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Effects of Varied Flows on Near Shore Physical and Biological Parameters: Results and Recommendations

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Introduction & Background

- **Operations affect reproduction and recruitment of fishes in Grand Canyon** (McKinney et al. 1999; Gorman and Stone 1999; Robinson & Childs 2001; Korman et al. 2004; Korman et al. 2005)

- **2005 fall flows designed to evaluate sediment transport under steady vs. low fluctuating flows.**

- **Opportunity to evaluate biological response to flows**

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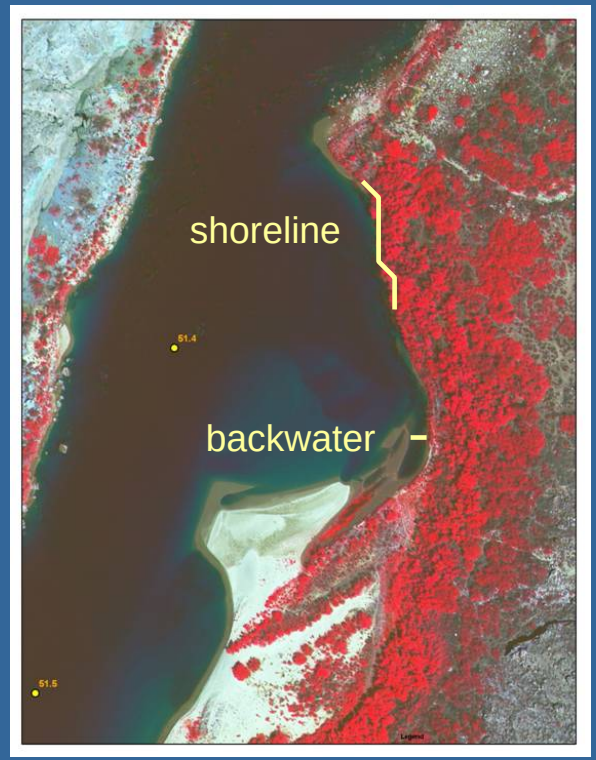
Objectives

To determine if physical and biological parameters differed between flows and habitats.



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Parameters

Physical

Temperature

Turbidity

Specific conductivity

pH

Salinity

Velocity

Biological

Abundance and composition of:

- Phytoplankton
- Benthic invertebrates
- Fishes

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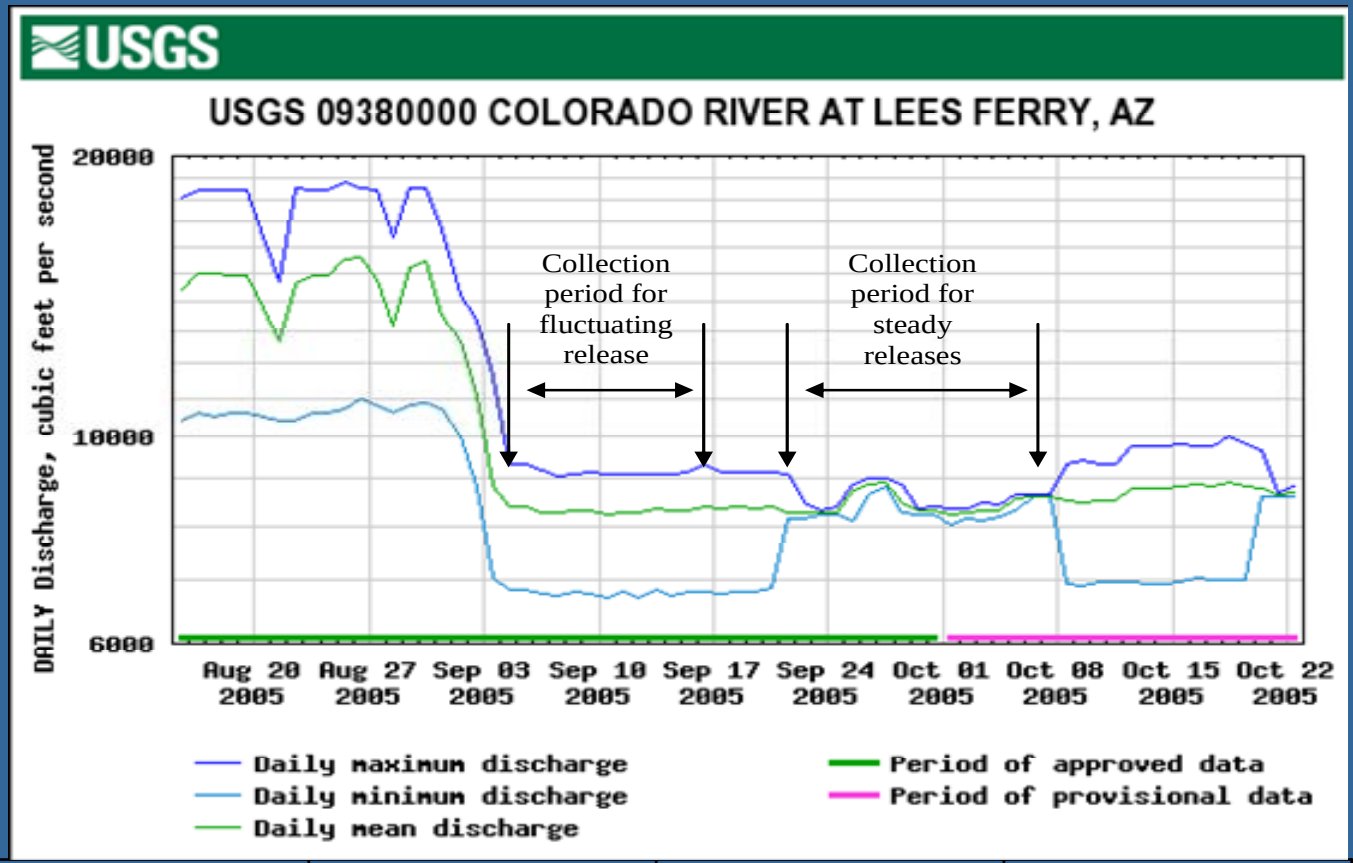
Hydrology



Collection Dates	Maximum Releases (ft^3/s)	Minimum Releases (ft^3/s)	Range (ft^3/s)	Median Release (ft^3/s)
Sept. 4 - 16, 2005	9310	6690	2620	8830
Sept 22 – Oct 7, 2005	9010	8040	970	8360

Physical parameters

	Fluctuating BW	Fluctuating shoreline	Steady BW	Steady Shoreline
Surface water temp (°C)	19.5 ± 0.5 s.e.	18.1 ± 0.3 s.e.	18.4 ± 0.4 s.e.	17.3 ± 0.5 s.e.

Temperatures were lower during steady flows relative to fluctuating flows.

Likely due to changes in day length/solar radiation

Water temperatures in backwaters were approximately 1°C warmer than shorelines.

Not certain of biological significance.

Physical parameters

	Fluctuating BW	Fluctuating Shoreline	Steady BW	Steady Shoreline
Turbidity (NTU)	21.6 ± 2.4 s.e.	25.3 ± 3.3 s.e.	5.6 ± 0.4 s.e.	3.9 ± 0.4 s.e.

Turbidity was higher during fluctuating flows than under steady flows

- Spates from Paria, LCR during first trip

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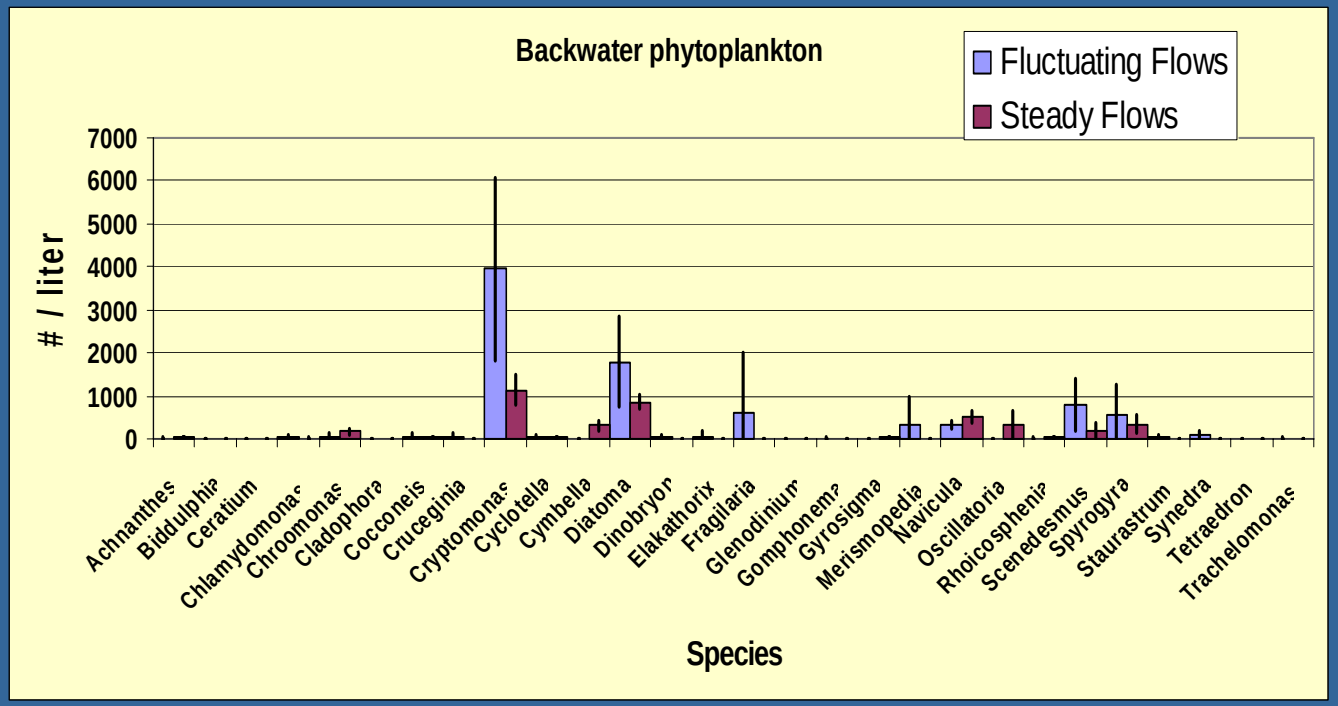
Backwater Phytoplankton

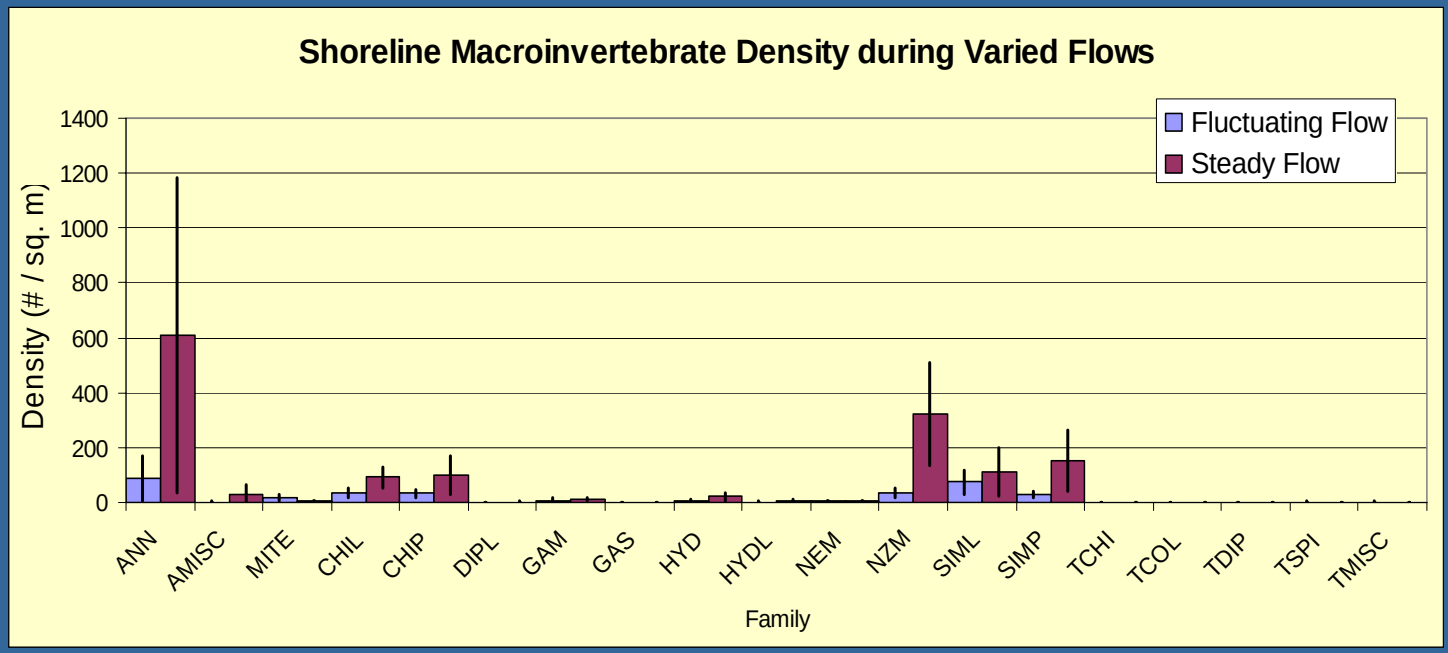


Plankton densities were significantly higher under fluctuating flows than under steady flows in backwaters and shoreline habitats.

Likely associated with antecedent flows + reservoir stratification

Plankton densities between habitats were not significantly different under either flow

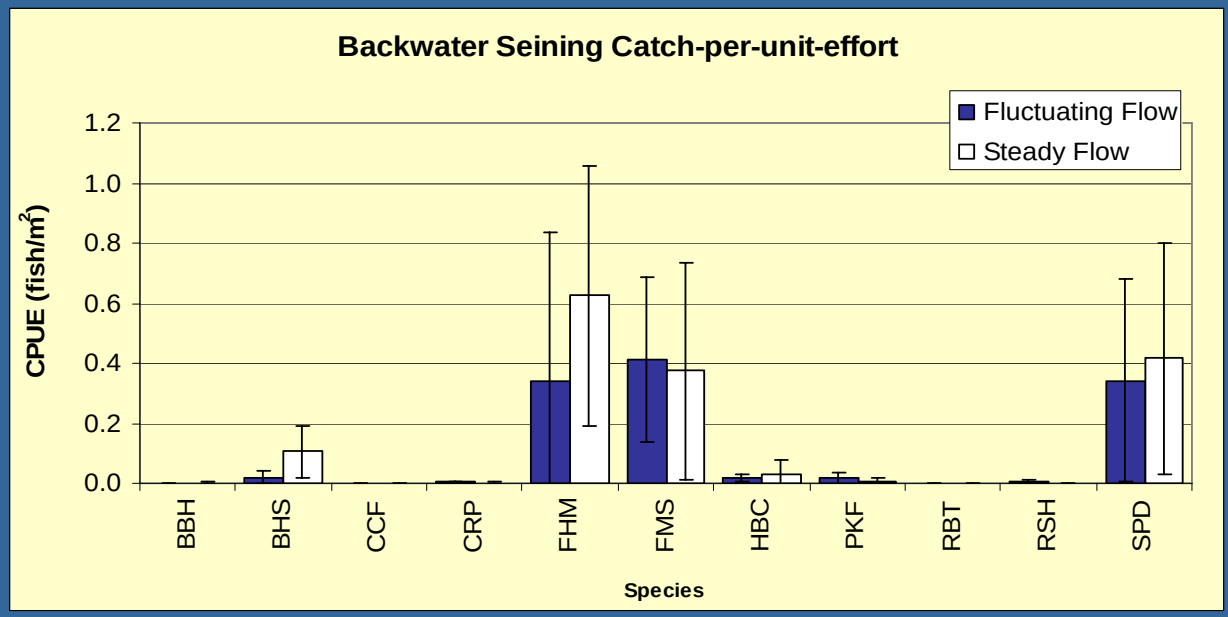
Shoreline Macroinvertebrates



Total Macroinvertebrate densities were not different between flows or habitats

- **Turbidity during first trip, antecedent conditions**
- **Life cycles & duration of flows insufficient to have an effect**
- **High variance in samples**

Backwater fish abundance



Bluehead sucker relative abundance in backwaters was higher during steady flows relative to fluctuating flows.

- **Lower turbidity during steady flow treatment?**
- **Tributary spates and fish entering mainstem?**

Relative abundance for all other fish did not differ between flows.

Overall Conclusions

- **Reliable conclusions about flows and biological resource interactions are limited.**
  - Treatment duration too short
  - Antecedent conditions
  - Local hydrology and change in day length

- **Biological and physical parameters measured were similar between flows with the exception of:**
  - Temperatures were higher in backwaters and declined over time.
  - Turbidity was higher under fluctuating flows in both habitats
  - Plankton densities were higher under fluctuating flows.
  - Bluehead sucker relative abundances increased under steady flow treatment.

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Recommendations

- **Studying in lab situation first**
- **Extend duration of treatment**
- **Conduct earlier in year (e.g., late spring, summer)**
- **Limit collections to areas of importance for native fishes (e.g., LCR confluence) and collect more frequently**

E-link: http://pubs.usgs.gov/of/2007/1195/.

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