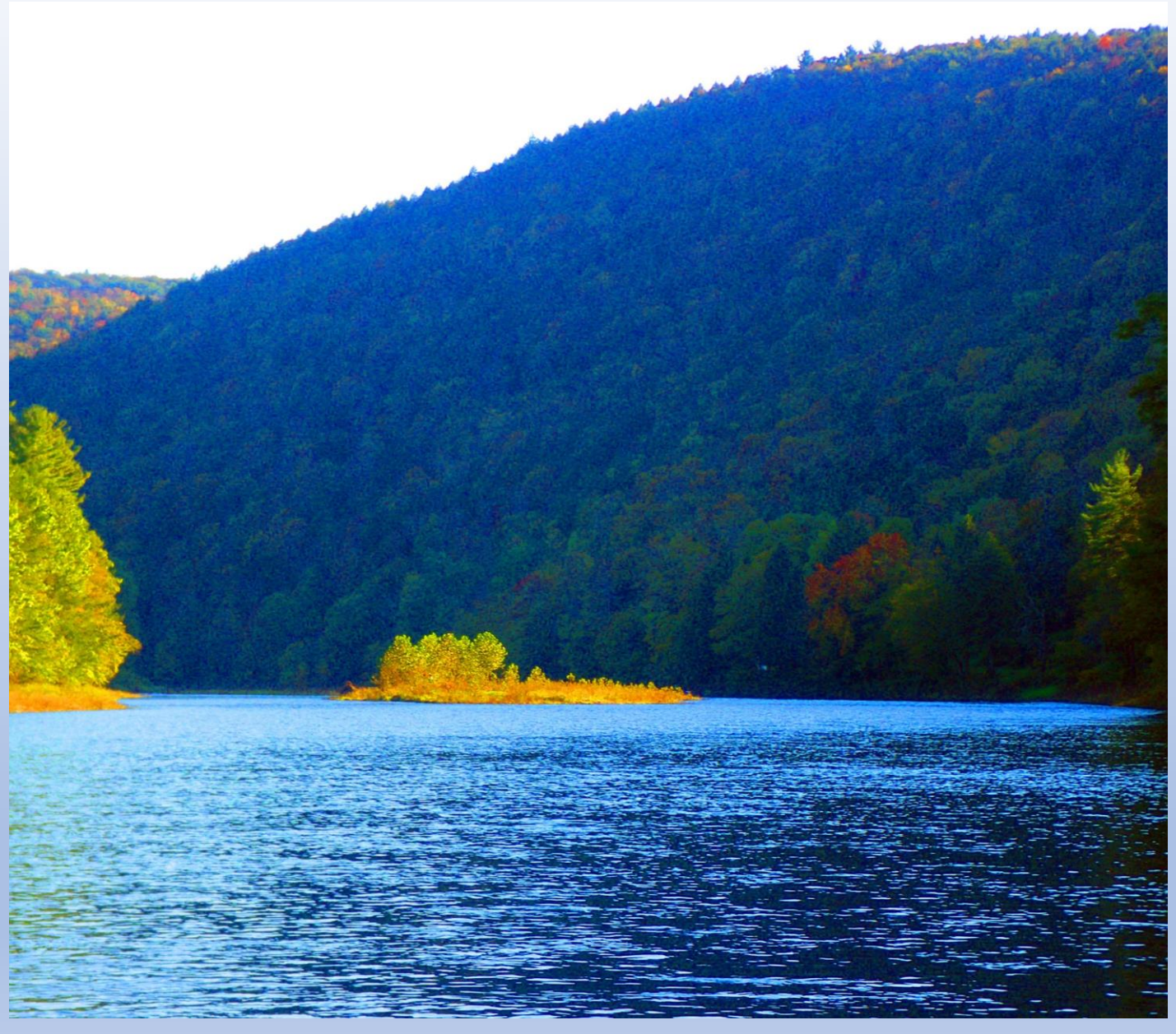


SEF Update: The Subcommittee on Ecological Flows

Peter Kolesar, Columbia Water Center

James Serio, Hancock, NY

For the Upper Delaware Council's WURM Committee

January 15, 2019

Narrowsburg, NY

What is SEF?

- A recently re-constituted committee of the DRBC to provide the Regulated Flow Advisory Committee (RFAC), and thereby the Decree Party decision makers, with "scientific and technical information and advice about the effects of flow management programs on habitat and ecological health [of the Delaware]."
- Currently, SEF has two primary missions, both due May 31, 2019:
  - Evaluate the Thermal Mitigation Bank proposal of FFMP 2017
  - Evaluate the Rapid Flow Change Mitigation Bank of FFMP 2017

Who is SEF?

- Reserved Members
  - Ross Shramko, NJ
  - Daryl Pierce, PA
  - Ian Park, DE
  - Chris VanMaaren, NYSDEC
  - Peter Sharpe, NPS
  - Lori Emery, NYCDEP
  - Molly Hesson, Philadephia

(Institutional representatives with no term limits)

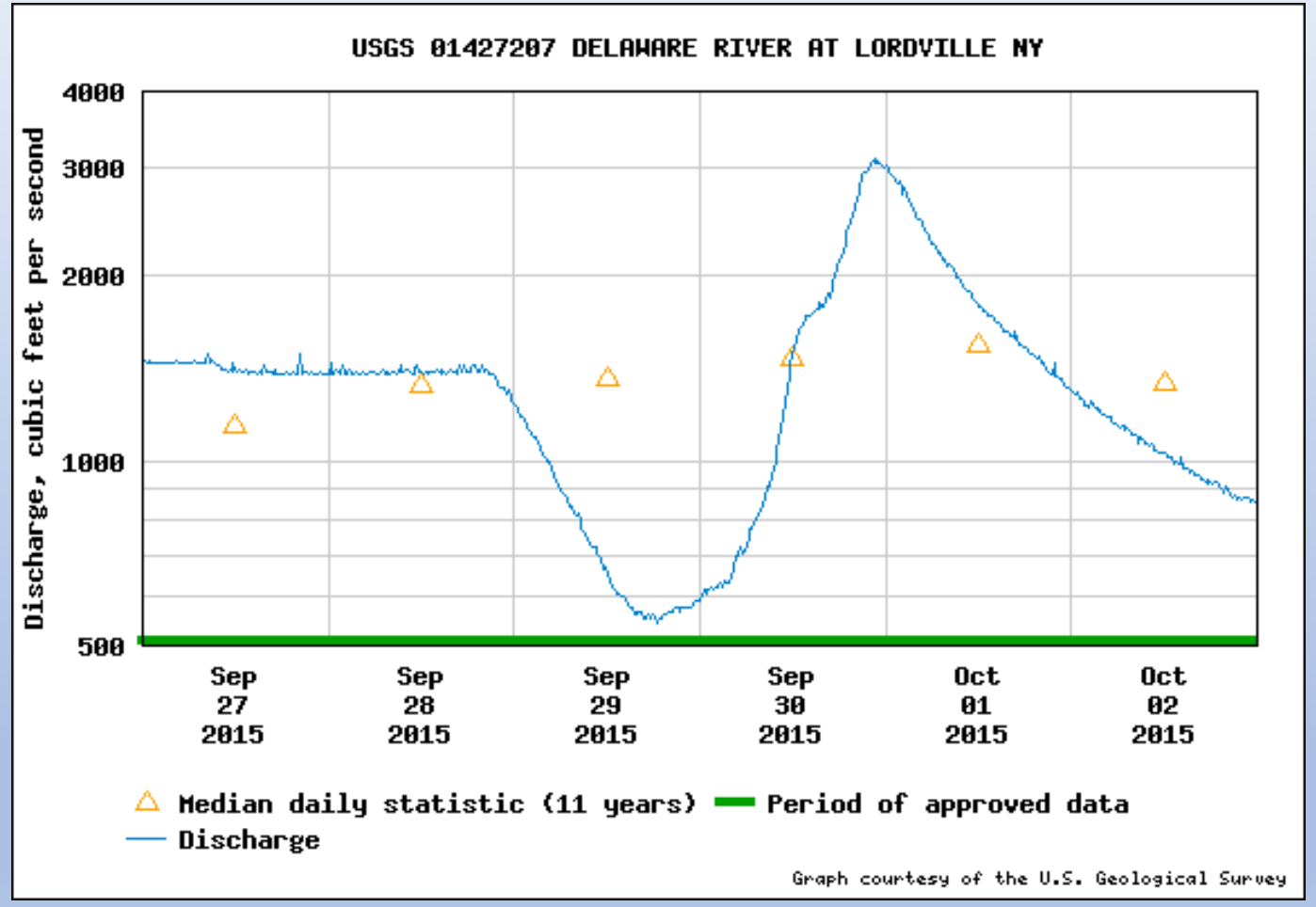
- Non-Reserved Members
  - Peter Kolesar, Columbia U
  - Jeff Skelding, FUDR
  - Jim Serio
  - Erik Sildorff, Delaware River Keeper
  - Sheila Eyler, DRBFWMC, USGS?
  - Garth Pettinger, TU

(Volunteers with two year terms, subject to DRBC/RFAC approval)

Issue 1. Rapid Flow Reduction

The River Master, rigidly following the rules of the 1954 Supreme Court decree to keep flows at Montague at 1750 cfs, at times calls for sudden drastic reductions in releases, which are unnatural and can harm the fish and other organisms in the river

An example of our concern: September 2015



SEGREGATION OF FLOW, DELAWARE
PRECIPITATION IN UPPER DEL
Discharge in cubic feet per second, loca

Date	Releases from NYC Reservoirs				Powe
	Directed release[1]	Pepacton	Cannonsville	Neversink	Wallen-paupack
Sept 14	588	139	408	90	0
15	0	139	404	90	41
16	274	139	401	90	91
17	232	139	396	90	119
18	432	133	331	90	161
19	783	99	594	90	128
20	1,002	99	979	90	144

1. Release directed to maintain a flow at Montague of 1,750 cfs and Trenton c
2. Includes conservation release of 60 cfs (September 14th – 16th), 90 cfs (Sept Reservoir.

Diversions by New Jersey through the D&R Canal September 14th - 20th, 2015 av

It really is dewatering the river!

Lordville: September 28, 2015

Lordville: September 29, 2015

Photos courtesy Lee Hartman

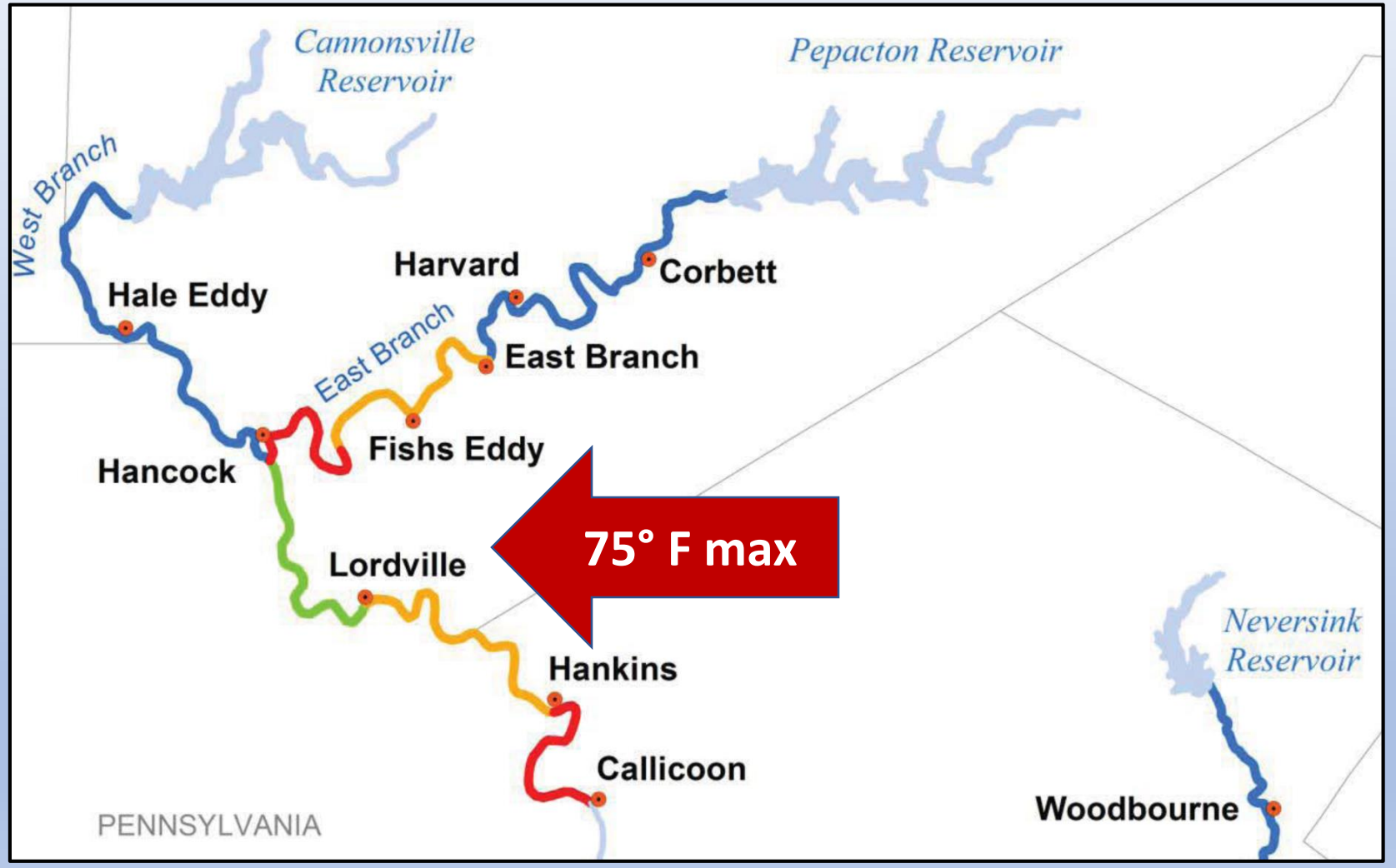
The Rapid Flow Change Mitigation Proposal in FFMP 2017

- A bank of water (1,000 cfs-days of the IERQ) to 'permit' ramping down River Master directed releases to avoid sudden drops in river level (dewatering). Bank administered at the discretion of NYCDEP and the River Master.
- The "Interim Guidance Document" proposes a ramping depending on the current Cannonsville releases:
  - When flow is over 700 cfs, reduce releases over two days, first to 500 cfs, then to 300 cfs.
  - When flow is between 700 and 450 cfs, do a one day reduction to 300cfs.
- *A major issue is how big is the need? Is the 1000 cfs days bank adequate? Is the ramping at the right speed?*

Issue 2. Thermal Stress Mitigation

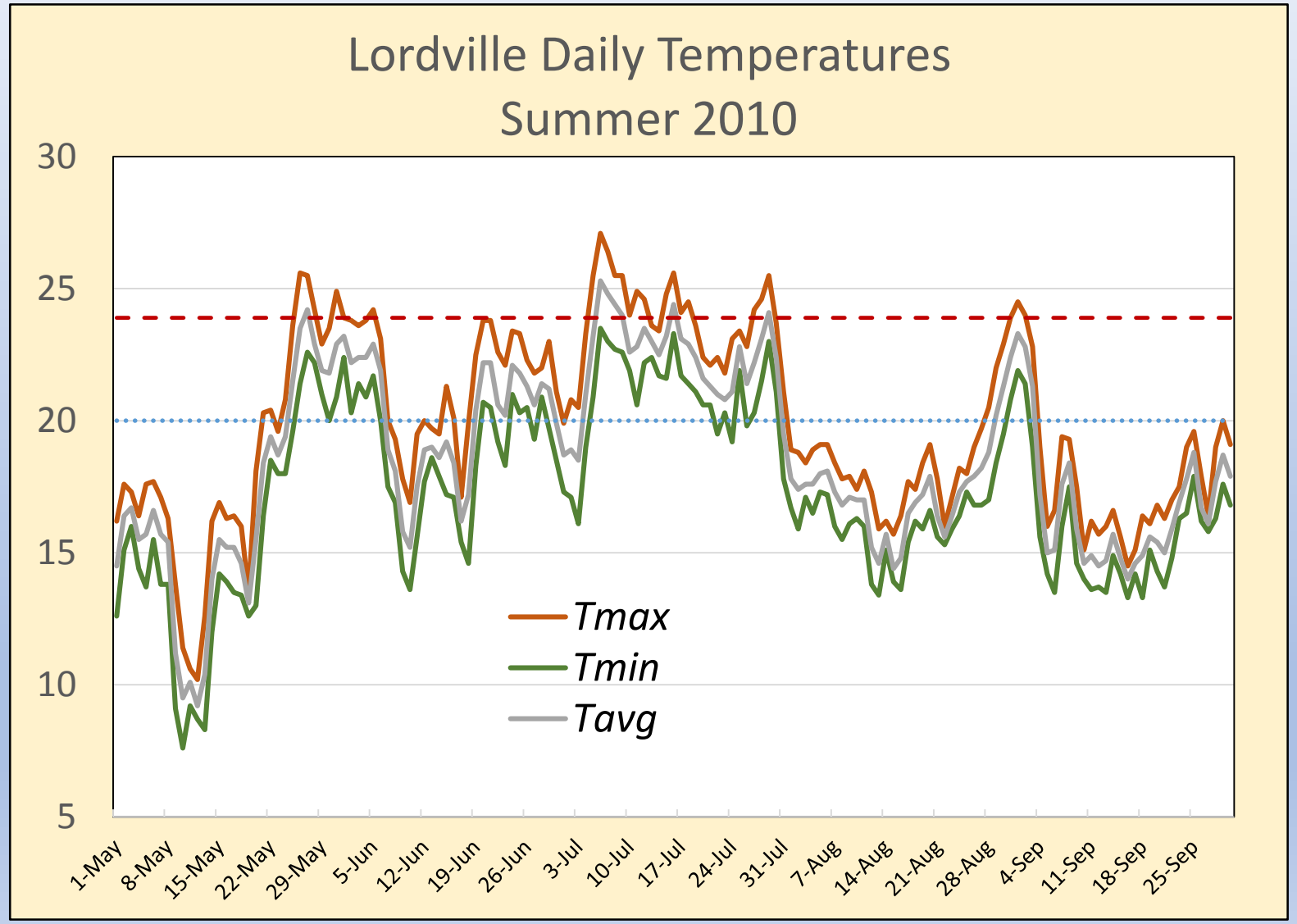
Trout are a cold-water fish species. They thrive best when river temperatures are below 68˚F. Temperatures above 75˚F can be lethal to trout if sustained for several days. The health of the upper Delaware trout fishery is dependent on cold water releases from the bottom of the three NYC dams on its headwaters.

The main focus is on keeping the river temperature below 75° F at Lordville, NY -- per the USGS gage there.



Source: Joint Fisheries White Paper, January 2010

This is a real problem. For example, in 2010 there were 24 stress days clustered in 4 stress events.



A Thermal Mitigation Strategy

- When the river gets too hot, or when it is predicted to get too hot, temporarily release more cold water – particularly from Cannonsville to protect the wild trout in the upper mainstem – Hancock to Lordville.

- Implementation Questions:
  - When should you do a mitigation release?
  - How much additional water should you release?
  - How much water would you need over a summer?

The Thermal Mitigation Bank proposal in FFMP 2017

- A bank of water (2,500 cfs-days) to ‘permit’ increasing releases during thermal stress events in the Delaware main stem, East Branch and Neversink. Releases made at the direction of the NYSDEC and administered by the River Master and the NYCDEP.
- The interim proposed guidelines suggest
  - From Sept 15 to July 6, the goal is to prevent a first day above 75˚F with use capped at 1250 cfs days.
  - From July 7 to Sept 14, the goal is to prevent three consecutive days above 75˚F or a 1st day above 77˚F.

Research Question 1: How Big is the Thermal Problem at Lordville?

- Some Answers: Taking the 75˚F daily max criterion, our computations based on the last 11 years under FFMP show that:
  - There were 18 thermal events --- 6 of which were partially ameliorated by the Decree Parties' special thermal releases.
  - The 75˚F daily max was exceeded on 78 days, with one day reaching 81.3˚F.
  - There were some extraordinarily severe events. For example, one lasting 12 days, another lasting 10 days.
  - Due to the 6 thermal mitigation releases and the Cannonsville seepage drawdown in July of 2015, the above are underestimates of the thermal load at Lordville.

The Seasonal and Temporal Pattern of Thermal Stress

Number of Days Above 75˚F

Lordville USGS Gage # 1427207: Summers 2008 to 2018

Month	May	June	July	August	September	Summer
2008	0	8	9	1	0	18
2009	0	0	0	0	0	0
2010	4	2	15	1	2	24
2011	0	0	3	0	0	3
2012	0	1	5	8	0	14
2013	0	0	2	0	0	2
2014	0	0	0	0	0	0
2015	0	2	0	0	0	2
2016	4	0	4	1	0	9
2017	0	0	0	0	0	0
2018	0	0	6	0	0	6
Average	8	13	44	11	2	78

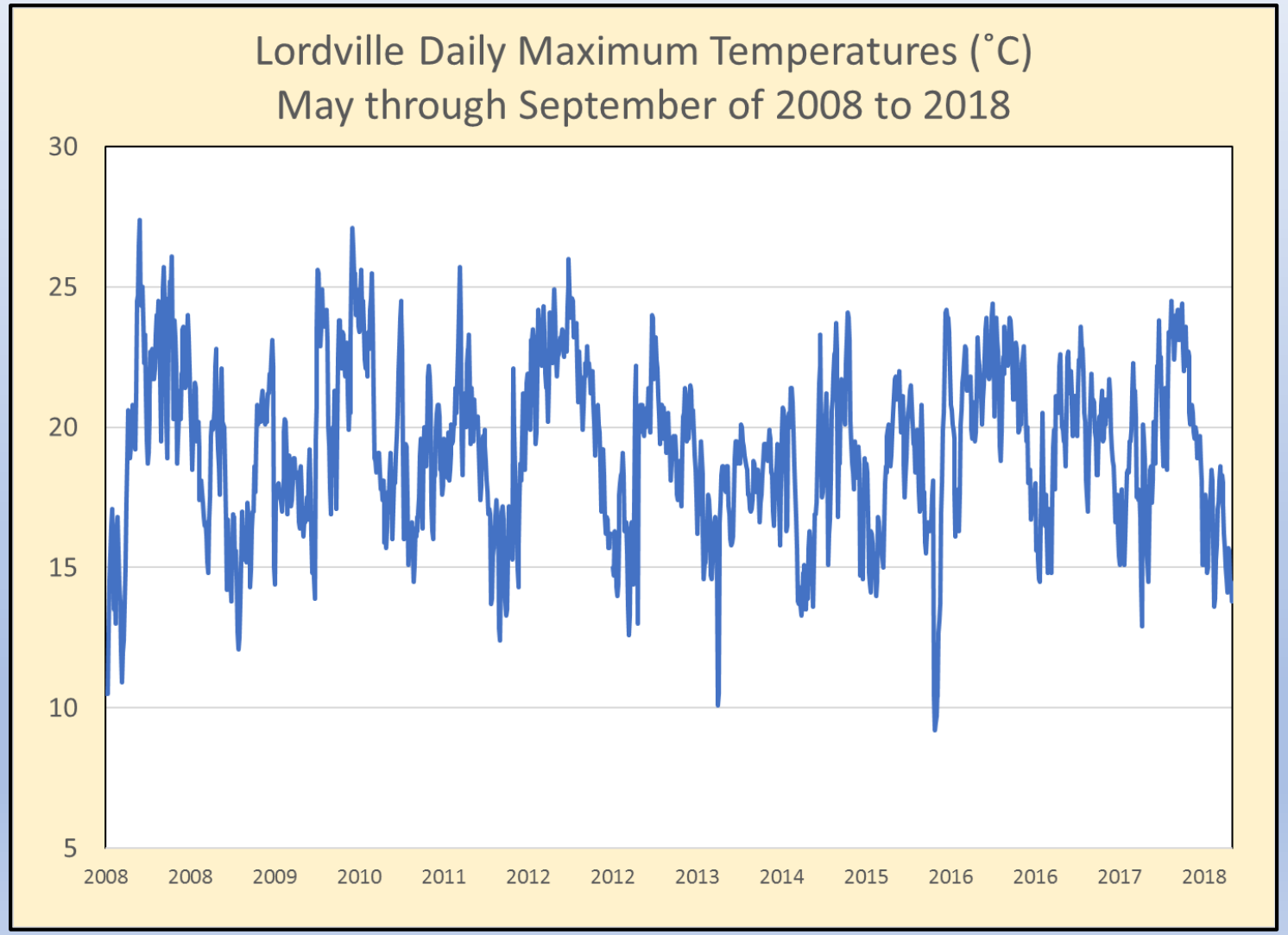
Research Question 2: How Much Water Does it Take to Cool the River at Lordville?

- We can statistically analyze the peaks and valleys in river temperatures and in the air temperatures and river flows that cause them to derive an equation for the cooling impact of Cannonsville releases on Lordville temperatures.

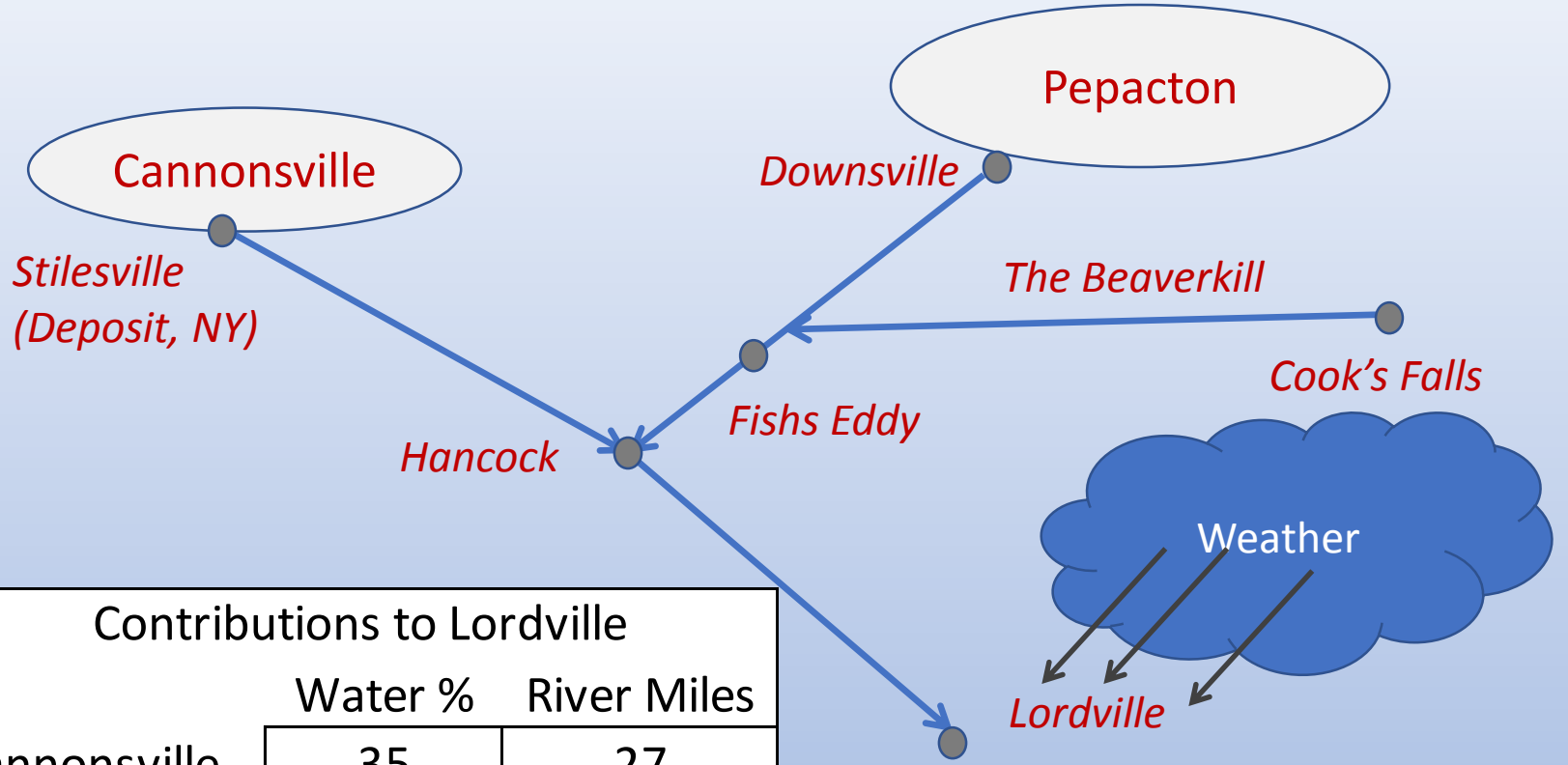
and

- We can analyze the results of the 6 thermal mitigation releases that were made between 2008 and 2018.

Our Challenge: Understand this temperature graph and quantify the impact of Cannonsville releases in its “ups and downs”.



An Engineering Perspective to Cooling Lordville



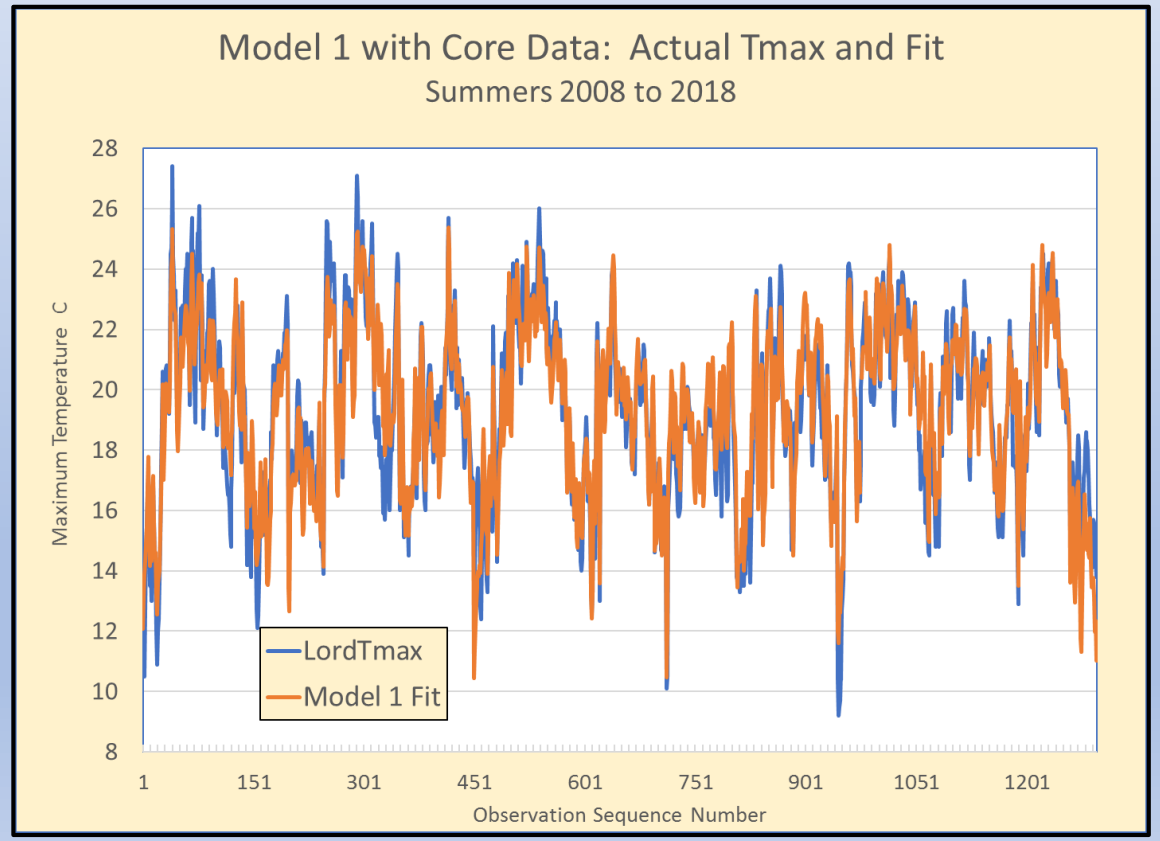
Contributions to Lordville	Water %	River Miles
Cannonsville	35	27
Pepacton	11	42
Beaverkill	22	35
Tributaries	32	-

$$\frac{\partial T}{\partial t} = -\frac{\partial (QT)}{A\partial x} + \frac{\partial}{A\partial x}\left(EA\frac{\partial T}{\partial x}\right) + \frac{H_f}{\rho c_p D} + S_b$$

Summers 2008 to 2018, when Lordville is below 5,000 cfs

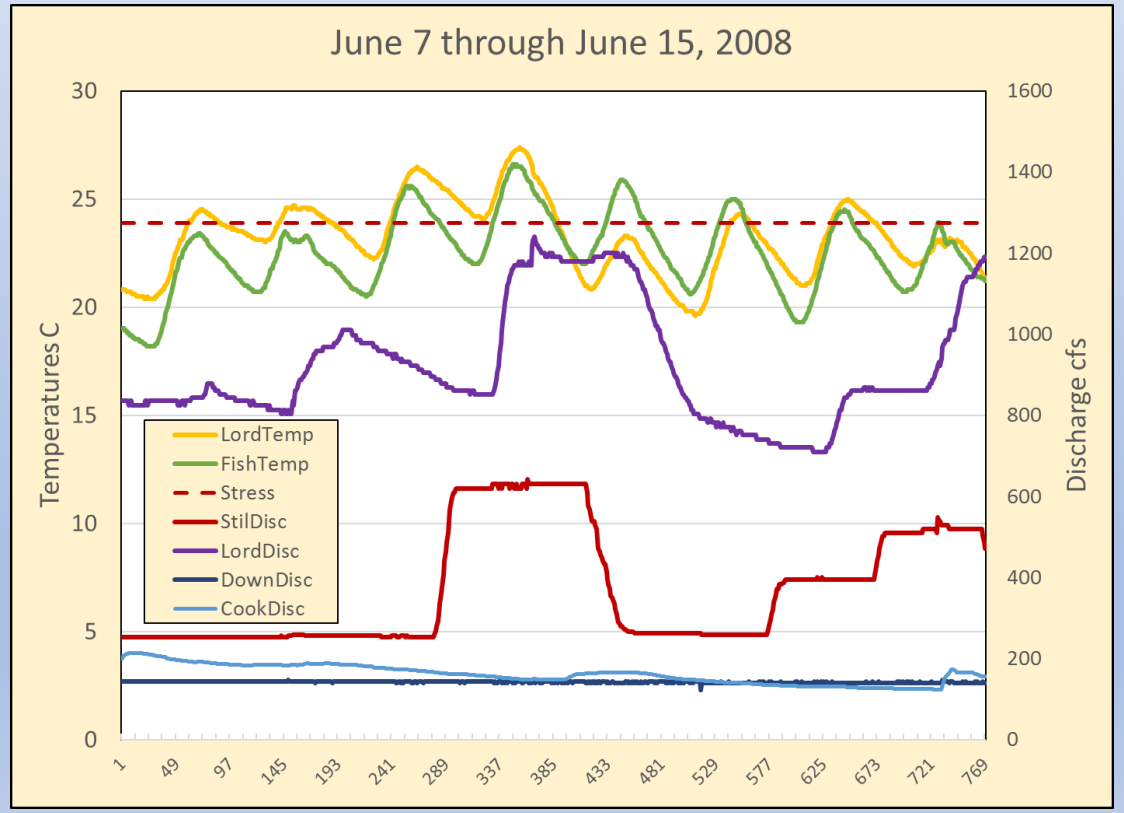
Some Results to date . . .

- Via Statistics ...We derived a regression equation that measures the simultaneous impacts of Cannonsville releases, Binghamton air temperatures, and Pepacton releases together with Beaverkill flows: We estimate that it takes about 65 cfs from Cannonsville to lower Lordville temperatures by 1 ˚F. Work in progress…..



Some Results to date . . .

- Via direct analysis of thermal releases: We compare Lordville and Fishs Eddy temperatures before and after a thermal release. Example: In June of 2008 a pulse release of 400 cfs over a day and a quarter lowered Lordville by about 4.8 ˚F --- for an estimated impact of about 67 cfs / ˚F. (Work in progress…)



Some Open Questions:

- Additional research on the impact of Cannonsville releases on Lordville temperatures is underway. More statistical regressions, analyses of all 6 thermal releases, an application of the thermodynamics river model developed by the USGS.
- Can the timing, intensity and duration of thermal stress events be predicted?
- Is it more important to mitigate thermal stress at the beginning, or at the end of the summer?
- What should be the rules for commencing a thermal release? Making a release versus not making a release is making a gamble. You will be wrong some fraction of the time.

The End

Some SEF Issues

- How will SEF operate? There is a draft proposal. SEF Chair? Voting? Drafting Reports? Minority Views? Who will actually do the work?
- Environmental vs Institutional/Political Viewpoints. Reserved vs. non-reserved members?
- Potentially conflicting ecological objectives?
  - Trout
  - Warm water species: Shad, smallmouth, walleyes, etc.
  - Dwarf wedge mussels
  - Delaware oysters
- The scientific tools "un" available
  - The new OASIS (PST 2.2) is still not available.
  - The USGS $1 million revision of the Bovee Habitat Model (DSS) has been a complete bust.
  - Lack of an integrated Delaware River Database. Electronically inaccessible data from the monthly River Master reports and OST-FFMP Summaries.

Additional Thermal Mitigation Issues

- What are appropriate temperature targets?
  - "We" have talked of, and argued for, a daily 75˚F max and a daily 72˚F average as worst cases to be avoided – and 68˚F max as desirable. The guidance document speaks of a daily 77˚F max and three days at 75˚F max at Lordville.
- What reaches of the Delaware are to be protected?
  - "We" have never seriously entertained thermal mitigation at Bridgeville on the Neversink nor Harvard on the East Branch. The interim guidelines do.
- How would water be released during the season?
  - What forecasts or events will trigger mitigation releases?
  - In what quantities?
  - Thermal events can occur throughout the season and can be of differing durations and intensities. Should water be husbanded early in the season or is protection more important early in the season versus later? The interim guideline given to SEF has different rules applying before and after July 7.

Some questions put to SEF by RFAC (Brenan Tarrier, NYSDEC Chair)

- Are the interim bank usage procedures effective?
- Is there a better way to implement the agreed-upon banks than the current interim procedures?
- How does the expected effect of elevated water temperatures vary with duration, time of day, time of year, rate of change, previous events, etc.?
- Are 500 cfs and 300 cfs appropriate levels for the ramp down?

PJK Research Question 2: How Big is the Upper Delaware Dewatering Problem?

- What has been the timing, frequency, magnitude and duration of dewatering events in the upper Delaware since the FFMP went into effect?
- Which of these are caused by drops in Rivermaster directed releases?
- Four sources of relevant data do not easily synchronize: USGS gage data, NYCDEP reservoir operations data, River master monthly reports, the “occasional” OST-FFMP summaries.

Some Candidate Dewatering Events

Some Apparent Large Drops in Directed Releases

Oct 1, 2017 to Sept30, 2018: All data in cfs

		Stilesville per USGS Gage			Cannonsville per NYCDEP		
"Event"	Date	Prev StiDisc	StiDisc	StiDiscΔ	Prev CanTot	CanTot	CanDirΔ
1	09/17/16	1420	663	-757	1332	538	-794
2	09/28/15	1220	961	-259	1213	653	-661
3	10/08/17	1030	313	-717	952	254	-634
4	10/16/14	899	437	-462	818	240	-628
5	09/26/10	1180	738	-442	1129	546	-624
6	07/13/08	852	324	-528	712	260	-593
7	08/23/14	840	567	-273	777	605	-576
8	10/24/08	877	137	-740	633	82	-568
9	10/27/17	774	401	-373	758	319	-562
10	10/26/16	847	393	-454	806	248	-559