



Humpback Chub: Population Status and Trends

Scott VanderKooi

Southwest Biological Science Center

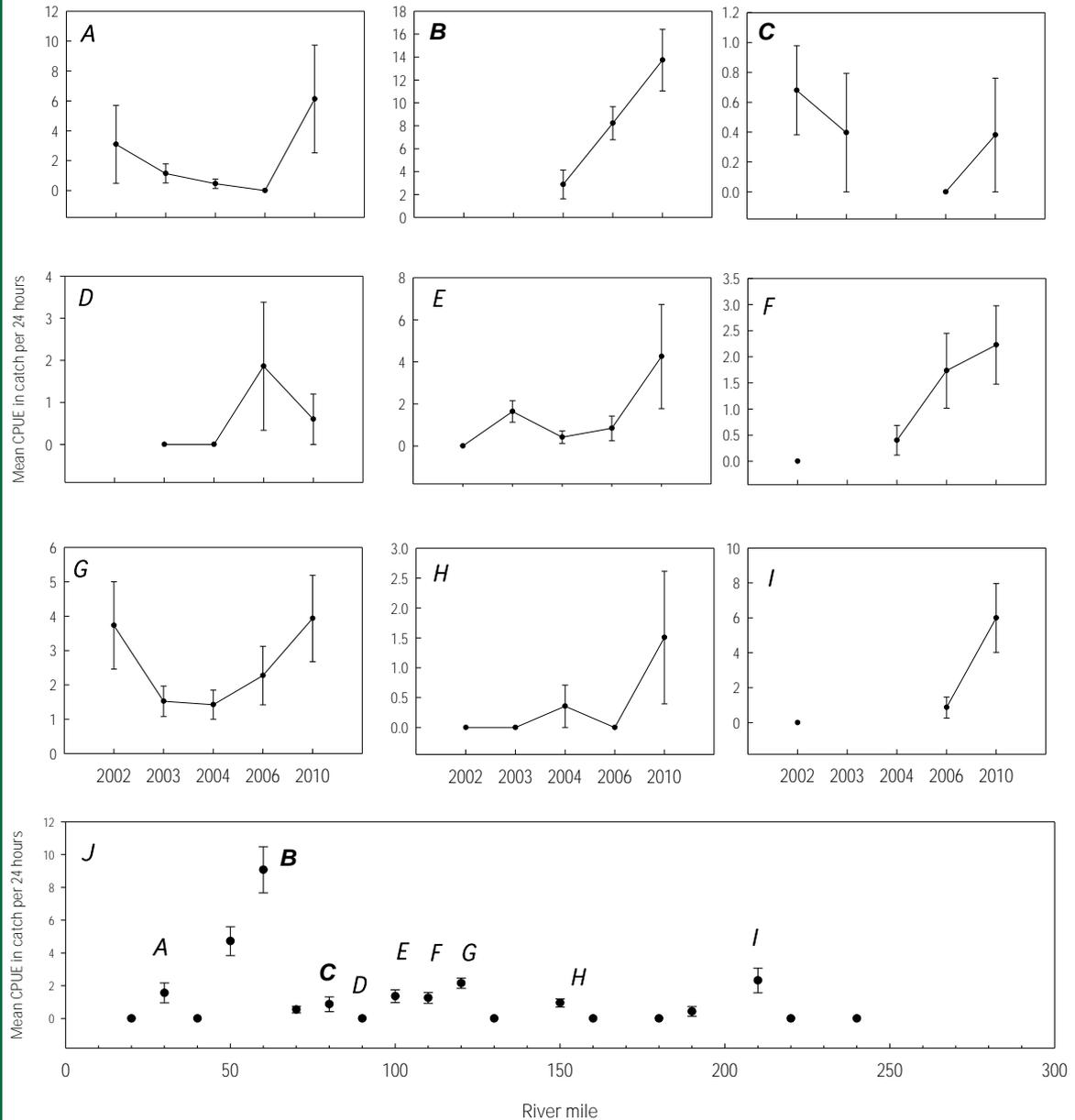
Grand Canyon Monitoring and Research Center

Mainstem Colorado River Monitoring

- Aggregation Sampling
- Near Shore Ecology

Aggregation Sampling: Trammel Net Catch Per Unit Effort

- A 30-Mile
- B Little Colorado River Inflow
- C Lava Chuar-Hance
- D Bright Angel Creek Inflow
- E Shinumo Creek Inflow
- F Stephen Aisle
- G Middle Granite Gorge
- H Havasu Creek Inflow
- I Pumpkin Spring



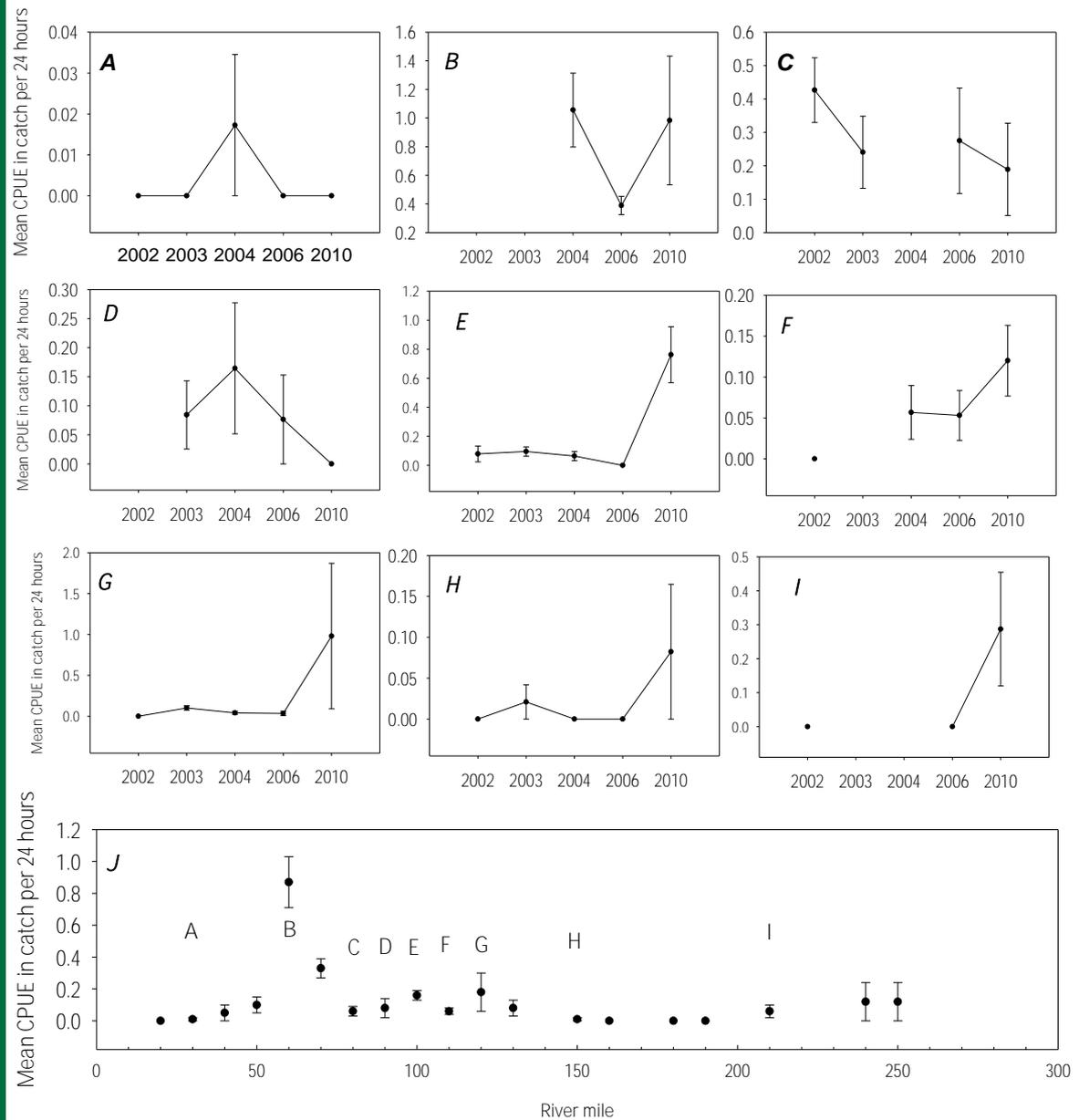
PROVISIONAL DATA



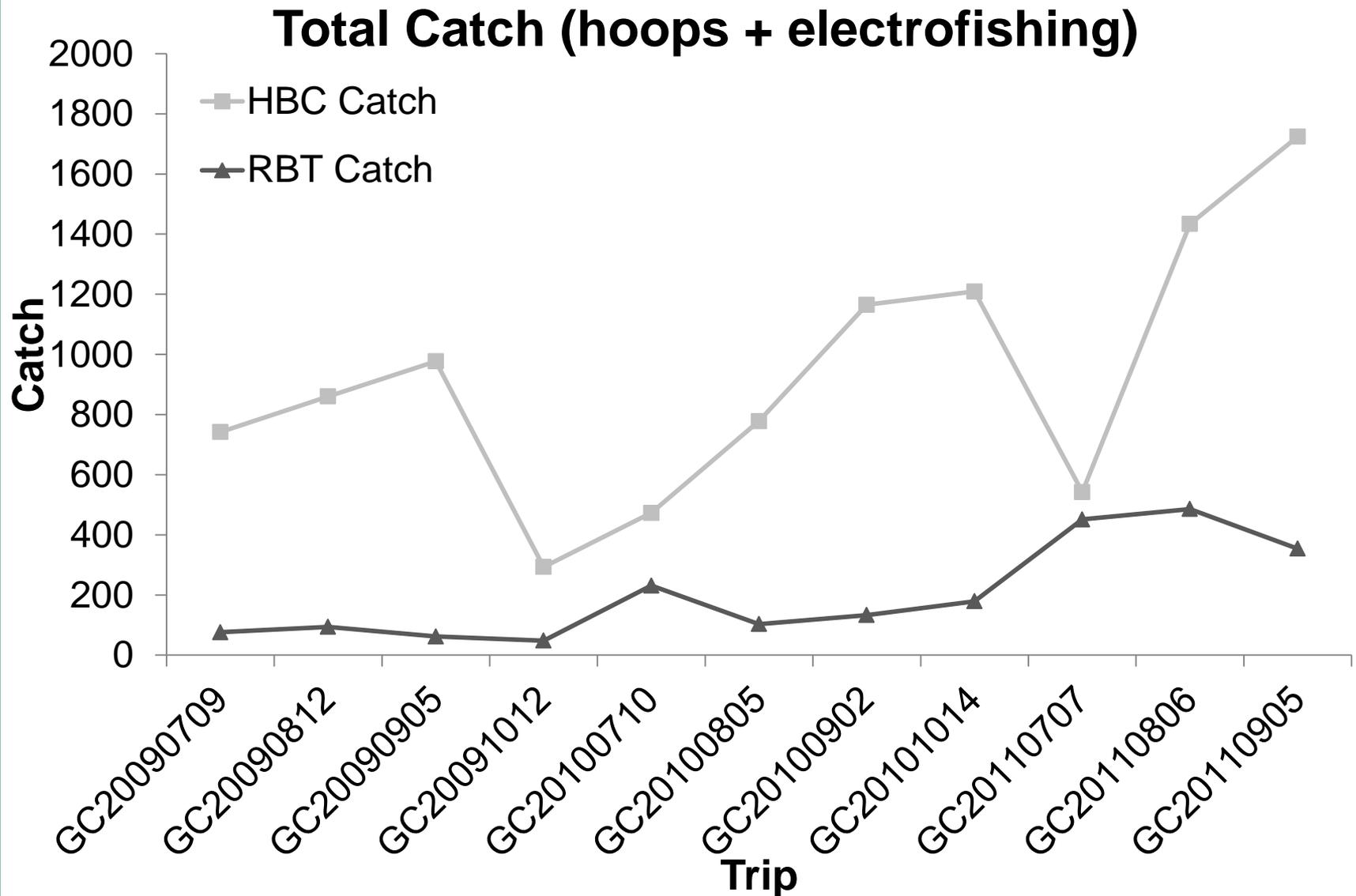
Aggregation Sampling: Hoop Net Catch Per Unit Effort

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PROVISIONAL DATA



Near Shore Ecology Sampling



(Pine et al. unpubl.)

Near Shore Ecology Sampling

Humpback Chub Inter-annual Survival

		Jul 09 – Oct 09	Oct 09 – Jul 10	Jul 10 – Oct 10	Oct 10 – Jul 11
HBC 40-99 mm TL	Monthly Survival Rates	0.9761583	0.9274564	0.9427993	0.8974030
	Annual Survival Rates	0.47228296		0.31633361	
HBC 100-199 mm TL	Monthly Survival Rates	0.86568 48	0.9864301	0.8045137	0.9925088
	Annual Survival Rates	0.5736886		0.48664204	

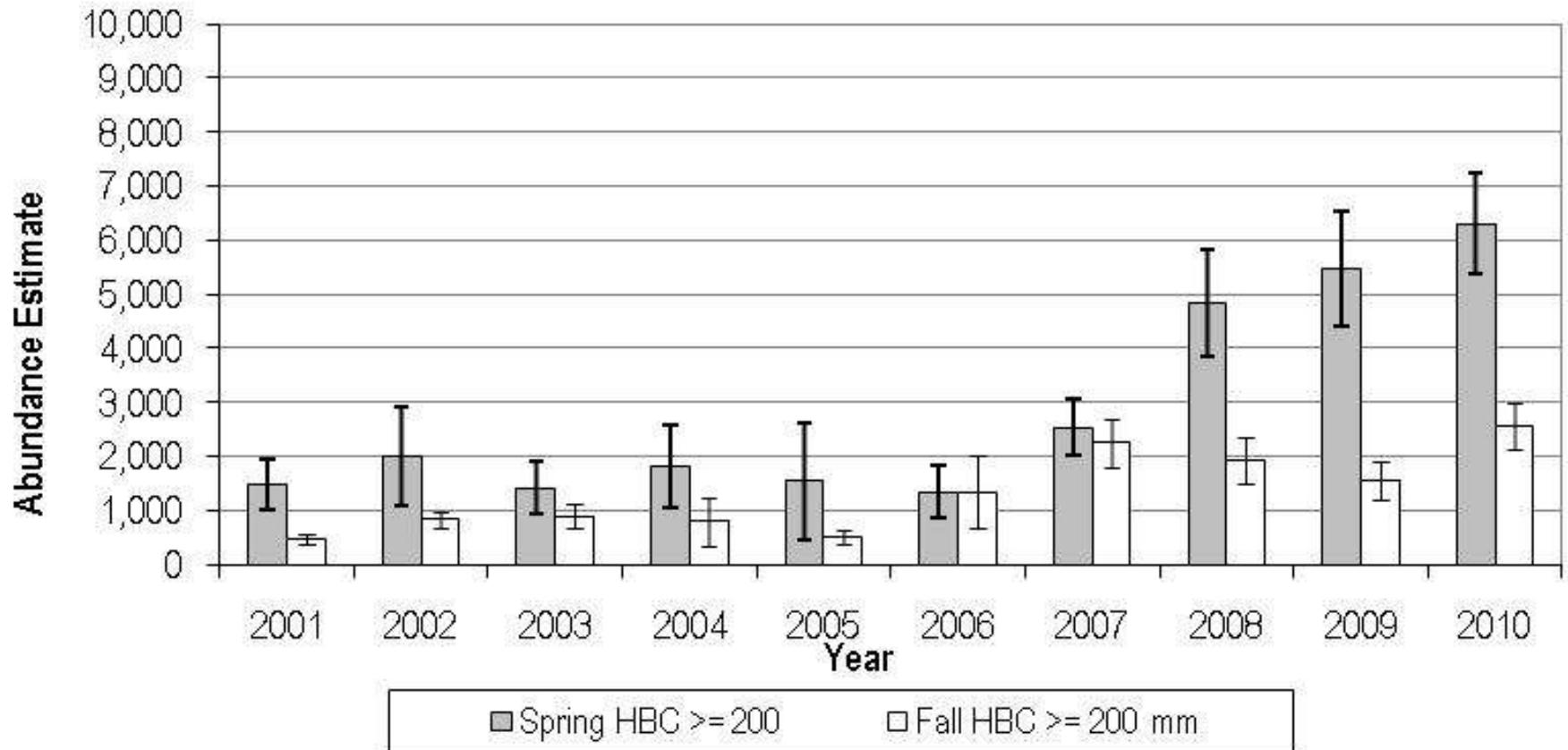
(Pine et al. unpubl.)

Little Colorado River Monitoring

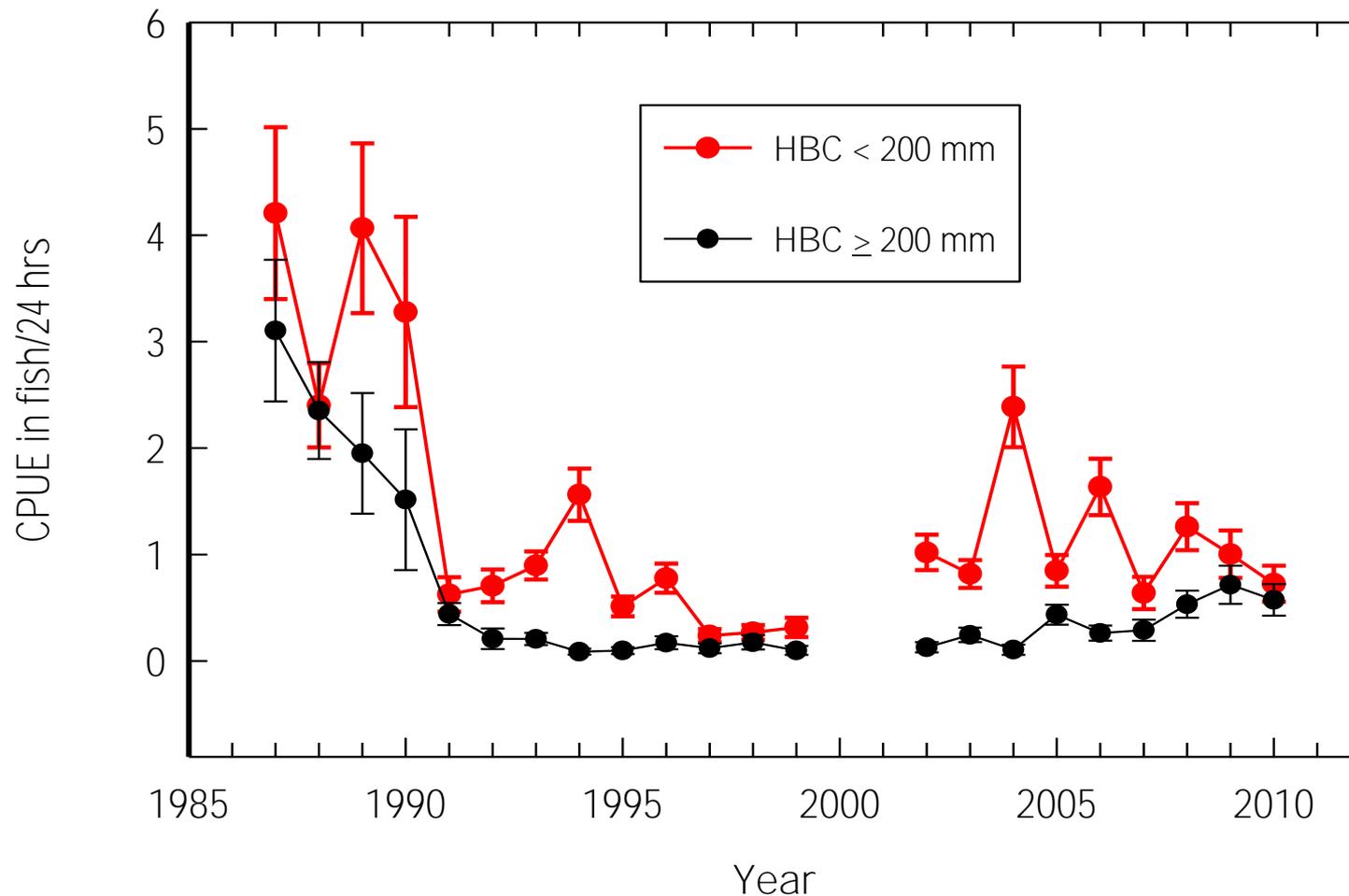
- Spring and Fall Sampling
- Lower 1200 Sampling



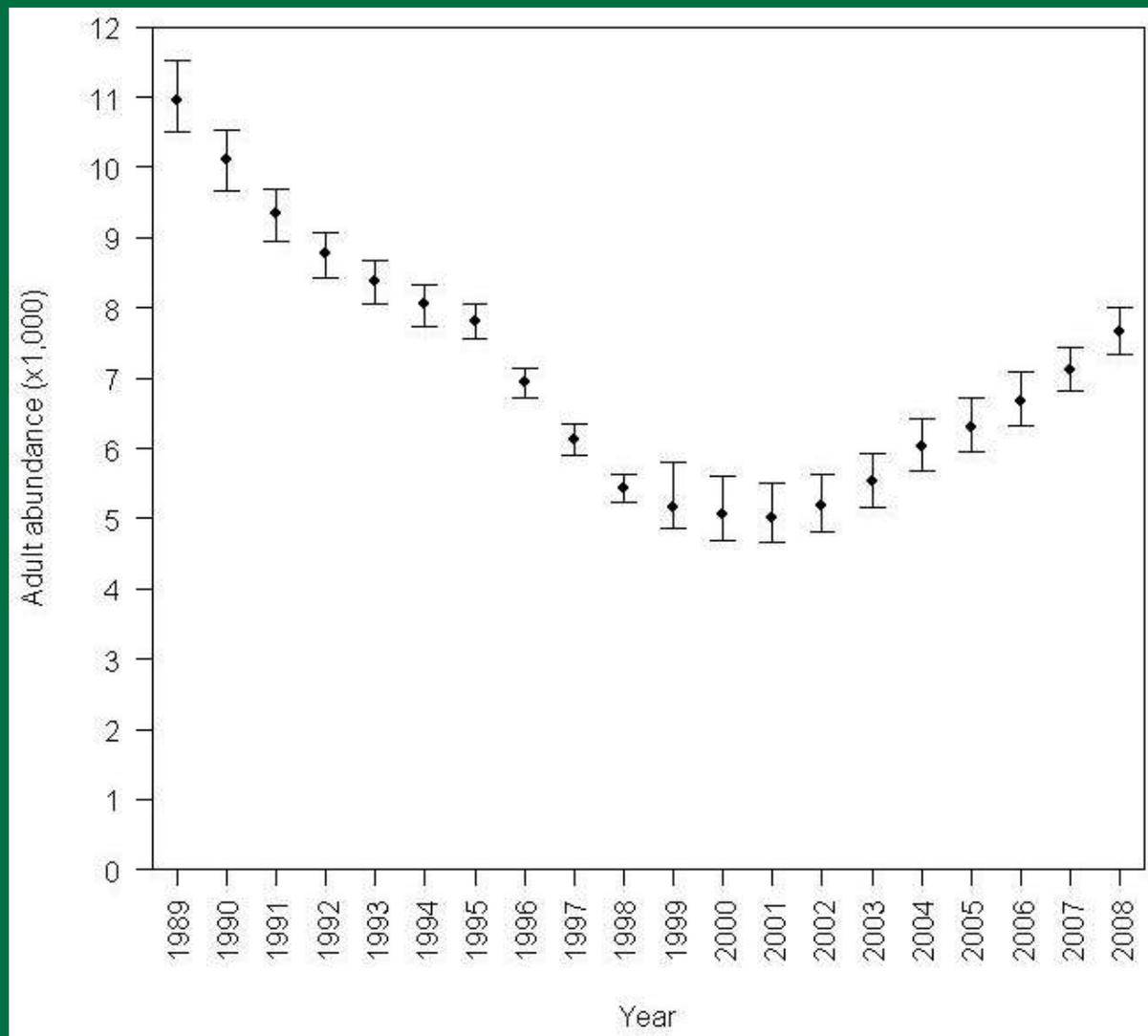
Little Colorado River Spring and Fall Population Estimates (≥ 200 mm)



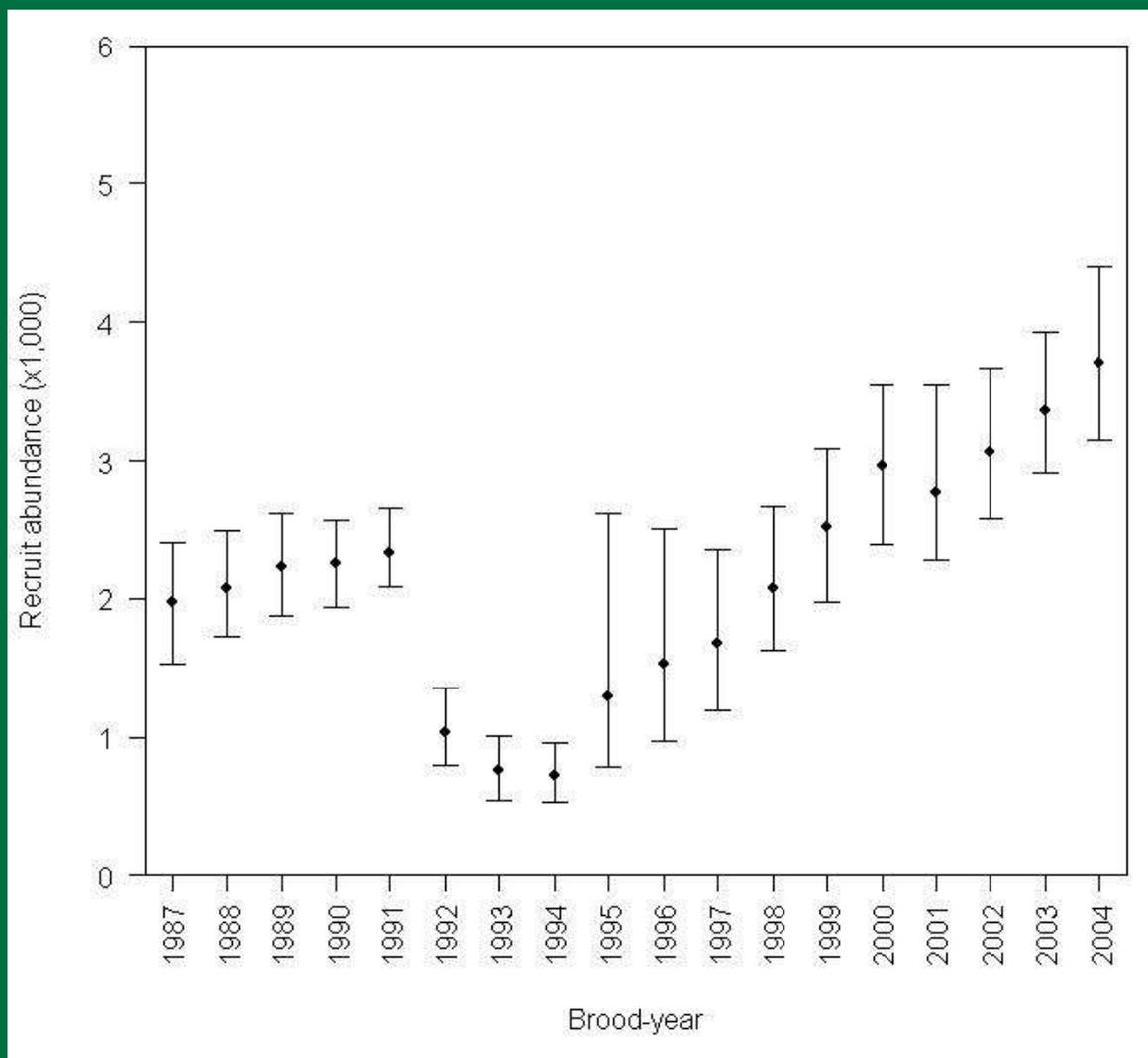
Little Colorado River: Lower 1200 m Sampling Catch Per Unit Effort



Age Structured Mark Recapture (ASMR) Model Population Estimates



Age Structured Mark Recapture (ASMR) Model Recruit Abundance Estimates



Humpback Chub Translocations

- Chute Falls:
1,752 age-1+ fish
- Shinumo Creek:
800 age-1+ fish
- Havasu Creek:
300 age-1+ fish
- Dexter: 685 age-0 fish
- NAU: 500 age-0 fish
(hatchery spawned)



(VanHaverbeke et al. unpubl.)

Conclusions on Humpback Chub Trends

- System wide increase in adult humpback chub population since early to mid 2000s
- Recruit abundance began increasing as early as mid 1990s
- High catches of juvenile humpback chub in NSE reach throughout the study
- Survival rates of juvenile humpback chub in NSE reach have remained relatively high
- Translocations: some survival and apparent good growth

Some Remaining Uncertainties Regarding Humpback Chub

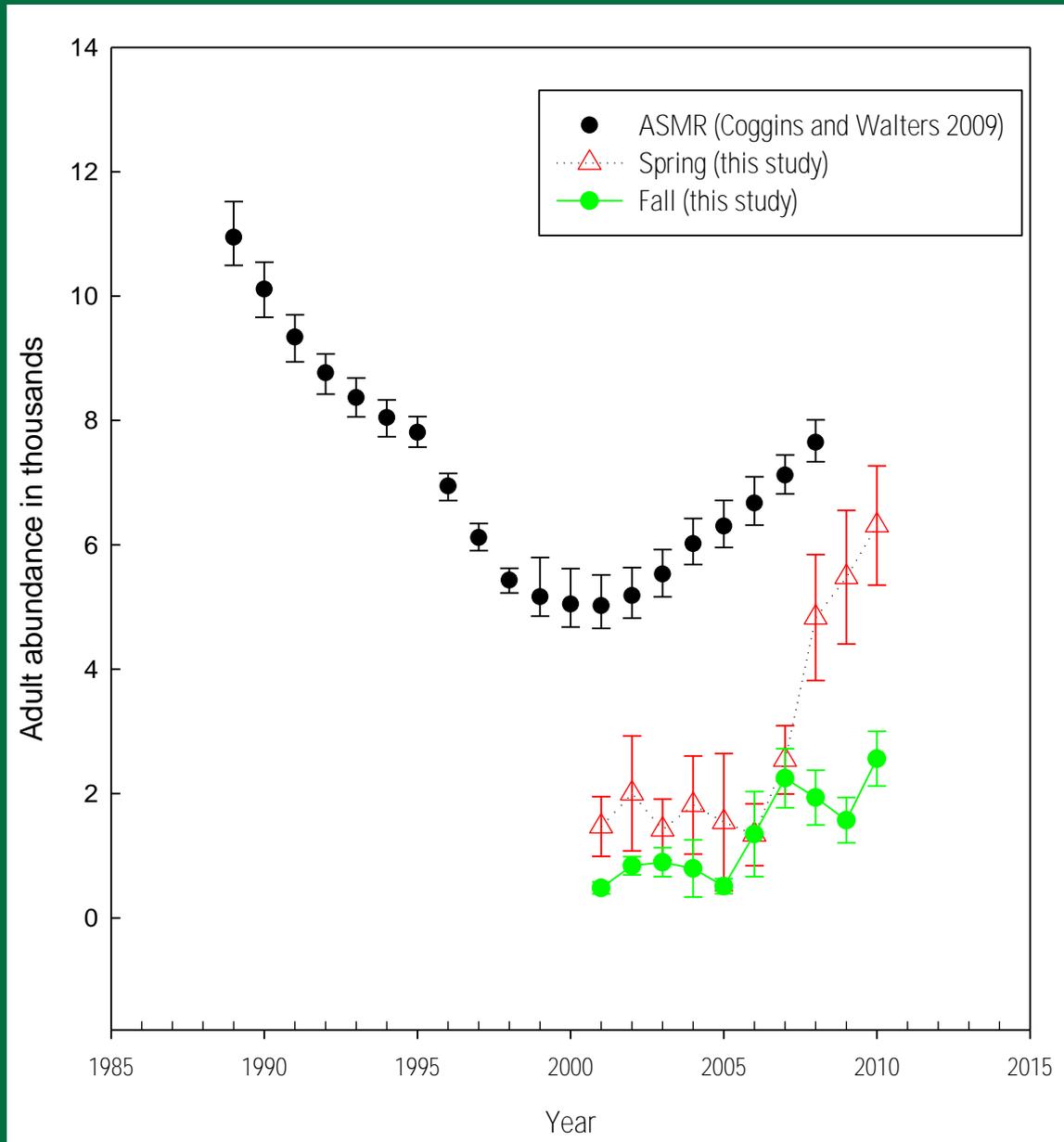
- Influence of various management actions on humpback chub population trends
- Relative contributions of mainstem and tributary groups to overall humpback chub population
- Applicability of NSE findings to other reaches of the river
- Relative contribution of translocated fish to overall humpback chub population

Most Relevant AMWG Priority:

Priority 1. Why are humpback chub not thriving and what can we do about it? How many humpback chub are there and how are they doing?



Humpback Chub Population Estimates



(Coggins and Walters 2009; VanHaverbeke et al. unpubl.)

Most Relevant Strategic Science Questions: SSQ1

- *SSQ1. To what extent are adult populations of native fish controlled by production of young fish from tributaries, spawning and incubation in the mainstem, survival of young-of-year (YOY) and juvenile stages in the mainstem, or by changes in growth and maturation in the adult population as influenced by mainstem conditions?*



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- Most population assessment work focused on humpback chub with much less effort on other native species
- Humpback chub populations have shown increases in adult (age 4+) population size since about 2000 (ASMR)
- Population increases can come from increases in births or decreases in death
- This question seems to ask which is most likely?

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- Response and source:
- *Start simple, before fish are adults, they are juveniles*
- *To date NSE otolith microchemistry results have only documented spawning in LCR or 30-mile region (from fish collected in 30-mile aggregation)*
- *NPS has captured small HBC in Havasu that are not PIT tagged and natal origin unknown*

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- Response and source:
- This suggests that **YES** adult populations of HBC are controlled by “*production of young fish from tributaries*”
 - LCR supports the majority of spawning and no evidence to date of spawning occurring in previously unknown locations

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- Response and source:
- “...*spawning and incubation in the mainstem...*”
 - No evidence to date of spawning occurring in previously unknown locations

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- “...*survival of young-of-year...*”
- *Estimates of YOY and juvenile survival in mainstem from NSE*
- *2009 juvenile HBC survival 49%± 0.03; 95% CI 44-54%*
- *2010 juvenile HBC survival 45%± 0.05; 95% CI 35-55%*
- *2011 estimates pending completion of trip that is on the water right now*

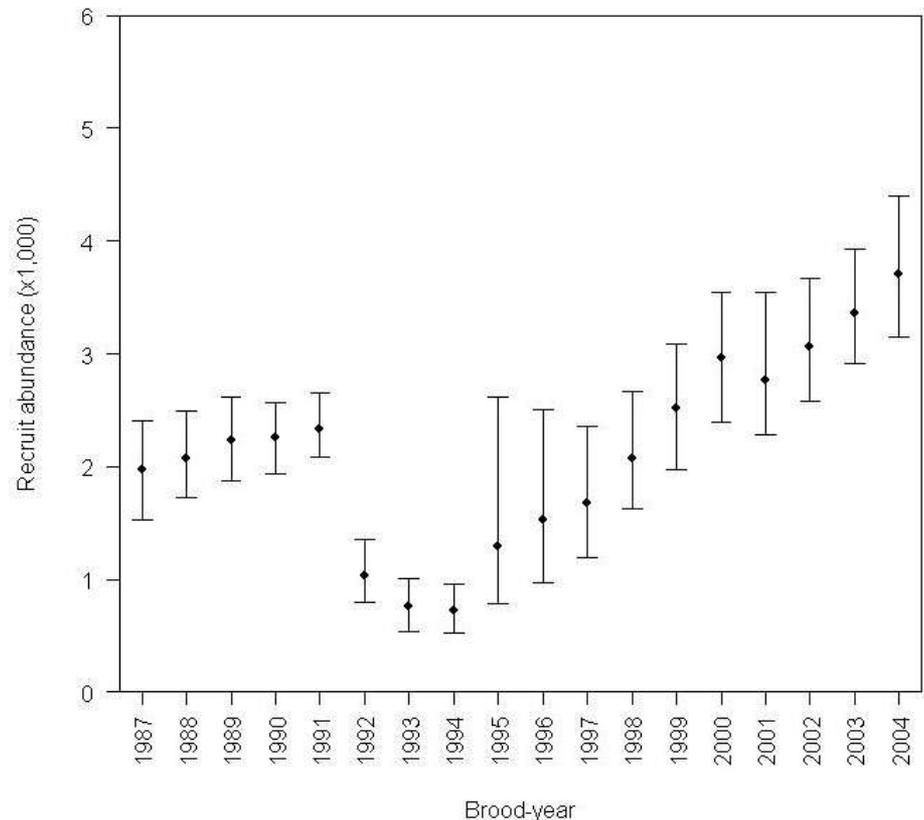
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- Response and source:
 - “...in the mainstem...”
 - NSE otolith microchemistry suggests movements between the LCR and mainstem for juvenile HBC are not uncommon
 - Migration from LCR to mainstem as a juvenile is not a “one way trip” and that some portion of juvenile HBC may use both LCR and mainstem habitats within a year
 - Need to link microchemistry with LCR recaptures

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- *ASMR (Coggins and Walters 2009) positive increase in age-2 HBC since mid 1990's*



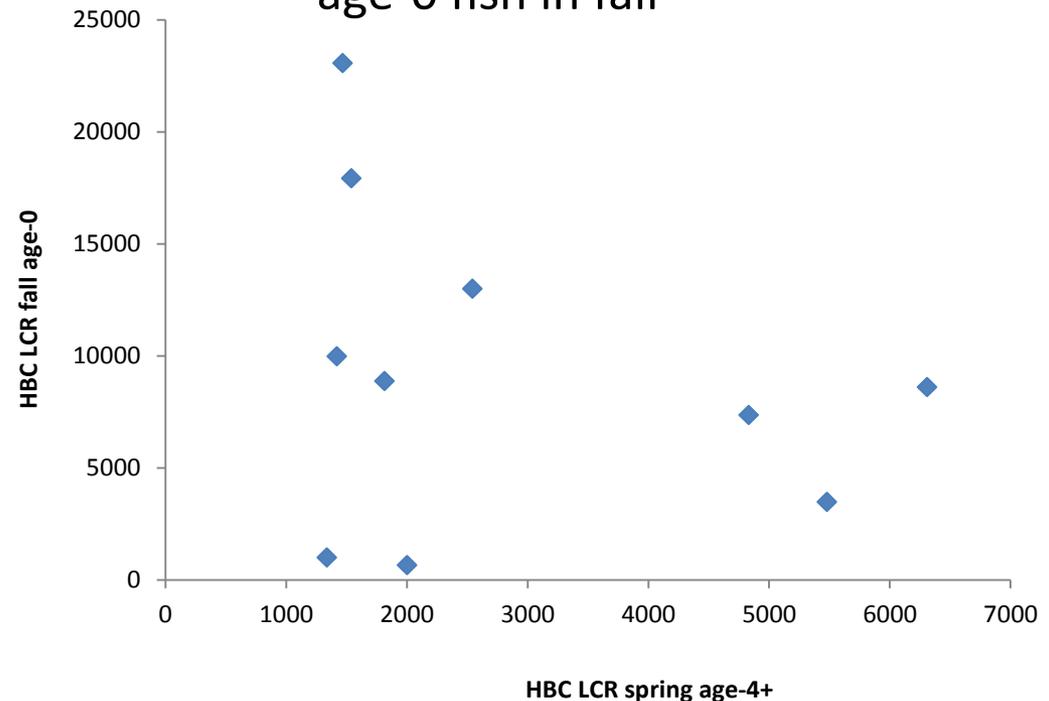
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- “... survival of young-of-year (YOY) and juvenile stages in the mainstem...”
- Reconstructed patterns in age-2 abundance from ASMR show increasing abundance since mid-1990’s
- 2011 NSE survival estimates will be during a year of much higher rainbow trout abundance than 2009 and 2010

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- USFWS LCR monitoring spring adult abundance vs. fall age-0 abundance
 - More adults in spring does not necessarily produce more age-0 fish in fall



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- Evidence of increasing HBC recruitment since mid-1990's (ASMR)
- Persistence of NSE mainstem tagged fish and first direct estimates of mainstem juvenile survival
- No new spawning locations identified
- No positive relationship between recruits and spawners in LCR

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- For populations to increase, birth rate has to increase and/or death rate has to decrease
- Increases in humpback chub adults likely a function of both, no single control variable dictating HBC population size
- I think juvenile production in LCR is extremely important and population ecology of juvenile HBC in LCR is poorly understood

SSQ 1-7

Which tributary and mainstem habitats are most important to native fishes and how can these habitats best be made useable and maintained?

What is habitat?

General: The place or environment where an animal lives

Specific: An environment that contains all of the resources that an animal needs to complete its life cycle (survive, grow to maturity and reproduce)



SSQ 1-7

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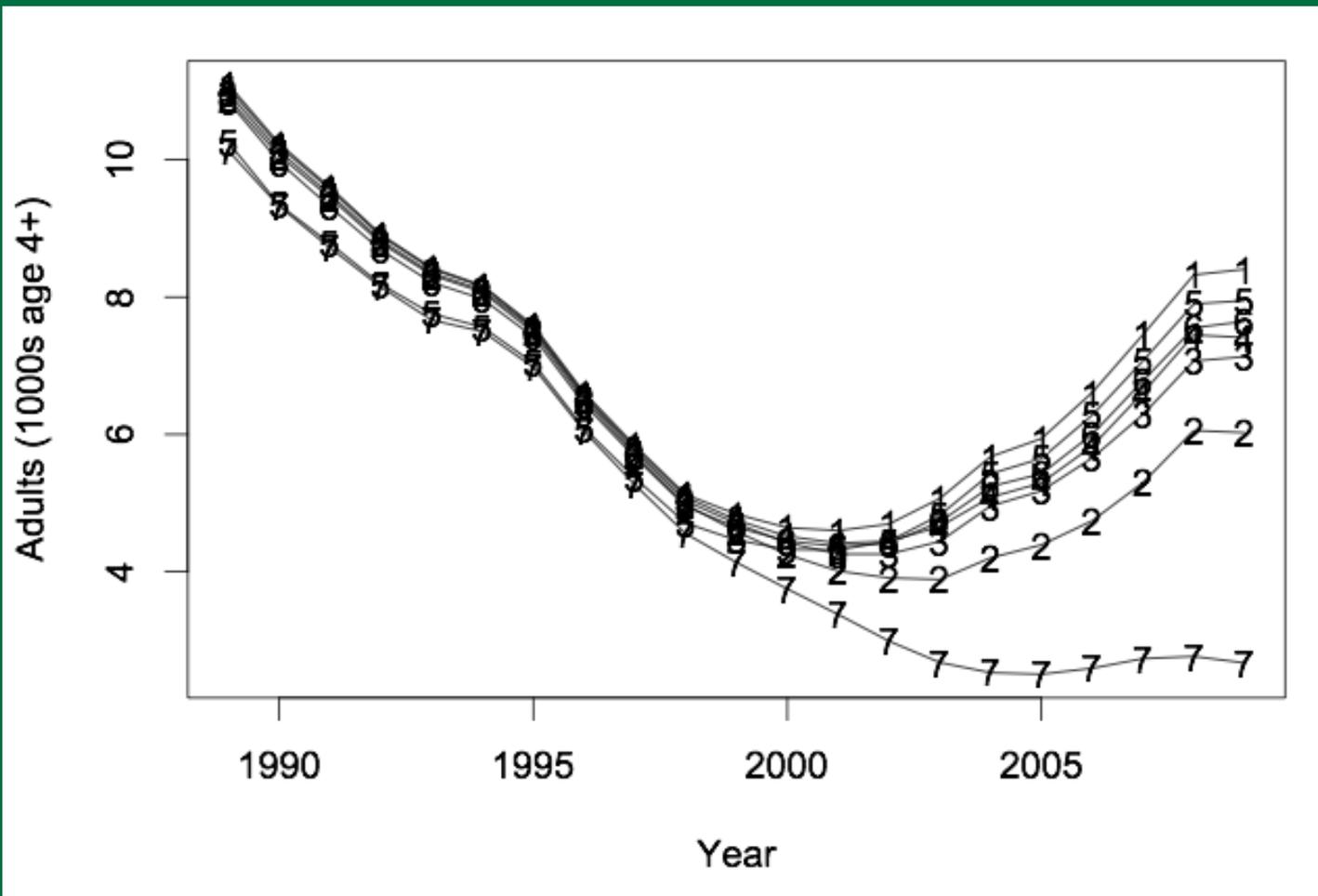
What resources do native fish need to be able to complete their life cycle?

Are **backwaters important to native fish?**

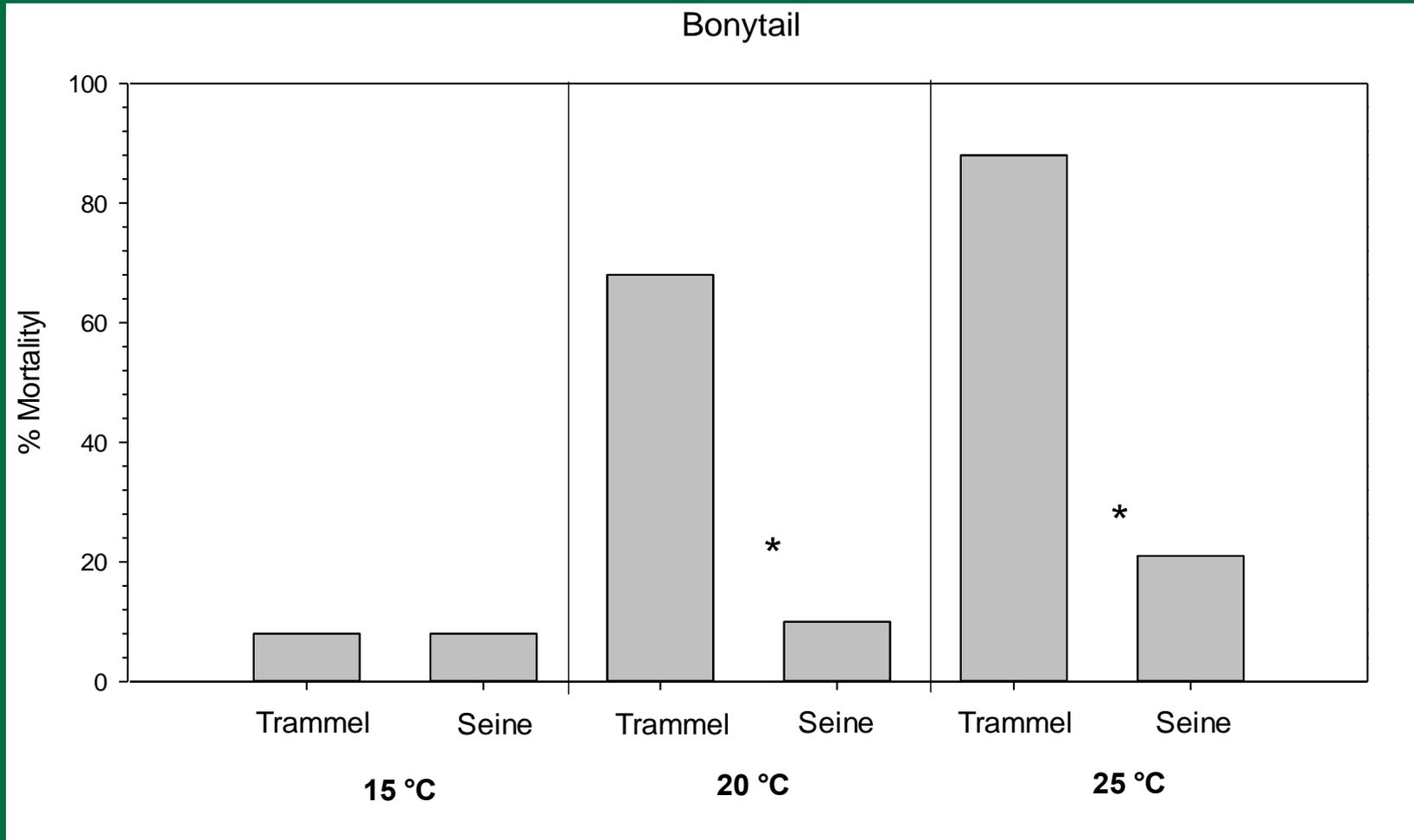
Most Relevant Strategic Science Questions

- **1-8. How can native and nonnative fish best be monitored while minimizing impacts from capture and handling or sampling?**
 - Standard methods: Standardized fish handling procedures (SOPs) updated annually
 - External review: Protocol Evaluation Panels (PEP) – 2009
 - Experimentation: PIT tag retention and mortality studies (Ward et al. 2008)
 - Study design: Modeling, power analysis, and planning

Effects of reduced sampling on ASMR humpback chub population estimates



The Effects of Capture by Trammel Net on Colorado River Native Fishes



Remote PIT tag arrays in Little Colorado River

