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Modeling Long Term Effects of HFEs on Trout and HBC

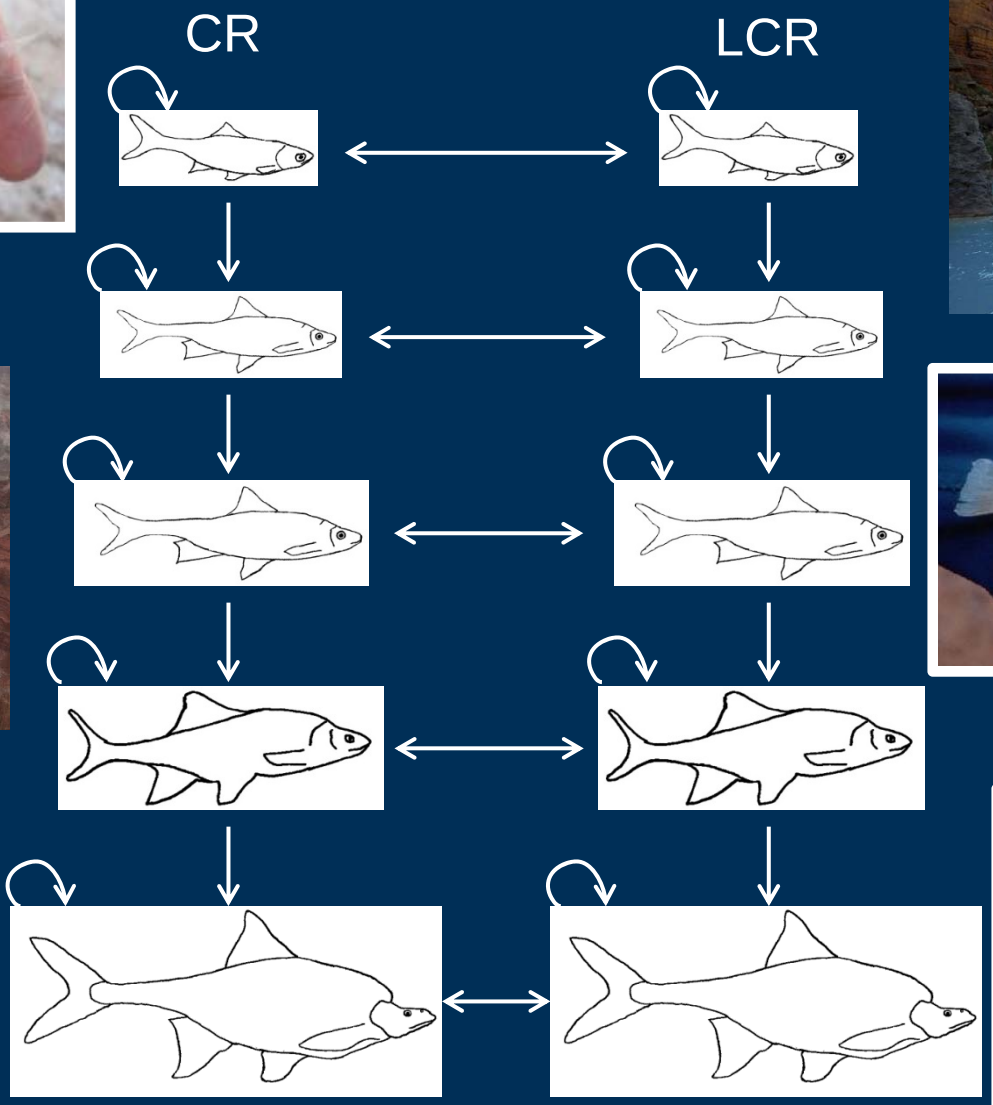
Charles Yackulic

Southwest Biological Science Center

Grand Canyon Monitoring and Research Center

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

Humpback chub population dynamics



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Outline

- General patterns – a rough sketch
- Temperature / Trout / Recruitment
- A historical perspective of lambda

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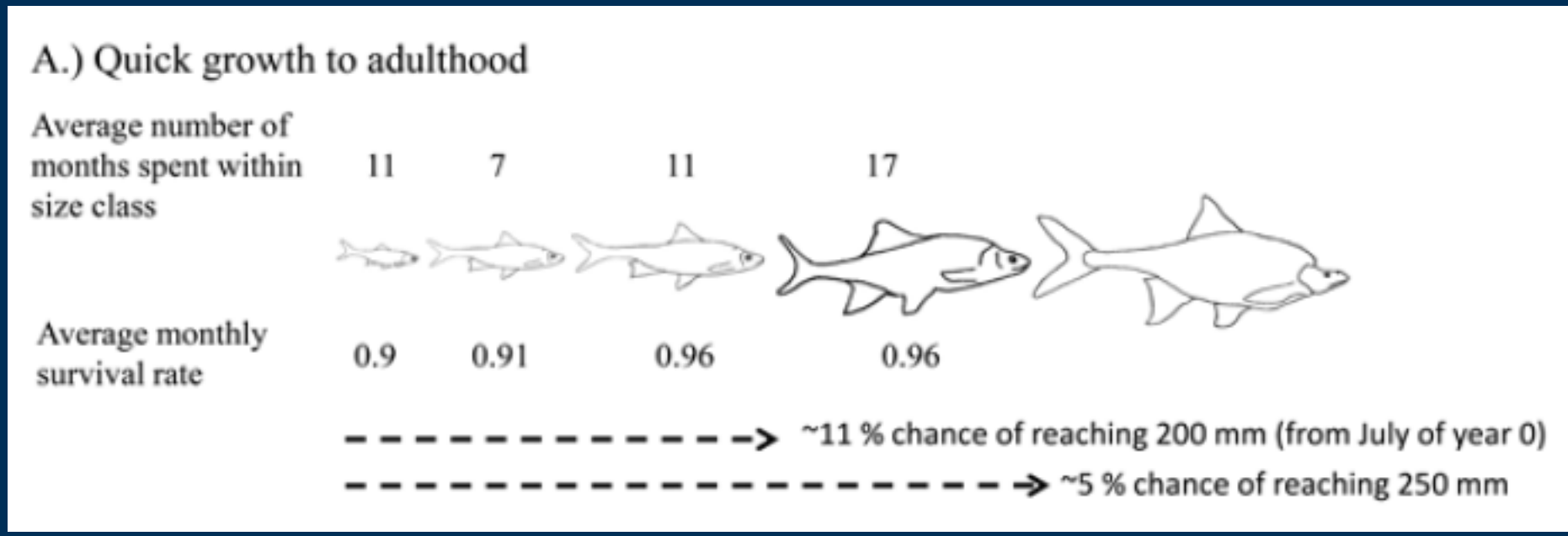
LCR – typical values based on 2009-2012 data



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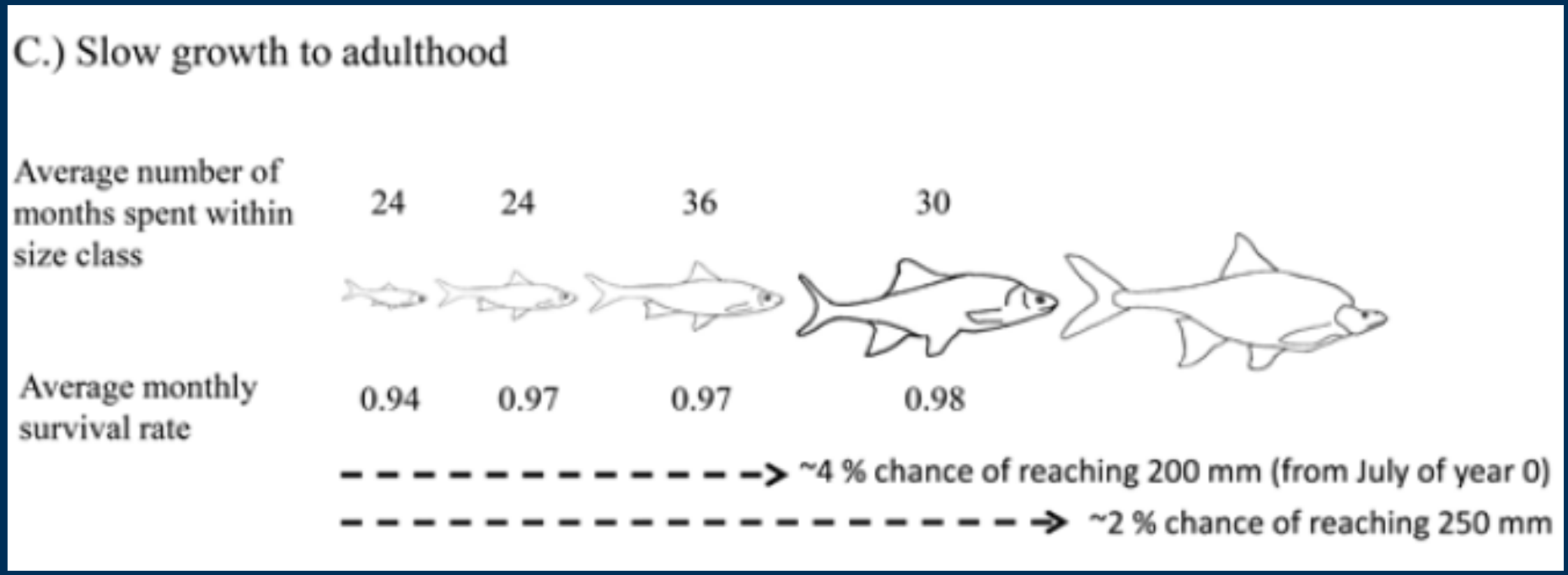
Yackulic, Yard, Korman and Van Haverbeke, *2014*

Colorado River – typical values based on 2009-2012 data



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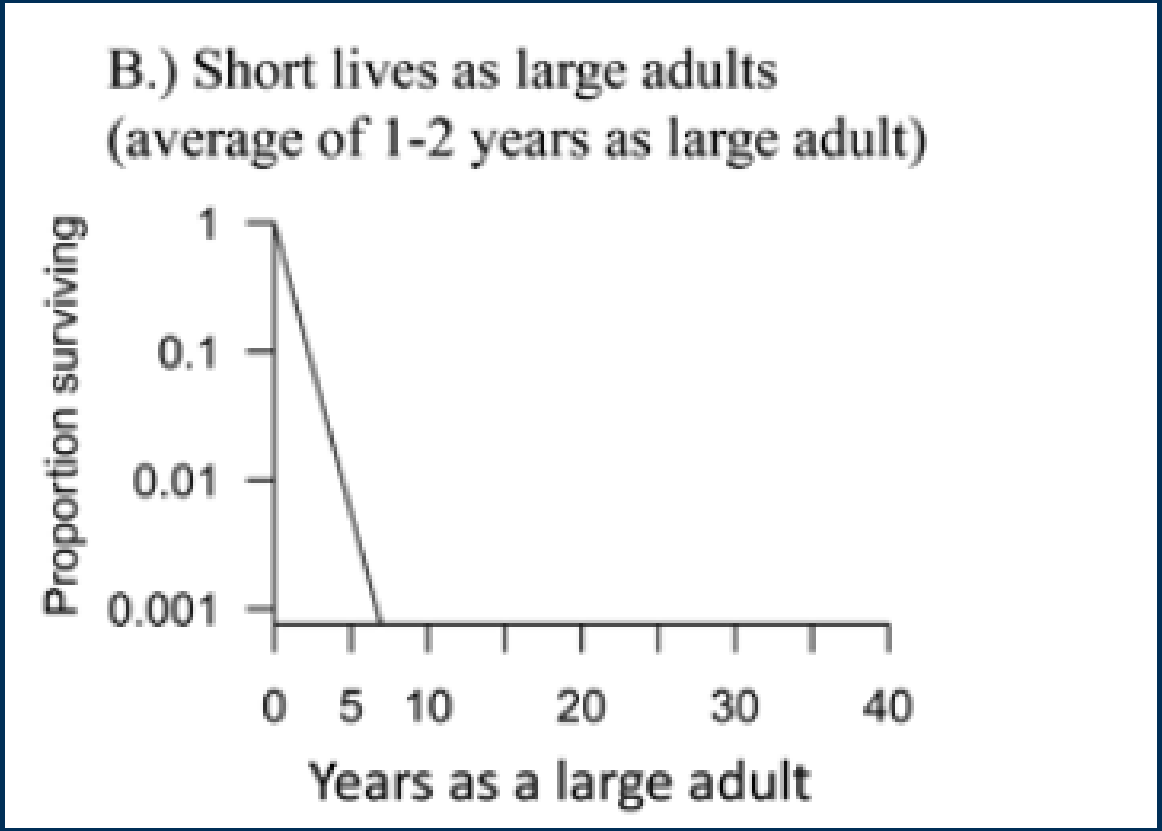

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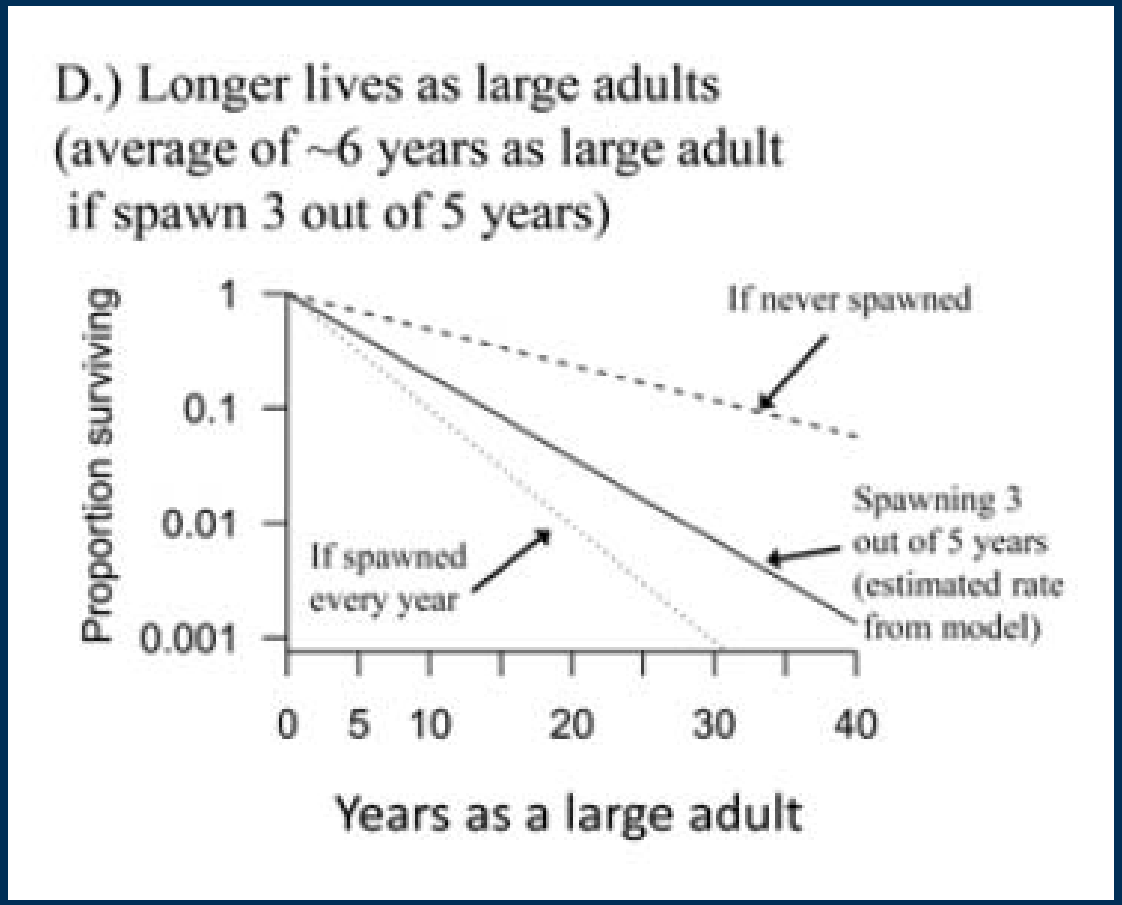

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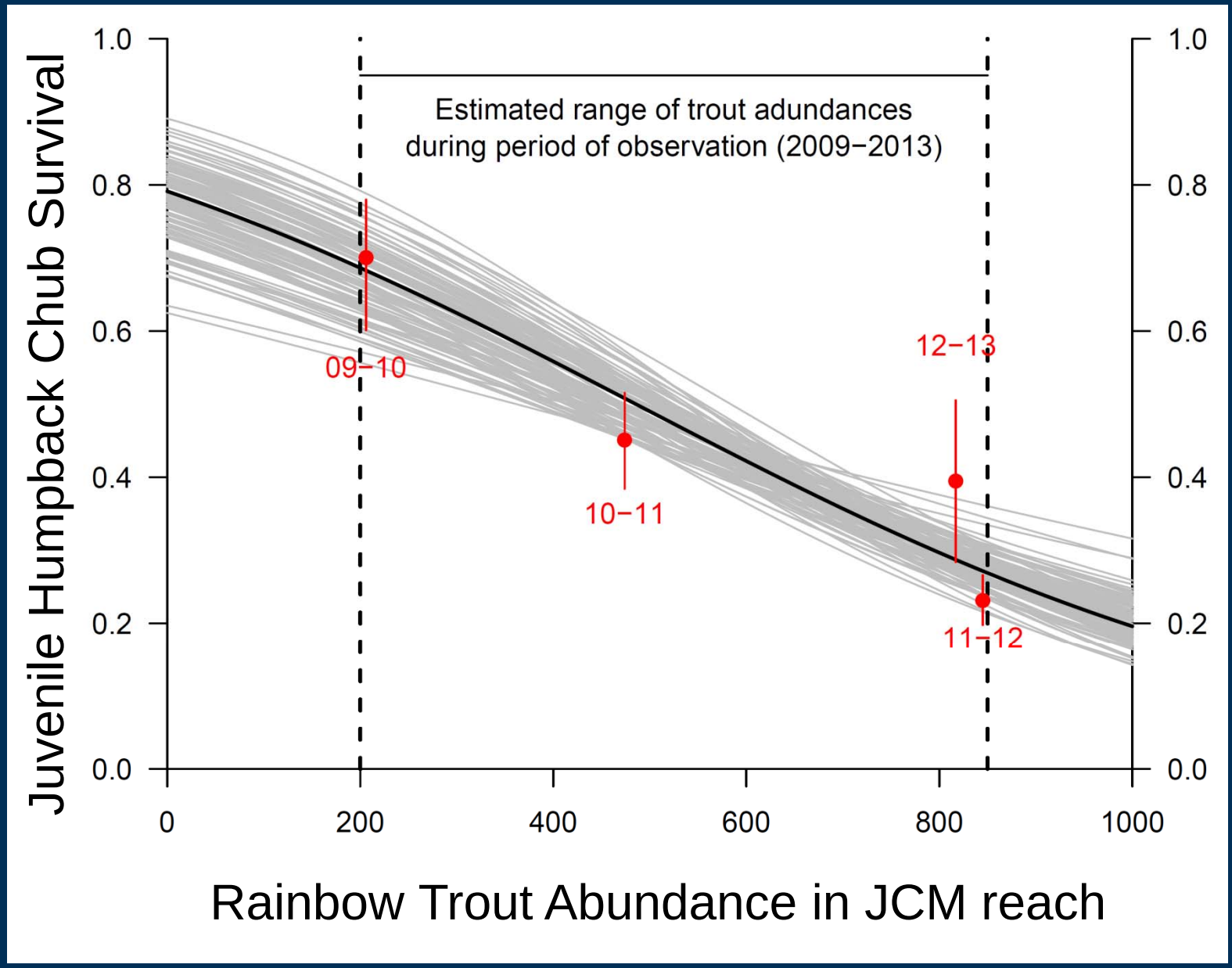

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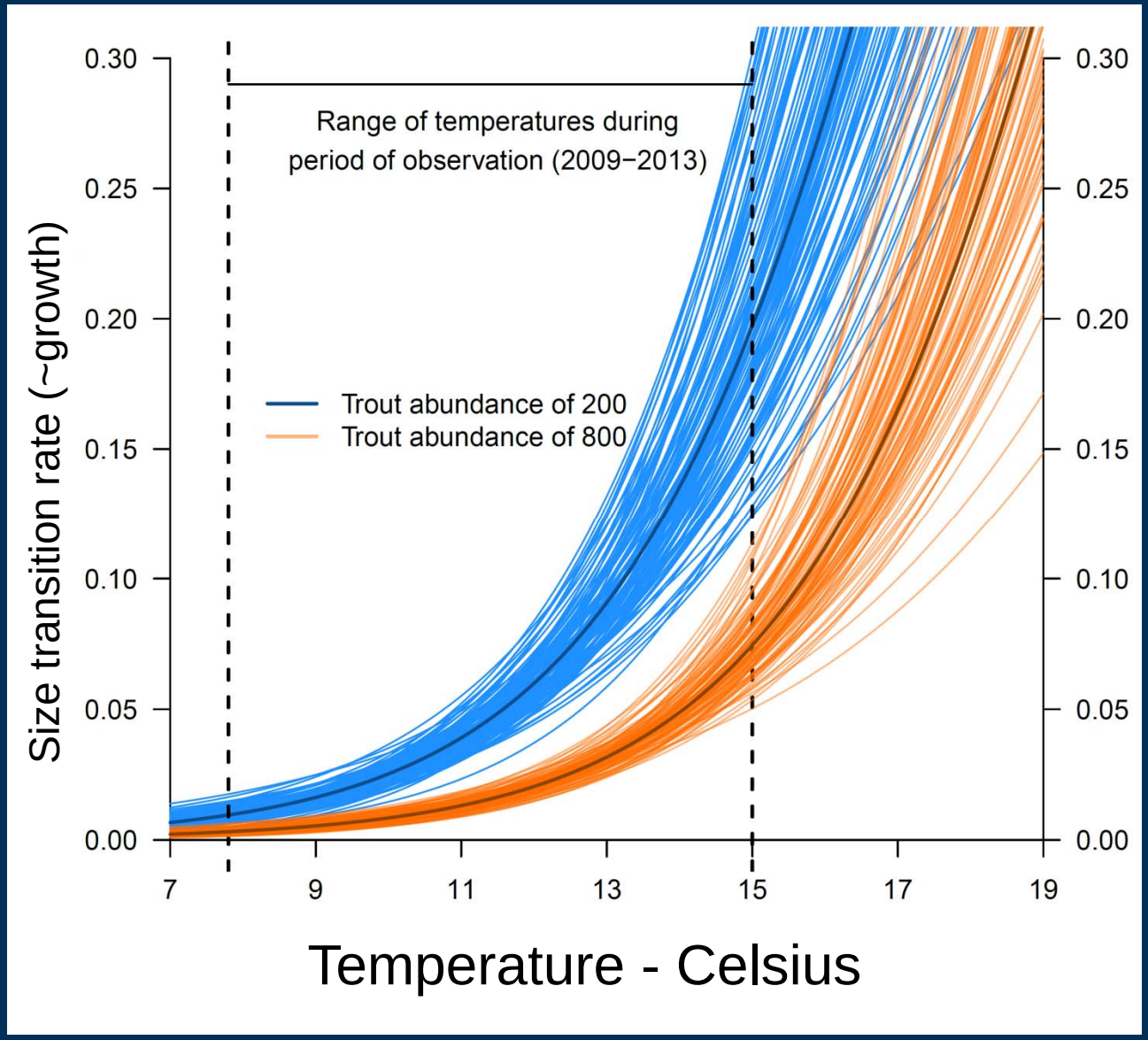
Comparison to annual estimates.



Fitted relationship between monthly size transition rate (~growth) of juvenile HBC and temperature at two different RBT densities.

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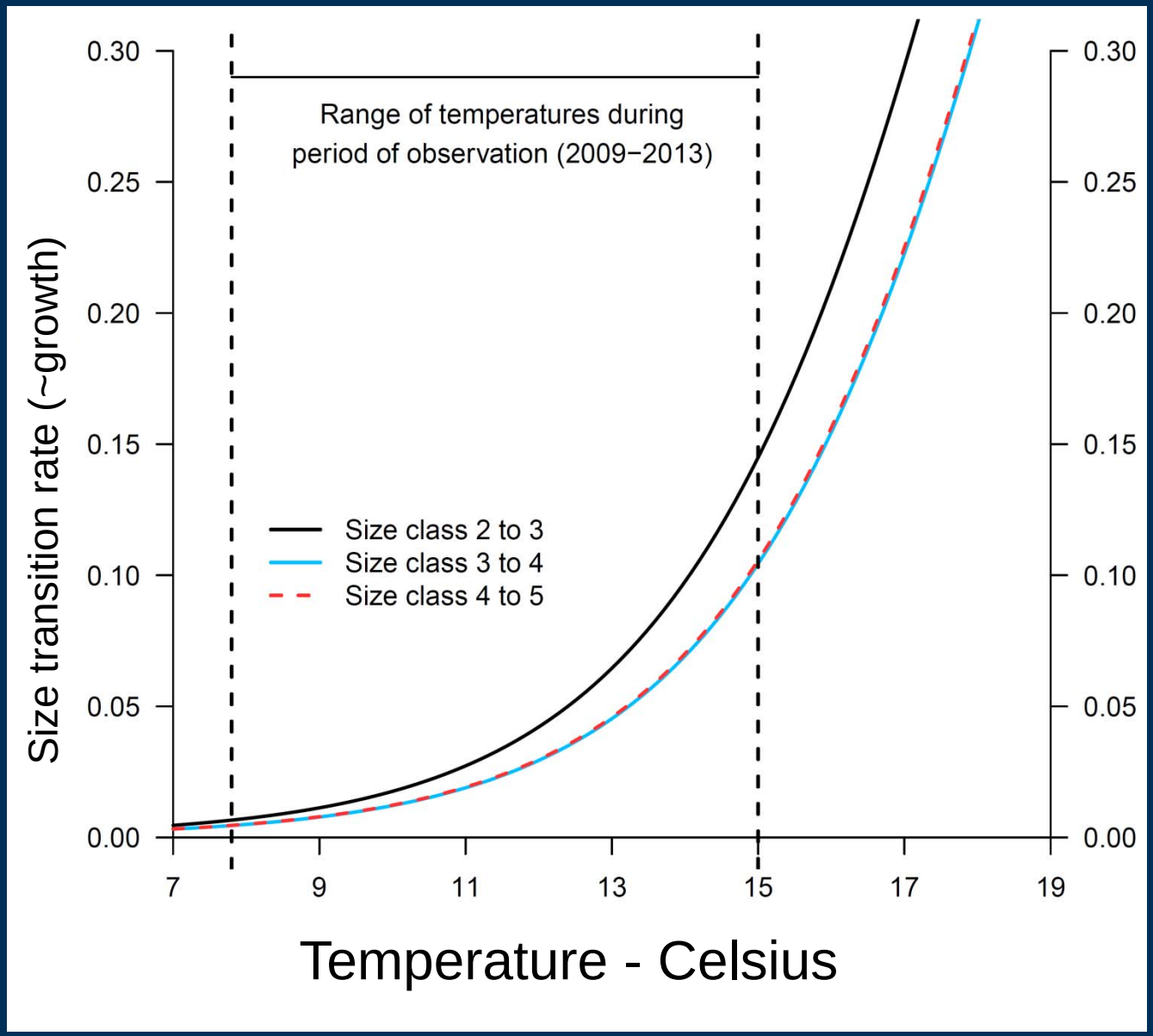

Fitted relationship between monthly size transition rate (~growth) of larger HBC size classes and temperature.

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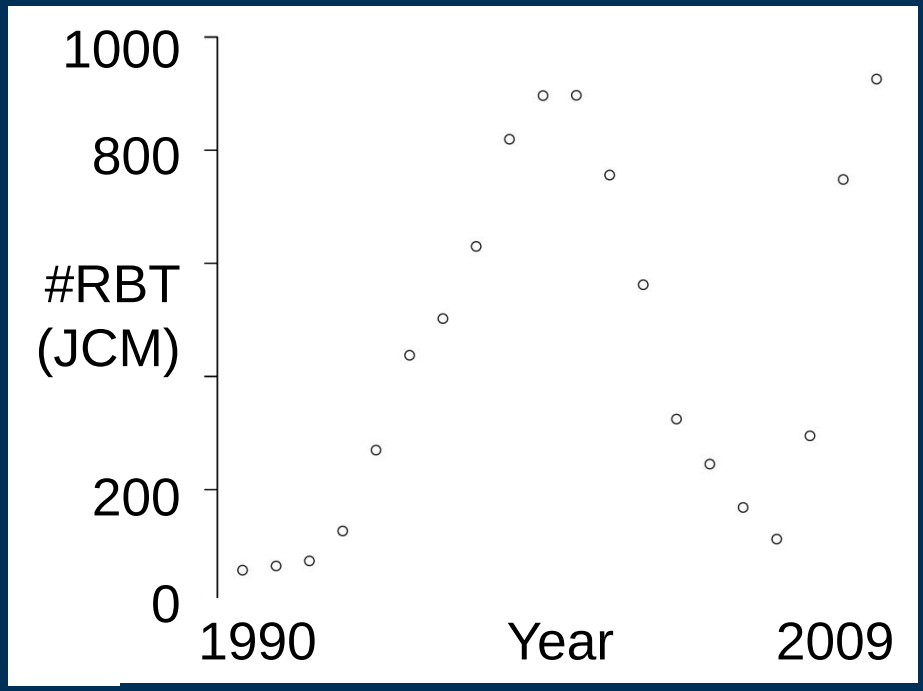
Backcasting

- Relationships I just showed based on 2009 – 2013 data.
- How well do these relationships explain behavior between 1990 & 2009?



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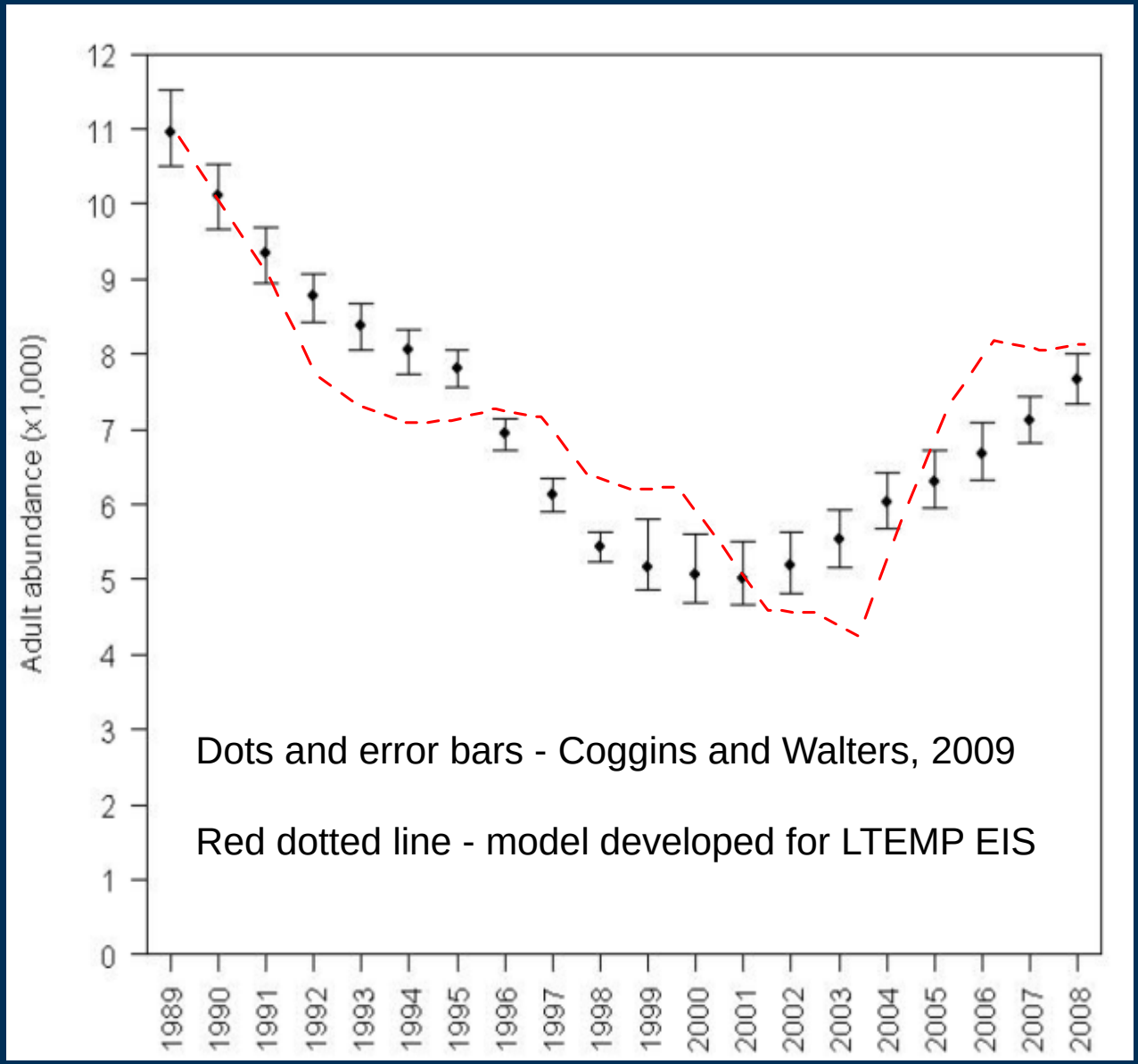
Back-casted predictions are reasonably close to ASMR estimates (keep in mind that ASMR is known to smooth trends).



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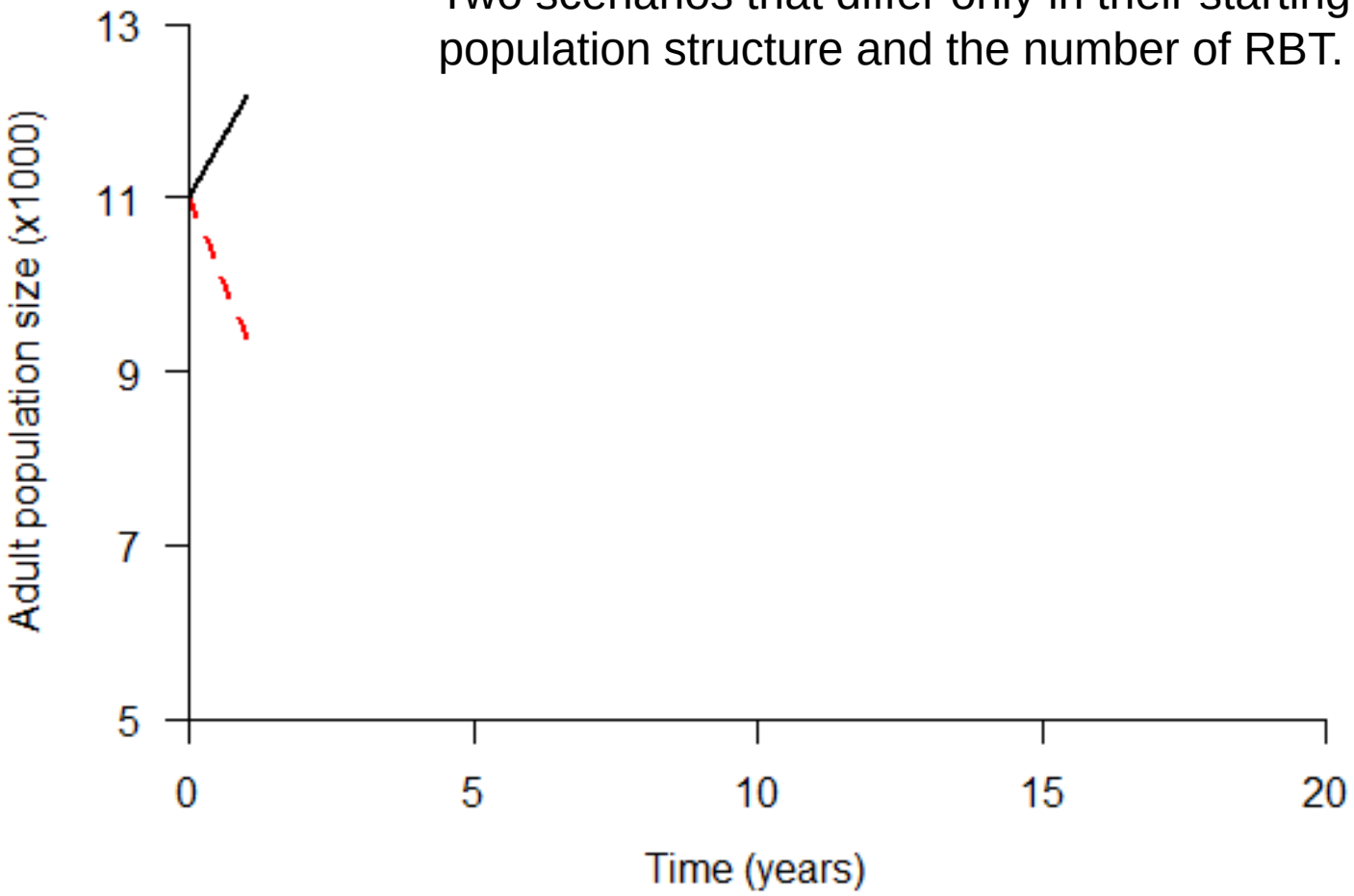
The problem with time lags

Two scenarios that differ only in their starting population structure and the number of RBT.



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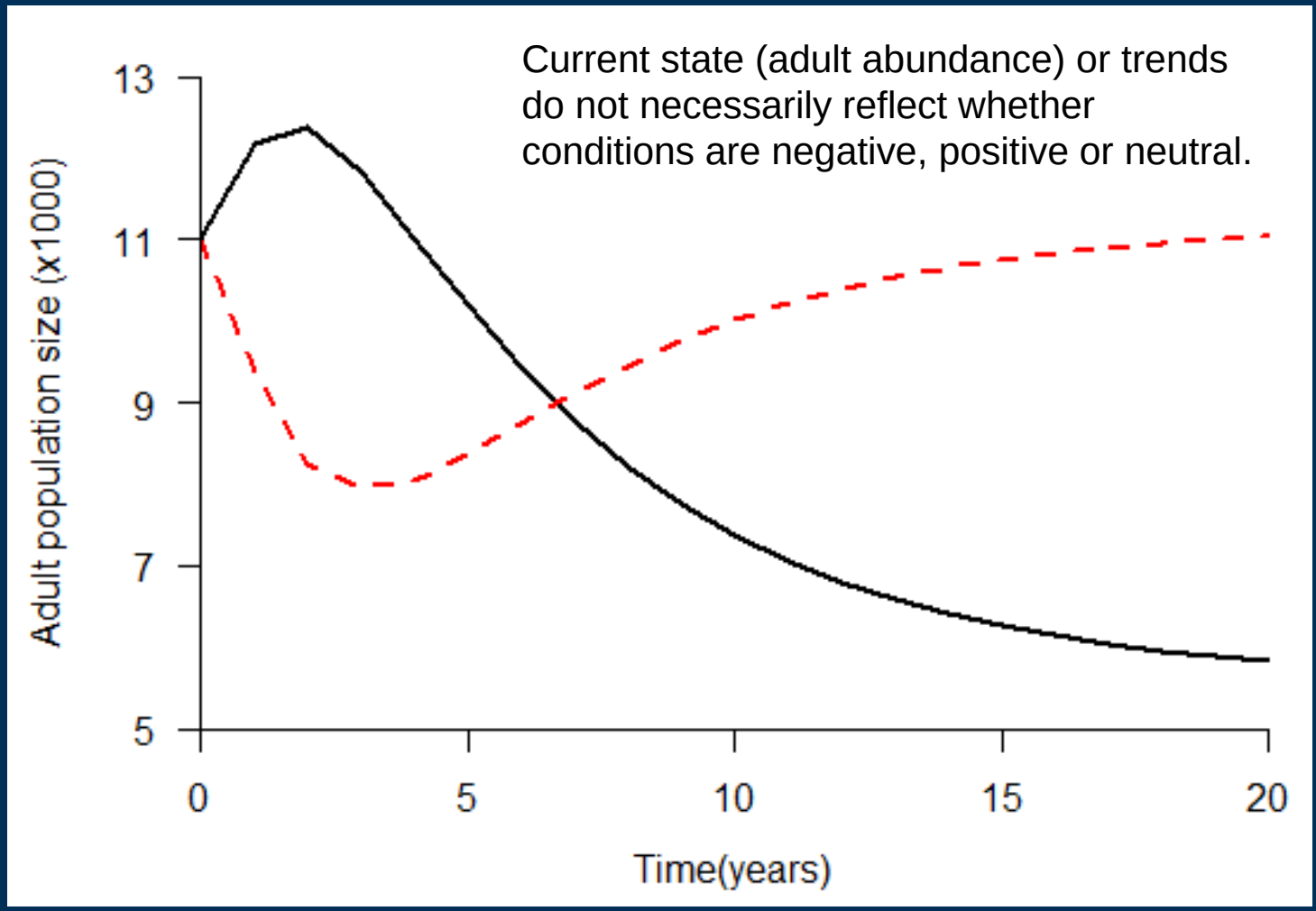
The problem with time lags



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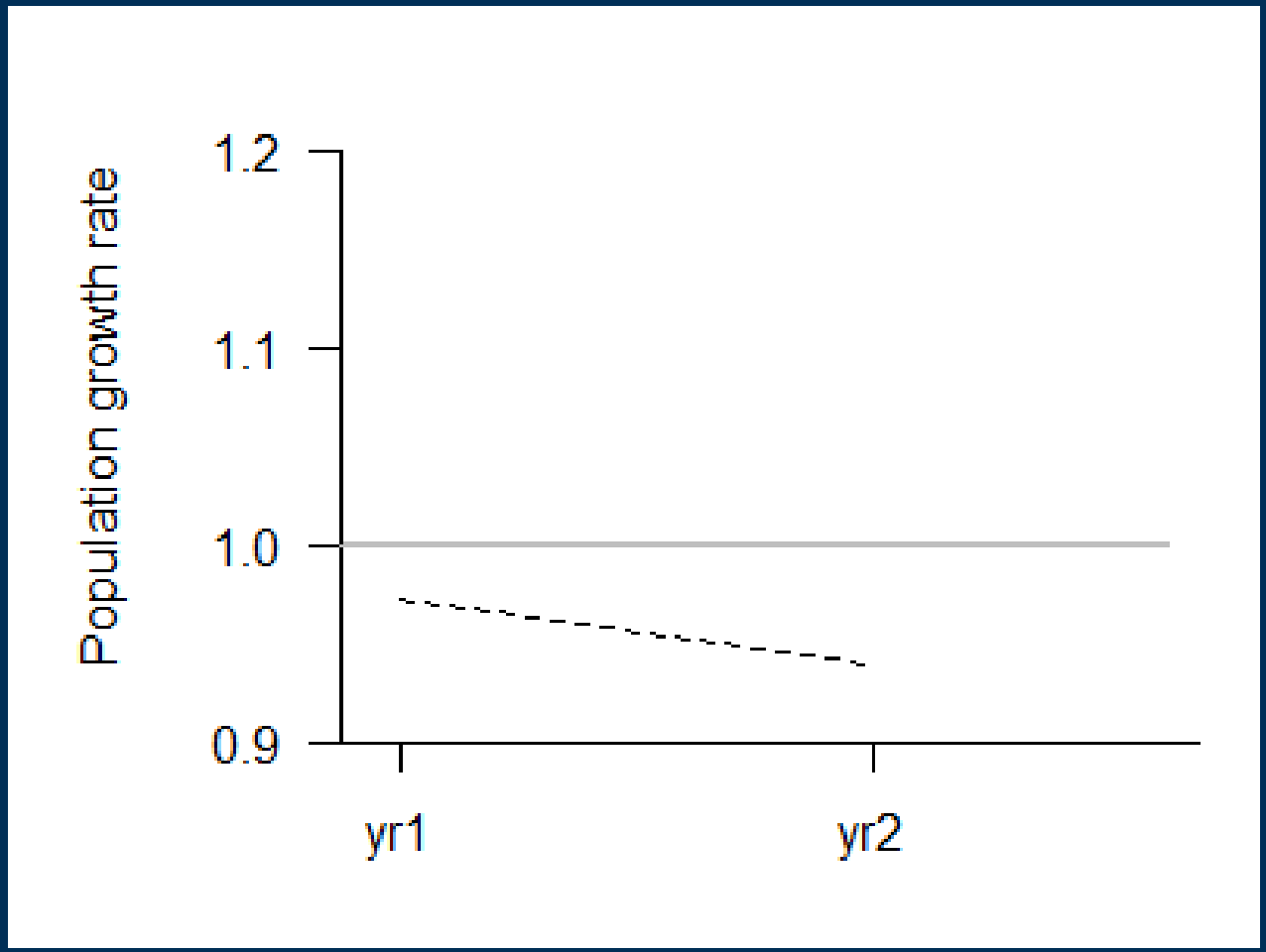
Population growth rate (λ)



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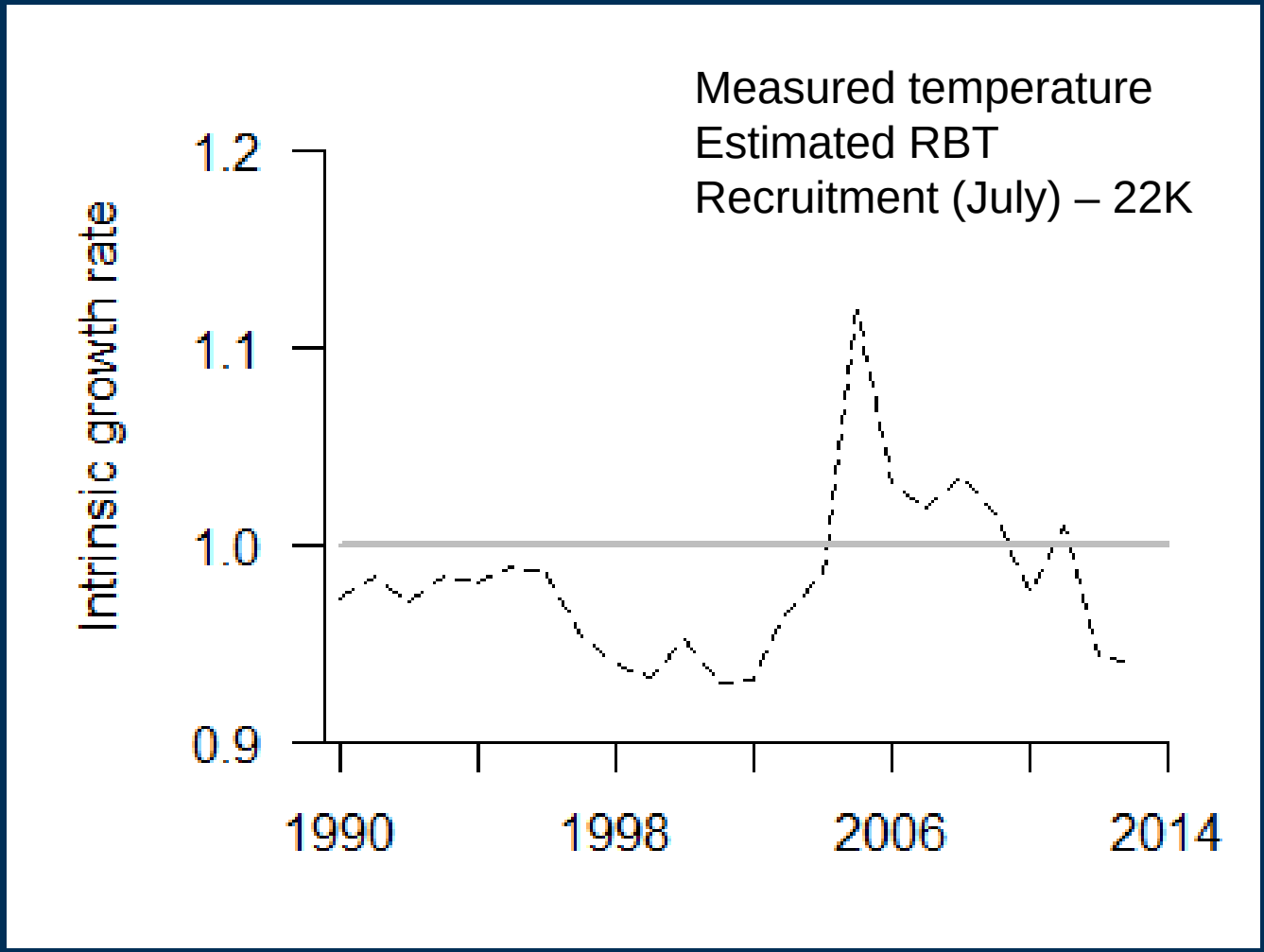

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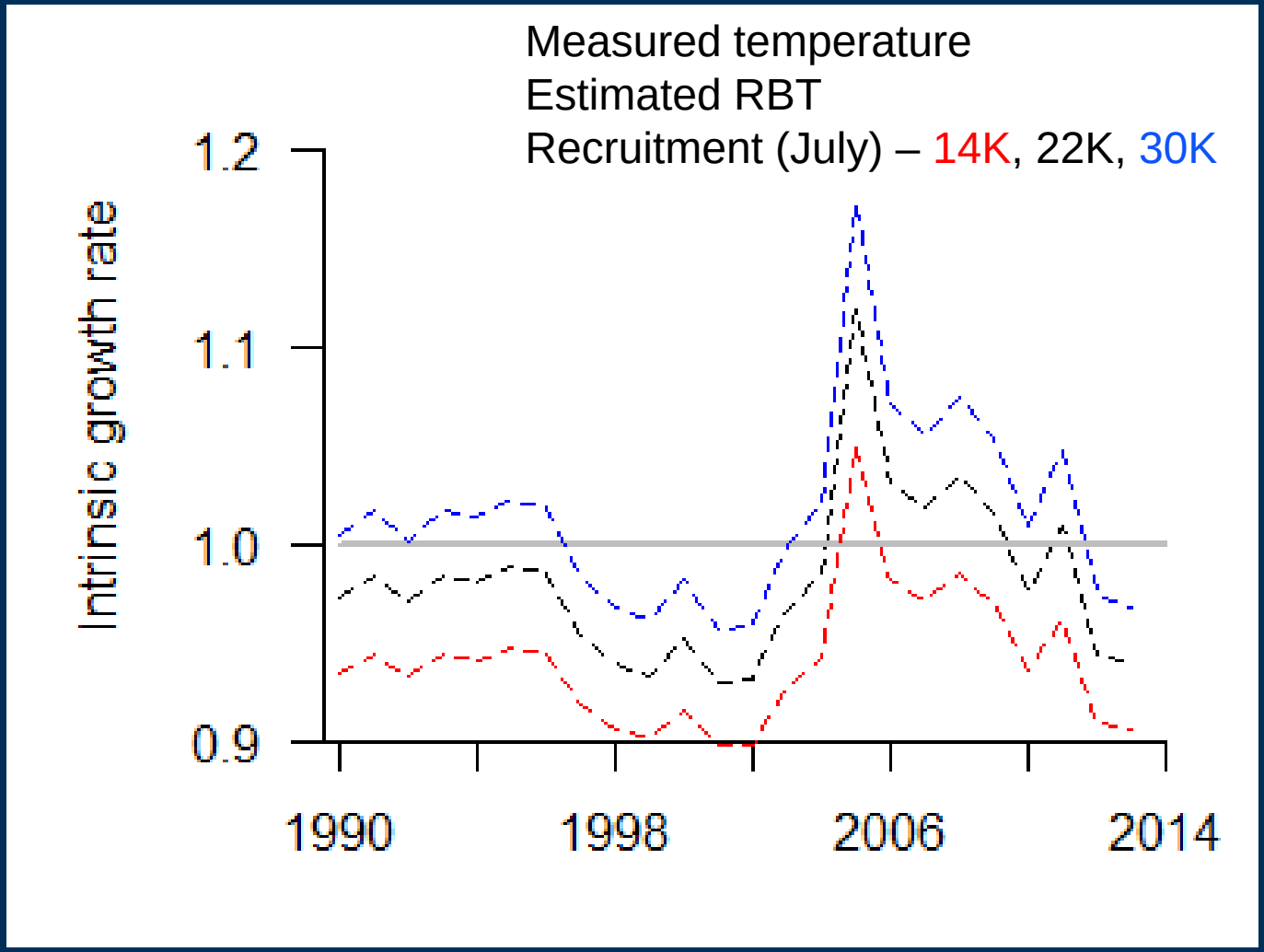

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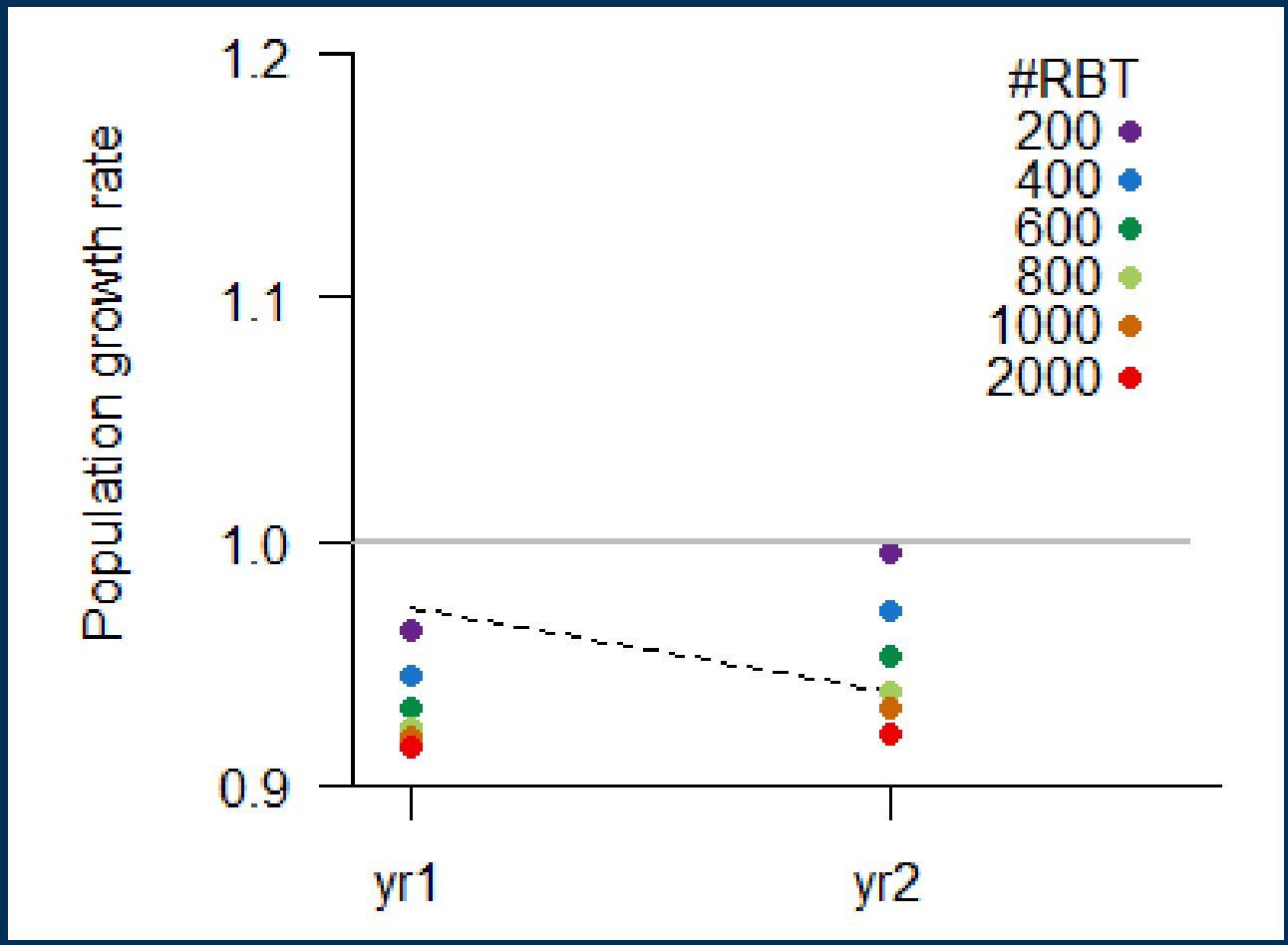

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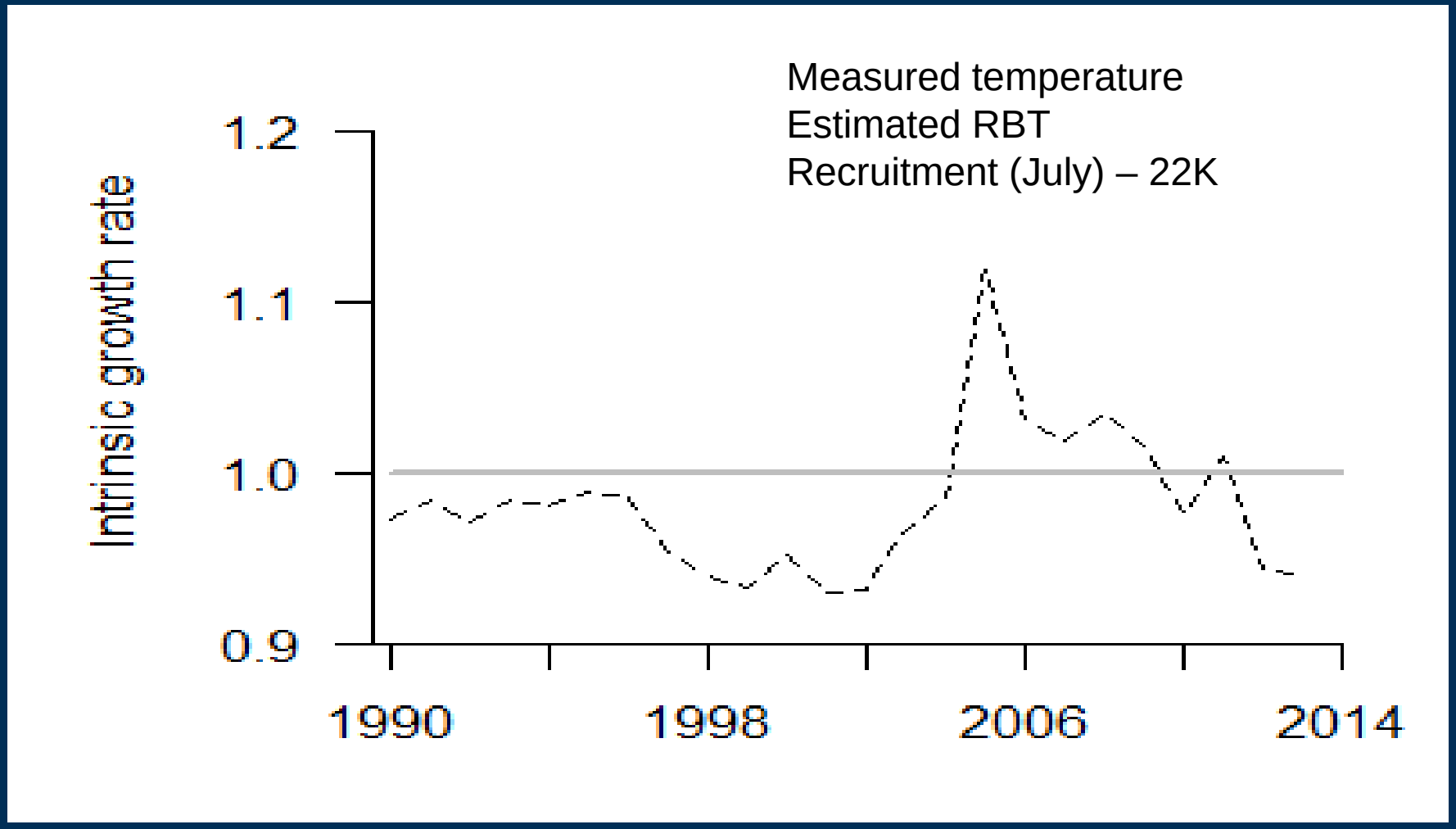

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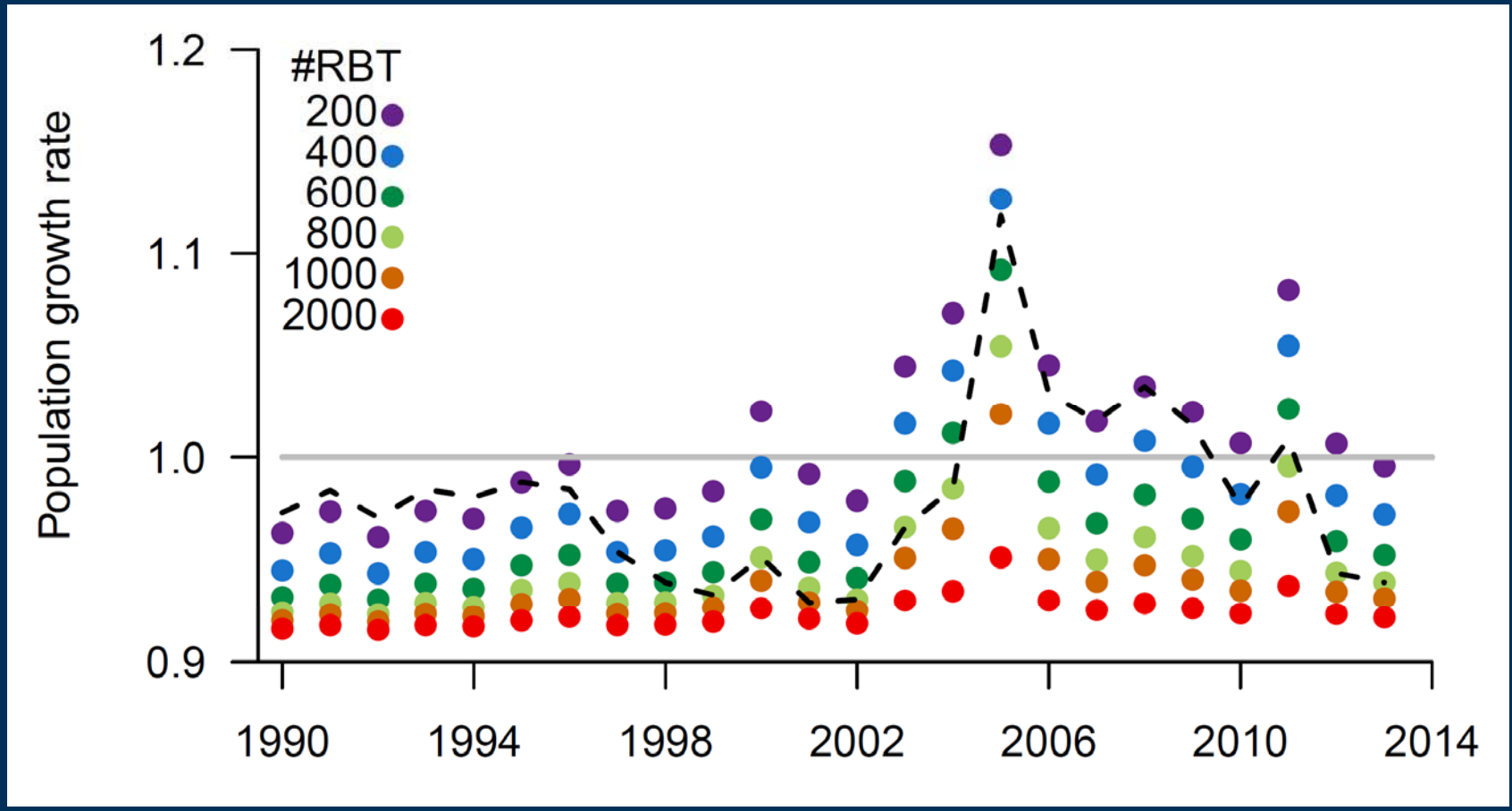

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Trying to address title in Agenda

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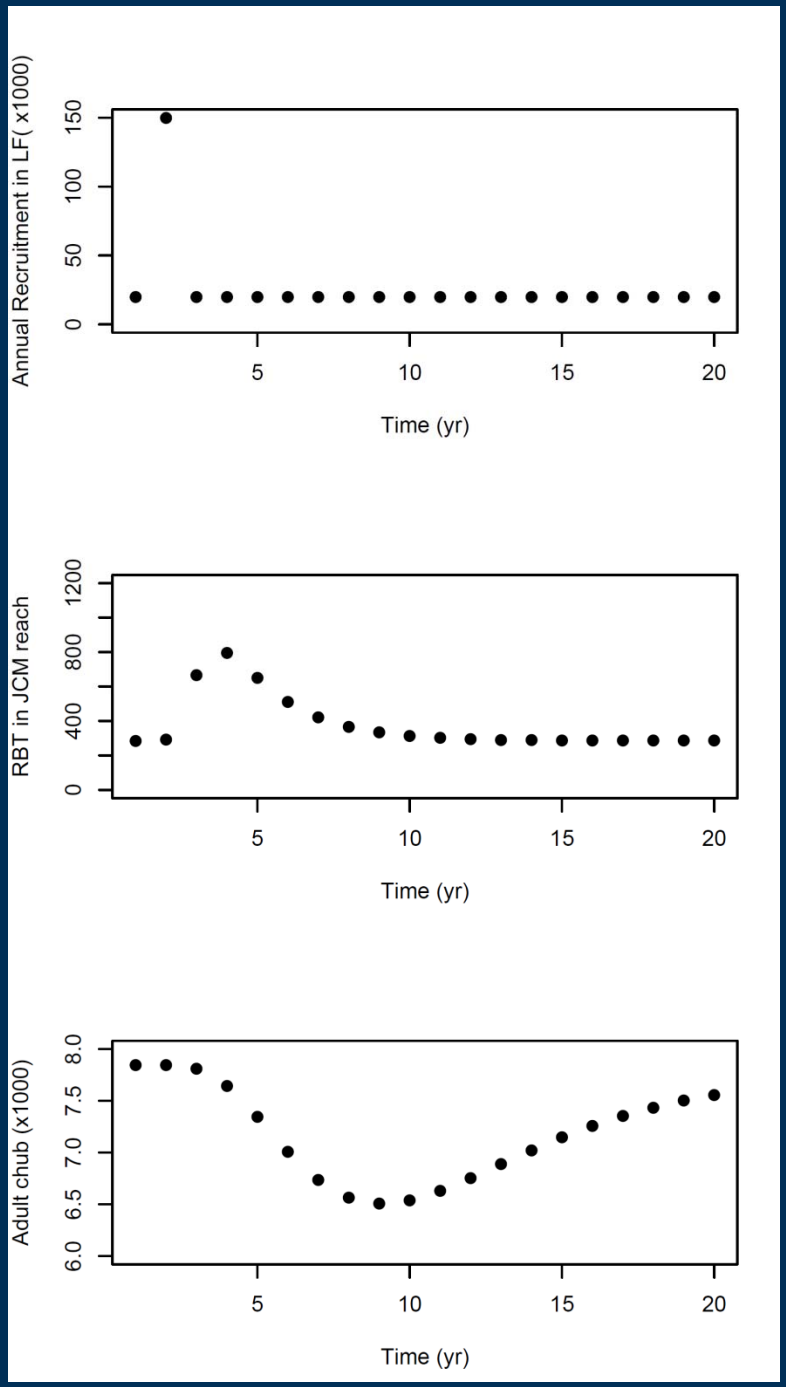

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Five questions regarding RBT recruitment/flow and movement

- Is it the seasonality of HFE's that matter or the amount of mouths already in the system (or fish condition)?
- Does the magnitude of HFE's matter?
- Is it the large discharge or steadiness associated with equalization that led to 2011 response, or both?

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Five questions regarding RBT recruitment/flow and movement

- How are movement rates downstream affected by extrinsic (e.g., turbidity) and intrisic factors (e.g., fish condition)?

- Is their a tipping point where Marble Canyon begins to maintain a large self-sustaining RBT population?

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Acknowledgements

- US Fish and Wildlife Service
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- National Park Service

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