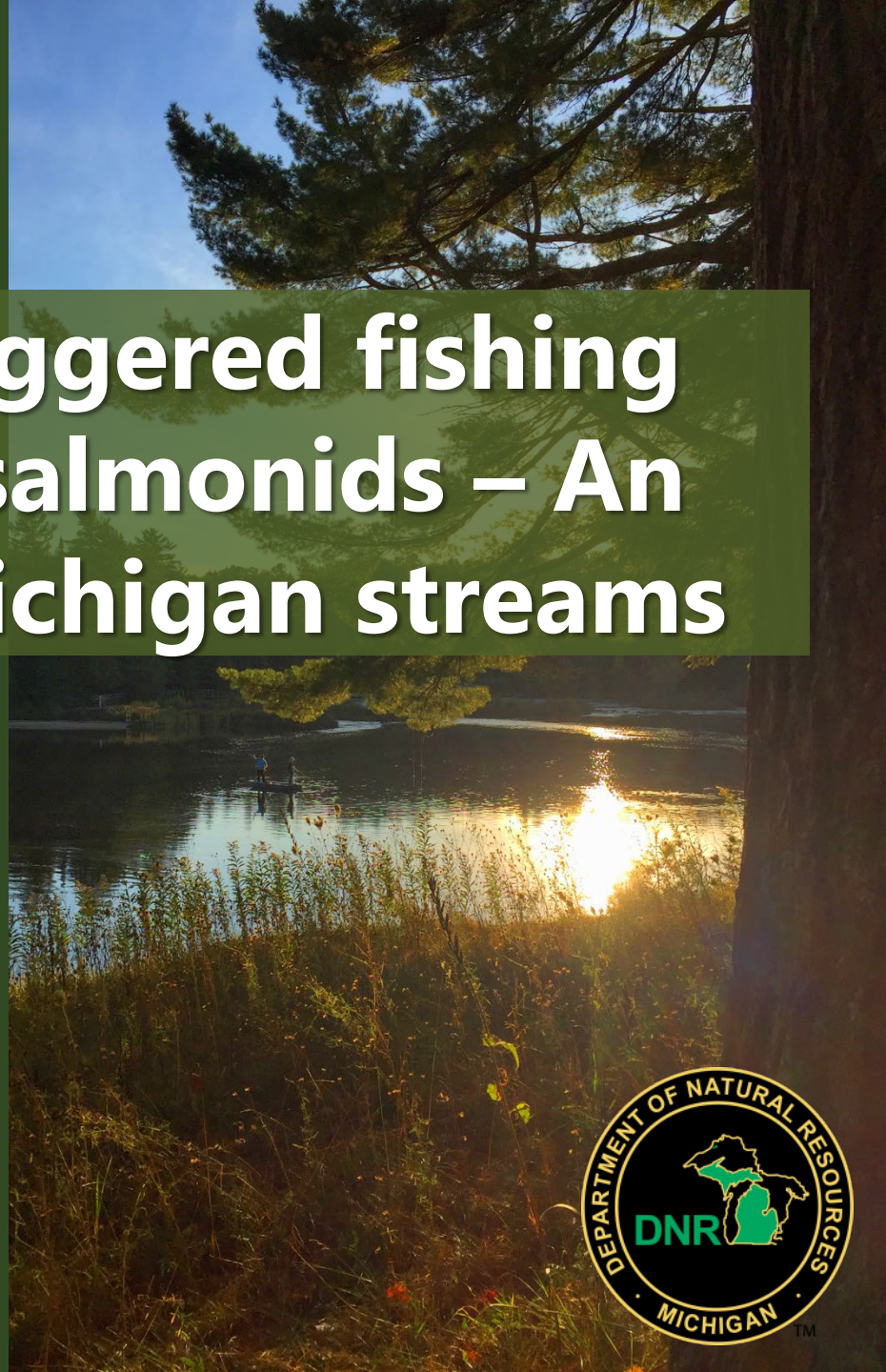
Temperature-triggered fishing regulations for salmonids – An evaluation for Michigan streams



Gary Whelan
Fisheries Division
March 2023 NRC Meeting

Fisheries Division Staff

- Tracy Claramunt
- Neal Godby
- Jan-Michael Hessenauer
- Seth Herbst
- Heather Hettinger
- Darren Kramer
- Kevin Wehrly
- Todd Wills
- Troy Zorn

Talk Outline

- Issue definition
- Salmonid biology
- How other states are dealing with temperature issues
- Angling effort
- Implications for Michigan waters
- Challenges for implementation

Issue Definition

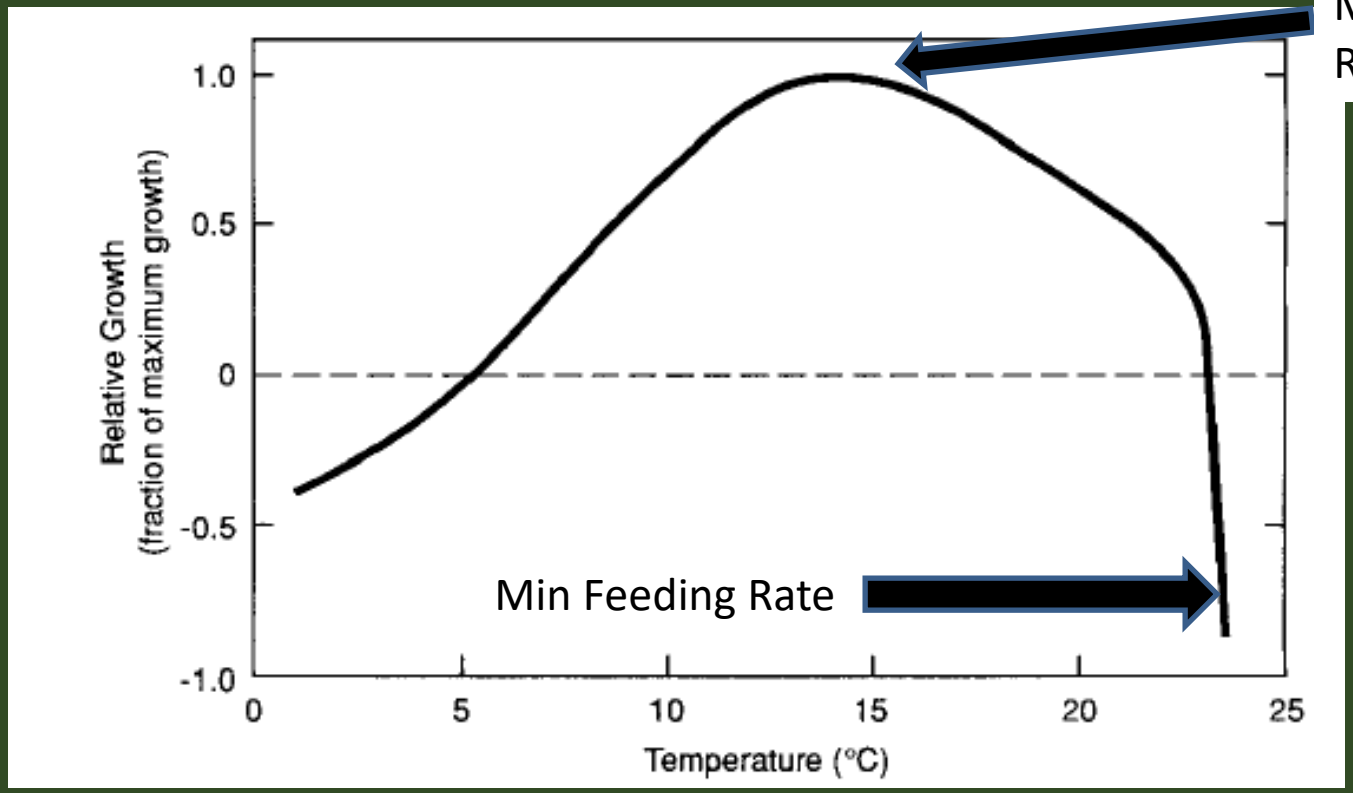
- Catch and release angling for salmonids is a large component of the angling experience.
  - Concerns with hooking and handling mortality during hot periods.
- Climate change concerns
  - Forecast climate will continue to increase the summer temperatures and stress on salmonid resources.

Salmonid Temperature Biology

- Lethal temperatures
  - Brown Trout – 77-86 F
  - Brook Trout – 75-82 F
  - Rainbow Trout – 79-86 F
- Metabolic Activity
  - Optimum Temperature
    - Brown Trout – 54-66 F
    - Brook Trout – 55-61 F
    - Rainbow Trout – 63-66 F

Data from Cherry et al. 1977, Wismer and Christie 1987, and Elliott 2010

Salmonid Growth and Feeding at Temperature



Rainbow Trout relative growth at temperature (Railsback and Rose 1999)

Do other states have temperature-triggered regulations?

State Survey

- Surveyed all fisheries chiefs in the US in January 2022
- 10 questions
  - Do you have temperature triggered regulations or restrictions for trout fishing
  - How implemented and what criteria used
  - Whose data used
  - Who handles implementation
  - Are the regulations in code or regulation

State Survey Results

- Received responses from 25 states
  - 3 states have specific temperature regulations
    - MT, OR and CO
  - 3 states have or are considering voluntary angling closures
    - CO, CA and NY
  - CT closes thermal refuges on the Housatonic, Naugatuck, and Salmon Rivers seasonally from June 15-September 15 to protect concentrated salmonids from overharvest and to reduce stress.
    - Fishing regulations/orders for Special Management Areas
    - Very localized

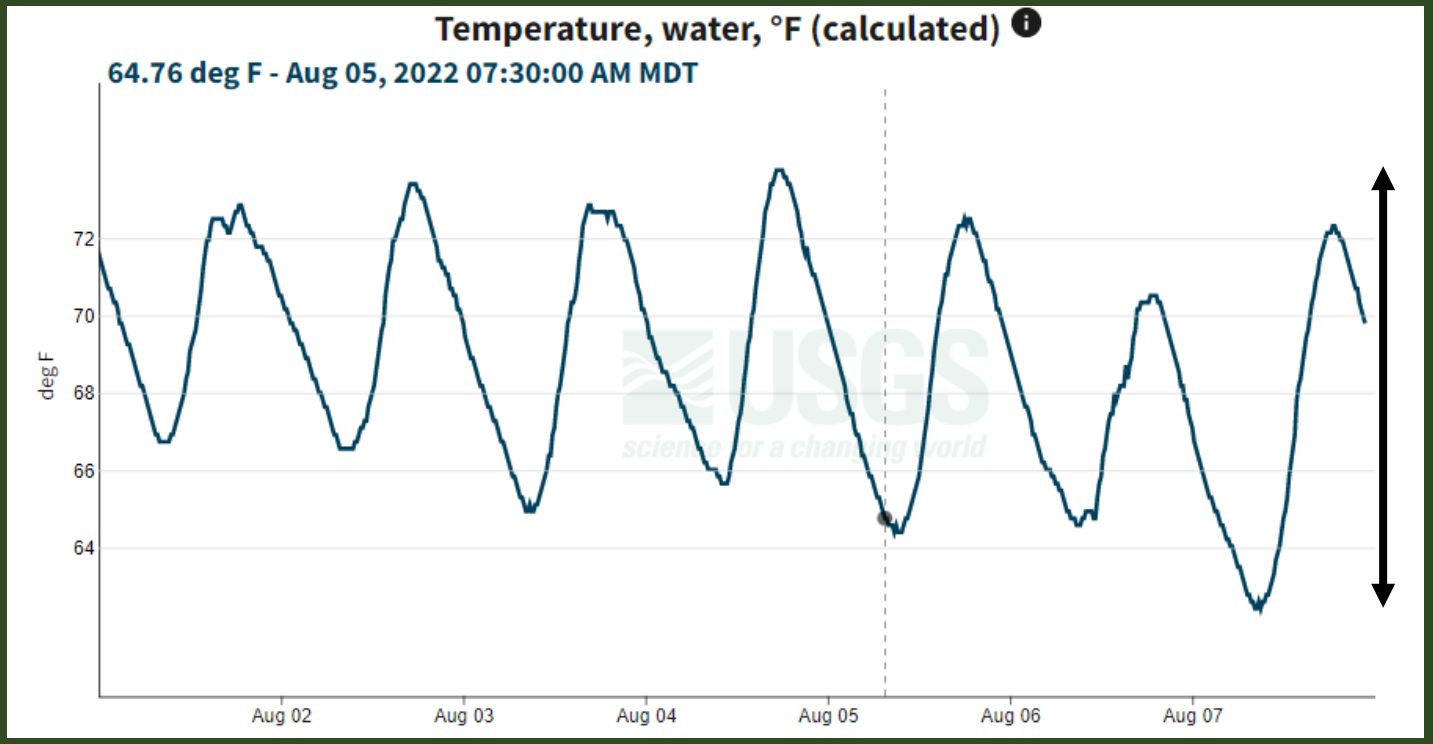
MT Regulation Details

- Regulation – “Hoot Owl Regulations” - Waters closed to fishing from 2 PM to 12 AM
- Criteria
  - 73F maximum temperature for 3 consecutive days for most streams
  - 70F maximum temperature for 3 consecutive days for systems with Bull Trout (*Salvelinus confluentus*)
  - Temperature criteria based on a few published studies
    - We conducted a broad literature search of over 60 publications and no definitive criteria were found

MT Regulation Details

- Where and for how long
  - Usually done for entire river systems or segments
  - Notification online and in press
  - Once implemented, in place until the fall
- Data from USGS, watershed groups, conservation districts and NGOs
- A broad range of staff are involved
- Regulations are currently under review

Bitterroot River near Missoula MT



An example of the diurnal temperature information used to put MT regulations in force.

OR Regulation Details

- Regulation
- Criteria
  - No set criteria for either specific streams or waters
  - Developing a statewide policy at this time
- Where and for how long
  - Usually done for entire river systems or segments
  - Once implemented, variable length and no reopening criteria
- Data used comes from USGS, state agencies and all other available sources
- Specific staff and management biologists are involved

CO Regulation Details

- Director Closure – Complete angling closure
- Criteria
  - Water temperature above 71F
  - Discharge below or equal to 50% of average
  - Existence of a known stressor event
- Where and for how long
  - Either entire river systems or segments
  - Opened by field and senior biologists
- Data used comes from USGS, Department of Water, direct measurements from staff and anglers
- Also use voluntary closures without Director's order to discourage anglers from fishing

Michigan Analysis

Analysis Components

- Literature review on appropriate trigger temperatures
  - No definitive criteria found in literature
- Are anglers using the trout resource in the mid-summer period
- Amount of resource affected
- Implementation challenges

Michigan Trout Stream Summary

Stream Type	Miles
Gear Restricted	184
Research Area	8
Type 1	28,254
Type 2	196
Type 3	845
Type 4	1,966
TOTAL	31,453

Michigan Trout Stream Summary

Temperature Type	Miles
Cold Stream	9,093
Cold Small River	433
Cold Transitional Stream	3,945
Cold Transitional Small River	496
Cold Transitional Large River	253
Warm Transitional Stream	12,201
Warm Transitional Small River	1,615
Warm Transitional Large River	740

Climate change will force trout in this direction

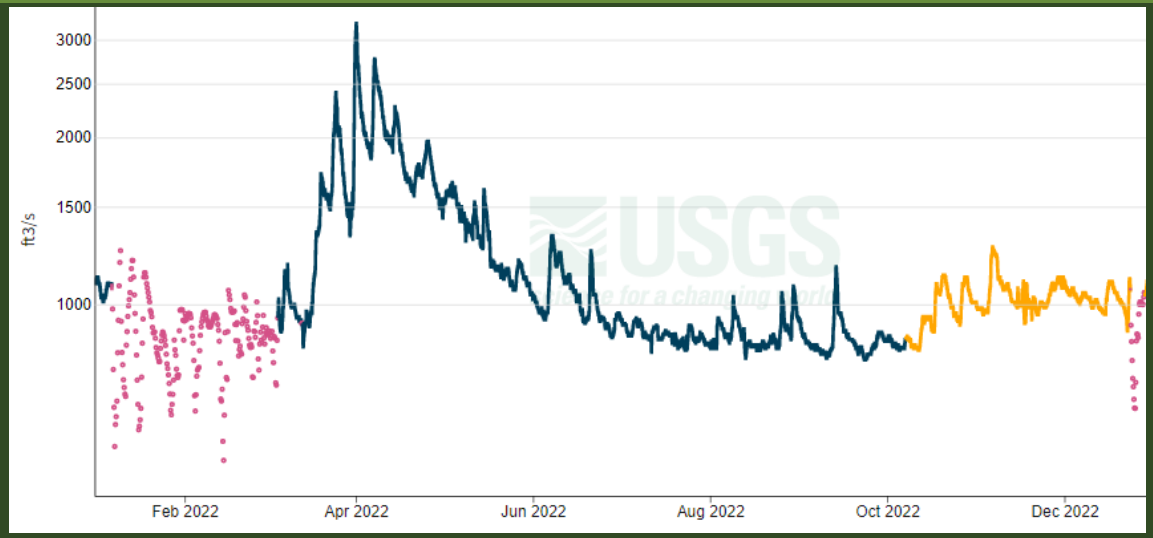
Currently, salmonids will annually move from warm transitional to cold streams and rivers if connectivity is available

Do anglers fish stream trout in Michigan during the summer?

- Unlike Western rivers which do not become fishable to all until mid-July, Michigan streams are generally fishable by all in May
- Staff observe a large drop in Michigan trout angling within a few weeks of the traditional opening with a larger drop after the *Hexagenia* sp. hatch
- On larger Michigan streams, there is a lot of interactions with floaters starting about July 4 which continues through Labor Day which reduces angler use
- Pressure is much less on Michigan streams than Western rivers during the hot weather periods

Hydrograph Comparison between AuSable River MI and Bitterroot River MT

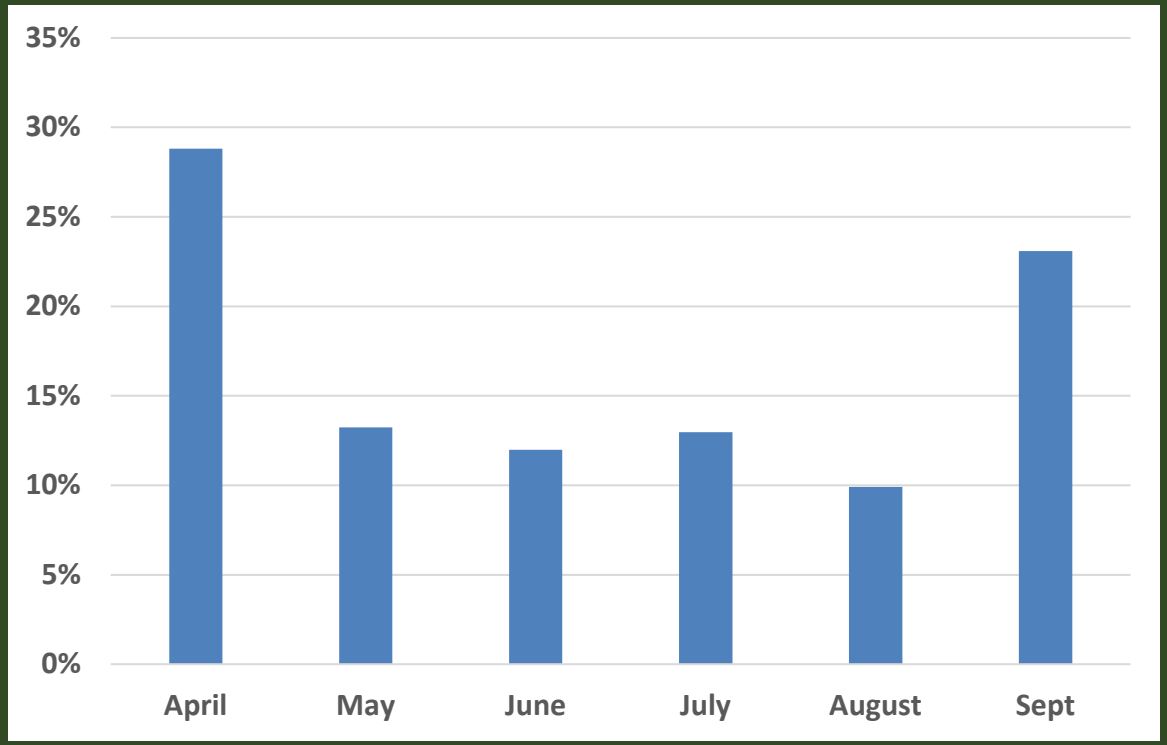
AuSable River at McKinley 2022



Bitterroot River at Darby MT 2022

DEPARTMENT OF NATURAL RESOURCES
DNR
MICHIGAN
TM

Mean Percent Angler Effort – Muskegon, AuSable, Pere Marquette, and Platte Rivers



Data used - AuSable River Mio – Alcona 2009, Pere Marquette River 2011, Manistee River 2016, Platte River 2014, and Muskegon River 1999-2005

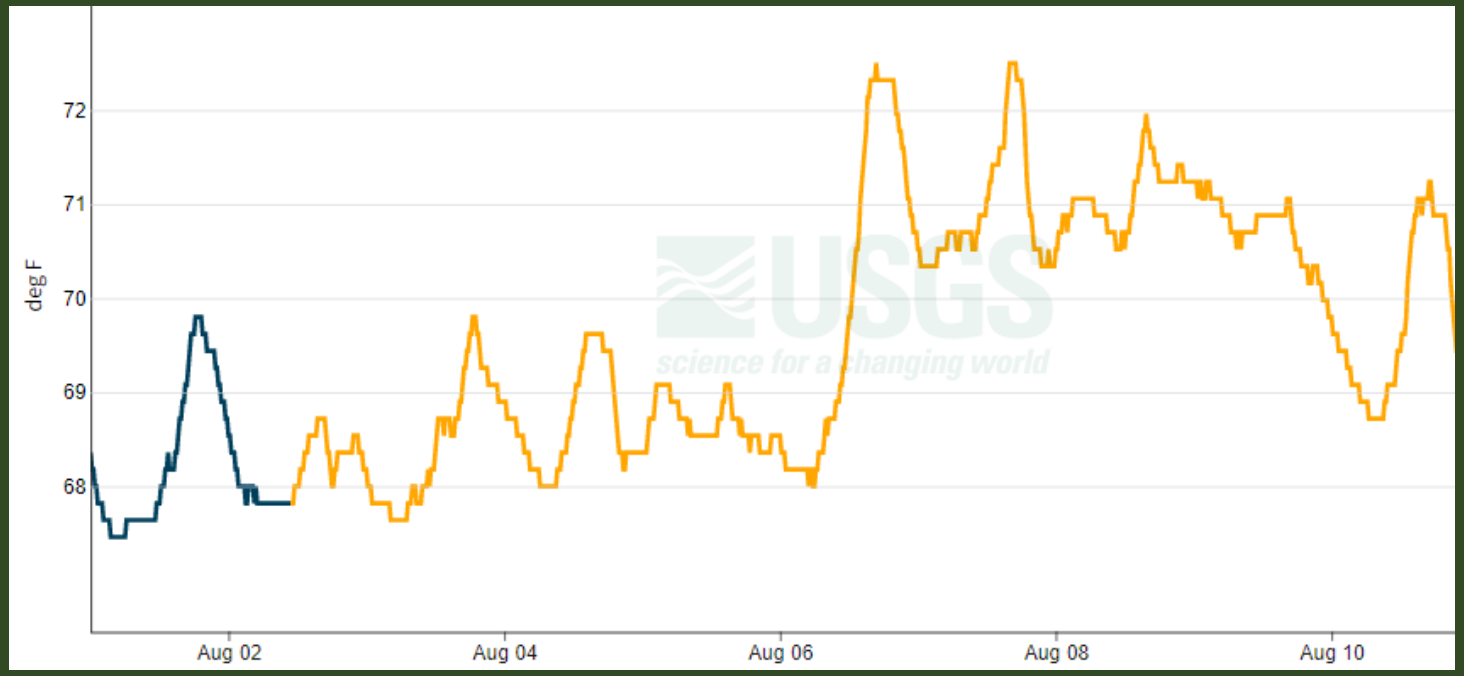
How many streams could be affected?

- Examined 124 locations statewide from 2000-2022 using USGS and TU data
  - 12 locations – 23 years – Long record
  - 5 locations – 7-19 years – Long record
  - 107 locations – 4 years or less – Short record

Record Length	Percent Years Triggered - 70F	Percent Years Triggered - 72-73F
Short	82%	68%
Long	71%	52%

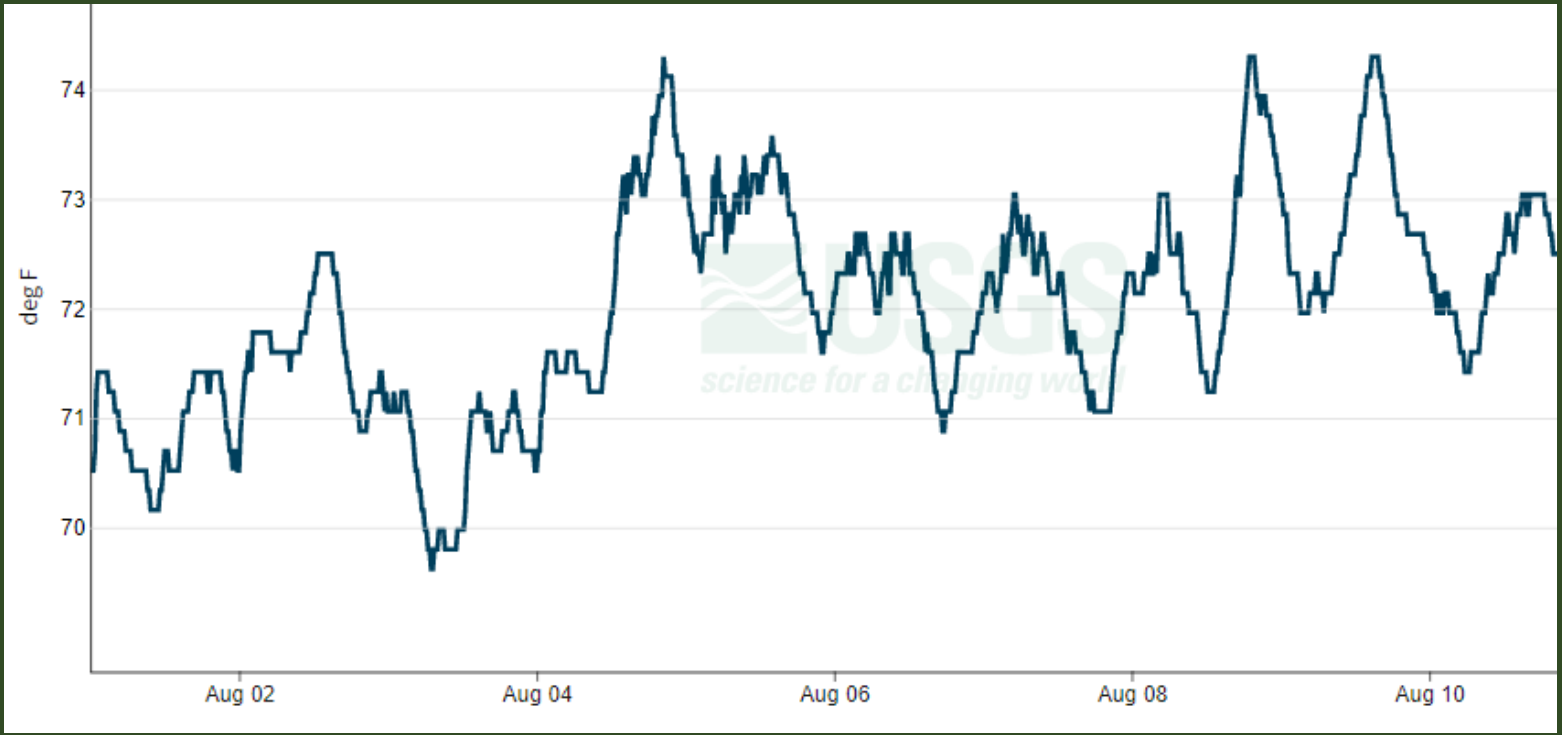
In every year, some streams would be triggered and often a high percentage.

Diurnal Temperature Variation is Required for Regulations to Work



Water temperature – AuSable River at Mio from August 1-10, 2022

Diurnal Temperature Variation is Required for Regulations to Work



Water temperature – Muskegon River at Croton from August 1-10, 2022

Implementation Challenges

- Geography
  - Drainages can be different to determine when compared to Western rivers
- Very incomplete real-time temperature network
  - How and where to measure
- Determining what streams are affected
  - Dams flatline the diurnal temperature changes
- Angler notification
- Multi-species fisheries
- Developing enforceable regulations

Analysis Conclusions

- Few states have temperature-triggered regulations.
- Little evidence was found supporting the trigger temperatures or the effectiveness of these regulations to protect trout populations.
- Fishing pressure is different in MI due to differences in the hydrograph, food resources, and competing river uses.
- Feeding activity is much lower in the hot periods thus fish are less vulnerable.

Analysis Conclusions

- Rivers that are of concern do not have the correct diurnal temperature pattern for these regulations.
- Climate change
  - Division has a strategy and a Climate Change Committee
  - Some current trout waters are not likely to be in the future
  - Focus is on connectivity – Resist strategy
- Encourage voluntary efforts that reduce angling when temperatures are above 70F.

Thanks much for the opportunity to discuss temperature-triggered trout regulations!!!!

Questions and Comments

whelang@michigan.gov