Early life history of humpback chub: patterns and potential drivers

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U.S. Department of the Interior
U.S. Geological Survey
Outline

- JCM survival
- Early life history in the Little Colorado River
- Survival and growth in the Colorado River
HBC survival in JCM reach

Results from traditional approach... assume each year has its own survival rate
HBC survival in JCM reach

Same results expressed on monthly base...model assumes “steps” in survival.
HBC survival in JCM reach

Using a slightly different approach (Bayesian) we can get estimates for each interval between sampling.
More or less agree.
If we model survival based on covariates, there is quite a bit more variation.
HBC survival in JCM

Patterns with covariates are similar to Bayesian model when aggregated and scaled to interval level.
Patterns with covariates are also similar at annual scale...but model is better supported by data. (same K)
Drivers of HBC early life history

- In the LCR – flooding and intrinsic factors
  - Production
  - Emigration rate
  - Growth

- CR – potentially many factors
  - Immigration
  - Trout?
  - Temperature?
  - Turbidity?
  - Discharge?
  - Growth
Drivers of HBC early life history

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Fall HBC abundance in the LCR

Preliminary Data Do Not Cite
Modified from Van Haverbeke et al. (Annual Reporting 2013)
Recruitment LCR

Additions to CR

N

mortality

stay

go

Time

LCR Fall Abundance

Additions to CR

Time
Analyzing abundances suggests highly variable export, which appears related to fall abundances in LCR.
Recruitment

N

LCR

Time

LCR Fall Abundance

Additions to CR

mortality

stay

go

USGS
July LCR juvenile HBC abundance estimates:

2013: 14,000 (95% CI: 11,000-17,000)
2014: 11,000 (95% CI: 9,500-13,000)

Two years of July LCR trips have likely been low years with little export.
Estimates of emigration seem to line up more or less with increases in abundance.
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Winter growth of humpback chub in LCR closely linked to amount of flooding (scouring?).
Growth effects size of humpback chub when they emigrate from LCR and could explain winter emigration.
Drivers of HBC early life history

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  - Growth
HBC survival in JCM reach
Potential monthly covariates considered

mini-multistate - 2012 – 2014

Growth and Survival

- Temperature
- Turbidity
  - > 10 NTU
  - > 50 NTU
  - > 100 NTU
- Stage
  - Average
  - Standard Deviation
- Size
- Interactions

CJS - 2009 – 2014

- Estimates of trout N
- Temperature
- Proportion of juveniles > 80 mm
- Turbidity
  - > 10 NTU
  - > 50 NTU
  - > 100 NTU
- Stage
  - Average
  - Standard Deviation
- Interactions
mini-multistate - 2012 – 2014

Survival

- Size (+)
- Turbidity (>10 NTU) (-)

Growth

- Temperature (+)
- Average Stage (Discharge) (+)
- Size (-)
Monthly growth of a 60-80 mm humpback chub
mini-multistate - 2012 – 2014

**Survival**
- Size (+)
- Turbidity (> 10 NTU) (-)

**Growth**
- Temperature (+)
- Average Stage (Discharge) (+)
- Size (-)

CJS - 2009 – 2014

- Proportion of larger juveniles (+)
- Estimates of trout N (-)
- Turbidity (> 10 NTU) (-)
- Interaction between Turbidity and Trout (+)
HBC survival in JCM reach

The graph shows the annual apparent survival rate of HBC in the JCM reach, varying with trout abundance and the number of turbid days.

- Dotted line: Low # of turbid days
- Dashed line: Average # of turbid days
- Solid line: High # of turbid days
Juvenile chub take home messages

- Flooding in the LCR plays a critical role in production, outmigration and growth.

- Growth in the Colorado River primarily driven by temperature, but may also be affected by monthly volumes / stage.

- Survival appears to be a function of fish size, trout and turbidity.
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