

# Aquatic invertebrate drift patterns downstream of Colorado River Basin dams

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# What is invertebrate drift?

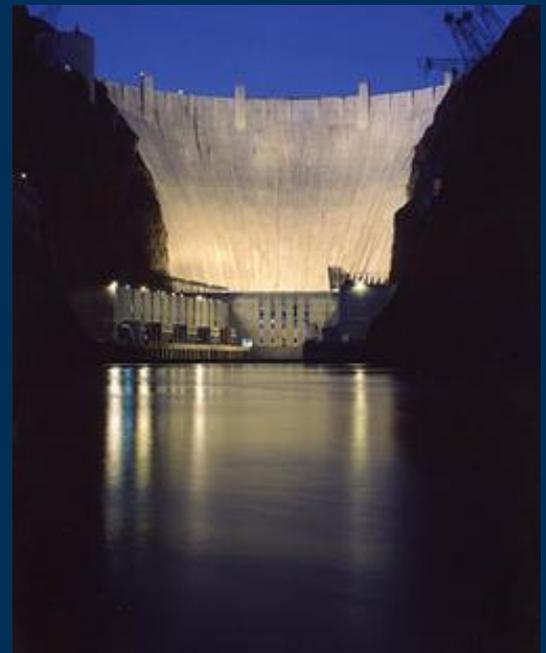
*(And why should you care?)*

- Entrainment of bugs in water column
- Critical life stage/behavior
- Better metric for large rivers
- Food for fish



# Drift in tailwaters

- **Measureable response to dam impacts**
  - **Drift still fundamental, even in tailwaters**
- **Does flow manipulation affect downstream recovery?**
- **How do flows alter community dynamics?**



# One “unique” ecosystem

- Glen Canyon Dam, Grand Canyon, Arizona

Big canyon

Big dam



Big  
river

# One “unique” ecosystem

- Glen Canyon Dam, Grand Canyon, Arizona
- 0 “EPT” taxa. Only 2 insects



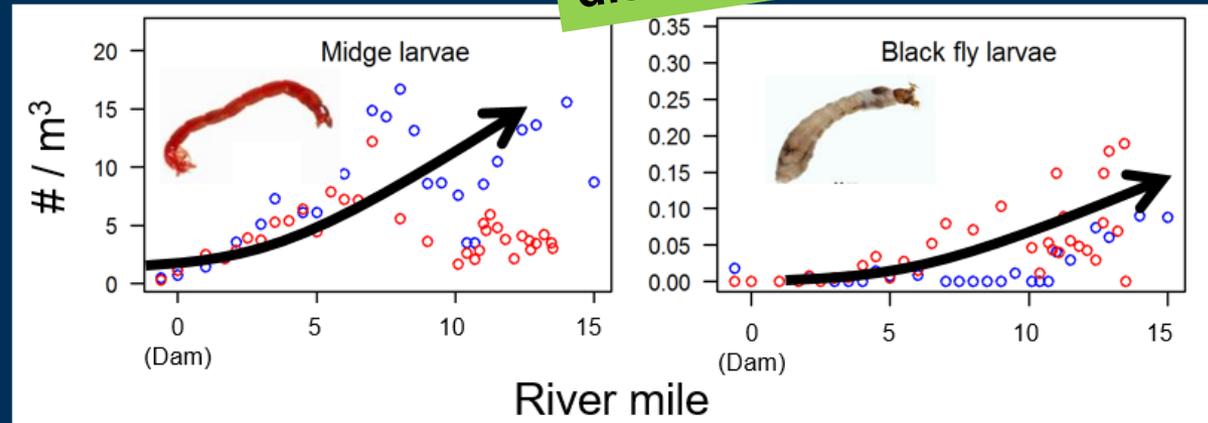
# One “unique” ecosystem

- Glen Canyon Dam, Grand Canyon, Arizona
- 0 “EPT” taxa. Only 2 insects
- Drift related to distance downstream

Is this normal  
for tailwaters?

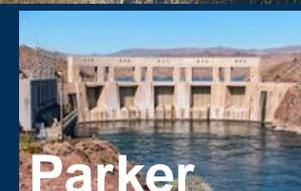
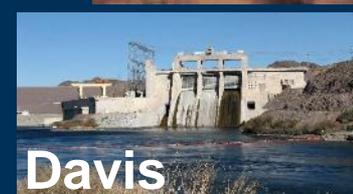
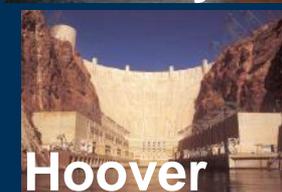
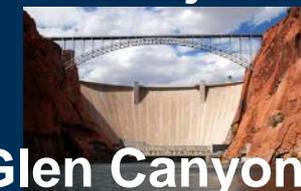
How can we  
tell?

Accumulation with  
distance from Dam



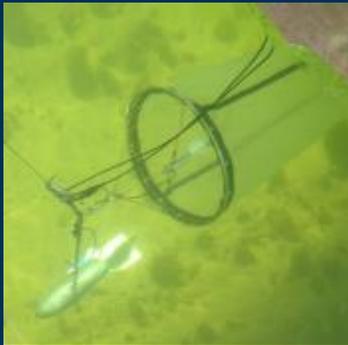
# Sampling drift

- 7 tailwaters in Colorado River Basin



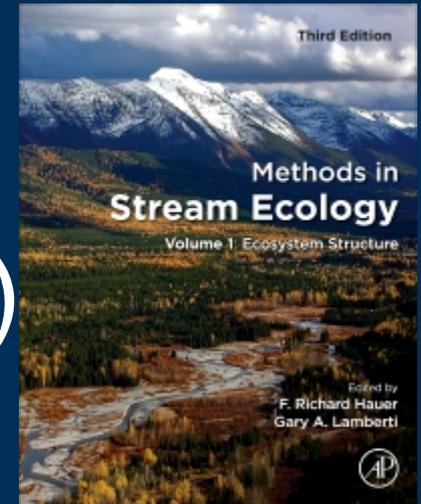
# Sampling drift

- 7 tailwaters in Colorado River Basin
- 15-mile reaches, sampled every mile



# Sampling drift

We wrote the  
book (chapter)  
on it!



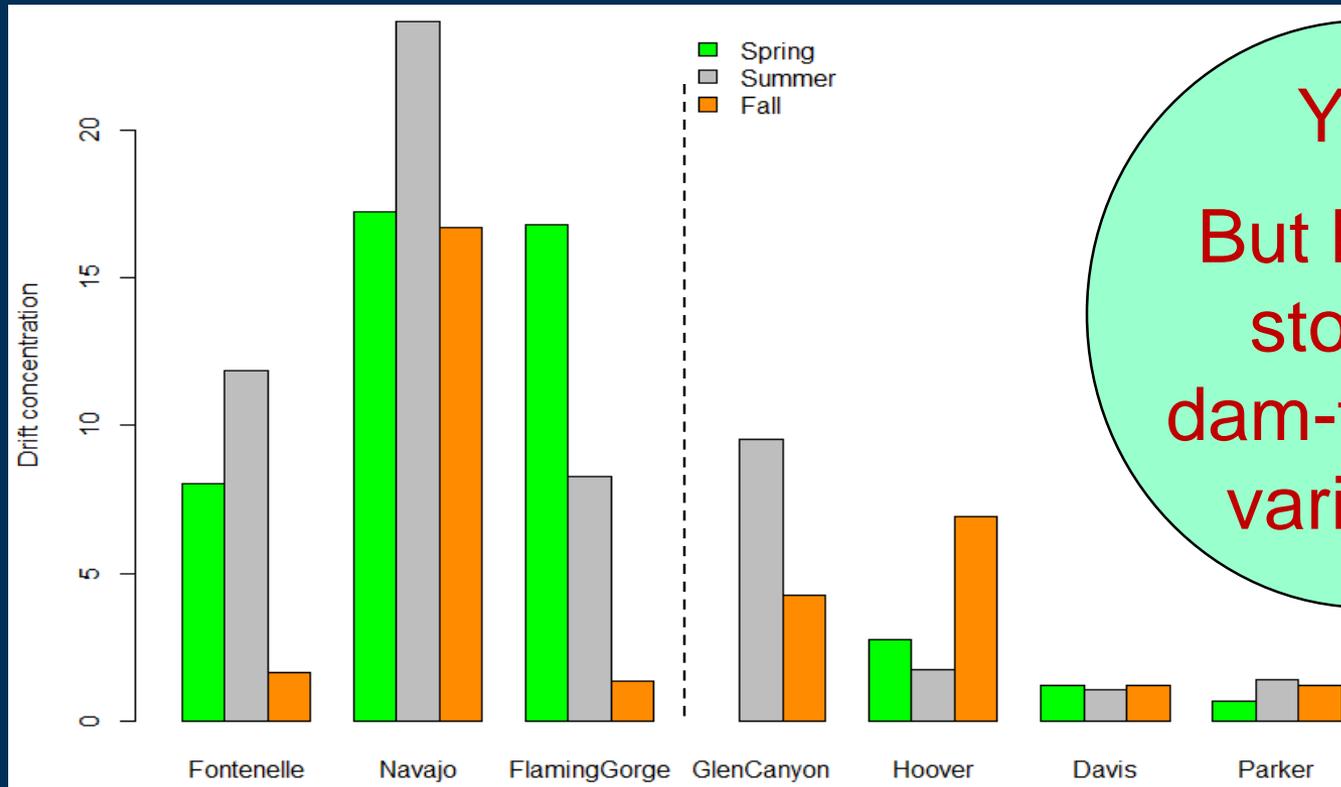
# Sampling drift

- 7 tailwaters in Colorado River Basin
- 15-mile reaches, sampled every mile
- Spring, summer, fall 2015



# 59,378 invertebrates later...

- Are there seasonal patterns to the data?



Yes!  
But bigger story is dam-to-dam variation

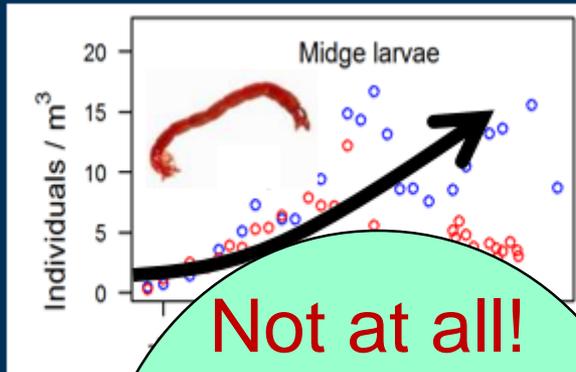


Unpublished data, subject to change.  
Do not cite.



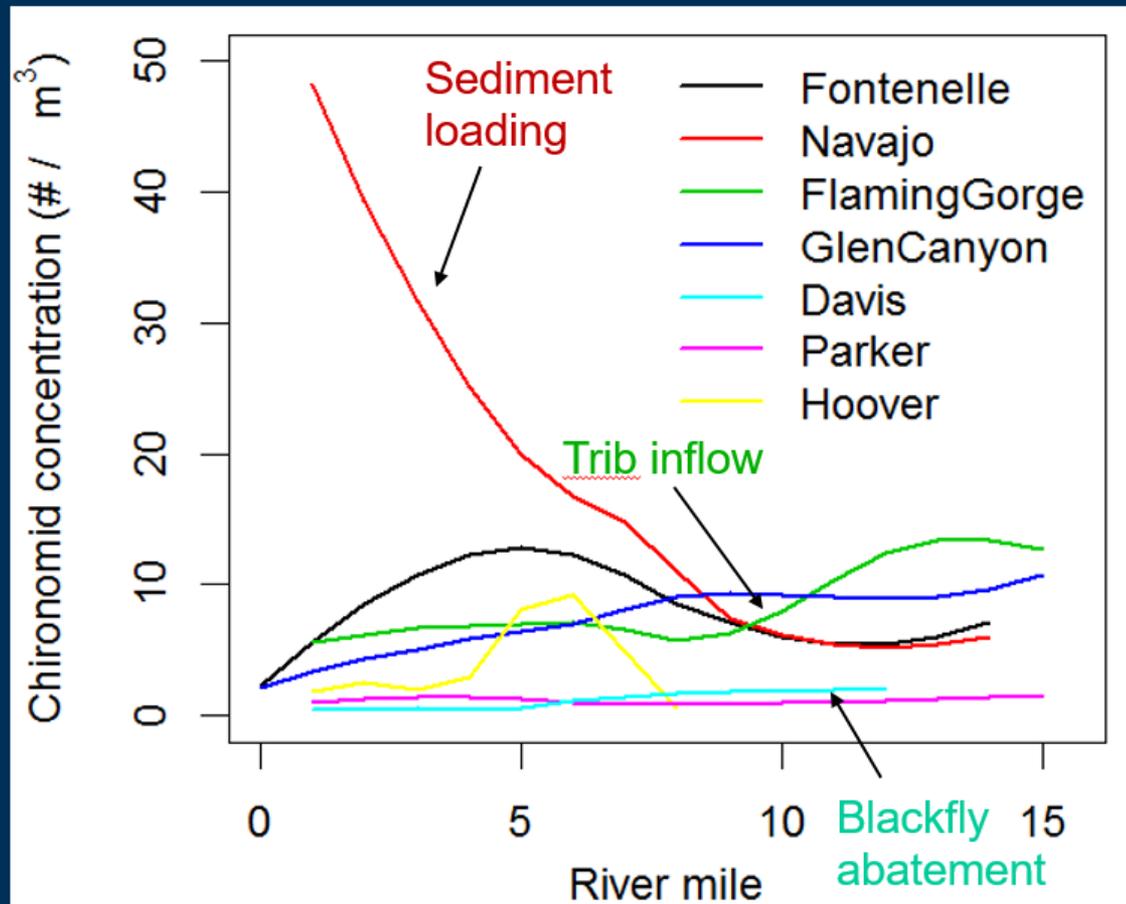
# Dam-to-dam variation

- Is downstream recovery consistent?



Not at all!

Local factors hugely important



# Does context matter?

- Dams vary notably in several ways

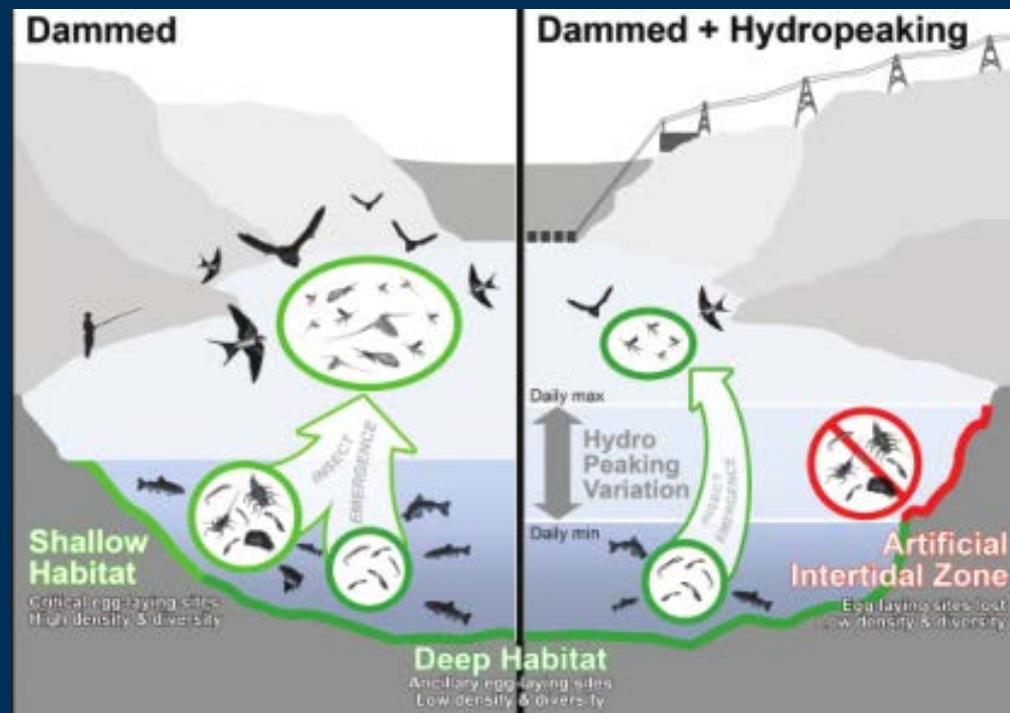
<u>Tailwater</u>	<u>Latitude</u>	<u>Discharge (Q)</u>	<u>HI</u>
Fontenelle	42.02	46	0.01
Navajo	36.81	10	0.02
Flaming Gorge	40.91	54	0.13
Glen Canyon	36.94	360	0.17
Davis	35.20	521	0.36
Parker	34.30	334	0.40
Hoover	36.01	412	0.56
	$R^2 = 0.14$	$R^2 = 0.26$	$R^2 = 0.77$

HI: Hydropeaking index

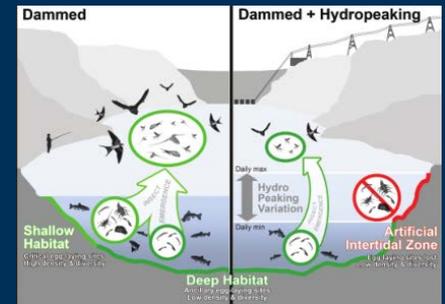
↑HI = ↑Daily flow variation

# Hydropower flows vs. bugs

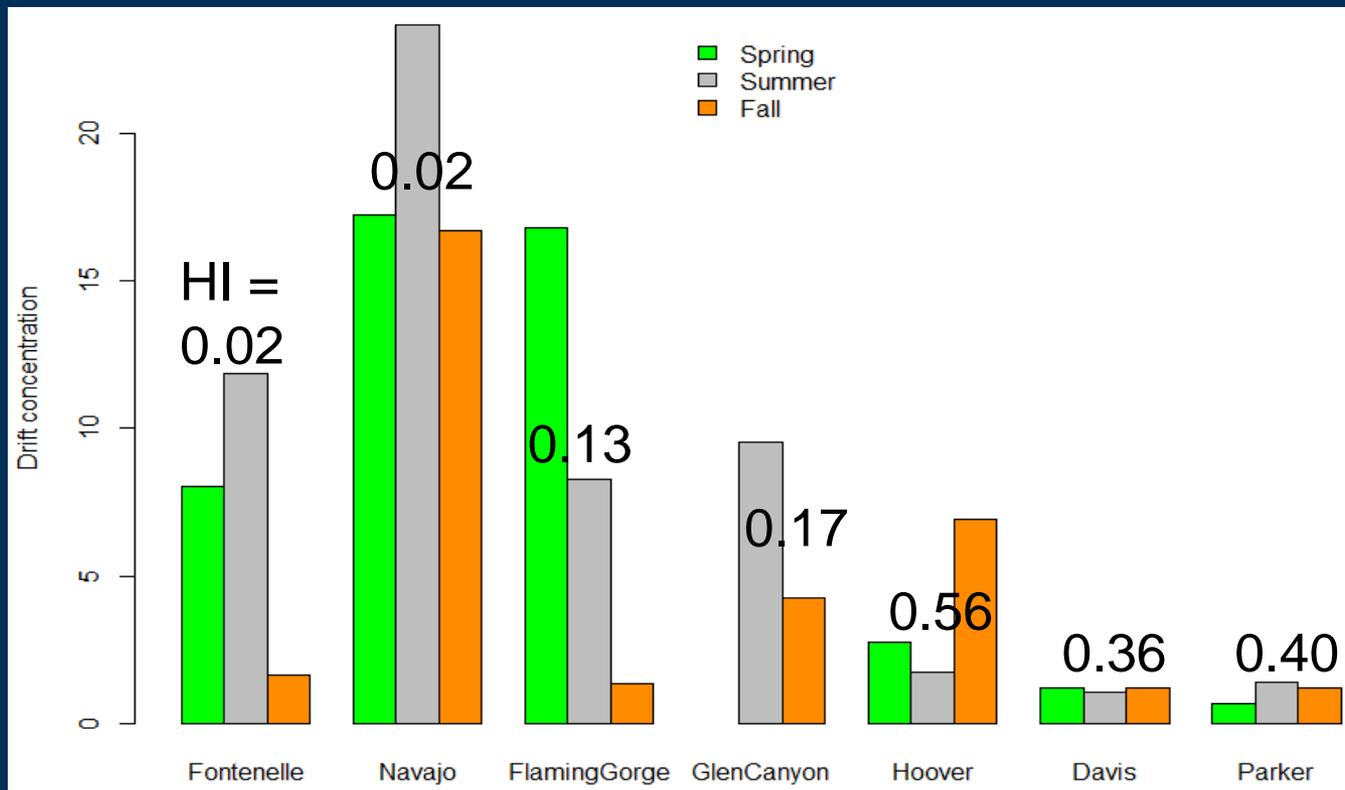
- Aquatic bugs: lay eggs at shoreline, at dusk
- Hydropower dams: High flows, at dusk
- Eggs laid at high flows, at dusk:
  - Dry out and die next day



# Hydropower flows vs. bugs



- ↑ daily flow fluctuation, ↓ drifting bugs

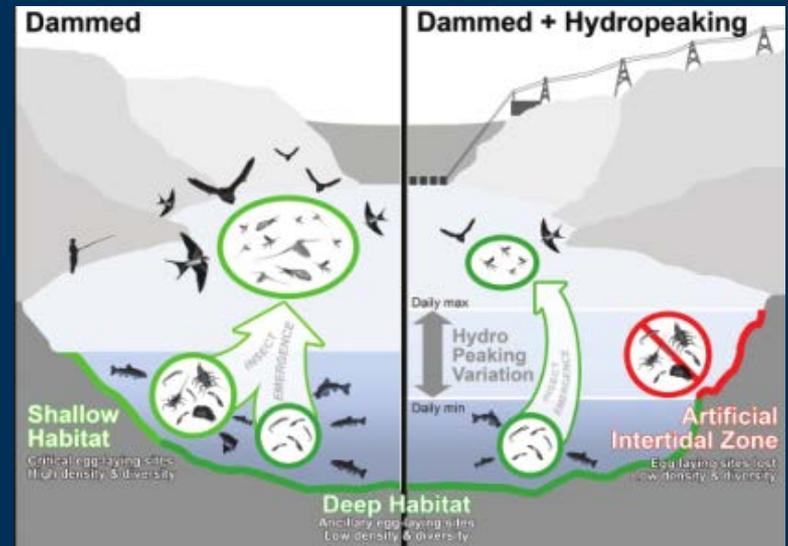
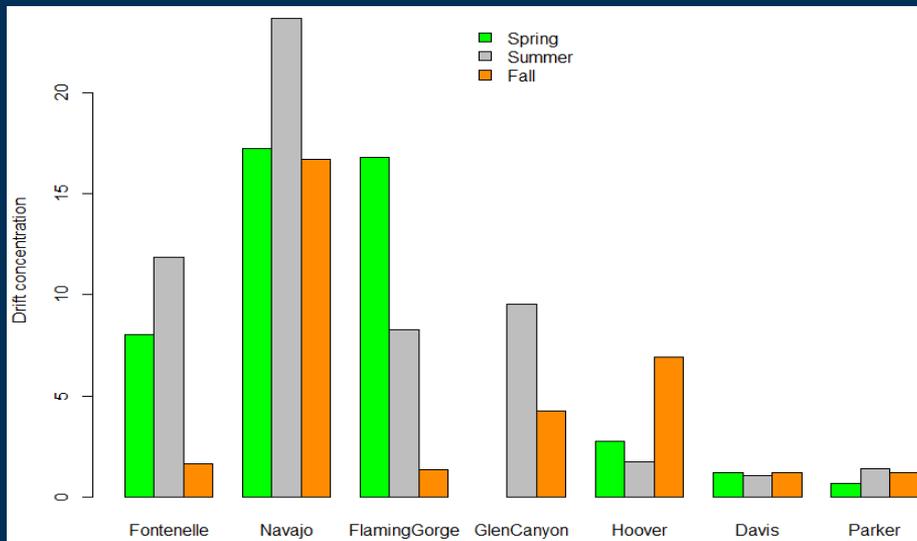


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# Summary

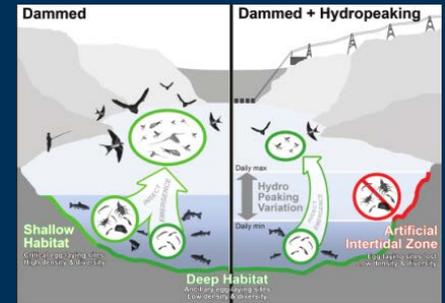
- Drift in large rivers a useful metric
- Dam context matters
- Hydropower flows affect drift predictably



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# Davis Dam is weird



- Despite high daily flow fluctuation, has EPT (LOTS of them!)
- Laying eggs in morning, on open water, on floating docks?
- Something else?
- Warrants study

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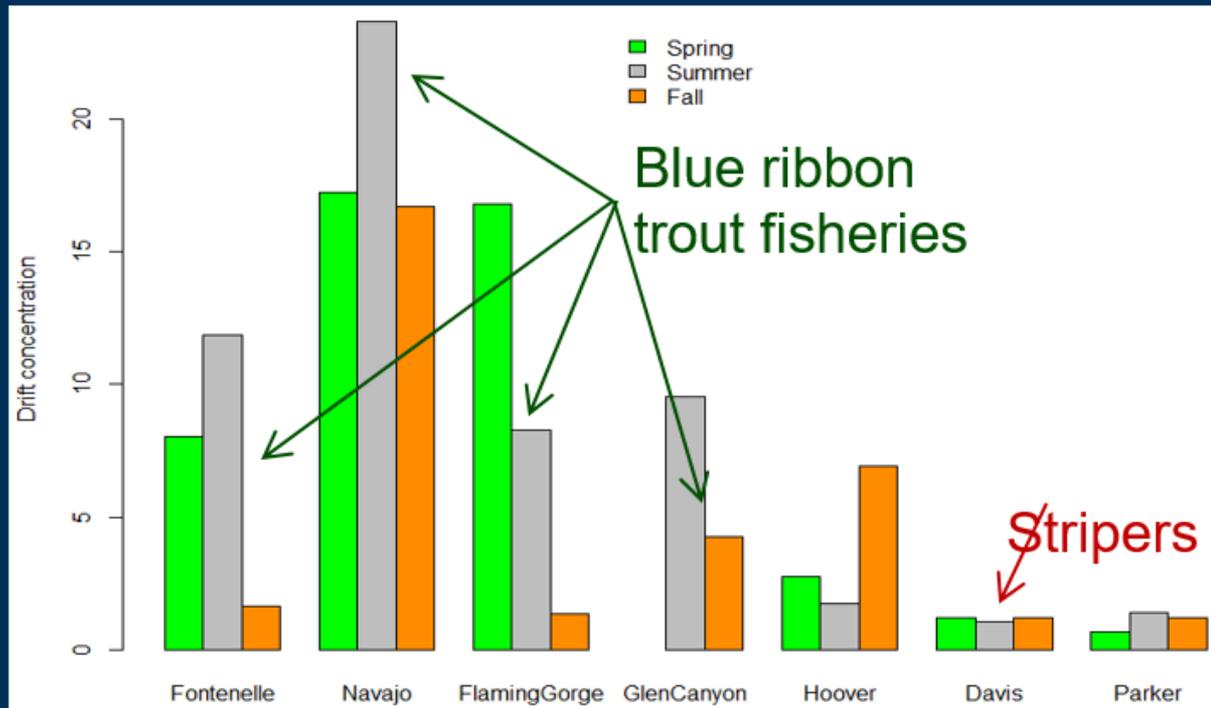
### Fight against caddisflies continues

By NEIL YOUNG and JULIE FAIRMAN News West Apr 26, 2016 0



# Caddisfly control

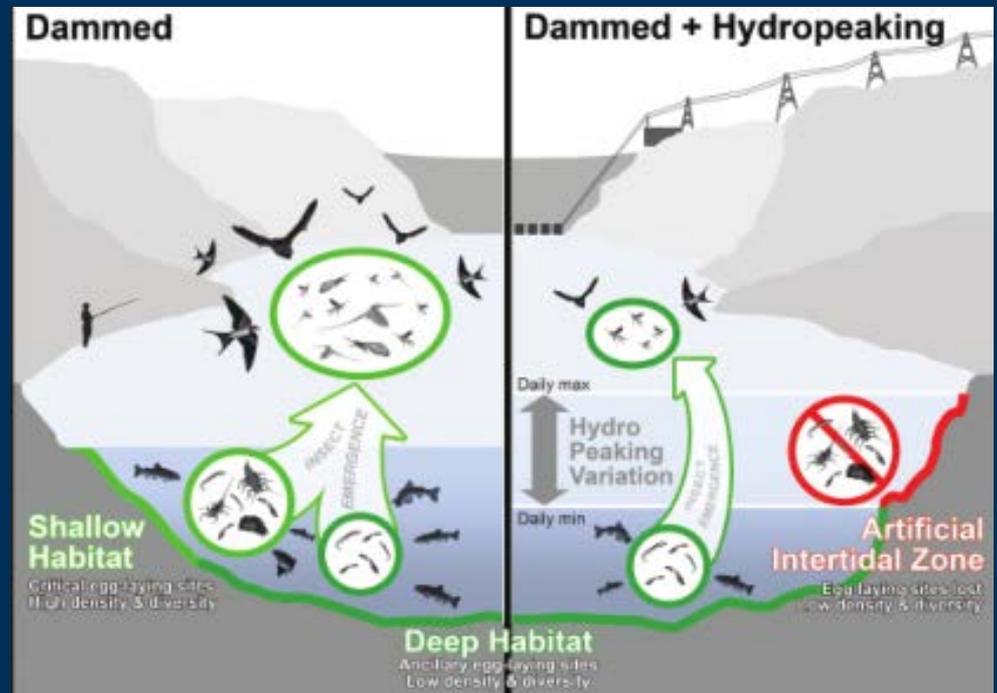
- Stocking thousands of drift-feeding trout
  - This caddisfly (*Smicridea*) not a prolific drifter
  - Top-down control not seen elsewhere in Basin



# Caddisfly control

- Stocking thousands of drift-feeding trout
  - This caddisfly (*Smicridea*) not a prolific drifter
  - Top-down control not seen elsewhere in Basin

- Hit the emerging adults instead?
  - Bats and swallows?



Kennedy et al. 2016 *BioScience*

# Thanks to a startlingly large group of really smart, good people

- **USGS Food base lab:** Adam Copp, Moriah Evans, Anya Metcalfe, Tom Quigley, Eric Kortenhoeven, Ali Ingram, Dallana Garcia-Pena, David Goodenough, Megan Daubert, Dave Foster, Kim Dibble
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- **OSU Lab:** Dave Lytle, Erin Abernethy, Richard Van Driesche
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