

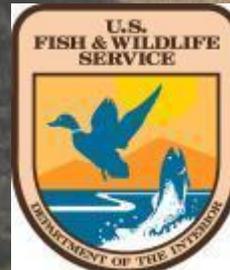
Knowledge assessment October 2011

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Objectives

- **Justification for talking today**
 - Many policy actions in Grand Canyon are directed at maintaining/restoring habitat YET we have little understanding if habitat relationships exist and whether they are important to population persistence.
 - We often look at associations between where fish are found and the types of habitat present in those areas
 - However, these associations rarely provide insight into the absolute requirement for a particular habitat
 - A habitat is required if it is necessary for the persistence of individuals or the population

Objectives

- **Justification for talking today**
 - When making decisions about habitats it is essential to accurately identify the subset of critical habitats which the species requires to persist.
 - “Without this knowledge managing habitat either defaults to educated guesswork, which often fails, or an overly conservative strategy of protecting everything, which often has economic and social consequences that are difficult to justify”
(Rosenfeld 2003)

Objectives

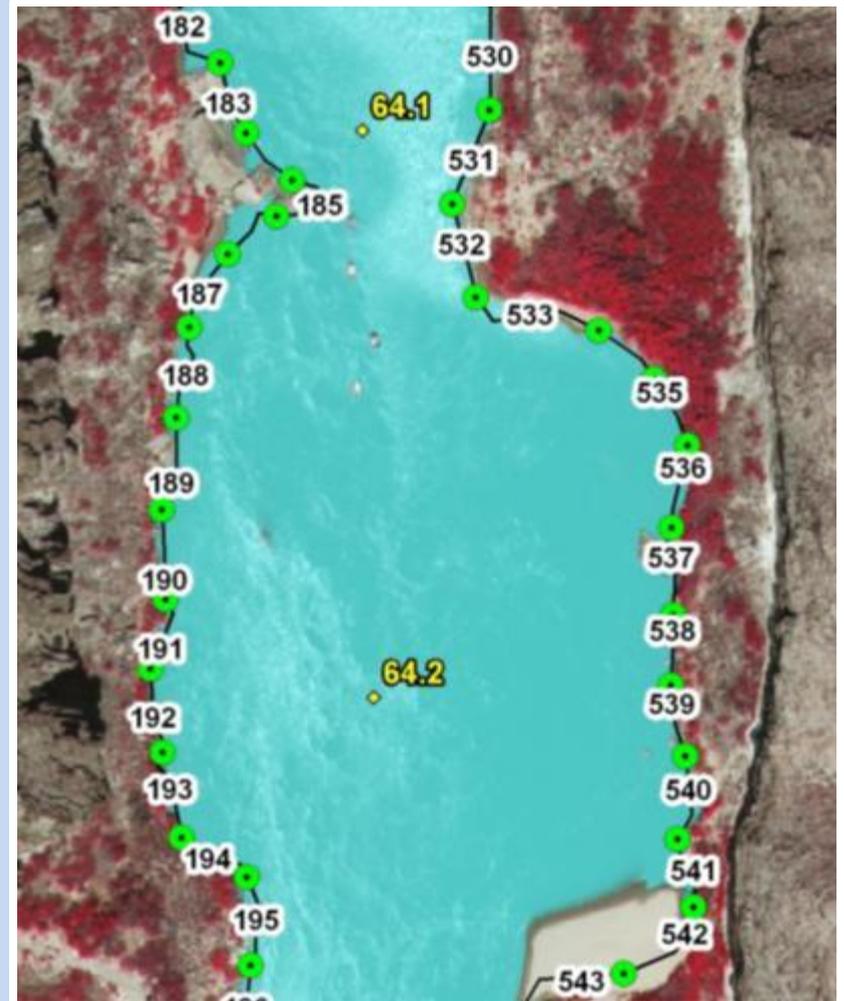
- **Justification for talking today**
 - “Although the importance of defining habitat relationships of endangered or managed species is widely recognized, information on habitat use is often collected in a haphazard way, correlative habitat associations are often confused with habitat requirement, and the significance of habitat relationships from field studies is often unclear or mis-interpreted” (Rosenfeld 2003)

Objectives

- **Justification for talking today**
 - I'm going to talk today about habitat use of juvenile humpback chub in Grand Canyon – basically what habitats do we find juvenile humpback chub
 - And I'm going to talk a little bit about habitat selection, whether humpback chubs are choosing to use some habitat types more than others
 - BUT I'm not going to talk about habitat requirements because I don't know which (if any) of these habitats *in the mainstem, in our study reach* are required by juvenile humpback for populations of humpback chub to persist in Grand Canyon (this is something we can talk about)

Methods

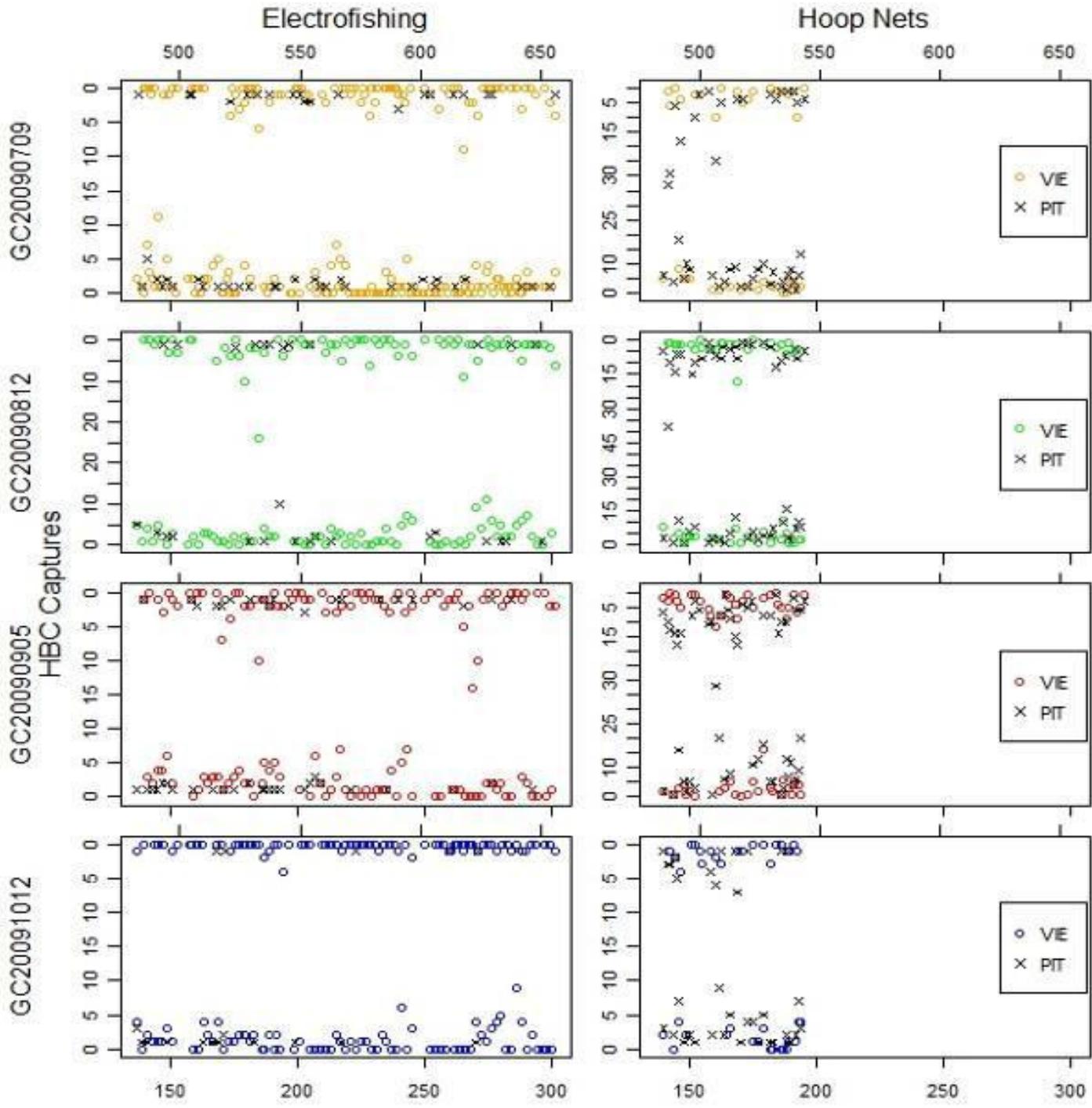
- Three 3000-m sites sampled (1500-m each side of river)
- Sites delineated into 50-m section of shoreline classified as five discrete habitat types
 - Cliff, Talus, Debris Fan, Sandbar, Backwater
 - Electrofishing in every 50-m block
 - 80-hoopnets in Site 1
 - Backwaters (rare in our reach) blocked and sampled with removal seining



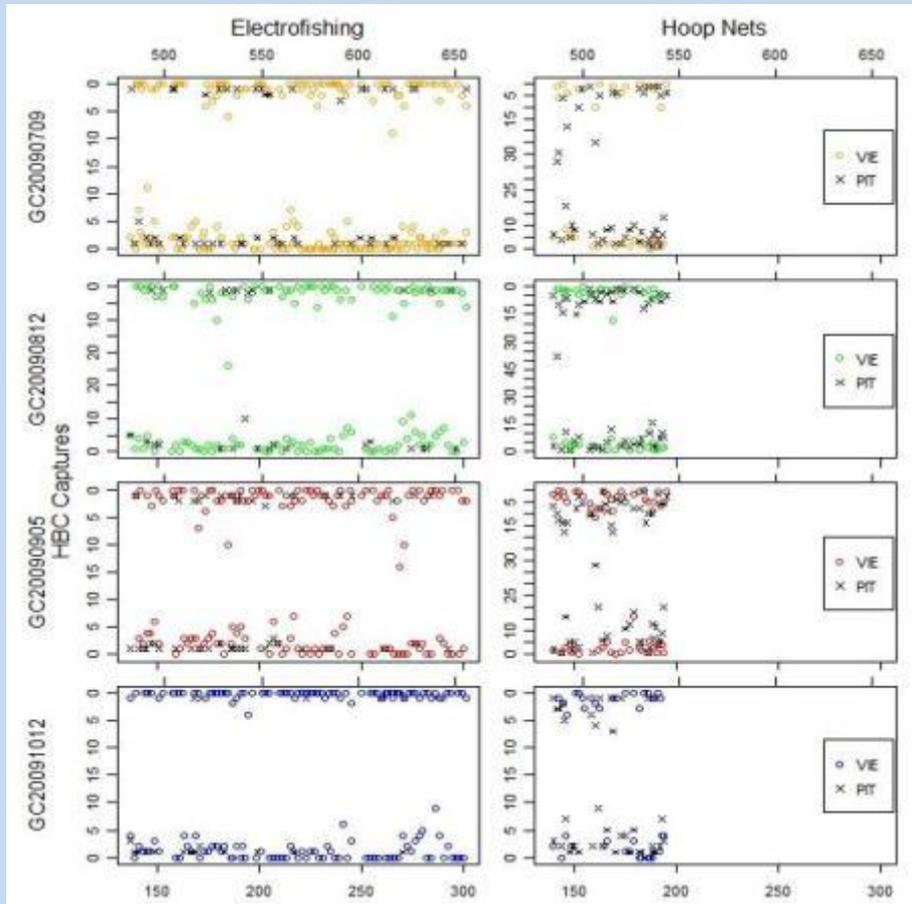
Where do we catch fish?



Distribution of HBC catch

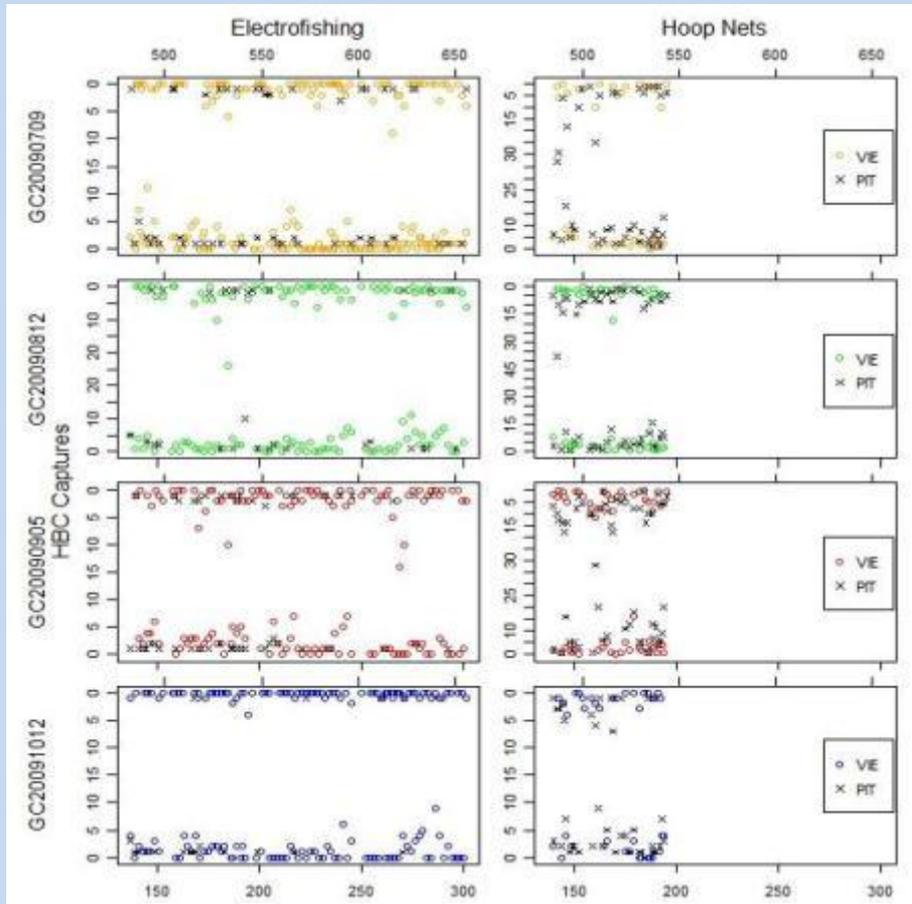


Where do we catch fish?



- Electrofishing samples in all sites, hoopnets sample in reach 1 only
- Humpback chub catches are widely distributed in our sampling reach
- Remember we are just downstream of the LCR

Where do we catch fish?

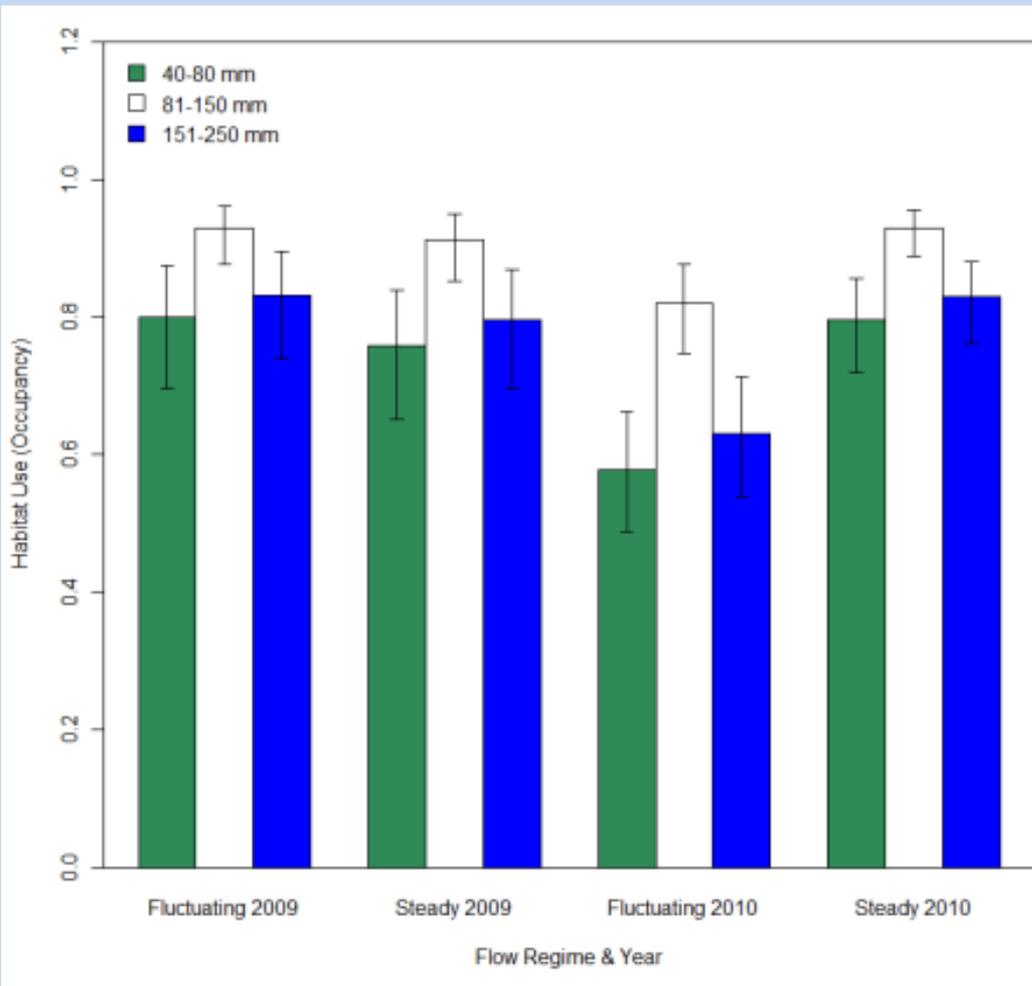


- OK neat....
- Why do we catch fish in some places and not in others?
- Is it because they are there and we just don't catch them?
- Or is it because we didn't catch them?
- And how does flow, turbidity, water clarity, habitat type, depth, flow experiment effect these patterns?

Estimate and assess...

- How is capture probability and occupancy influenced by
 - **Fish Size:** 40-80 mm, 81-150 mm, 150-250 mm
 - **Time:** Year, Trip
 - **Flow Regime:** Fluctuating flow or Steady flow
 - **Habitat Characteristics**
 - Mean depth, Proportion substrate size (GIS)
 - Habitat type (Cliff, Debris Fan, Sandbar Talus)
 - **Pass specific:** Water clarity (turbidity)

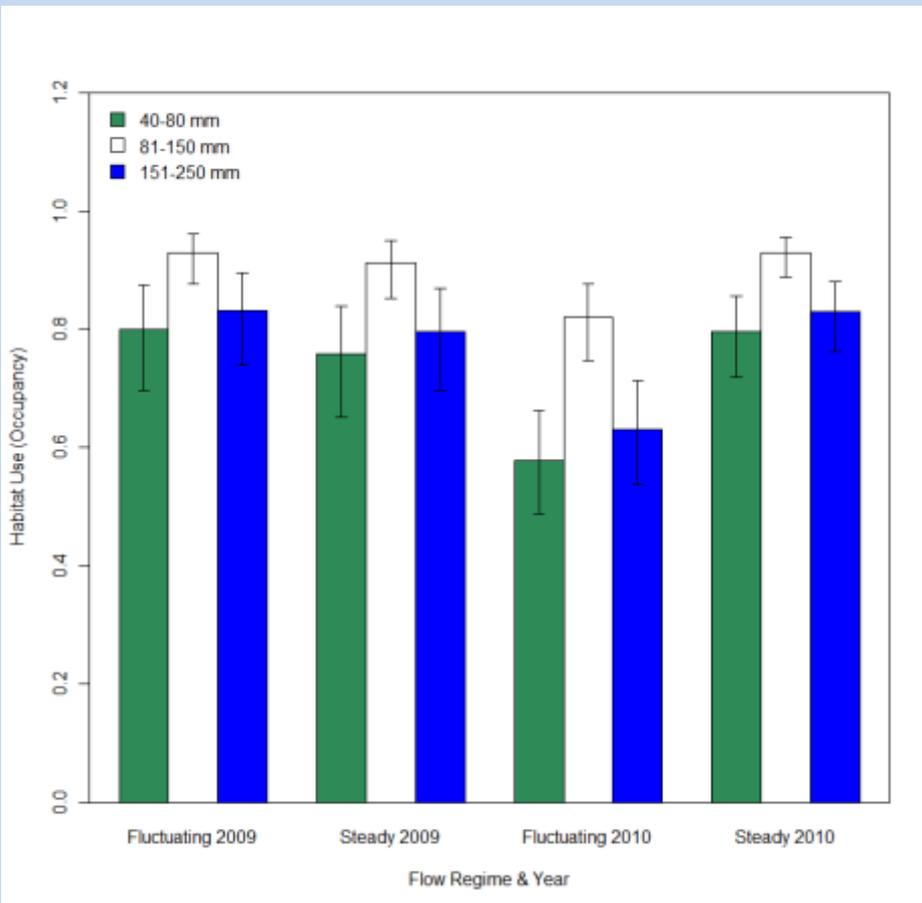
Occupancy results...



- Juvenile chub are present in about 75% of our hoopnet sites
- Factors strongly influencing occupancy: fish size
- Factors NOT strongly influencing occupancy: include habitat types

Habitat use....

- So this tells us that a lot of our habitat types are occupied, humpback chub are “present” in these sites
- Let’s look at abundance in these different habitats now, shift from presence to abundance



What about backwaters?

Colorado River Backwater Paradigm...

- Thought to be important to juvenile native fish.
 - 2008 Final Biological Opinion for Glen Canyon Dam
 - Warm more than mainstem river
 - Low velocity habitats
- Most previous juvenile fish studies have focused mostly on sampling backwaters, with limited evaluation of other habitats

Colorado River Backwaters

- In our study reach backwaters are:
 - Small spatial area compared to other habitat types
 - Ephemeral, under fluctuating flows or flows above about 15,000 cfs they are underwater



Habitat Selection

Are juvenile humpback chub selecting for backwater habitats?

Abundance

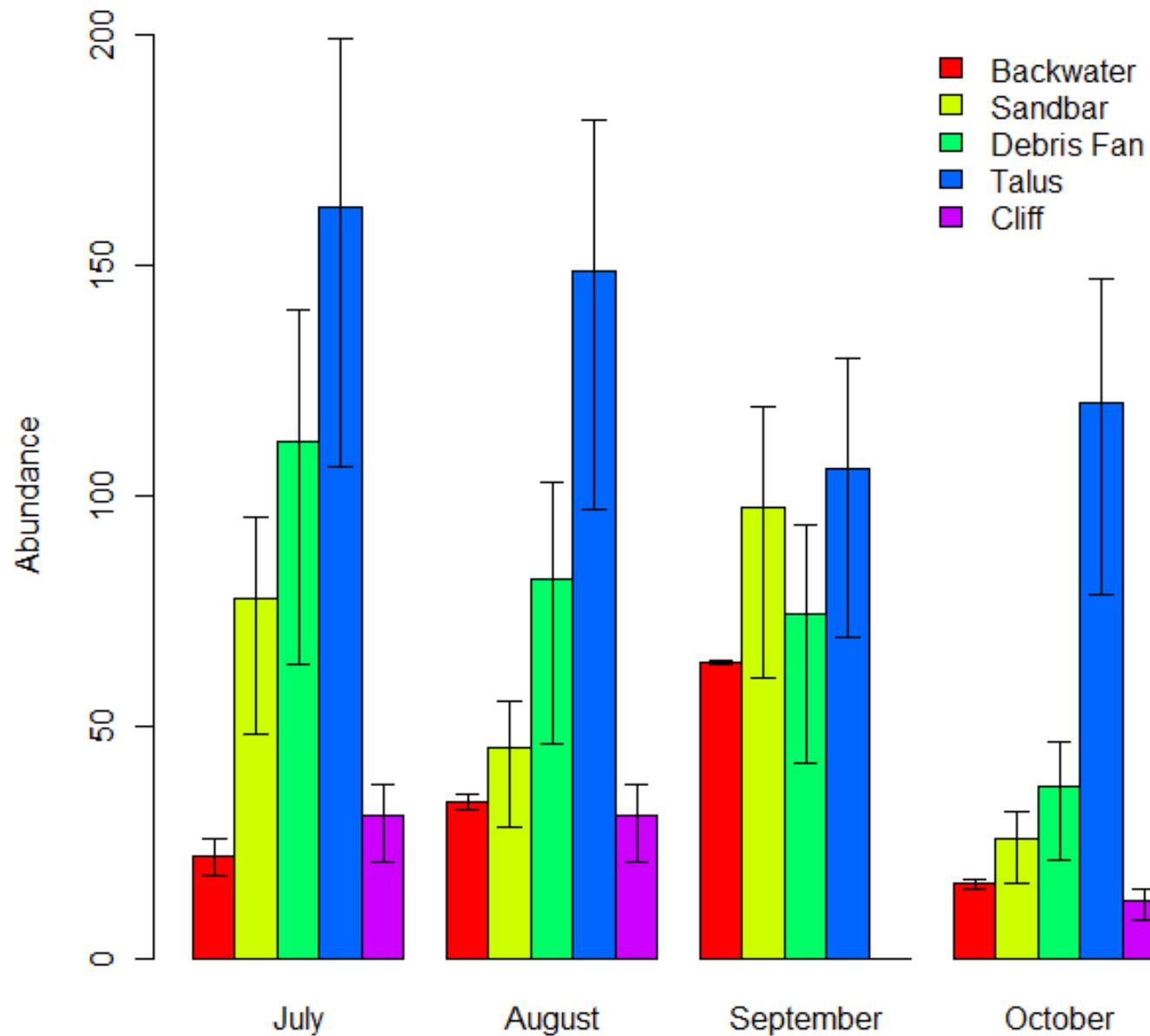
- VIE marks to estimate capture probability and abundance from hoopnets and electrofishing
 - Cliff, Talus, Debris Fan, Sandbar
- Multinomial likelihood to estimate abundance from removal sampling
 - Backwaters
- This let's us compare apples to apples, abundance to abundance in each habitat type

Selection

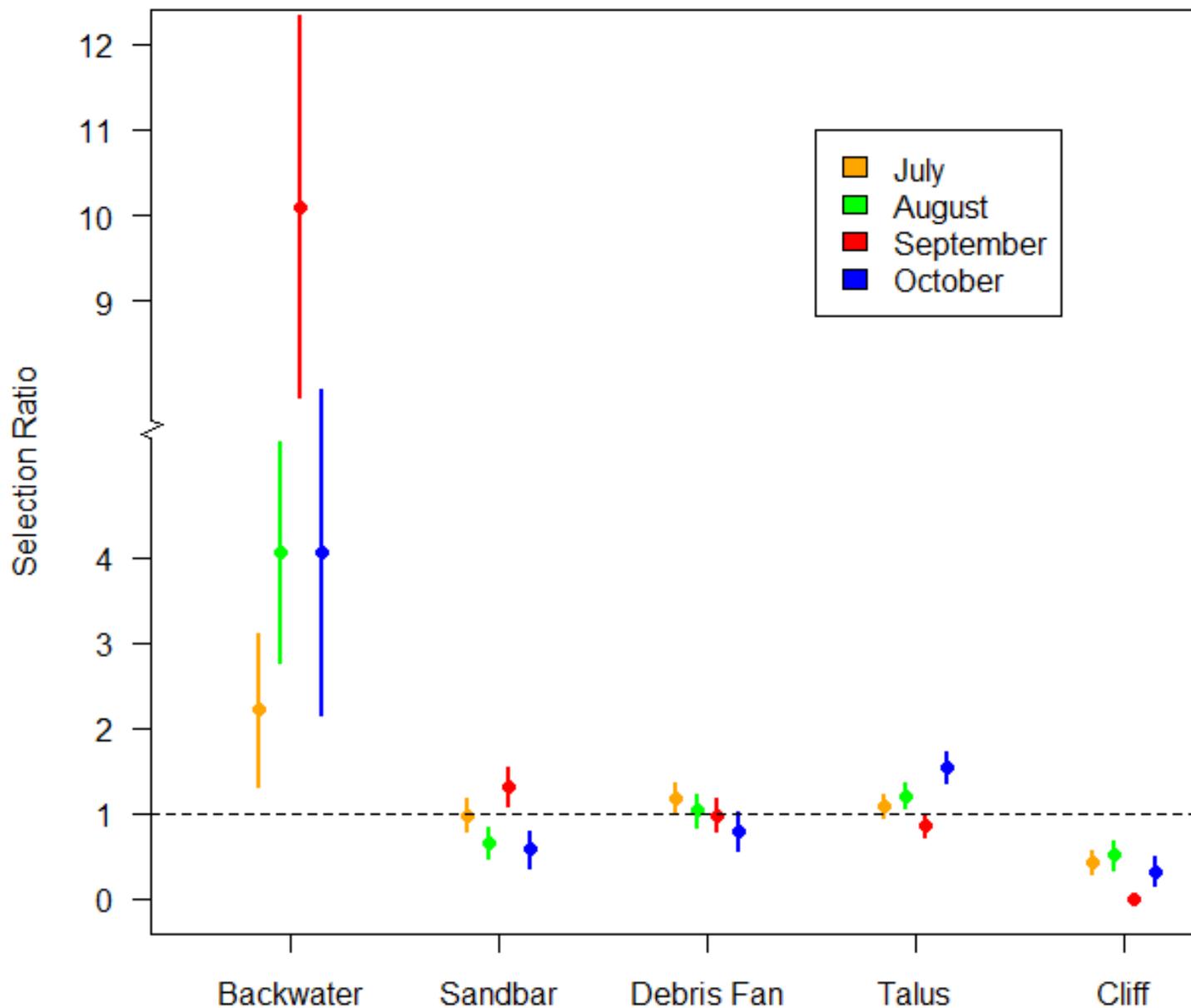
- Manly's selection ratios

$$W_i = \frac{\textit{Abundance in habitat } i}{\textit{Proportion of habitat } i \textit{ available}}$$

2010 Humpback Chub <100mm Abundance by Habitat Type



2010 Humpback Chub <100mm Selection Ratios



Conclusions

- The highest abundance of humpback chub was found in talus habitat across all four sampling periods.
- Backwater and cliff habitat had the lowest abundance

Conclusions

- Humpback chub show positive selection for backwater habitats across all four months.
- Suggests that chub are preferentially occupying backwater *when these habitats are present.*
- Backwater habitats were not always available in our reach *but humpback chub were available and they did not go extinct when backwaters were not present*

Challenging the backwater paradigm?

- NSE results may not be the same elsewhere in GC because
 - We are working in what is likely the highest juvenile HBC abundance in the mainstem, so habitats may be “swamped” with juveniles using required, preferred, and all available habitat
 - No low elevation habitats, no “permanent” backwaters

Challenging the backwater paradigm?

- *So while we might not have some habitat features in the NSE study site, we do have juvenile humpback chub....*
- Going forward...
 - We work 1-3m off the shoreline, are we measuring the right habitat variables in existing GIS?
 - Are juvenile fish just a bit further downstream?
 - Use information from NSE project to identify locations downstream of Lava Chuar rapid that may support juvenile humpback chub aggregations
 - NSE style sampling in those locations

Challenging the backwater paradigm?

- *So while we might not have some habitat features we do have juvenile humpback chub*
- Going forward...
 - Is the proximity to the LCR the only reason juvenile HBC are found in the NSE study site?
 - As Carl says, fish worry first about not getting eaten, then about eating
 - Compare habitat selection and diet in LCR and mainstem

Thank you

- Questions? Send email to billpine@ufl.edu