Potential LTEMP Experiments Water Year 2021

Adaptive Management Work Group Meeting

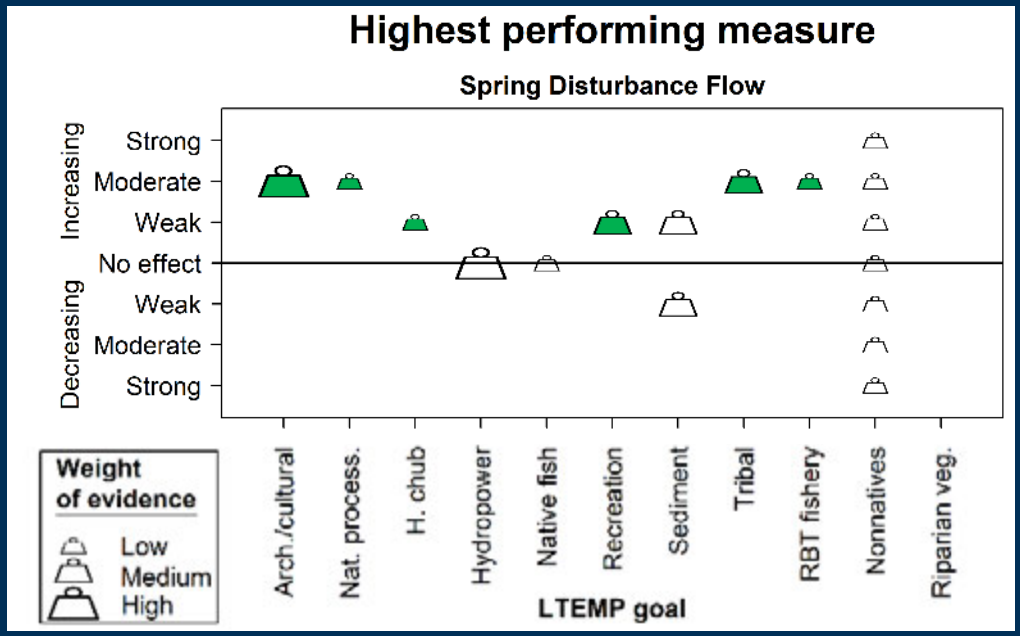
February 11, 2021

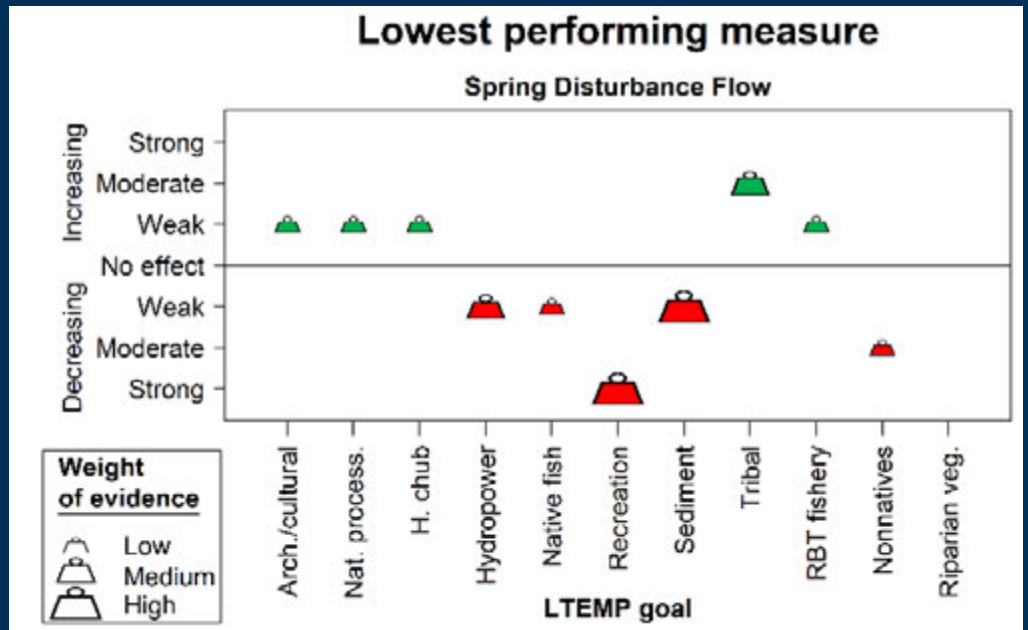
Knowledge Assessment Results

Intriguing upsides

No major red flags

USGS



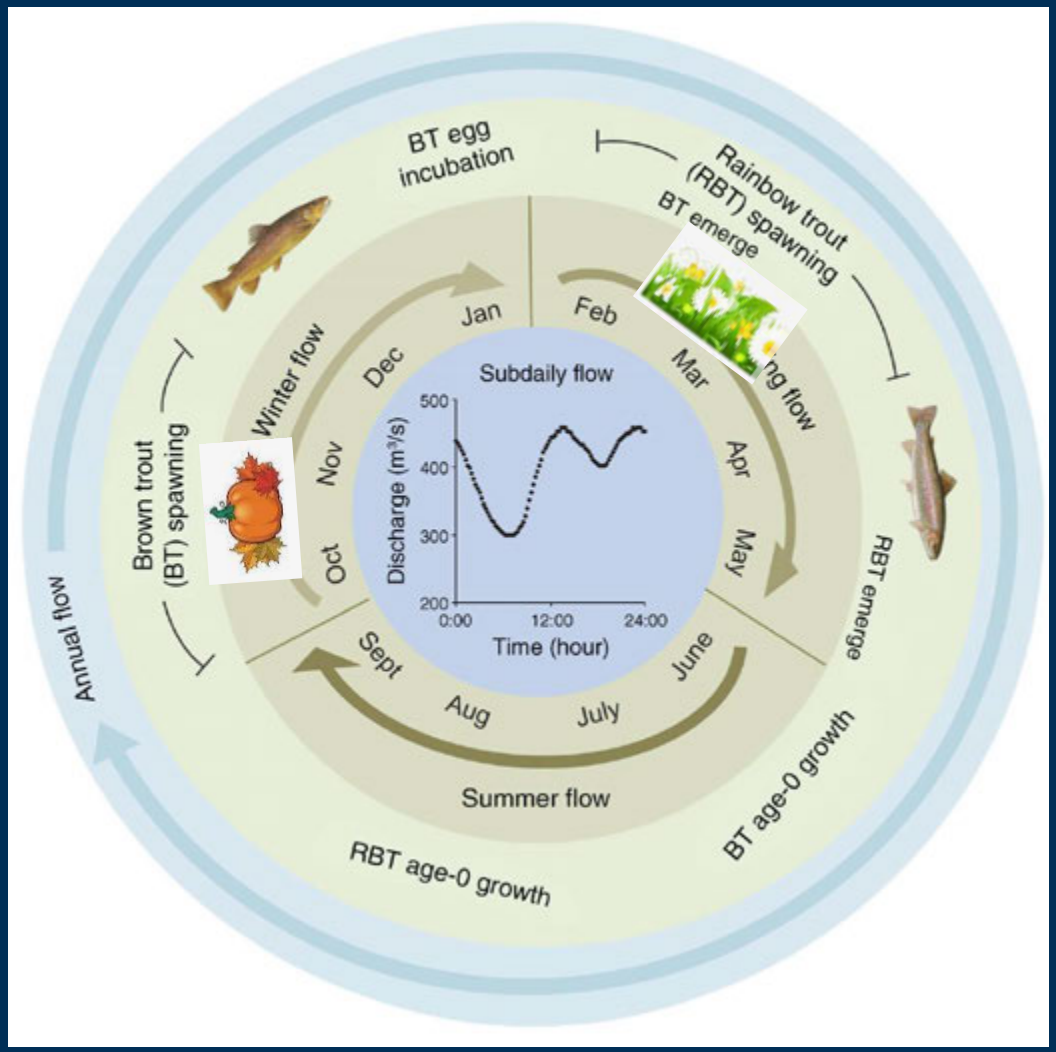


Spring Disturbance Flow may disfavor brown trout


Spring HFE


Fall HFE

Spring timing does not align with brown trout spawning calendar



From Dibble et al. 2015, *Ecological Applications*.

USGS

Spring Disturbance Flow

-May knock-back food base for brown trout

2008 Spring HFE favored right side of food web

Mudsnails, worms declined

Midges, blackflies increased

Rainbow Trout feed on right side, their numbers increased

Brown trout feed on left side

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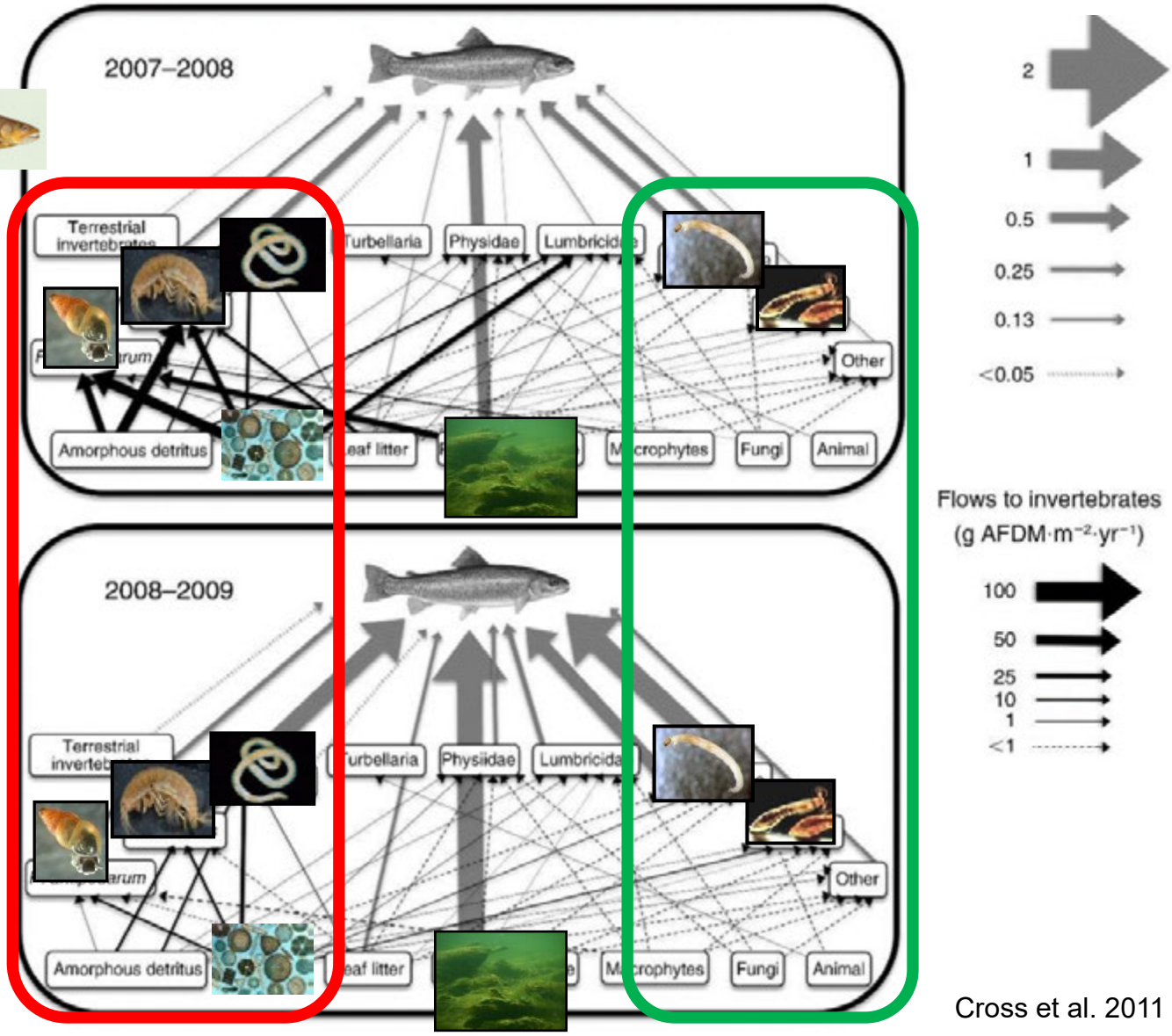

Cross et al. 2011

Spring timing may benefit recreation

Spring Disturbance Flow 2021

Boatmen's Quarterly Review, Winter 2021

"For river runners, the idea of conducting HFEs in the spring has some appeal."

"We hope this baby step can help the TWG and AMWG better understand disturbance flows and in this case if it is beneficial to time them in the spring."

"…this pulse flow may give campsites a much-needed cleanse at the river margins, where impact from users is greatest."

-Ben Reeder and David Brown

USGS

2021 Remote Sensing Overflight

- Aerial image acquisition during steady 8,000 cfs flow
  - maximizes data quality & continuity with previous overflights
- Approved 2021 data collection effort (NOT an experiment)
- 8 years since last overflight
- Will provide updated imagery for change detection
- Expenditures and planning underway for months

USGS

Feb. 10, 2021

2021 Remote Sensing Overflight-1

What?

- **Orthorectified four-band (visible and near-infrared) imagery with 20 cm pixel resolution**
- **Digital elevation model with a 1-meter pixel size**

Where?

Glen Canyon Dam to

Pearce Ferry Rapid

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2021 Remote Sensing Overflight-2

When?

- Steady 8,000 cfs GCD Release
  - Starts evening Friday May 28, 2021
  - Stops early morning Friday June 4, 2021
- Gives contractor 8 days of flying to acquire data
  - Flights commence on Saturday May 29th
  - ~10 am to 2 pm each day
    - minimizes shadows
  - Start at GCD, move downstream with 8k flow
- Inclement weather may require extending daily flight window and/or duration of mission

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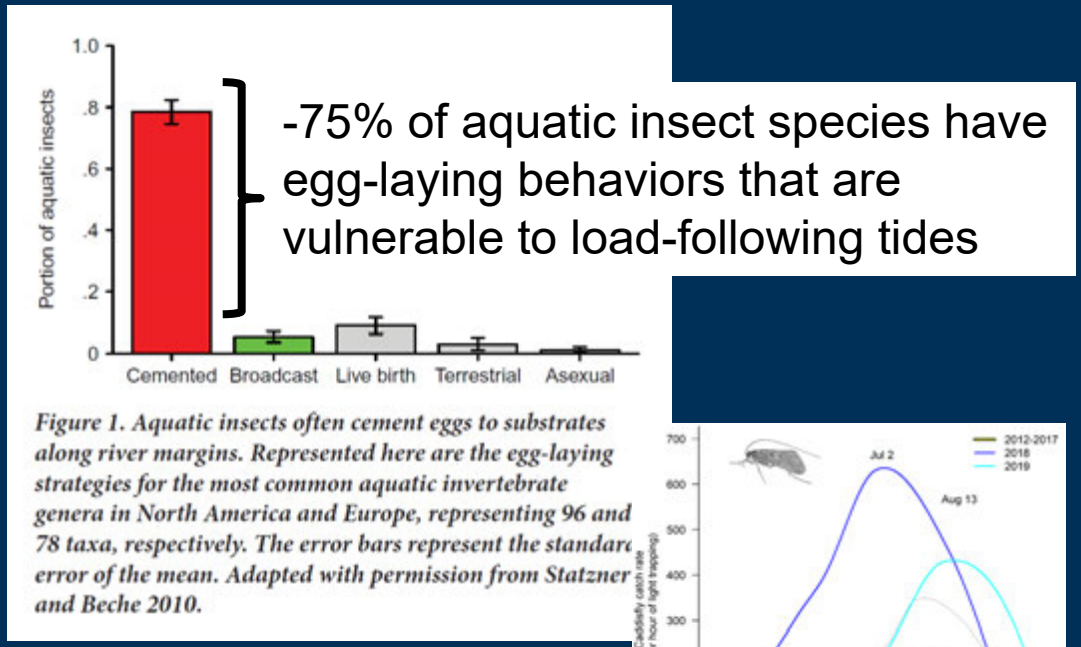
Macroinvertebrate Flows

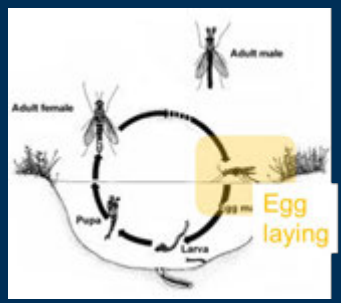
"Bug Flows" Objective: Improve production and diversity of food base.

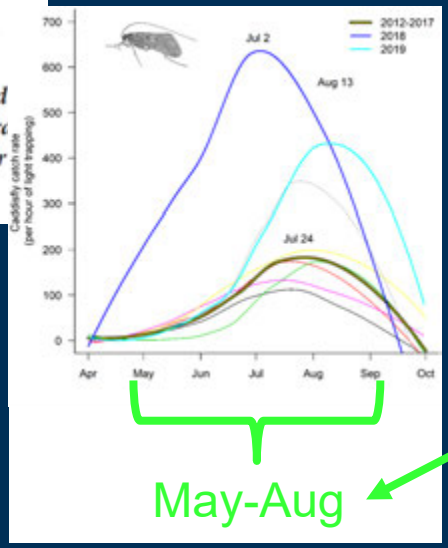


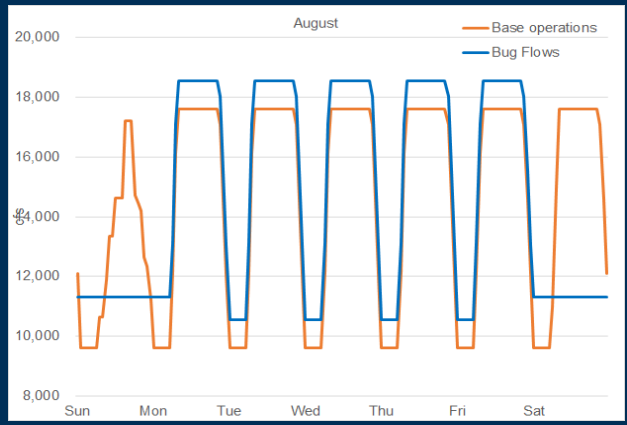
-75% of aquatic insect species have egg-laying behaviors that are vulnerable to load-following tides

Figure 1. Aquatic insects often cement eggs to substrates along river margins. Represented here are the egg-laying strategies for the most common aquatic invertebrate genera in North America and Europe, representing 96 and 78 taxa, respectively. The error bars represent the standard error of the mean. Adapted with permission from Statzner and Beche 2010.

From Kennedy and others, 2016
Bioscience





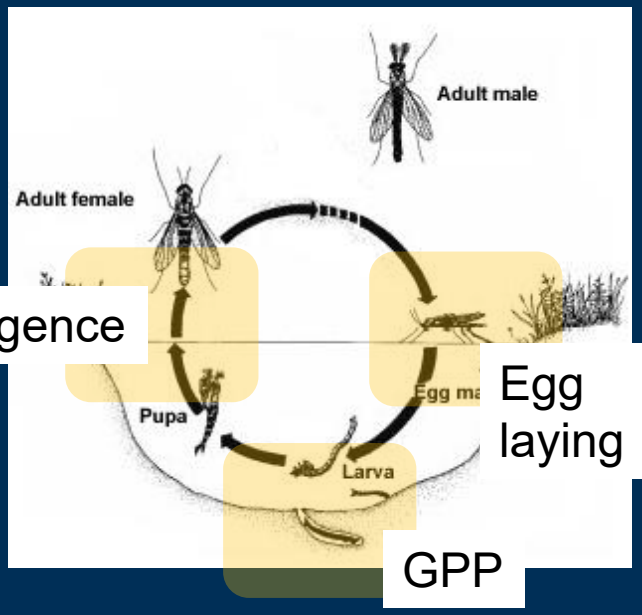


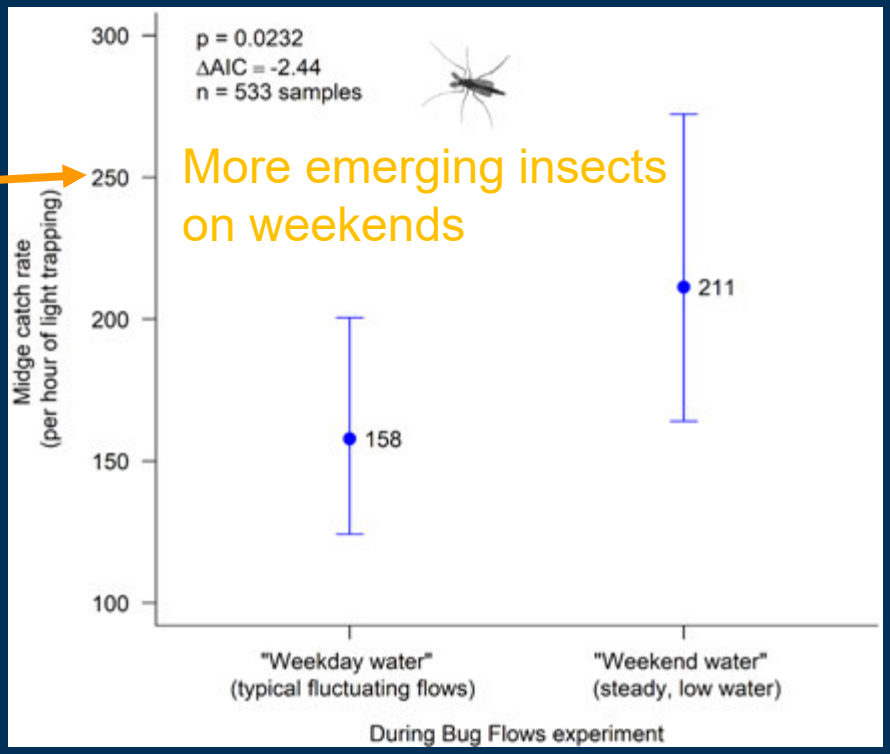
- **"Give bugs the weekends off"**
- **Weekend stable low flows May-August**
- **Eggs laid on weekends never dry**

Bug Flows

- Goal was to improve egg survival, but…
- Seeing benefits to other <u>natural processes and life stages</u>
  - ↑GPP
    - ↑ larval growth
  - ↑Emergence
  - ↑Egg laying substrate

2019 ARM





2019 ARM

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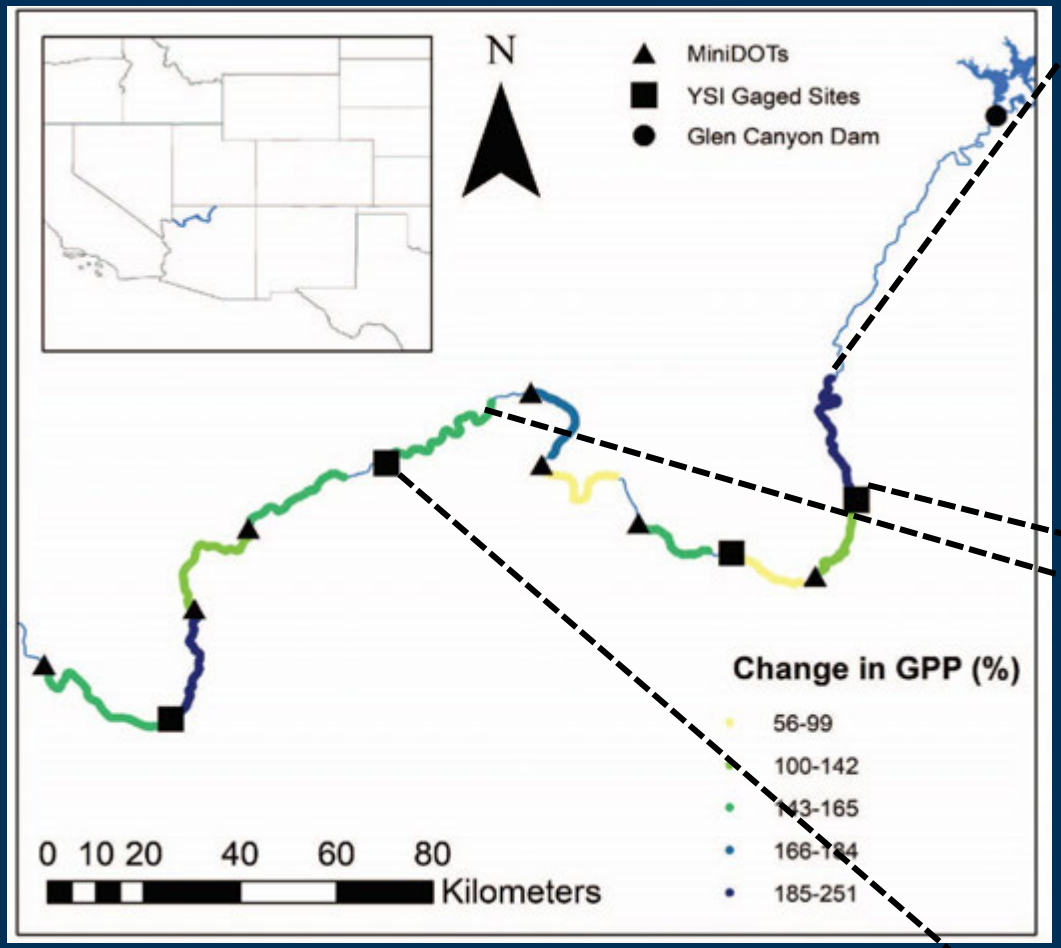
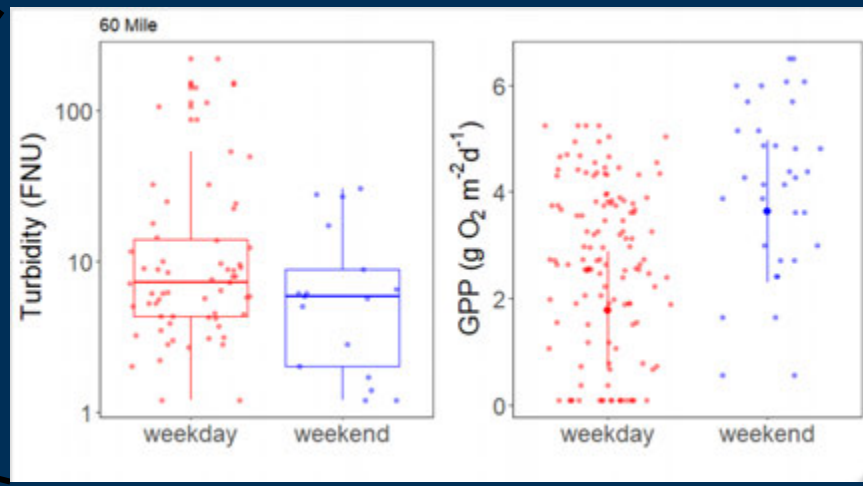
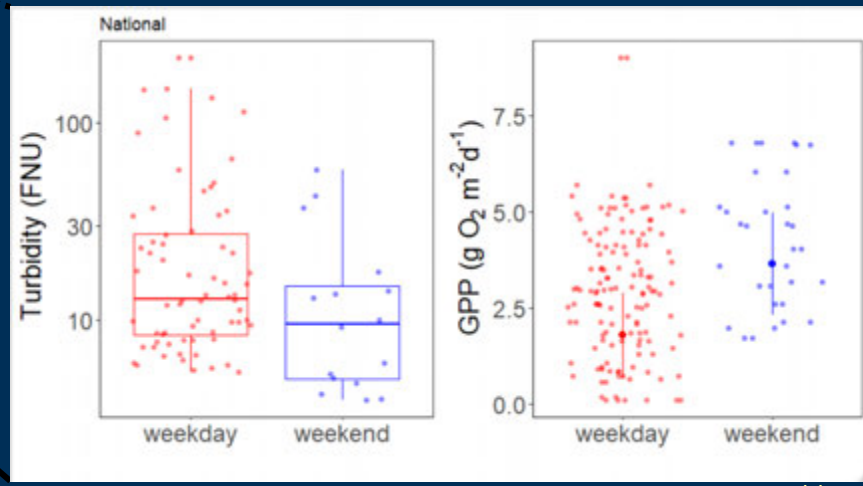
Preliminary results subject to review and revision

River-wide increase in GPP on weekends (45% higher = +100 metric tons carbon/yr)

Much of this GPP effect is turbidity driven







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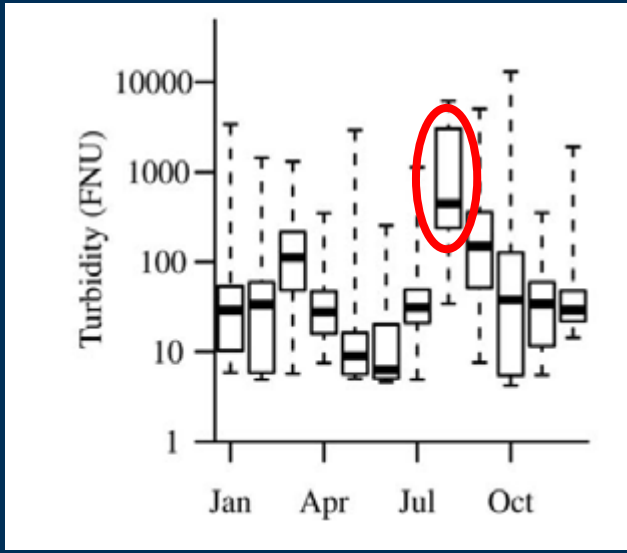
Unpublished data, subject to change, do not cite.

Deemer, Yackulic and others

Do GPP results inform Bug Flow design improvements?

- YES
- GPP results lead to conclusion that:
  - ROI (return on investment) is low when turbidity high
  - If high turbidity, no GPP increase on weekends
- What is most turbid month of year?
  - August

(by far)



From: Hall and others, 2015, Limnology & Oceanography

August
-Highest cost to hydropower
-Very low ROI for GPP

Consider dropping August from experiment.

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