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Low Summer Steady Flows Report Status & Preliminary Conclusions

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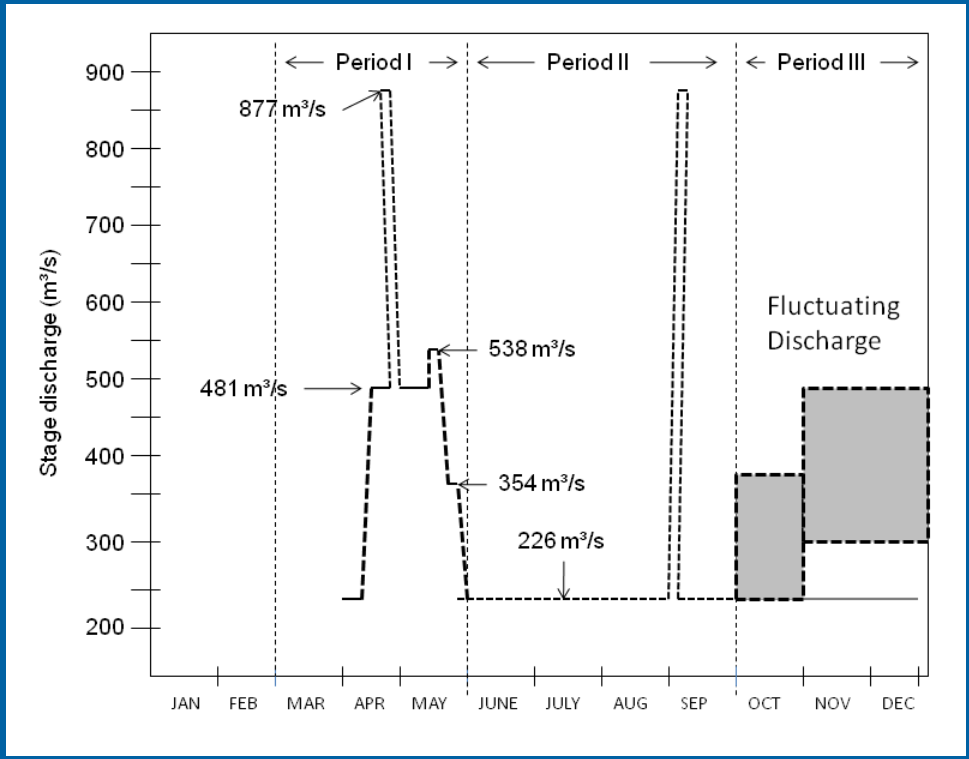
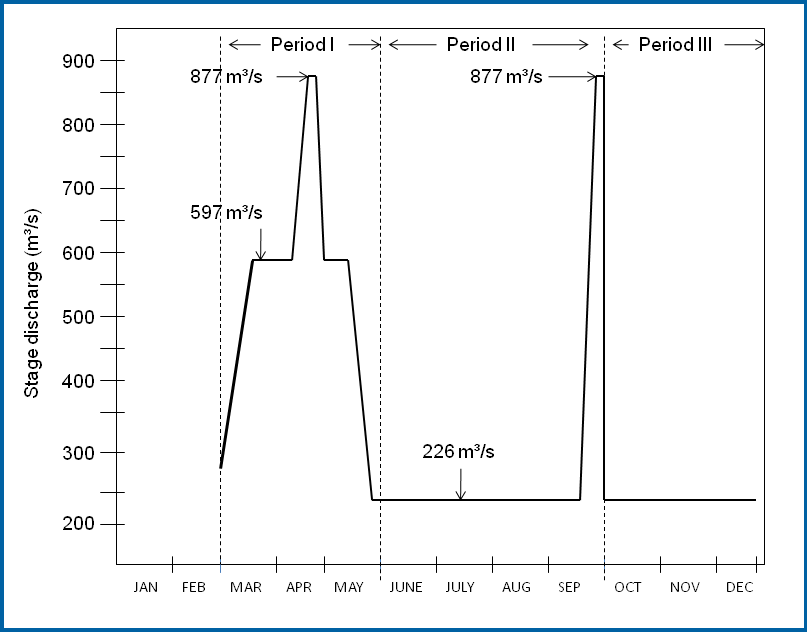


Background

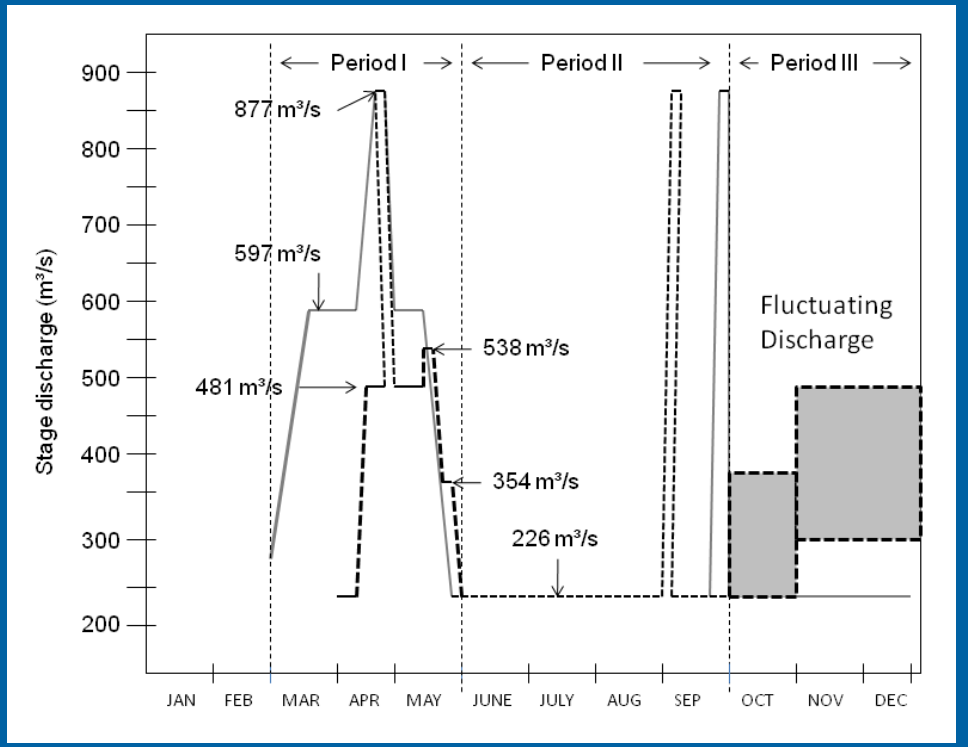
- **U.S. Bureau of Reclamation identified need for plan of experimental flows (SASF) for native fishes.**
- **SWCA developed plan beginning in 1998 w/finalized plan in Spring 2000.**



-To enhance survival and growth of young native fishes by providing stable, warm, productive shoreline nursery habitats
-To increase recruitment of native fishes
-To minimize adverse effects of nonnative fishes
-To contribute to recovery of endangered humpback chub.

Background

- Inflows indicated an 8.23 MAF year
- Discussion of implementing SASF- biological opinion RPA began in January 2000
- Decision to implement in March 2000
- Reduced planning time
- Little monitoring in place
- Revised hydrograph
  - Shortened spring
  - Earlier fall HMF
  - Removed Period III



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Resources/element studied during LSSF experiment

- Physical resources –
  - sediment transport/storage
  - Habitat availability
  - Mainstem & shoreline temperatures
- Biological resources –
  - Lees Ferry and downstream response of fish
  - Riparian vegetation
- Cultural resources
  - Recreation – campsites, safety, experience
  - Economics – power, local economy

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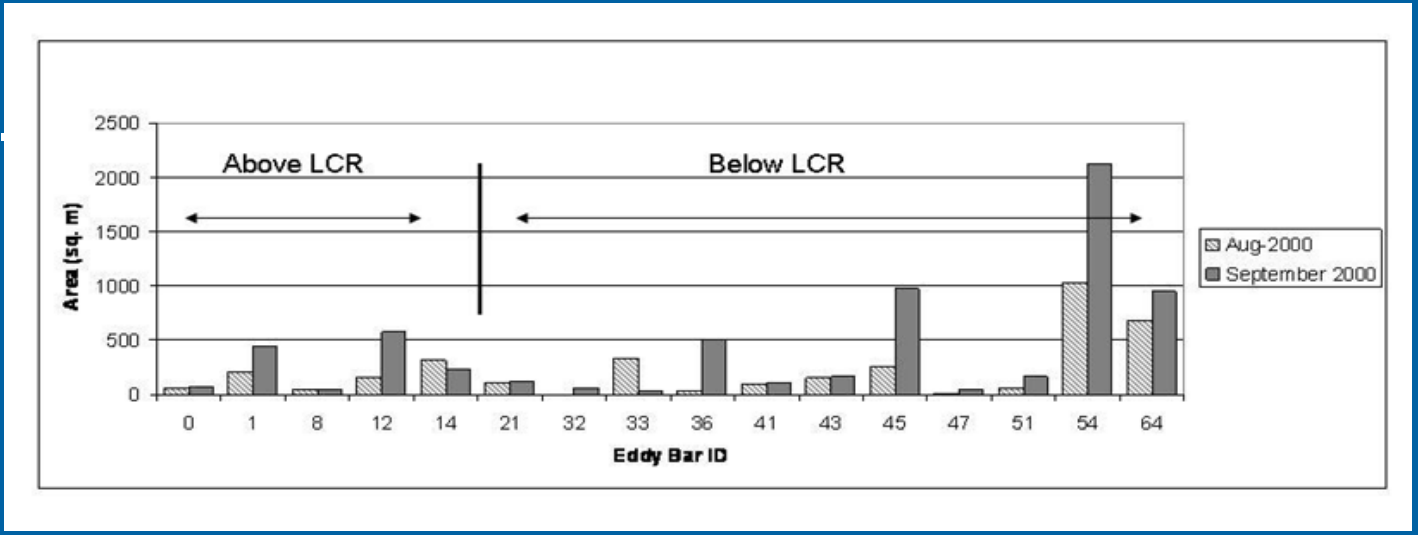
Habitat/sediment export

Short-duration high flows (HMF) export sediment in the absence of inputs (Schmidt and others, 2007)
Backwater habitats change but are stage dependent (Goeking and others, 2003; Grams and others, 2010)

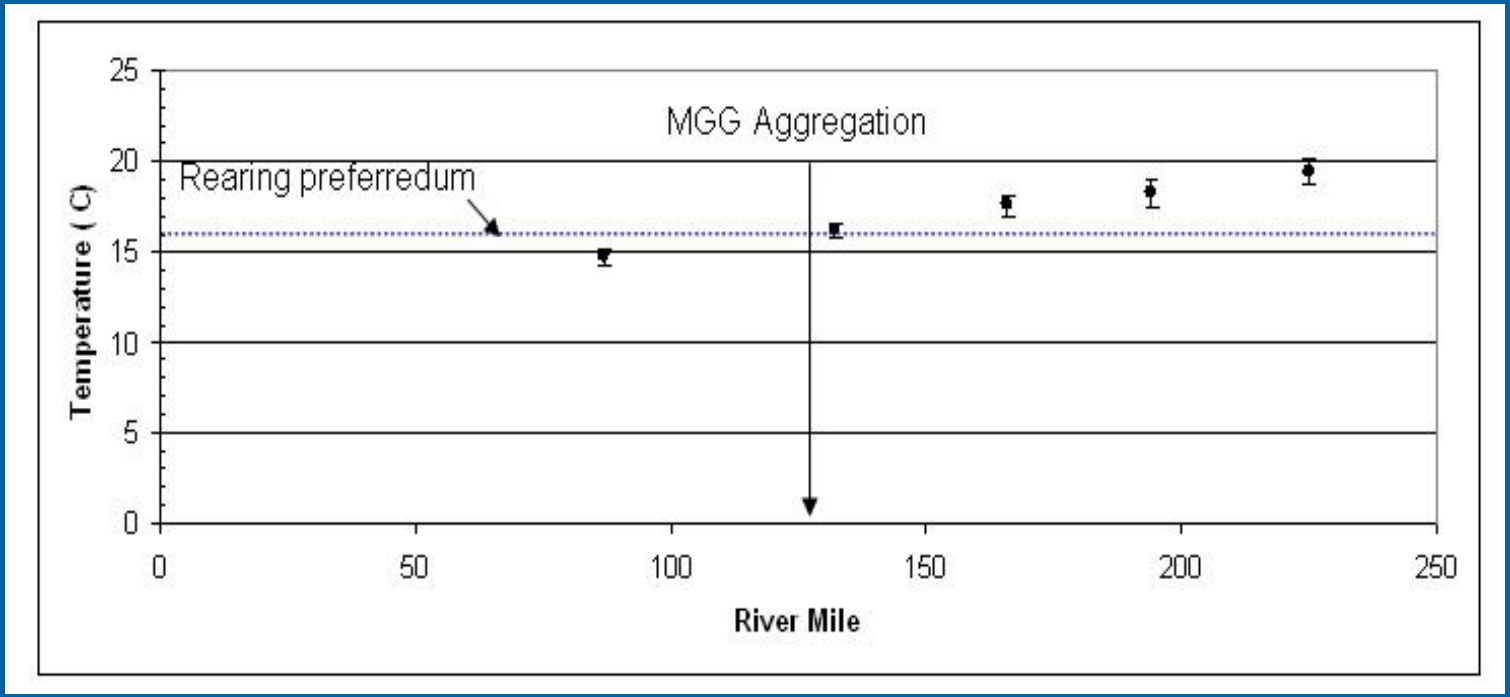


Shoreline habitat availability is controlled by local geomorphology, but generally increases with decreasing discharge (Korman and others, 2004; Protiva and others, 2010)

Mainstem temperatures

Mainstem warming is geographically dependent and affected by volume and release temperatures (Wright and others, 2007).

Warming was not greater than under MLFF w/similar volumes



Mean mainstem temperatures June – August 2000 for RM 87-225

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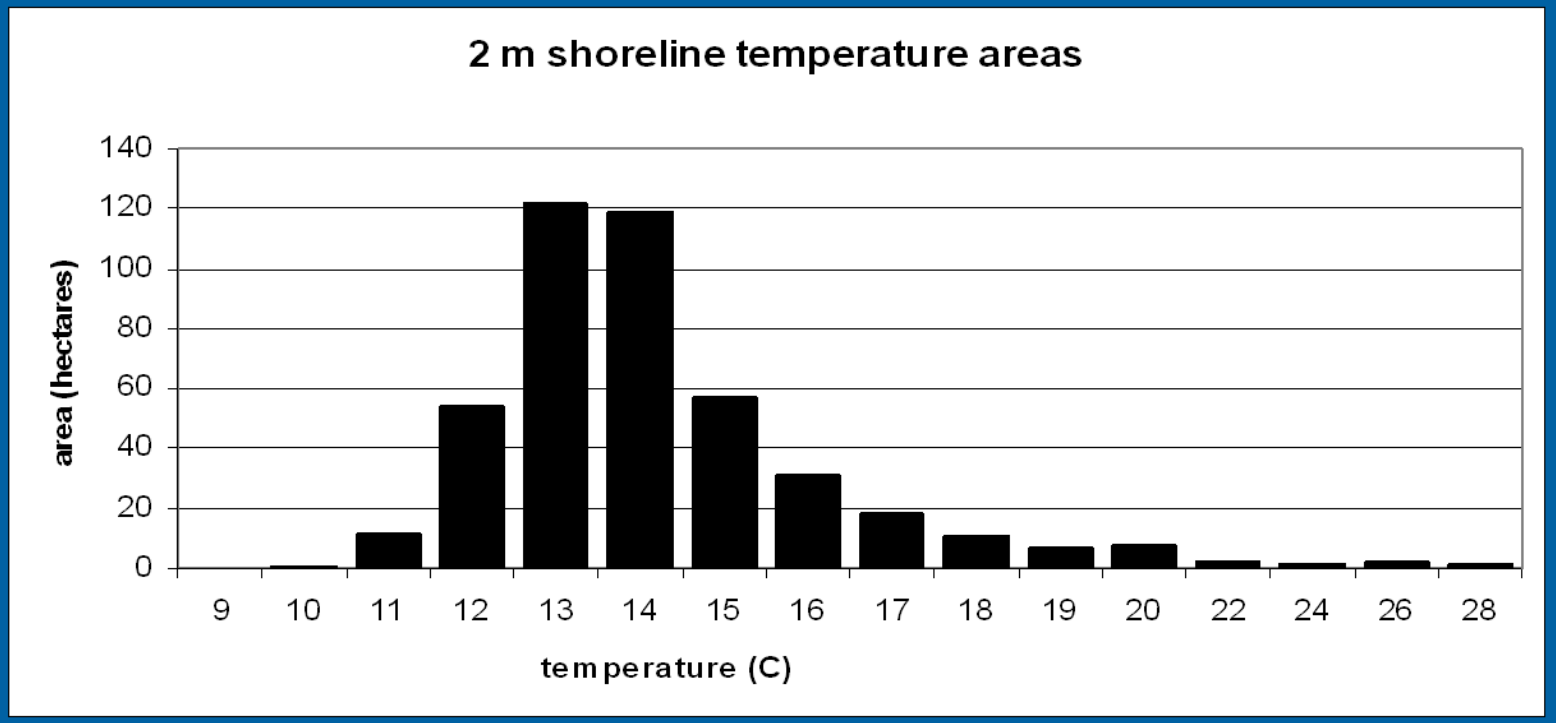
Shoreline temperatures RM 30-72

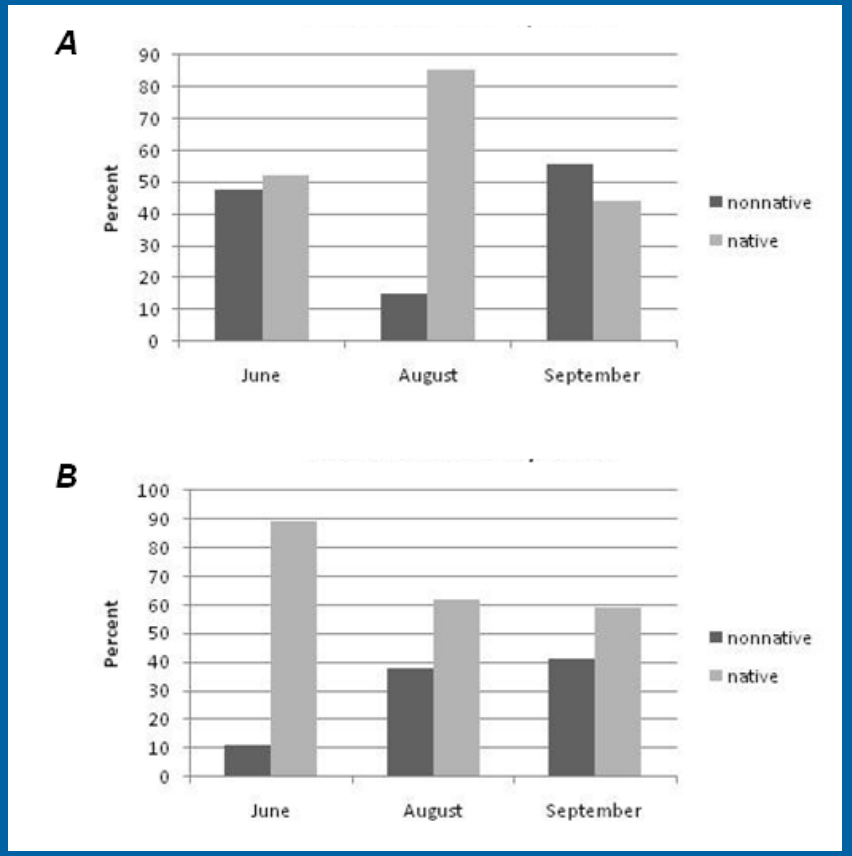


Warming along shorelines occurred though warming was fragmented

Biological Resources – Relative Abundance

seining results

- Nonnative fish abundance were similar to previous years (Trammell and others, 2002)
- Increased abundance of native fish
- More native fish below RM 150 in all seining samples



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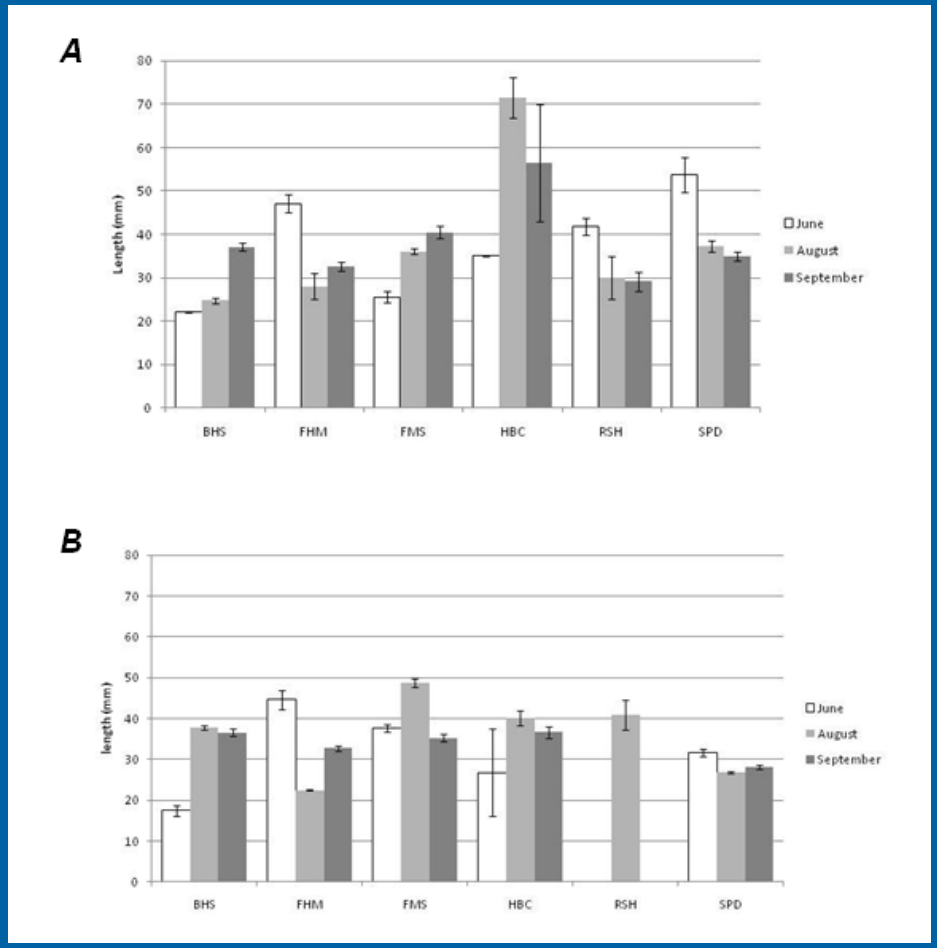
Biological Resources - Growth

Downstream Fish

- Mean length of fish was similar to previous years
- Increases in HBC, FMS, BHS lengths associated with influx from tributary
- Reduction in length of nonnatives associated with mainstem recruitment through summer



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Biological Resources

Downstream Fish

- Trout/brown trout numbers approached their greatest numbers in 2000 and 2001
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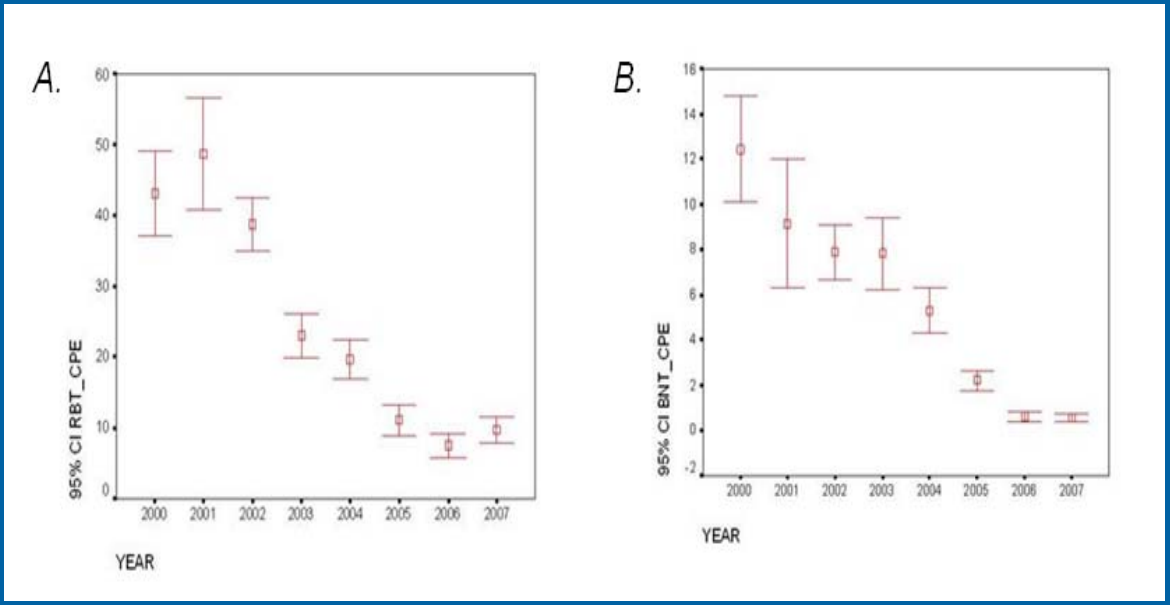

From AGFD, unpublished

Downstream fish

- Native fish did not respond +/- to hydrograph
  - Tributaries play a large role in native fish reproductive success.
  - Spring ponding flows are likely too small in magnitude and too short to be effective – Have no information to know if spawning/larval survivorship is a problem.
  - May have had increased survival and mainstem spawning in Western Grand Canyon by Flannelmouth sucker- warmer water.
- Mainstem operations may benefit predatory nonnatives by increasing water clarity
- Critical to have robust monitoring in place to evaluate response.

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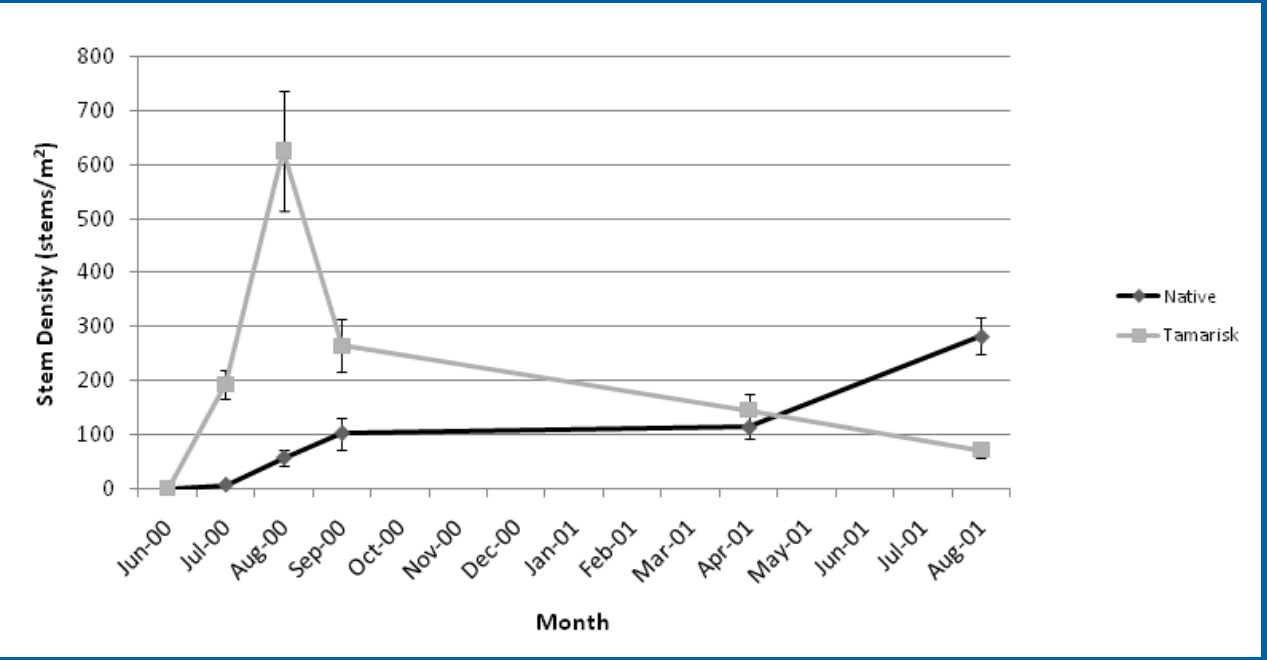
Riparian vegetation

Spring and summer hydrograph provided opportunity for tamarisk seedling establishment

- Spring flows scoured shoreline
- June steady flows timed w/tamarisk seed production



From Porter, 2002

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Recreation

Rafting

- More campable area
- Mid-elevation sandbar area increase
- Accidents early but boaters adjust
- More time spent on water (50 percent less time at attraction sites (e.g., 3.5 hrs vs. 7 hrs) (Roberts and Bieri, 2001)

Recreation – Angling Quality

- Better shoreline access for wading
- HMFs limited angling
- Invertebrate biomass – little affected by LSSF
- Exception - - New Zealand mudsnail biomass increased significantly under steady flows

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Economics

Limited to financial costs to power customers, commercial recreation businesses, regional costs.

- **Power customer costs ($32 million)**
  - **Shifted water allocation & onset of basin-wide drought**
  - **reduced power generation**
  - **spot market costs in summer for replacement power and market price fixing in 2000 (e.g., Enron)**
  - **short notice prevented buying supplemental power in blocks prior to experiment.**

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Economics

Commercial recreation – 124,000

- **Day rafting not affected**
- **White water rafting – $70,000**
  - **equipment damage early in summer**
  - **Refund evacuated trip**
- **Angling - $33,000**
  - **Cancel trips during HMF (spring and fall)**
  - **Holiday weekend HMF in September may have affected more than if planned in mid-week.**

- **Total cost include evacuation costs, related – businesses – health care, lodging, restaurants**

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Learning Opportunities

- Complicated hydrograph reduced learning opportunities
- Mainstem experiments should focus on life stages affected by mainstem operations
  - High spring flows have little effect on tributaries, but a short pulse reworks sediment and creates campable area/backwaters for summer. HFE protocol
  - Habitat stability was variable being tested – September HMF disrupted this.
  - Mainstem spawning is limited by mainstem temperatures w reservoir temperatures a strong driver
- Lack of monitoring weaken interpretive ability
- Publishing results is important step in learning.