Drivers of humpback chub population dynamics

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U.S. Geological Survey
Presentation outline

1) Two species mark-recapture model

2) Adult humpback chub population dynamics in eastern Grand Canyon

3) Humpback chub in western Grand Canyon (pilot year)
Two species mark-recapture model

Yard et al., 2011. Trout Piscivory in the Colorado River, Grand Canyon: Effects of Turbidity, Temperature, and Fish Prey Availability, Transactions of the American Fisheries Society


Dzul et al., 2016. Incorporating temporal heterogeneity in environmental conditions into a somatic growth model. *Canadian Journal of Fisheries and Aquatic Sciences*, 74(3), 316-326.

**Covariates:**
- Turbidity
- Temperature
- RBT density
- HBC density

**Responses:**
- Survival
- Growth
- P-cap
Effect on survival:

Turbidity (-)
RBT (-)
pseudo-$R^2$: 0.38

Effect on growth:

Temperature (+)
Turbidity (+)
RBT (-)
pseudo-$R^2$: 0.43
Effect on p-cap:

Temperature (+)
RBT (-)
pseudo-$R^2$: 0.59
RBT negatively affect HBC recruitment in the Colorado River

July abundances of age-0 humpback chub in the LCR

Mean $N = 14,061$

Preliminary data. Do not cite.
Take-home messages

- RBT had negative effects on HBC survival, however, magnitude of this effect is still uncertain
- Environmental influences (temperature and turbidity) were stronger than RBT effect
- Lots of unexplained variability in survival and growth (e.g., food limitation)
- Temperature has a large effect on capture probability
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Abundance of adult humpback chub (≥ 200mm TL) that spawn in the LCR

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.
Abundance of subadult humpback chub (150-199mm TL) in the Little Colorado River (LCR) and in the Colorado River juvenile chub monitoring (CR-JCM) reach

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.
Spawning probabilities of adult humpback chub

200-249mm TL >250 mm TL

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.
Take-home messages

- The adult humpback chub population in eastern Grand Canyon seems to be stable.

- Subadult humpback chub numbers are more variable, potentially a decrease in numbers in the LCR since 2013 and an increase in JCM since 2016.

- Spawning probabilities decreased from 2015-2016. Some evidence that the 2012 age-0 cohort is starting to recruit.
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Preliminary data. Do not cite. Water temperatures of the Little Colorado River (LCR) and the Colorado River at river mile (RM) 61 and 225.
Preliminary data. Do not cite. Truncated length-frequency distributions of humpback chub captured near Fall Canyon (FAL) and Parashant (PAR).
Take-home messages

- Humpback chub were captured in all three sites in western Grand Canyon. We will probably choose Fall Canyon for our longer-term research.

- Growth patterns of juvenile humpback chub vary throughout Grand Canyon and seem to be mainly influenced by water temperatures.
Thanks!

Glen Canyon Dam Adaptive Management Group

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