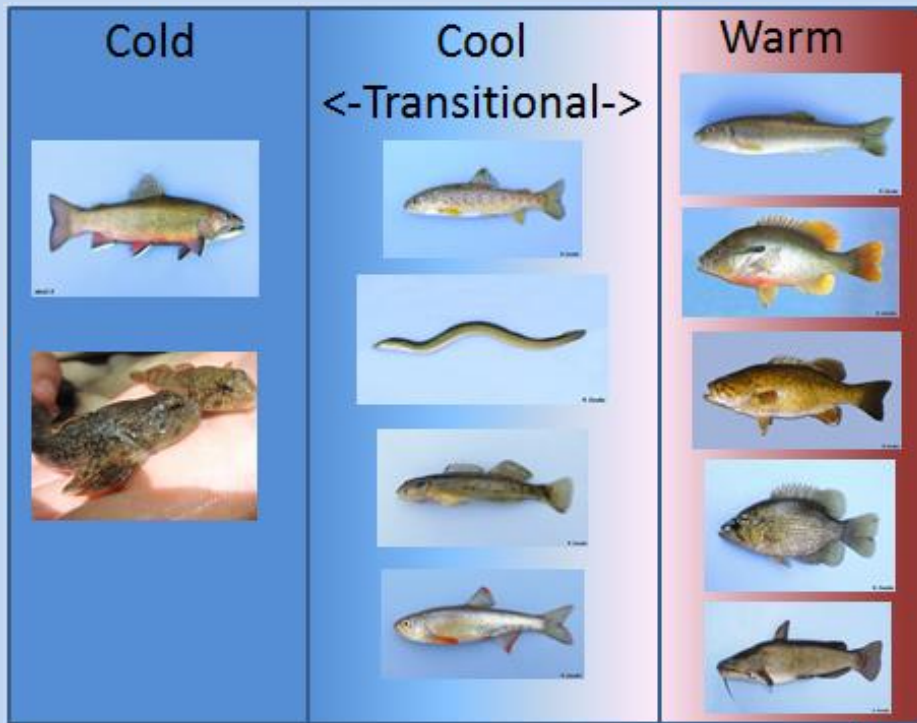


# Cold Water Stream Habitat in Connecticut



Chris Bellucci and Mary Becker  
April 7, 2020  
GC3 Rivers Sub-working Group



Connecticut Department of Energy and Environmental Protection

# Presentation Outline

## Part 1

*North American Journal of Fisheries Management* 34:119–131, 2014  
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ISSN: 0275-5947 print / 1548-8675 online  
DOI: 10.1080/02755947.2013.855280

### ARTICLE

#### Summer Thermal Thresholds of Fish Community Transitions in Connecticut Streams

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79 Elm Street, Hartford, Connecticut 06106, USA*

**Yoichiro Kanno<sup>1</sup>**

*U.S. Geological Survey, Silvio O. Conte Anadromous Fish Research Center, One Migratory Way,  
Turners Falls, Massachusetts 01376, USA*



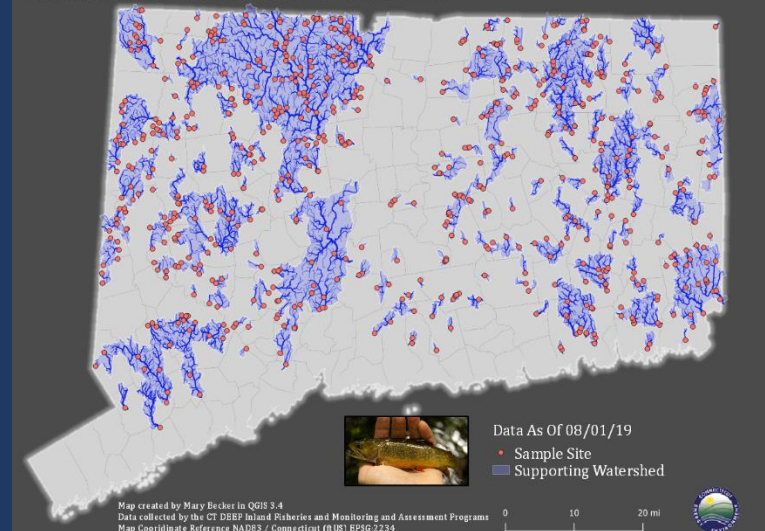
Identified fish species and summer temperatures that are indicative of cold water stream habitat

## Part 2

Use this study to mine datasets to identify cold water habitat everywhere we have measurements



### Connecticut Cold Water Habitat



# Deriving Water Temperature Categories

Continuous Temperature Loggers



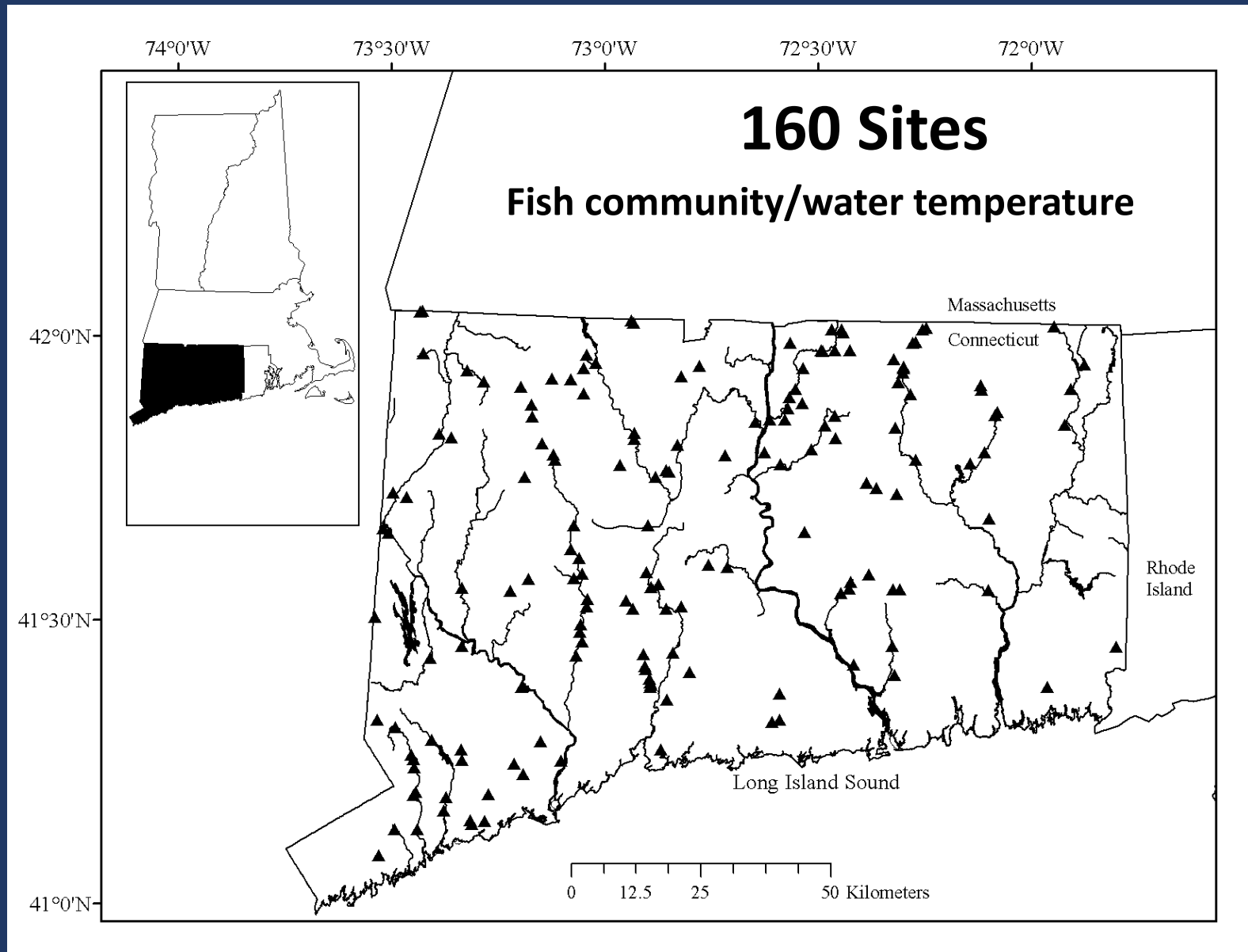
Fish Community Surveys



Continuous Temperature Loggers



# Deriving Water Temperature Categories



# Temperature Bins for CT using Threshold Indicator Taxa Analysis

Category	Maximum Daily Temp °C	July Mean Temp °C	June-Aug Temp °C	Indicator Fish
Cold	< 22.40	< 18.45	< 18.29	Slimy sculpin Brook trout
Cool	22.40-26.30	18.45-22.30	18.29-21.70	None
Warm	>26.30	>22.30	>21.70	Cutlip minnow, Smallmouth bass, Rock bass, Brown bullhead, Redbreast sunfish, Yellow bullhead



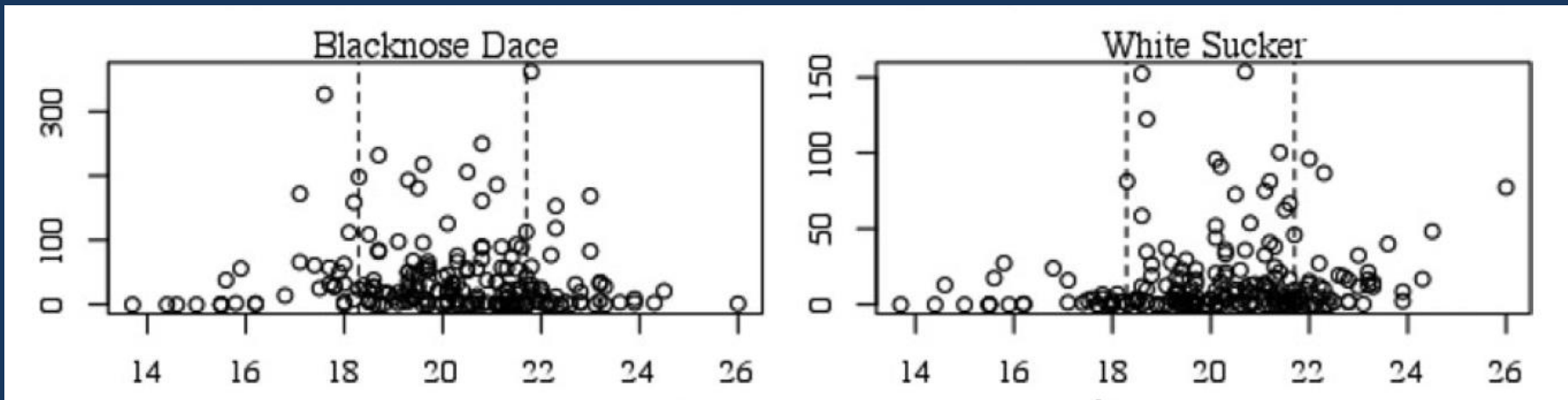
Beauchene et al 2014. *North American Journal of Fisheries Management* 34:119–131

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# Any Stream Temperature Will Do



Fish/100 M



June-August Mean Water Temperature (Celsius)

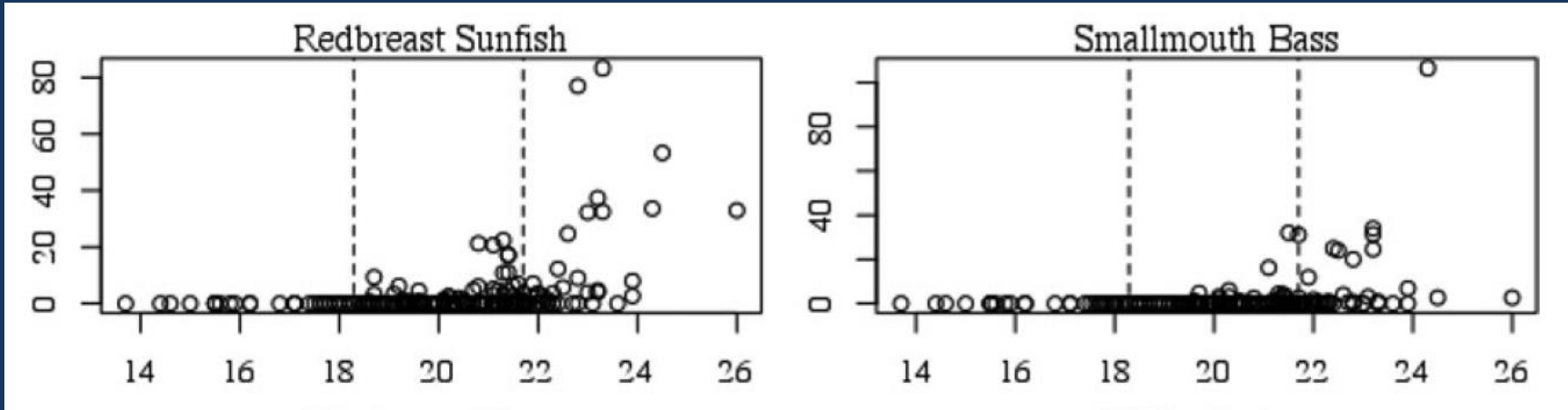


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# Warm Water Species



Fish/100 M

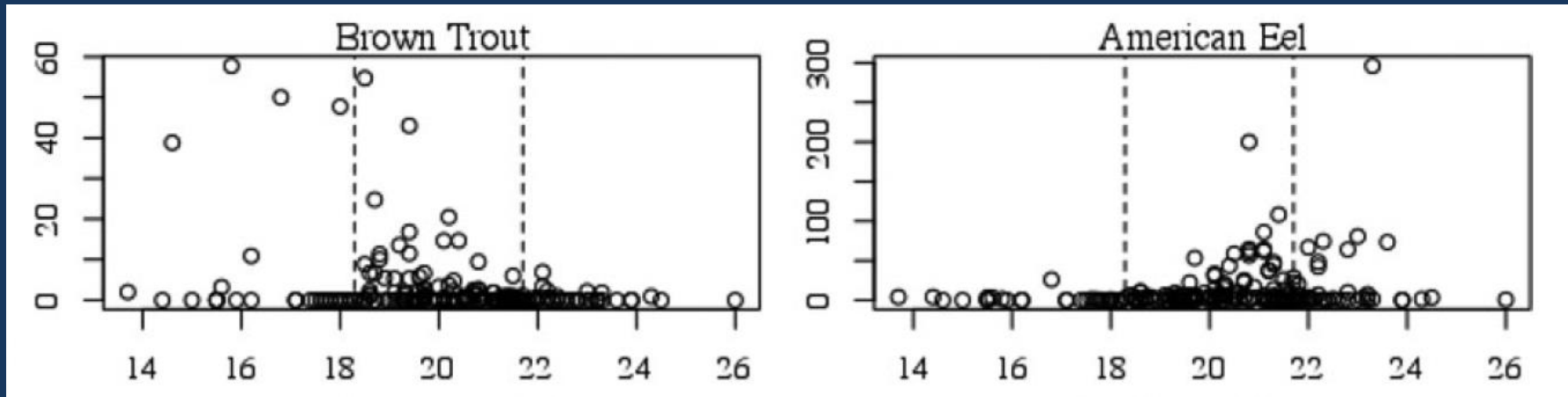


June-August Mean Water Temperature (Celsius)



Connecticut Department of Energy and Environmental Protection

# Tweeners



June-August Mean Water Temperature (Celsius)

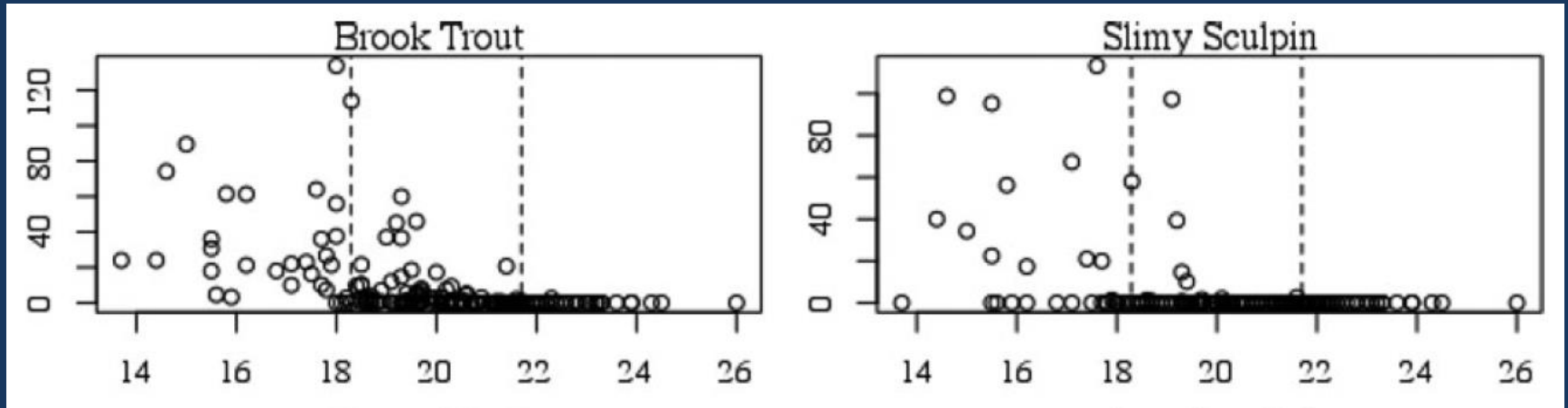
Connecticut Department of Energy and Environmental Protection

Fish/100 M





# Cold Water Species



June-August Mean Water Temperature (Celsius)

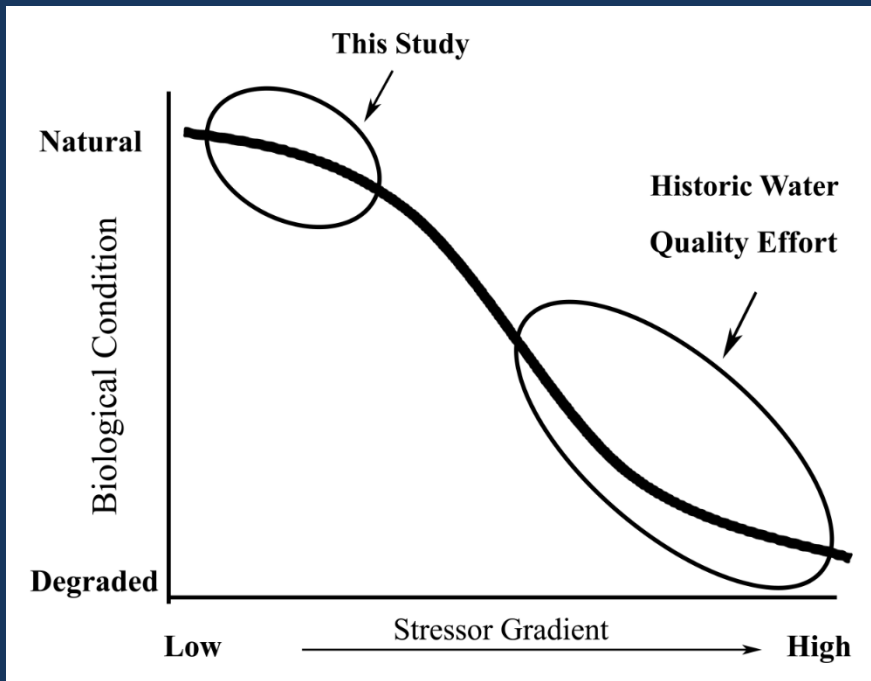
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Fish/100 M



# Brook Trout

.....“ 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 ...”



*Bellucci et al 2011. Northeastern Naturalist 18:411-444.*

# 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												77	161	77	122	59	176		43	130		122	97		37	
Mott Hill Brook																141			64	40		29			121		141
Rugg Brook	164															42				27		18			12		

## 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					35							30			5										22		
Patton Brook			0					46								0											
Eagleville Brook											0					22		5	16		67		13				
PENDLETON HILL BROOK						31										6			4	9		9		10			11
Anguilla Brook						20														0							
Ballymahack Brook					185															5							
Fulling Mill Brook																12					0		0			1	
Fulling Mill Brook																							5			17	
Hemp Swamp Brook					72																5						
Kahn Brook											1						22			0		34		11			
Nonewaug River					8											0					2				105		2

123

> 10 cold water fish/100m

9

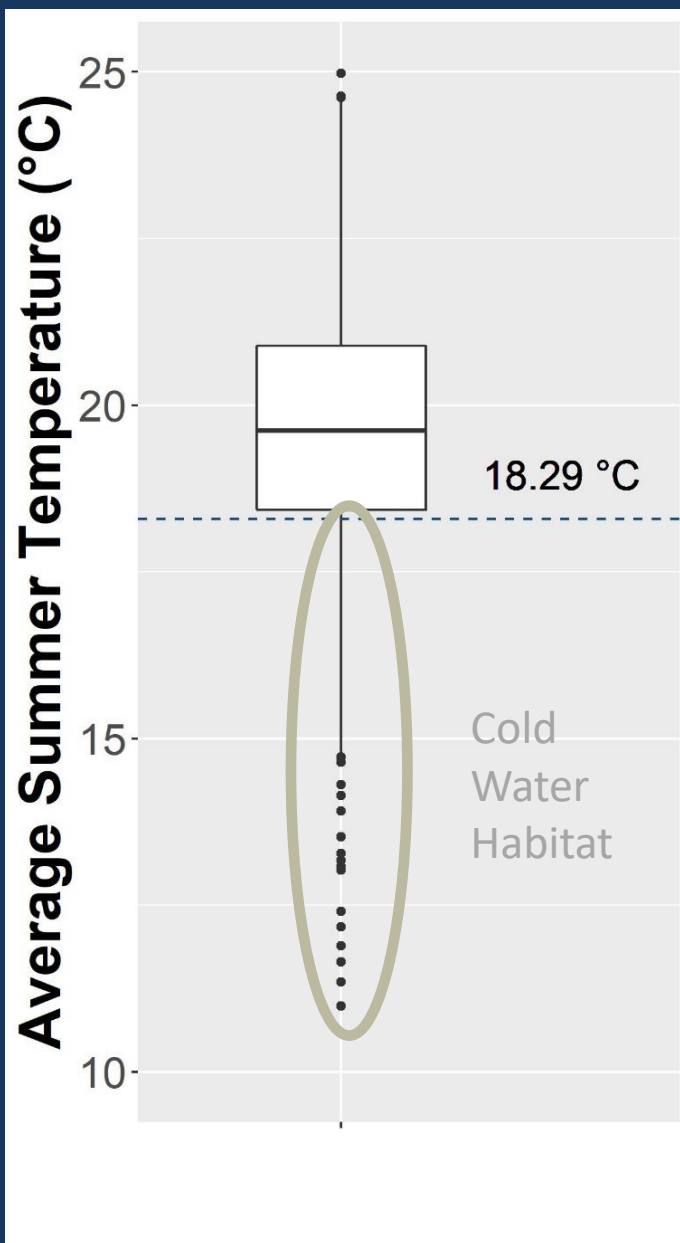
< 10 cold water fish/100m

0

No cold water fish

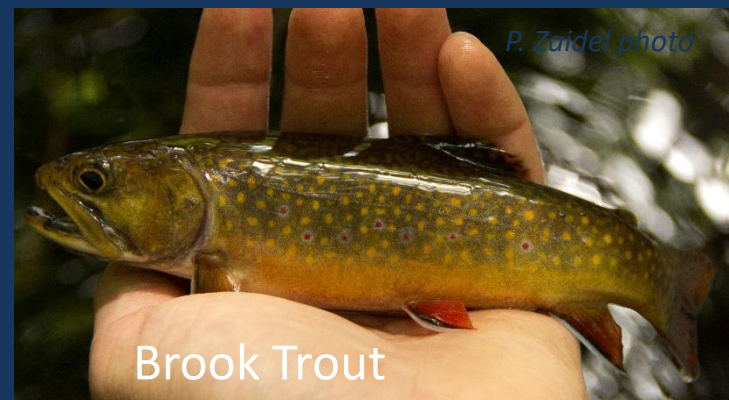
# Mapping Methods

Water Temperature- streams with an average summer water temperature of  $< 18.29\text{ C}$

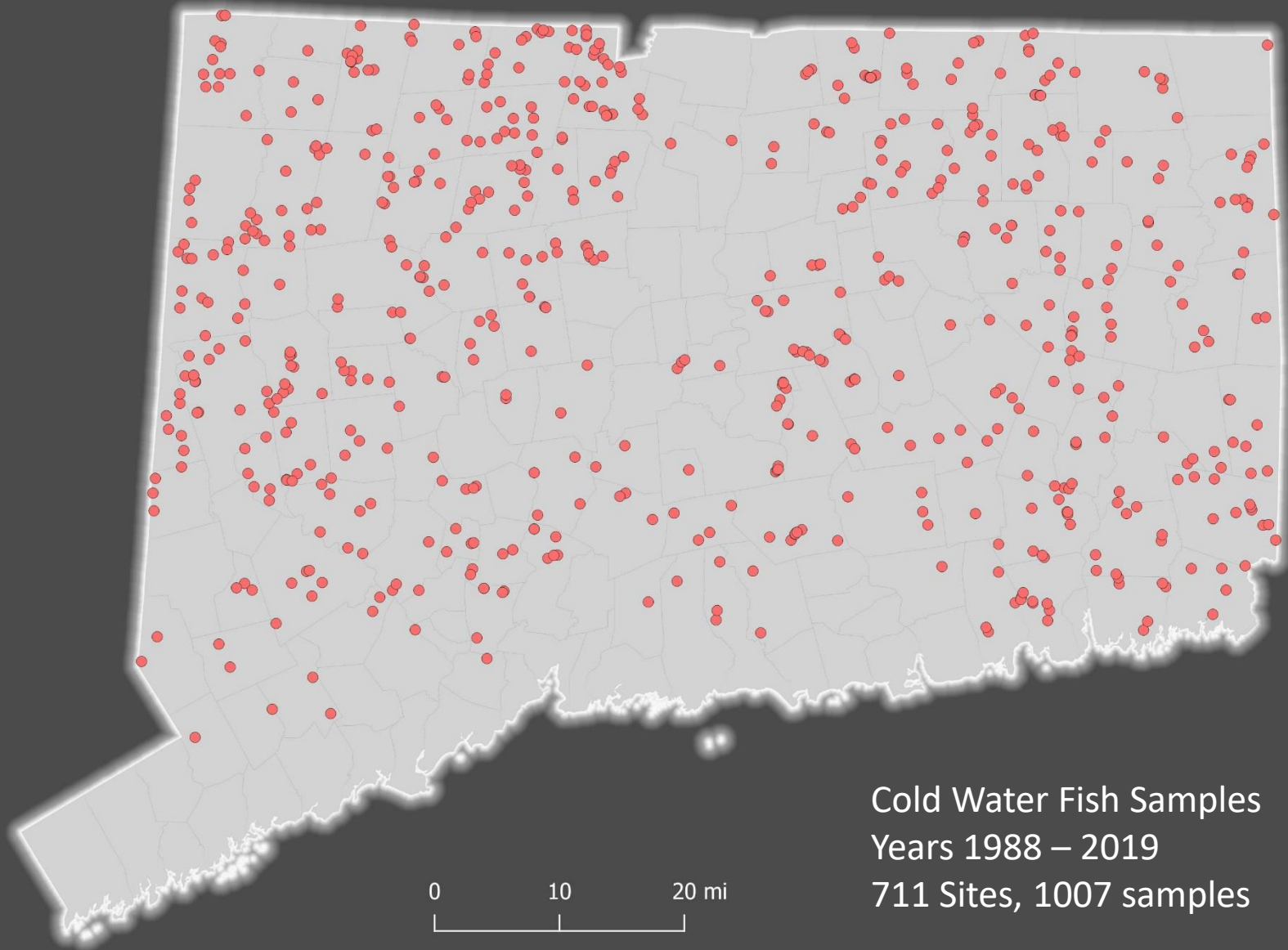


The map can be updated periodically as new data are collected.

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

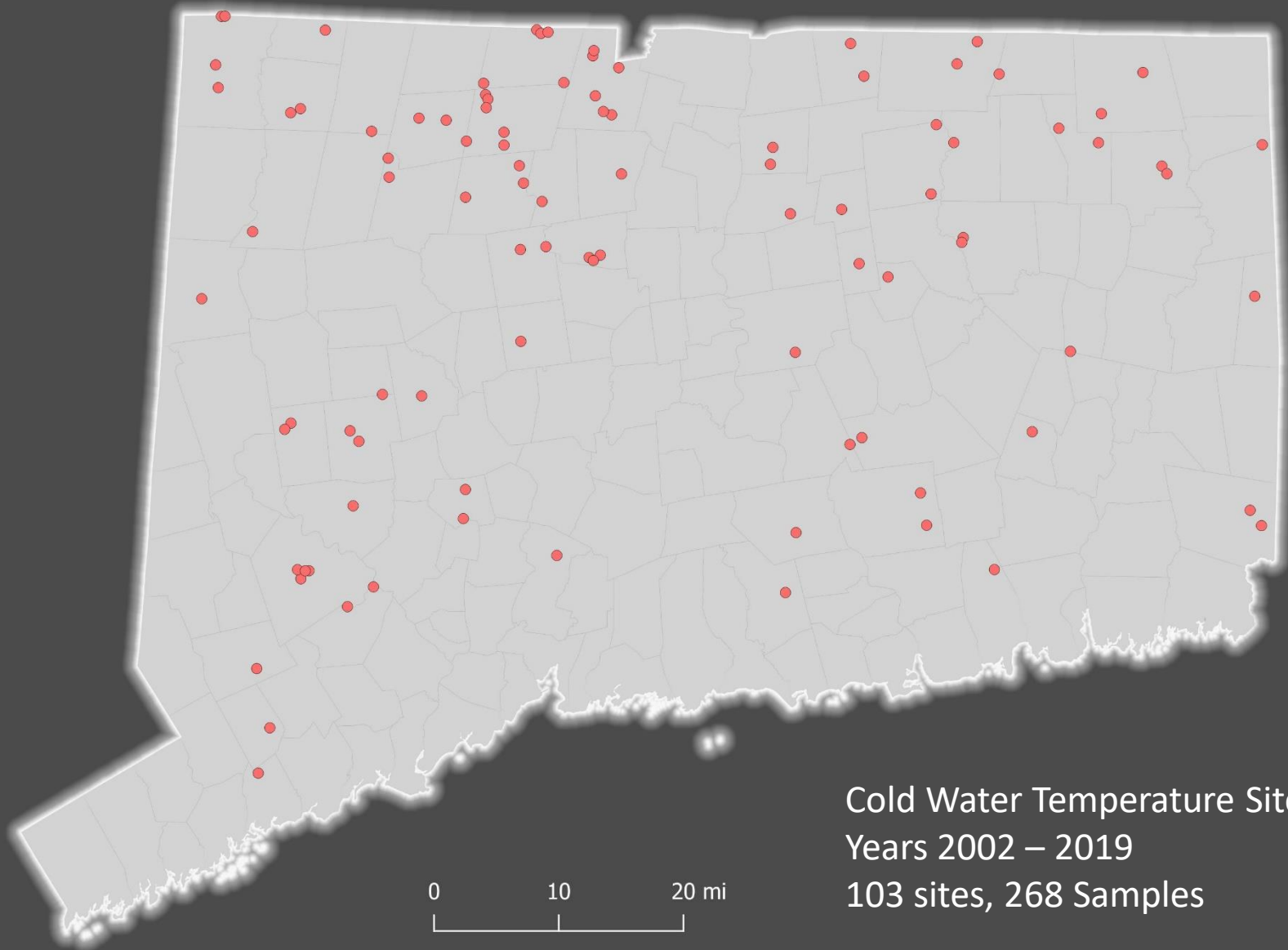


# Fish Community Samples



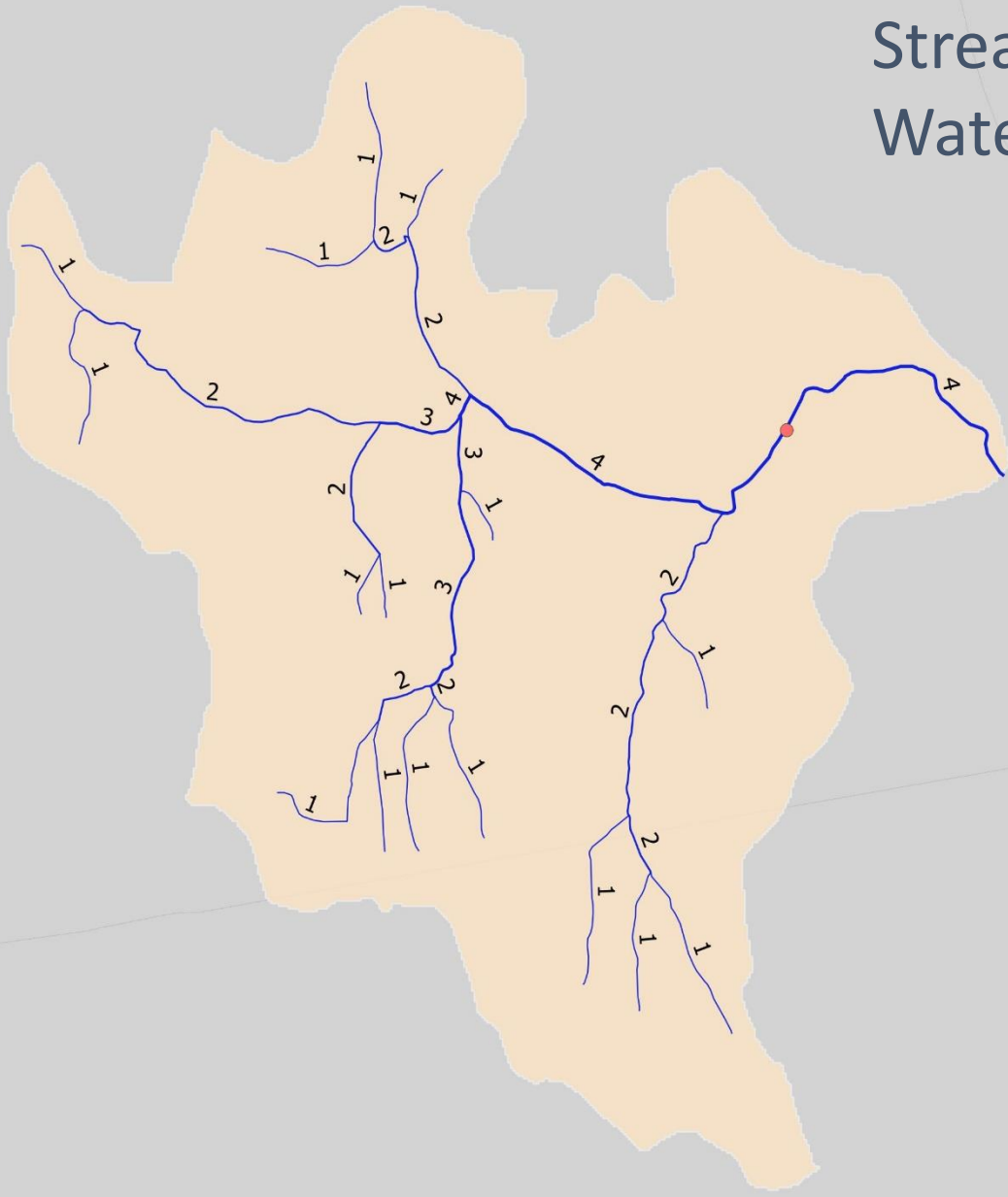
Cold Water Fish Samples  
Years 1988 – 2019  
711 Sites, 1007 samples

# Temperature Loggers



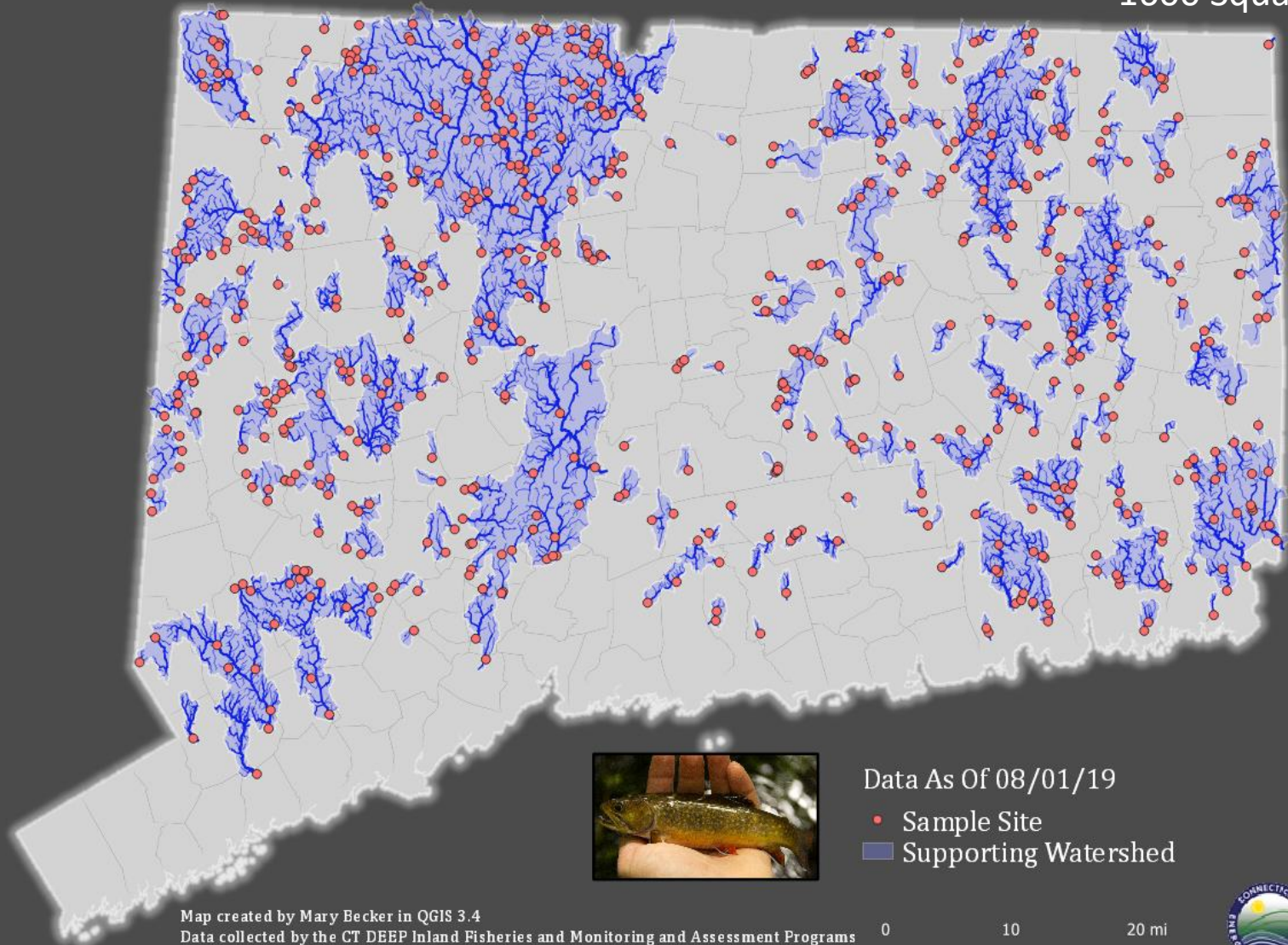
Cold Water Temperature Sites  
Years 2002 – 2019  
103 sites, 268 Samples

# UPSTREAM WATERSHED – Streams that Support Cold Water Habitat



# Connecticut Cold Water Habitat

~4000 Stream Miles  
~ 1600 Square Miles



Map created by Mary Becker in QGIS 3.4  
Data collected by the CT DEEP Inland Fisheries and Monitoring and Assessment Programs  
Map Coordinate Reference NAD83 / Connecticut (ft US) EPSG:2234

Data As Of 08/01/19

- Sample Site
- Supporting Watershed



<https://ctdeepwatermonitoring.github.io/ColdWaterHab/>



about

## Cold Water Habitat - Draft

map about download data

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### 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 fragmented 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-



Brook Trout. CT DEEP Photo Credit.

<https://ctdeepwatermonitoring.github.io/ColdWaterHab/>

download data

## Cold Water Habitat - Draft

map

about

download data

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## 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://ctdeepwatermonitoring.github.io/ColdWaterHab/>

# Map

## Cold Water Habitat - Draft

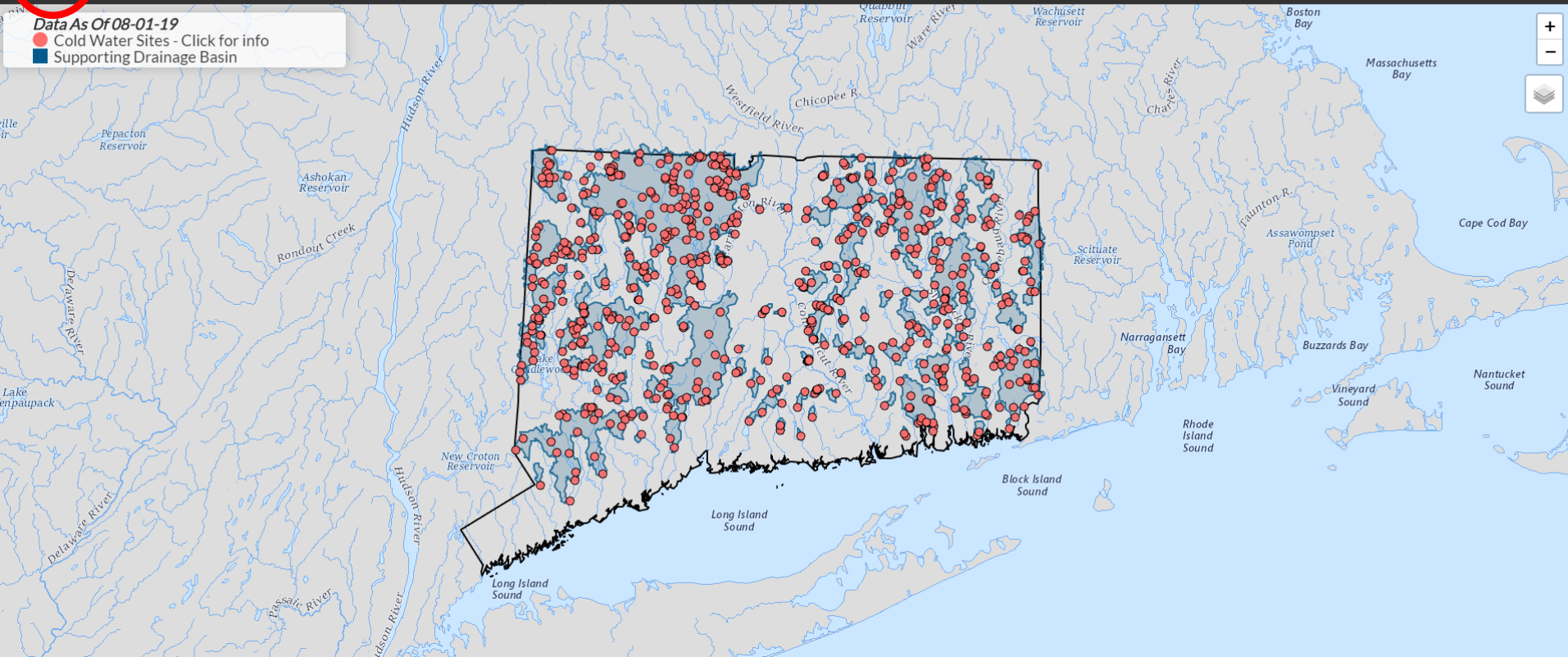
map about download data

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Data As Of 08-01-19

- Cold Water Sites - Click for info
- Supporting Drainage Basin



<https://ctdeepwatermonitoring.github.io/ColdWaterHab/>

# Map

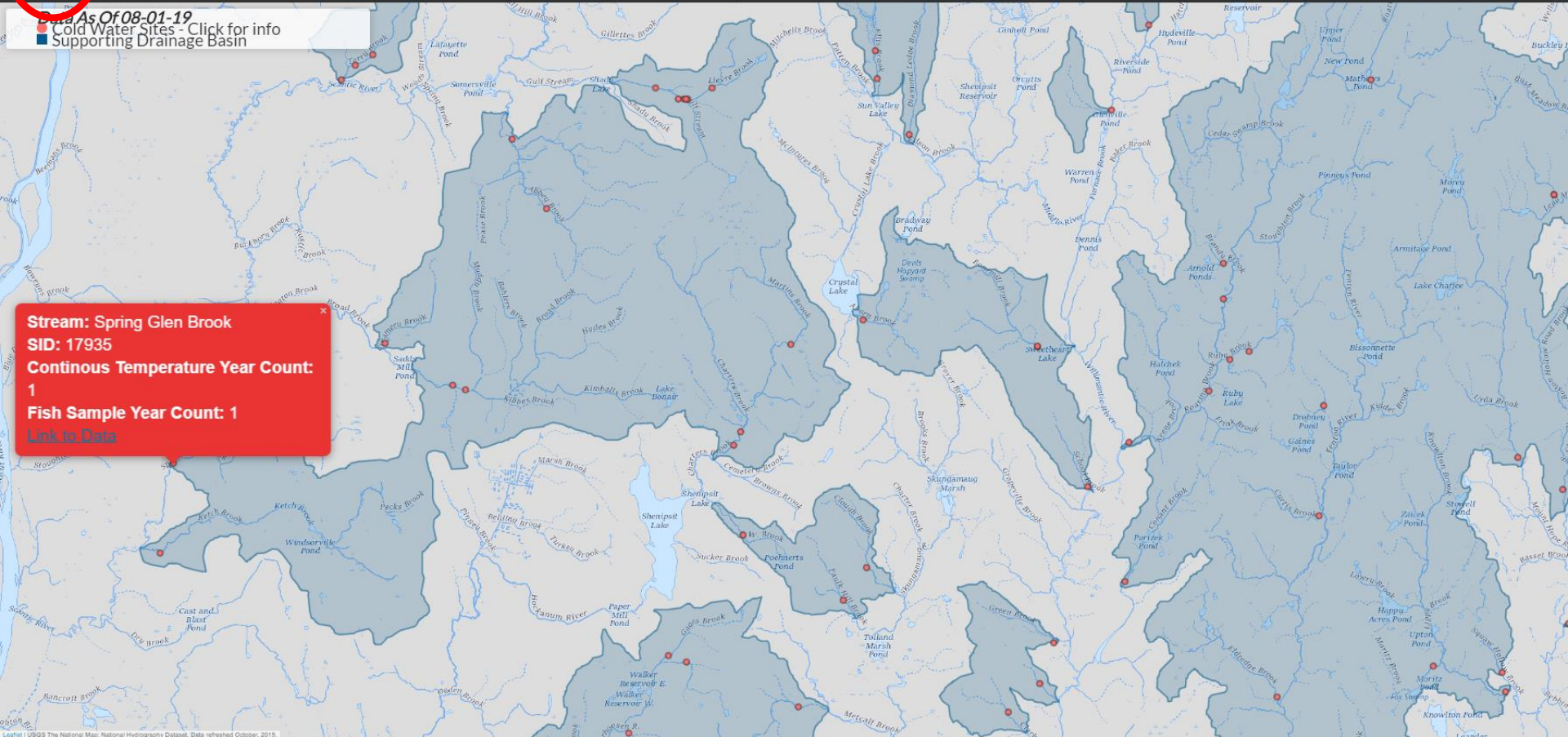
## Cold Water Habitat - Draft map

[about](#) [download data](#)

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**Data As Of 08-01-19**  
● Cold Water Sites - Click for info  
■ Supporting Drainage Basin

**Stream: Spring Glen Brook**  
**SID: 17935**  
**Continuous Temperature Year Count: 1**  
**Fish Sample Year Count: 1**  
[Link to Data](#)



<https://ctdeepwatermonitoring.github.io/ColdWaterHab/>

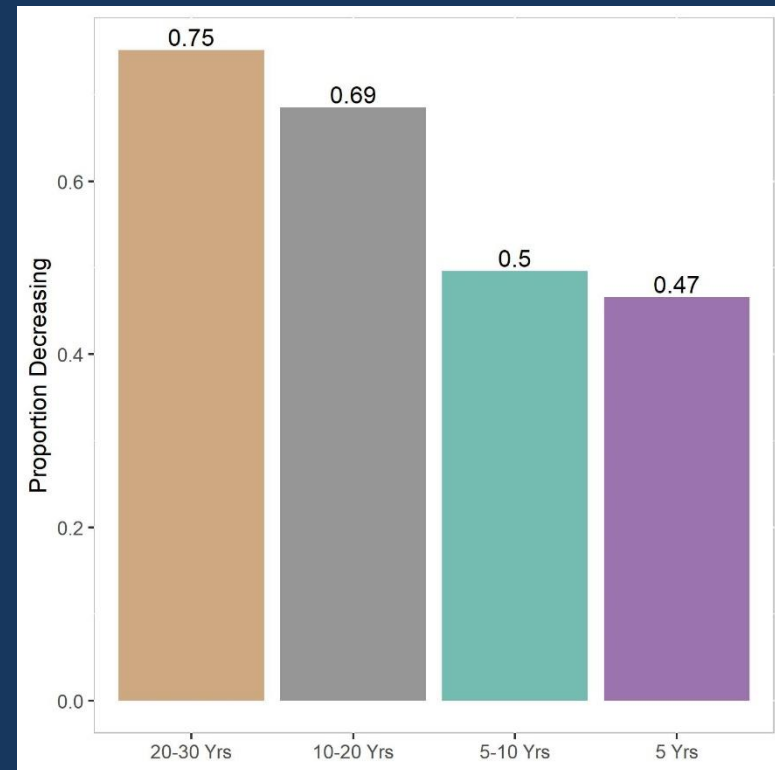
# Summary

- 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 measurements also can be used to highlight cold water habitat.
- ~ 27% (~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.

# Initial Observations, Still Digging

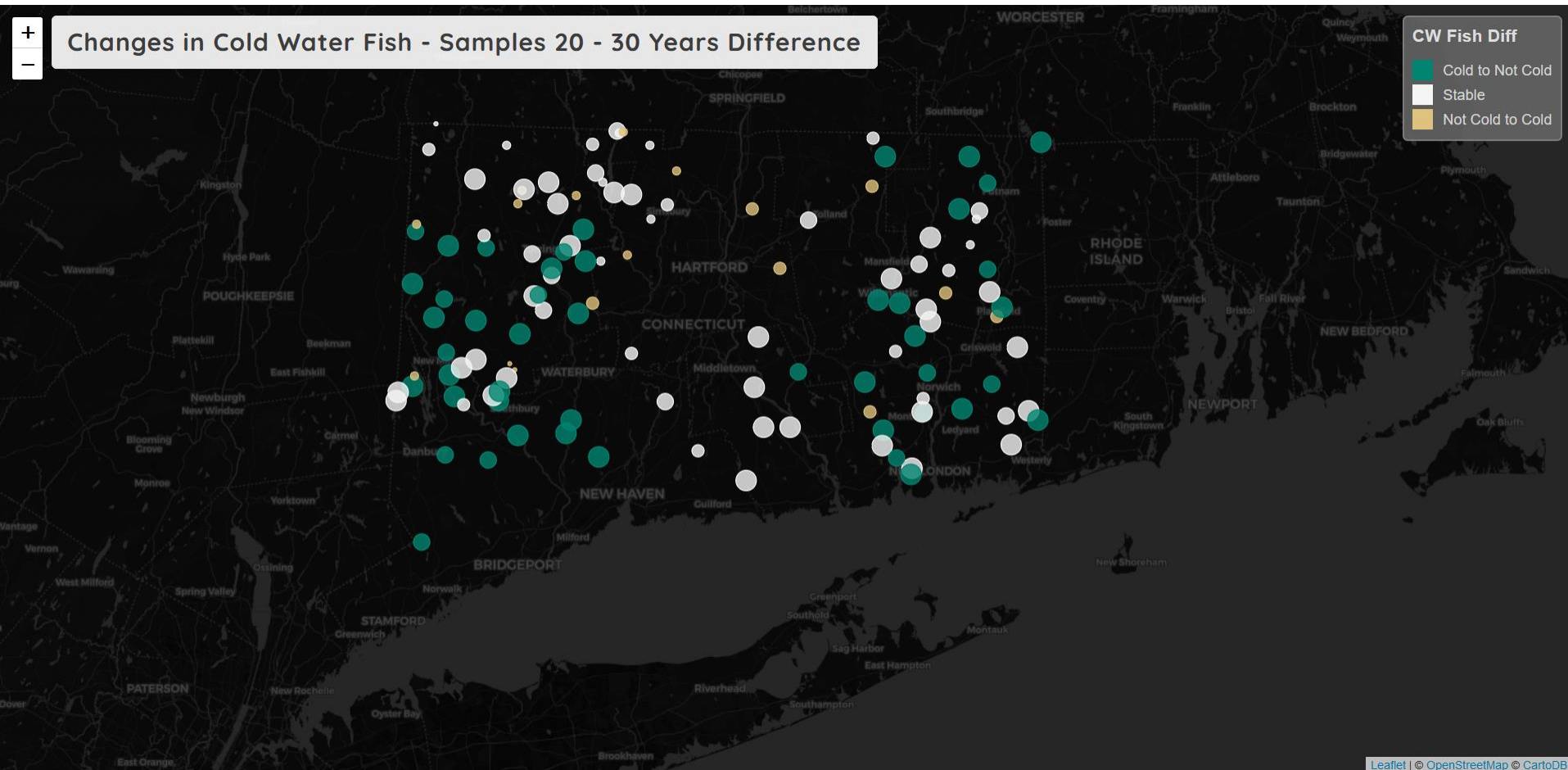
- 61% of fish community samples taken at T1 had a cold water community present at T2, 20 or more years later
- 15% for fish community samples and 13% of hobo data logger samples where a sample at T1 measured cold, but was not cold at T2
- declines in cold water fish density has occurred over time

Proportion of Samples Decreasing in Density Between Two Time Points



# What is causing change at some site?

Landscape Changes? Geological of the Site? Climate Change?



<https://marybecker.github.io/BioVariability/>

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# 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.



Chris Bellucci, [christopher.bellucci@ct.gov](mailto:christopher.bellucci@ct.gov), 860-424-3735



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