Recent advances in population modeling, preliminary estimates, and their relevance to BO triggers

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Outline

- Review of timing of HBC sampling in and near LCR
- Comparison of methods used for HBC population assessment
- Multistate modeling of HBC – background
- Multistate modeling – preliminary results
- BO triggers
Monthly schedule

Little Colorado River

Colorado River
<table>
<thead>
<tr>
<th>Method</th>
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<th>Strengths</th>
<th>Weaknesses</th>
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<td>Multistate models</td>
<td>Time step: Monthly (trips)</td>
<td>Includes tag loss; Heterogeneity in rates over space and within year; Movement.</td>
<td>Relatively data hungry; Assumes NSE representative of CR.</td>
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Multistate Model - Background

- 3 spatial locations (LCR, NSE, rest of CR)
- 3 Size groups (4-10cm; 10-20cm; 20cm<)
- Incorporates information from tag loss studies.
- Assumes CR fish don’t move around much,
- Assumes that NSE is representative.
Multistate Model - Background

- Parameters of interest
  - Survival \( \psi_t^{L1} \)
  - Transition between size classes \( \gamma_t^{L12} \)
  - Movement \( \alpha_t^{LM1} \)
  - Proportion of CR fish in NSE \( \tau \)
  - Recapture probabilities (82)

- State specific abundances also estimated (derived parameter).
Size Transitions

![Graph showing size transitions with monthly transition rates for LCR and JCM. The graph indicates transition rates between 1 to 2, 2 to 3, and 1 to 2 for both locations.](image-url)
Movement

SC1 during J&A

SC3 during M&J

SC3 during F&M

LCR to Mainstem movement

Mainstem to LCR movement

USGS
State specific abundances
Abundance over 20 cm
BO triggers

- Adult humpback chub <7000 fish

- OR

- ALL 3
  - LCR pop of ~size class 2 <910 fish
  - Temperature <12° C for 2 consecutive years
  - Survival of size class 1 in JCM drops 25% from preceding year
BO triggers

- AND

- Rainbow trout abundance over 760
  - Korman closed model estimates ~450 (330-600)
  - Open models?

- AND

- Brown trout abundance over 50
  - Unknown – 8 total fish caught
Acknowledgements

- US – Fish and Wildlife Service
- Bill Pine and NSE group
- Mike Yard, Lew Coggins, Josh Korman
- Jim Hines and Jim Nichols
- Arizona Game and Fish
- National Park Service
- Bureau of Reclamation
- Navajo Nation Department of Fish and Wildlife