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2020 GCDAMP Annual Reporting Meeting Overview – Part 2 (cont.)

Adaptive Management Work Group Meeting
Feb 12-13, 2020

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Southwest Biological Science Center
Grand Canyon Monitoring and Research Center

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

Outline

- Part 1
  - Humpback Chub
  - Native and Nonnative Fishes
  - Bug Flows
- Part 2
  - Nutrients and Temperature as Ecosystem Drivers and Lake Powell
  - Riparian Vegetation
  - Warm-Water Invasive Fishes
  - Trout
- Part 3
  - Sediment
  - Archaeological Site Monitoring
  - Socioeconomics and Hydropower

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Project I. Effects of Warm-Water Invasive Species on Native Colorado River Fishes

Channel Catfish

- Nocturnal
- Effective predator in turbid water
- Large gape
- Abundant in Little Colorado River

Green Sunfish

- Aggressive predator
- Group hunting behavior
- Highly fecund
- Prone to rapid colonization
- Can be spread with HFE's

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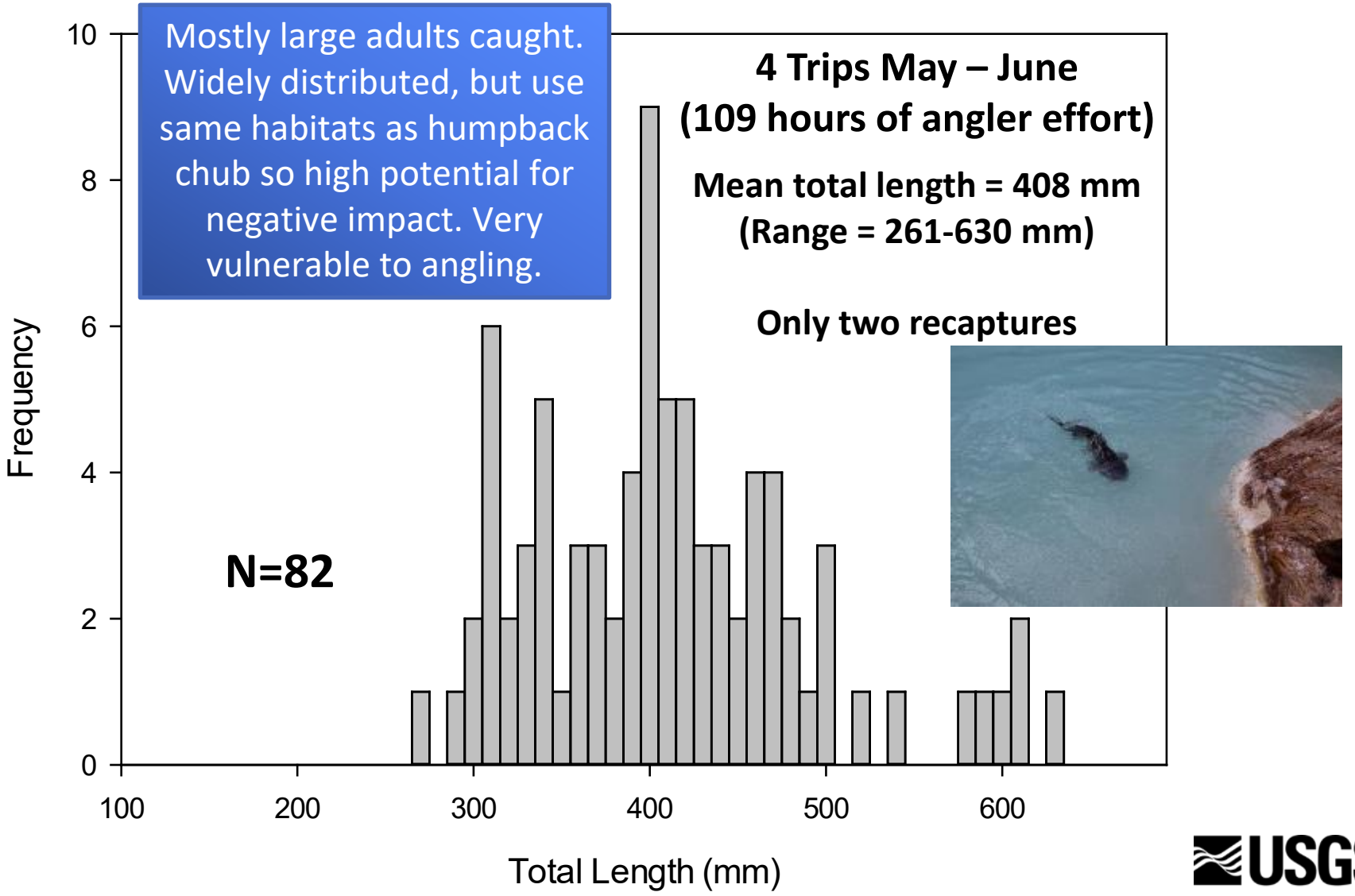
Channel Catfish caught in the Little Colorado River by Angling – 2019



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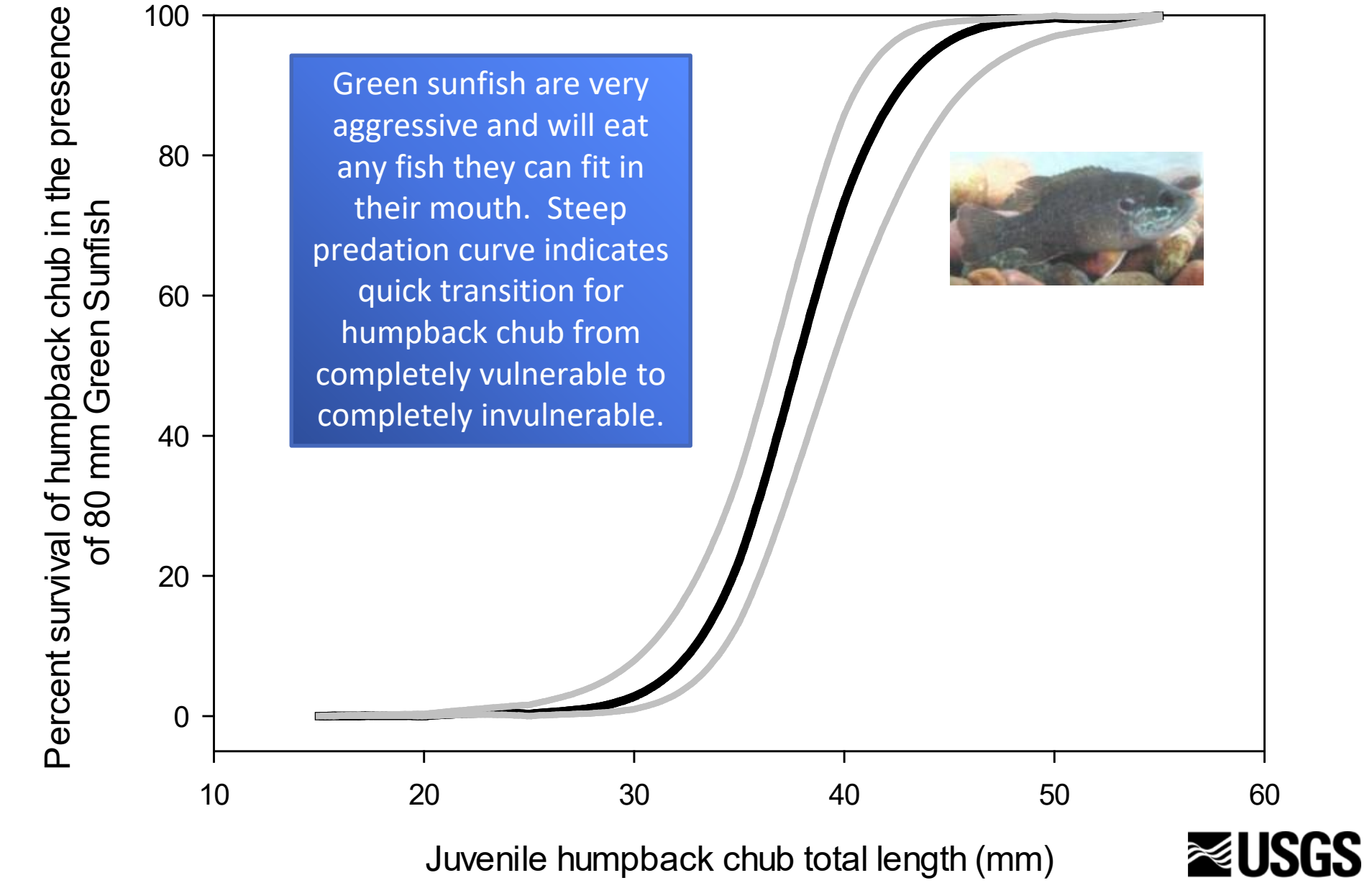
Laboratory predation trials with Green Sunfish



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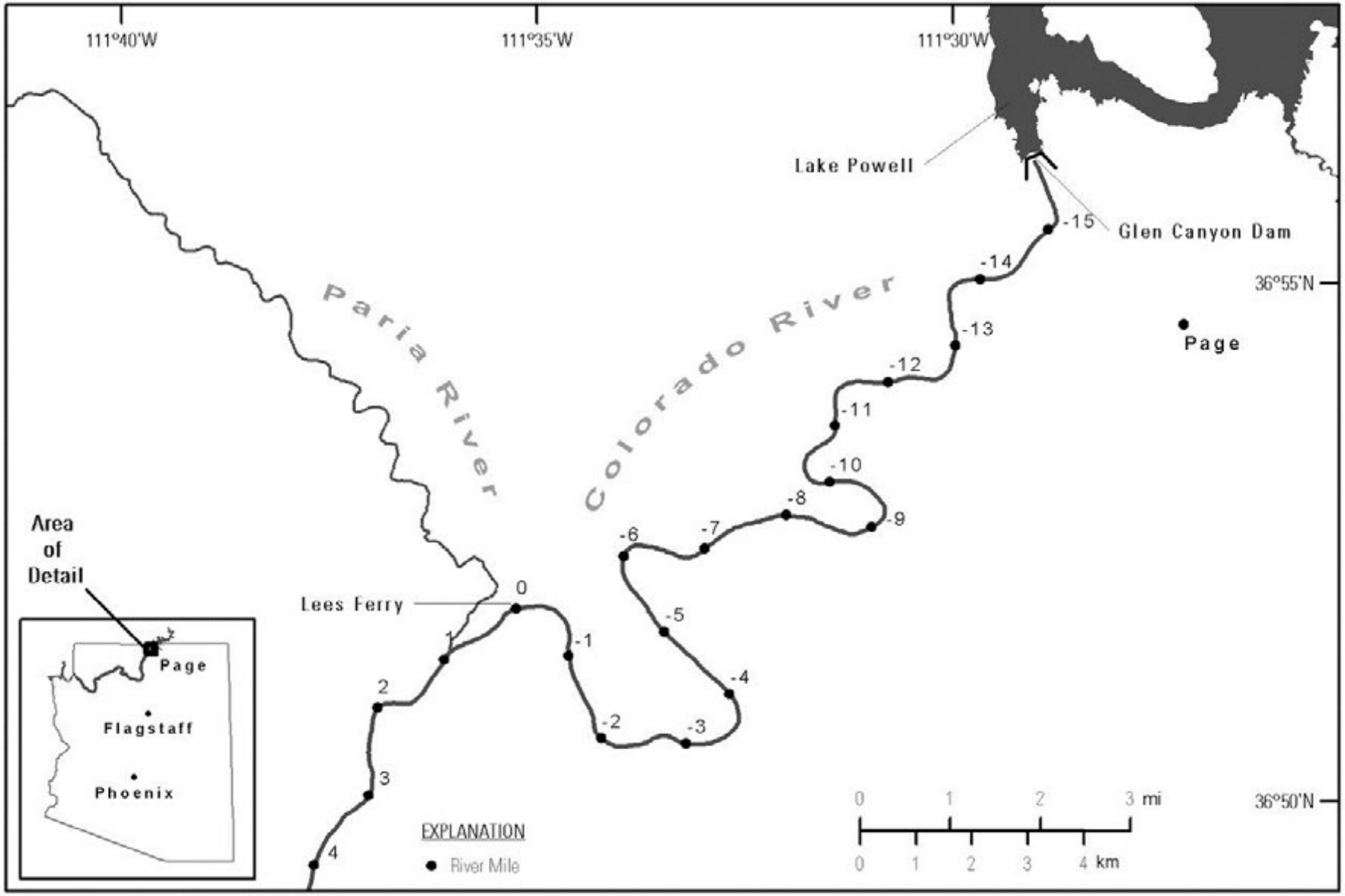
Rainbow Trout and Brown Trout
Project H

Lees Ferry and Glen Canyon



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Rainbow Trout Catch Rate – electrofishing

Rainbow trout catch rates in Glen Canyon are cyclical and exceed levels in AG&F management plan for Lees Ferry.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)

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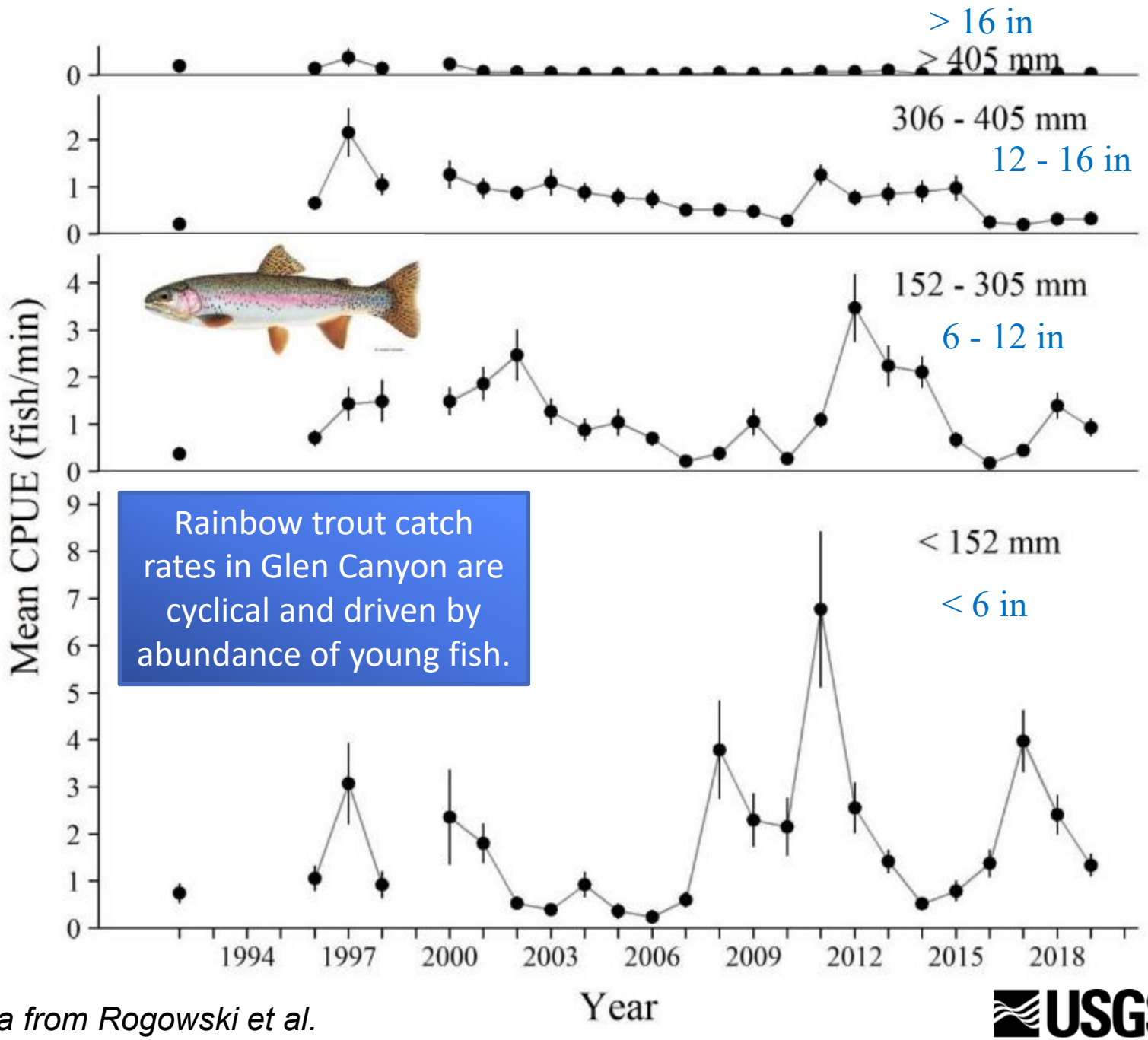
Rainbow Trout Catch Rate by size class



(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)

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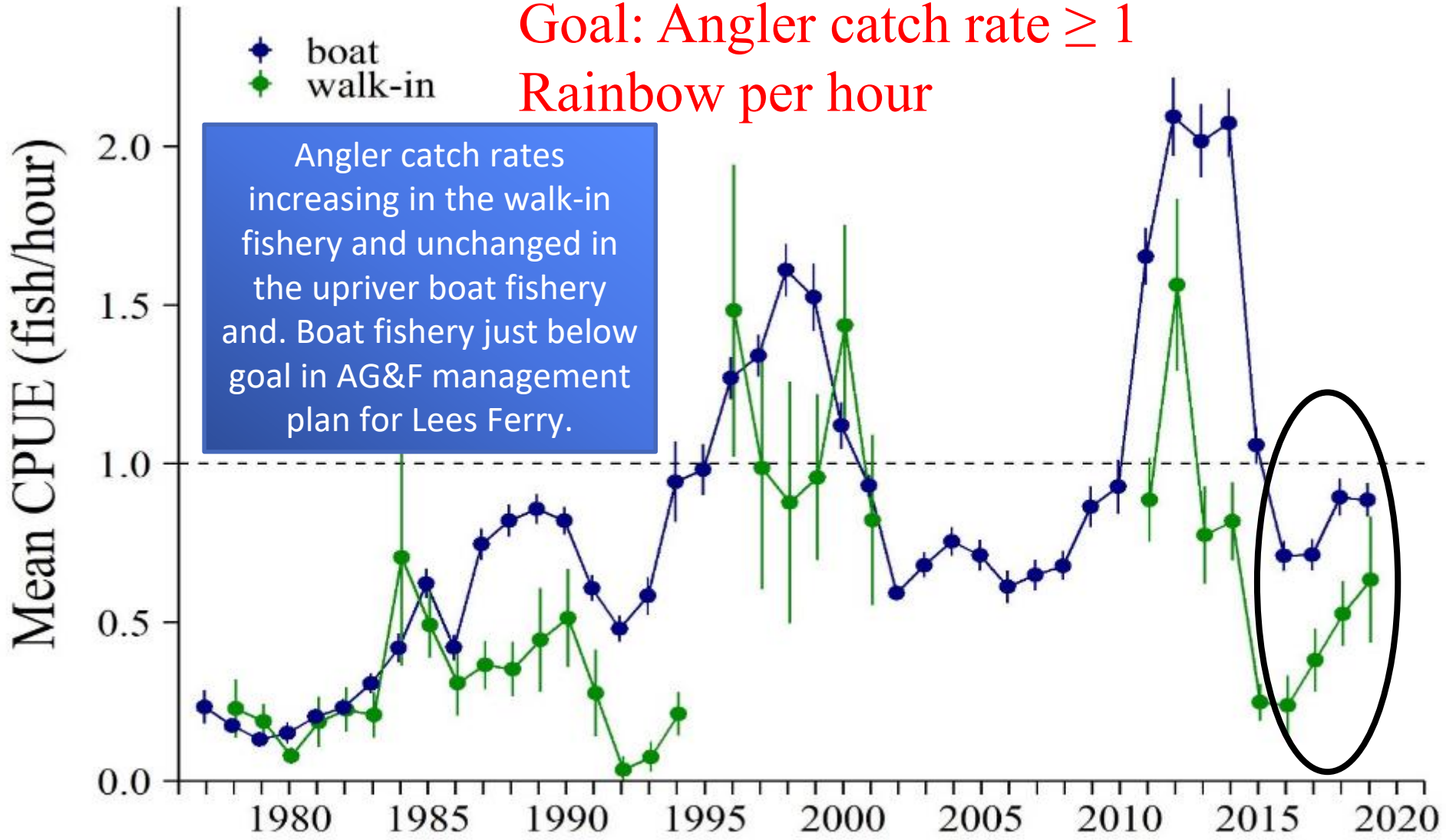
Angler Catch Rate

Goal: Angler catch rate ≥ 1
Rainbow per hour



(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)

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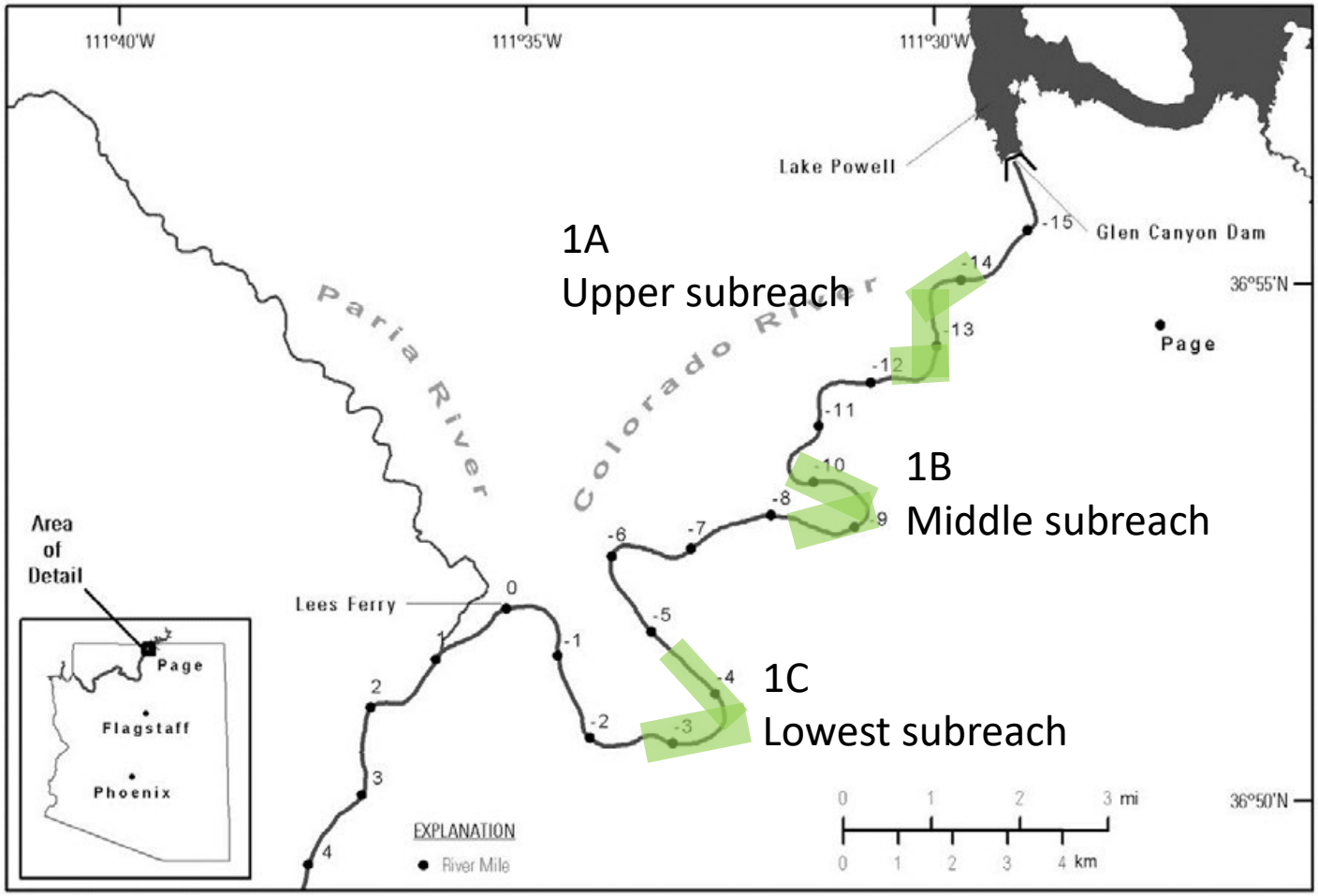
Glen Canyon Study Area



Trout Recruitment, Growth, and Population Dynamics Sampling Design

- Years 2017 – Present
- 4 Full trips per year
- Trips: Jan, Apr, Sep, & Oct
- Sample 3 Subreaches
  - 6 Nights / trip of sampling
  - Subreach - 3 km
- 1 Single mid-summer trip
  - 1C Subreach
  - 2 passes (2 nights)
  - 3 km

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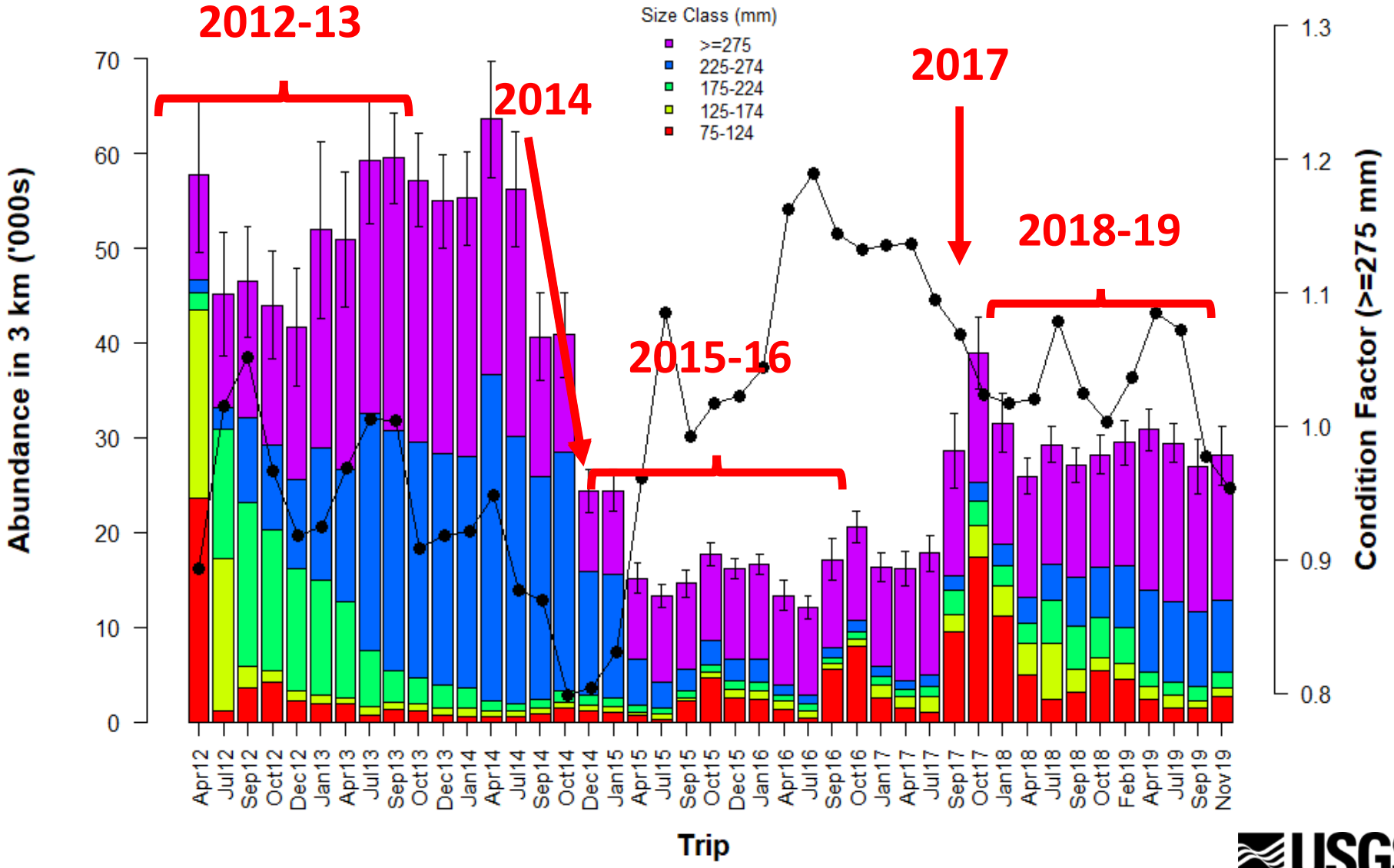
Rainbow Trout Abundance And Condition

1C - Subreach



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Conceptual model

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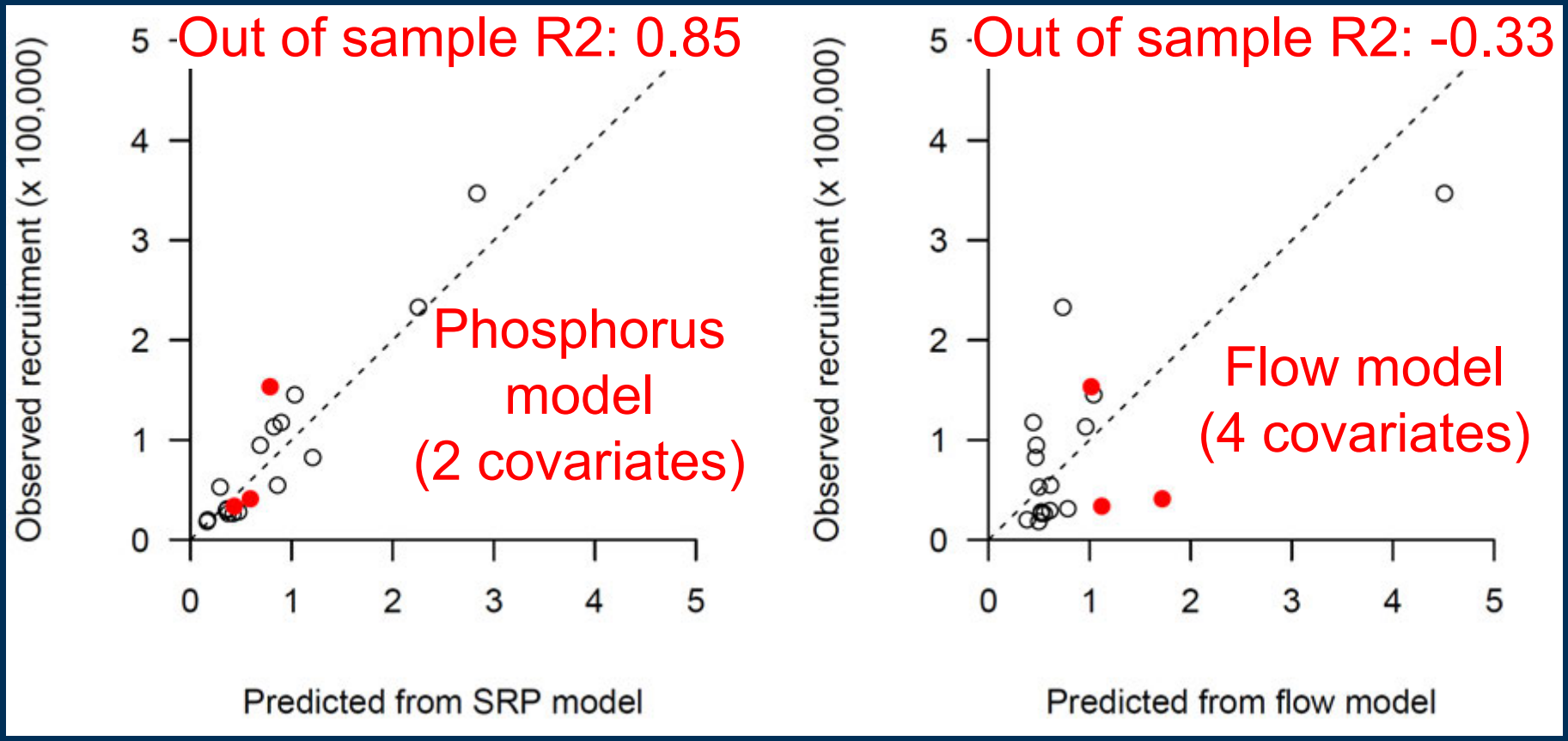
Rainbow Trout Recruitment Models



Model using soluble reactive phosphorus (SRP) and existing rainbow trout population size as covariates outperforms flow model used in LTEMP EIS.

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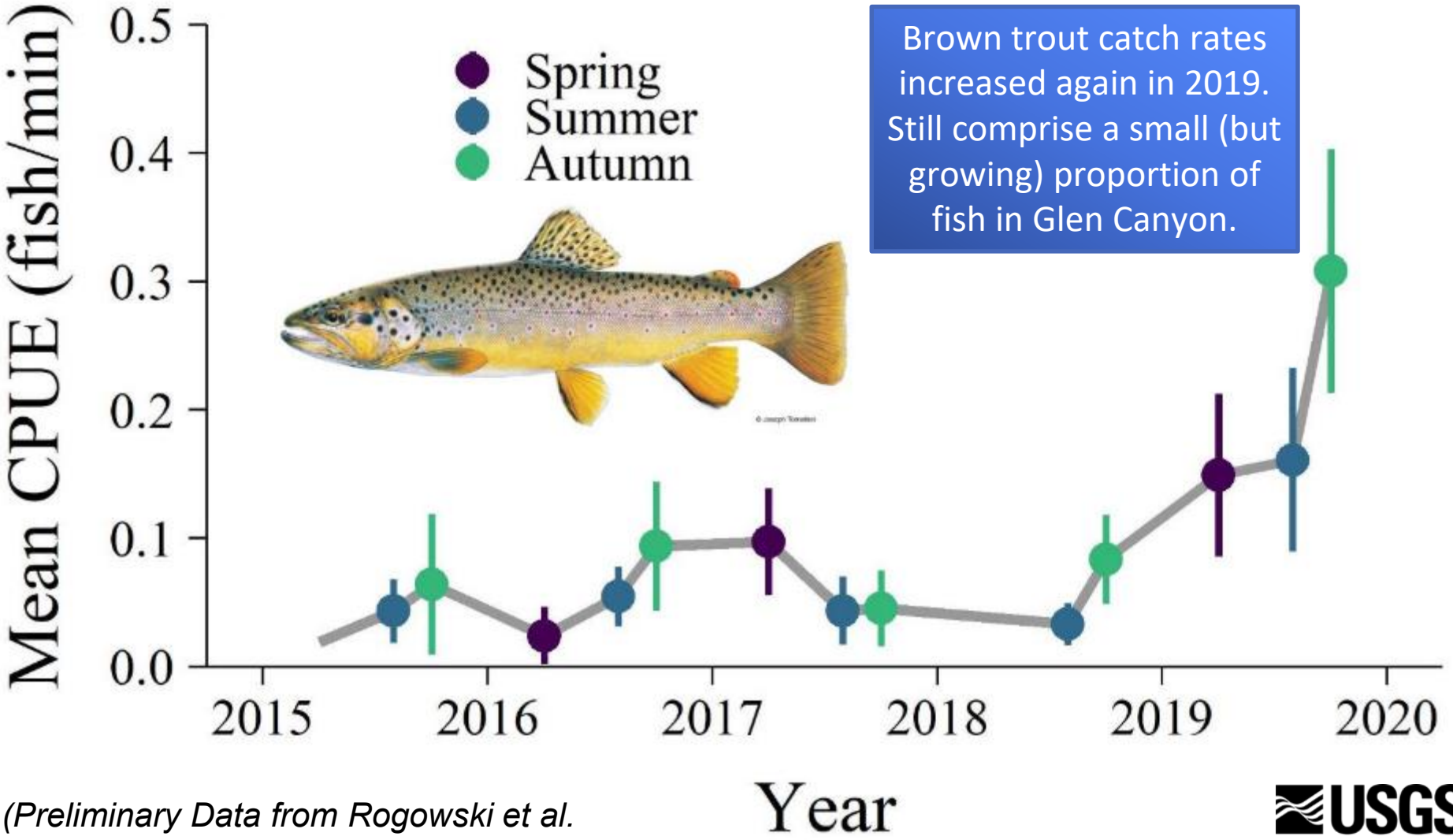
Brown Trout Catch Rate by season (2015-2019)



Brown trout catch rates increased again in 2019. Still comprise a small (but growing) proportion of fish in Glen Canyon.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)

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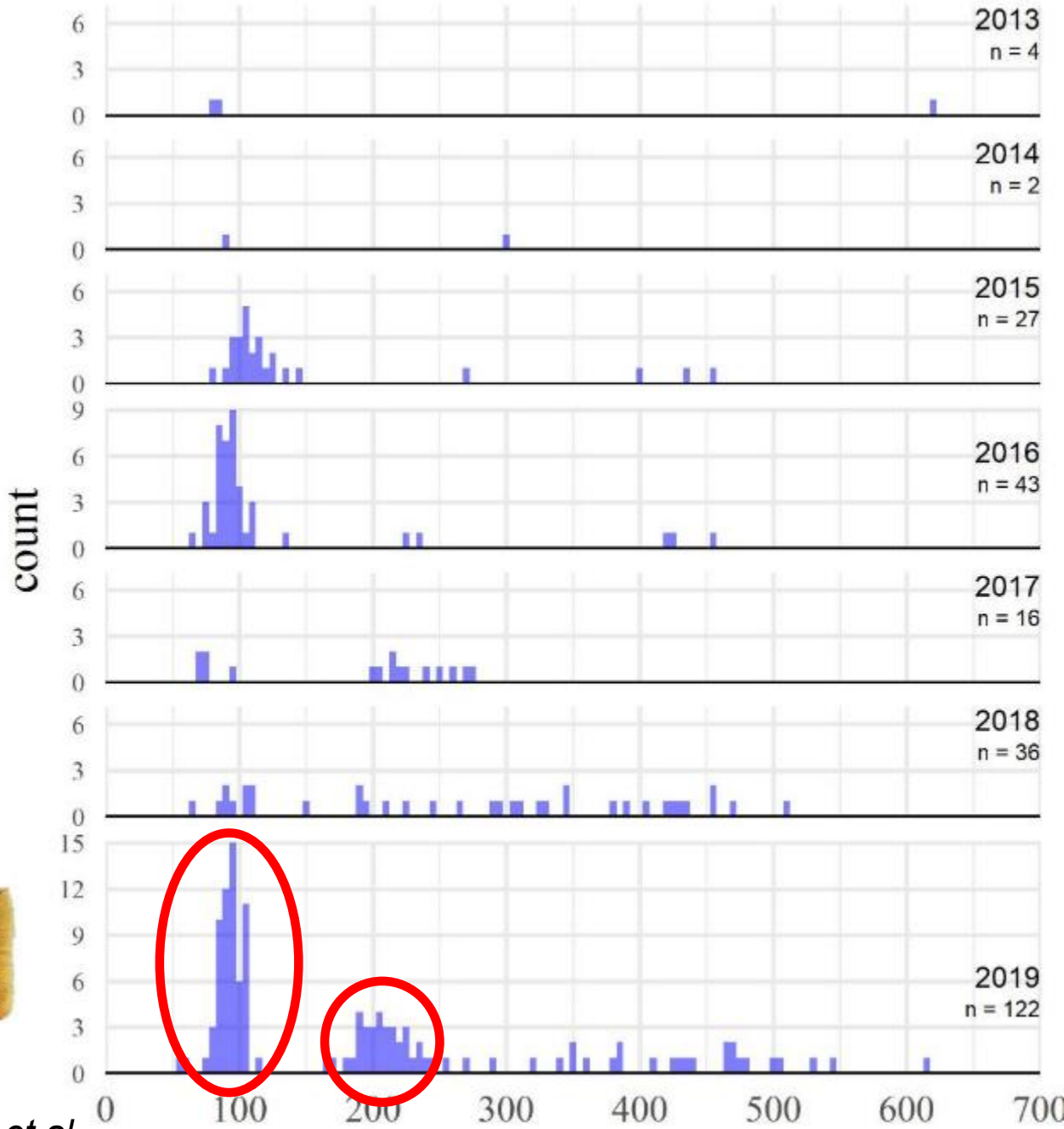
Autumn Brown Trout total length

Higher catch rates in 2019 driven by increase in numbers of young of year and sub adult (200-250 mm) fish. Indicates successful reproduction and recruitment to larger size classes



(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)

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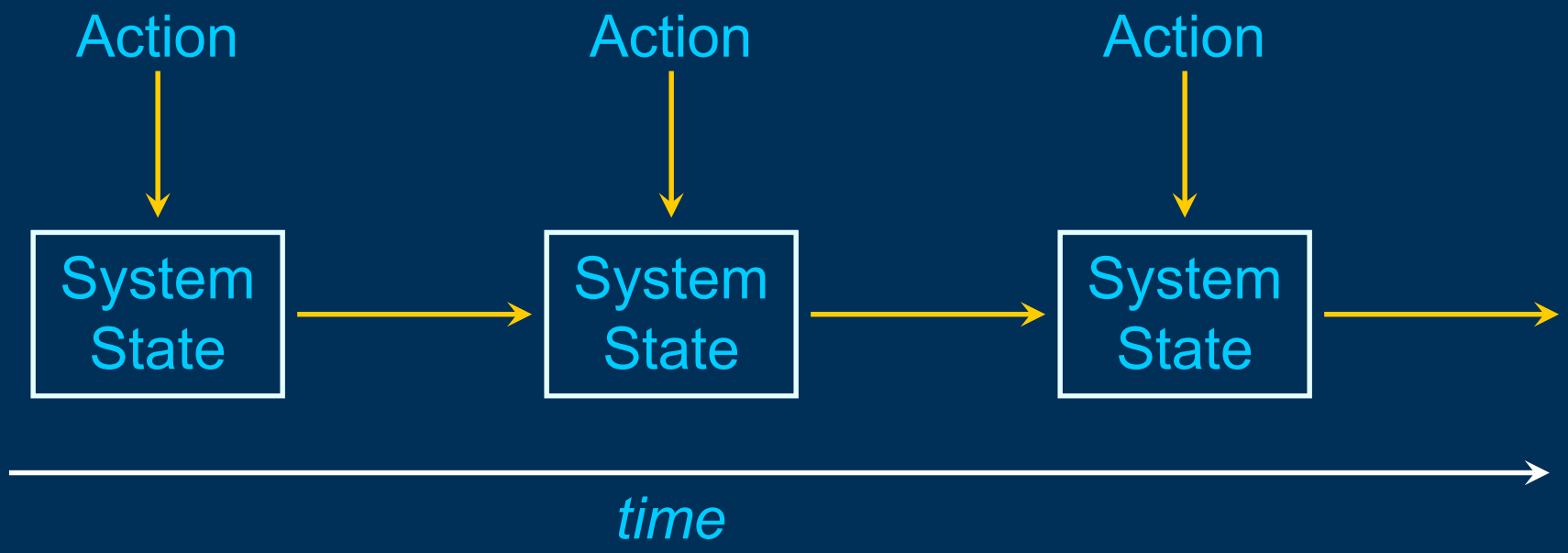
Science needs to improve predictions to be useful
Process understanding (arrows)
State-dependent decisions (boxes)*



Predicting how a state will change through time (horizontal arrows) without management intervention, and how interventions do or do not change this trajectory should be the primary motivation of applied science. Improved precision about actual states only matters when optimal management depends on the state.

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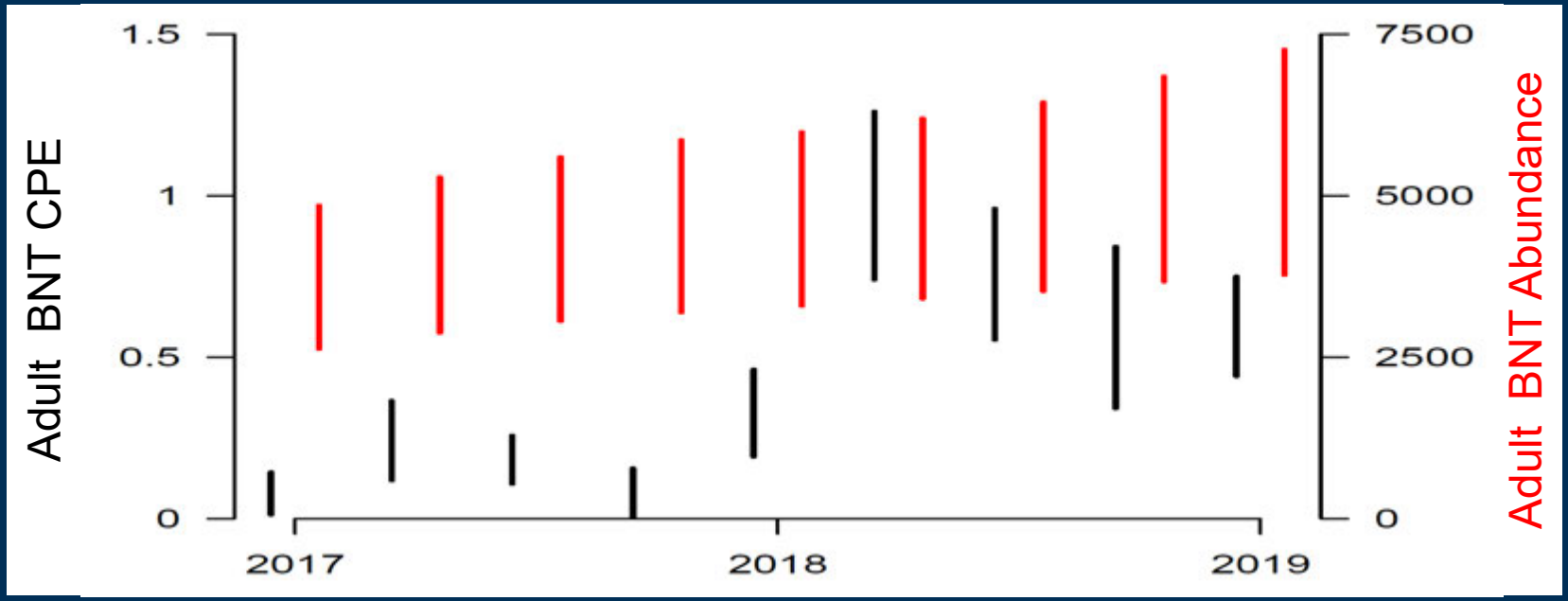
Prediction, models and management

"An approximate answer to the right question is worth a great deal more than a precise answer to the wrong question.“ - Tukey



While catch rates can be useful, mark-recapture methods generate metrics of most value to managers.

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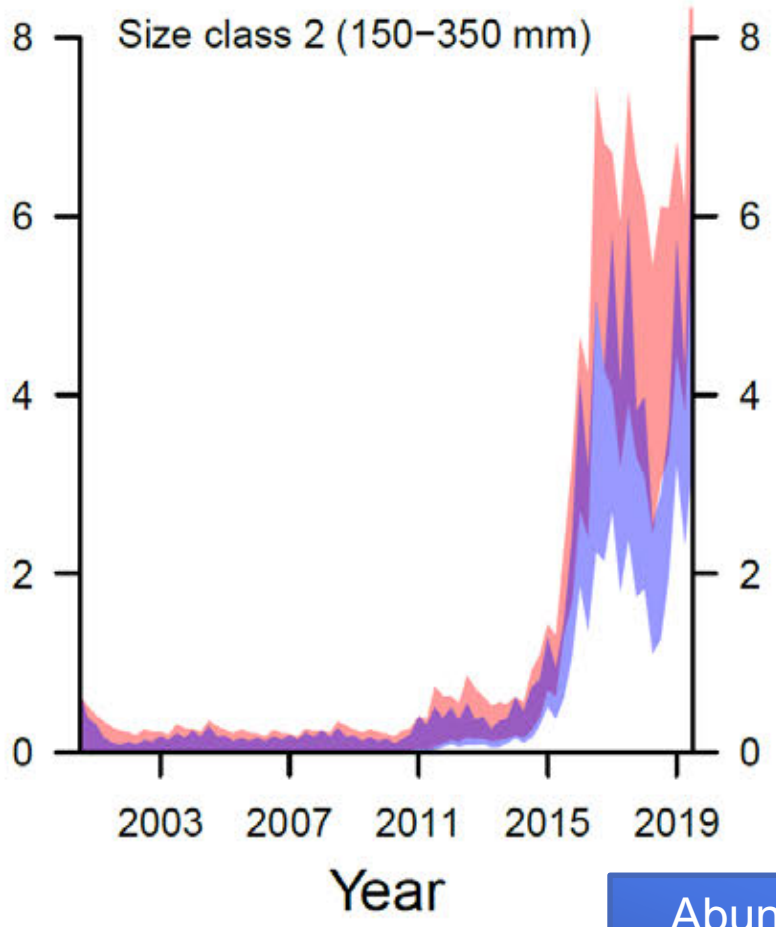
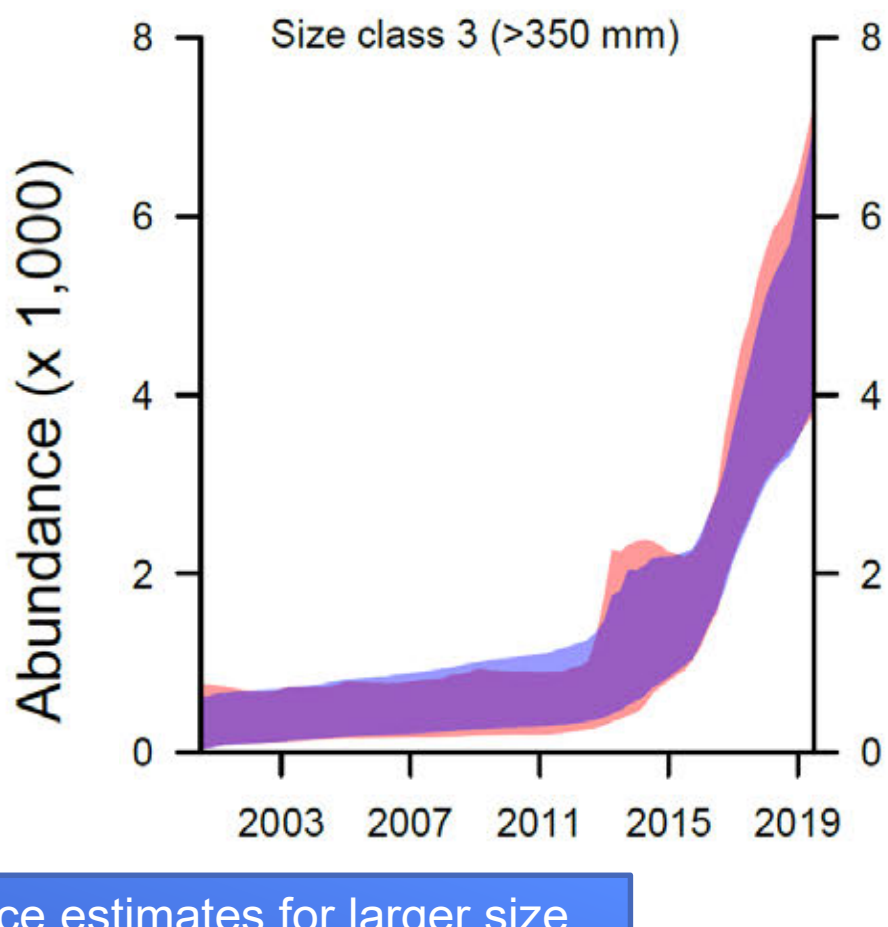
Brown Trout Abundance Estimates - Glen Canyon





Abundance estimates for larger size classes of brown trout are more similar now between models with different assumptions (red and blue represent different assumptions on survival)

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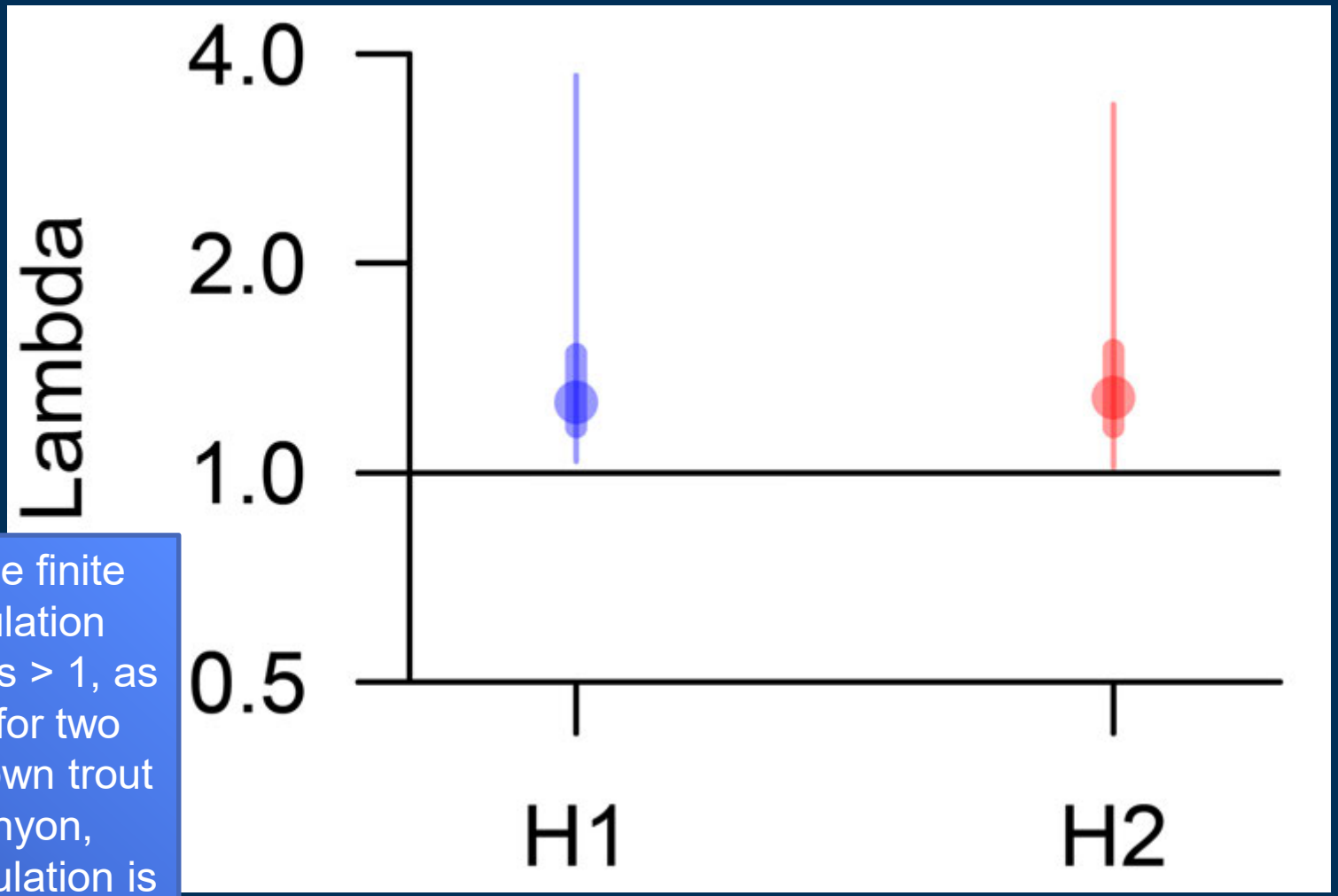
There is no doubt population growth will continue if things don't change



Lambda is the finite rate of population change. Values > 1, as shown here for two models for brown trout in Glen Canyon, indicate a population is increasing.

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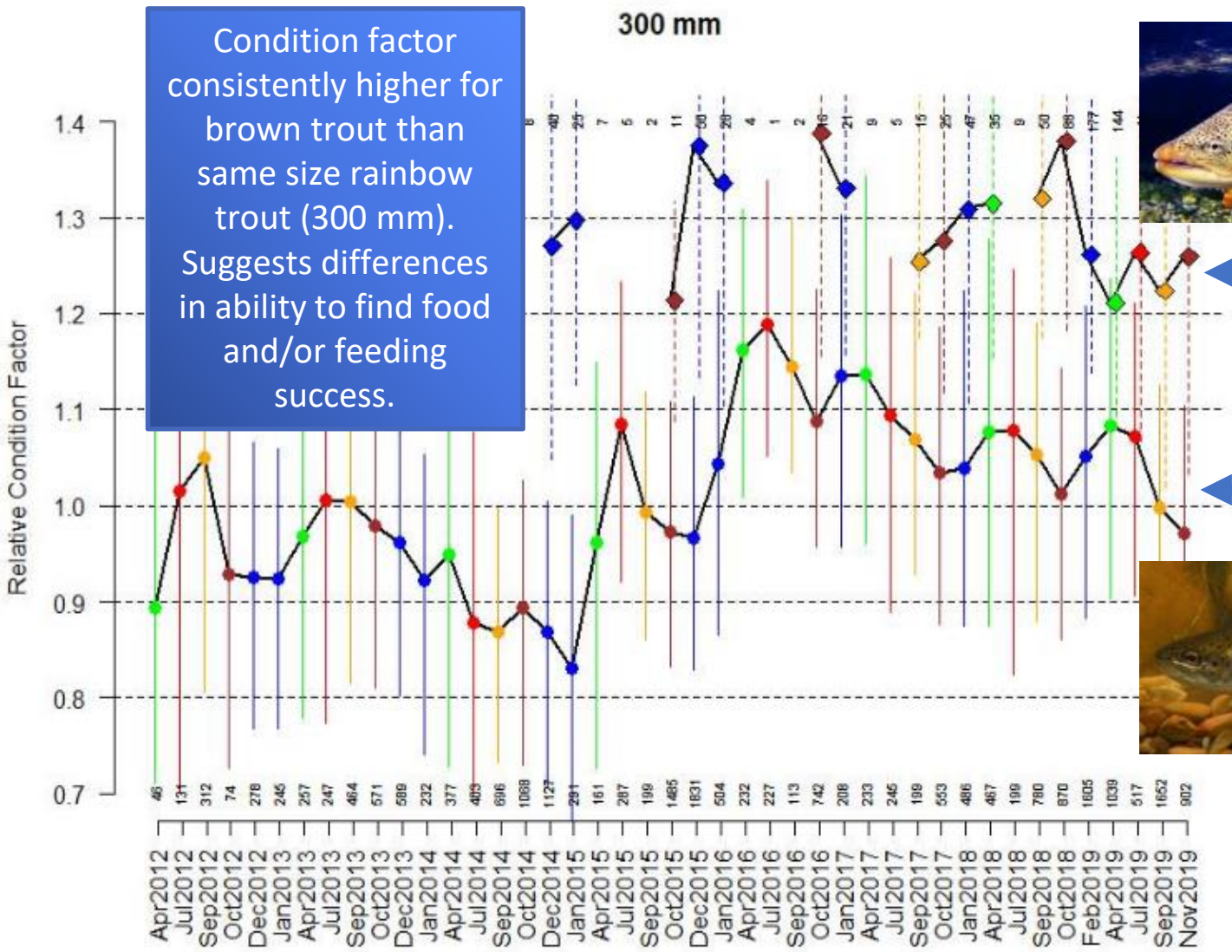
Rainbow Trout And Brown Trout Condition Factor

Condition factor consistently higher for brown trout than same size rainbow trout (300 mm). Suggests differences in ability to find food and/or feeding success.



Brown Trout

Rainbow Trout

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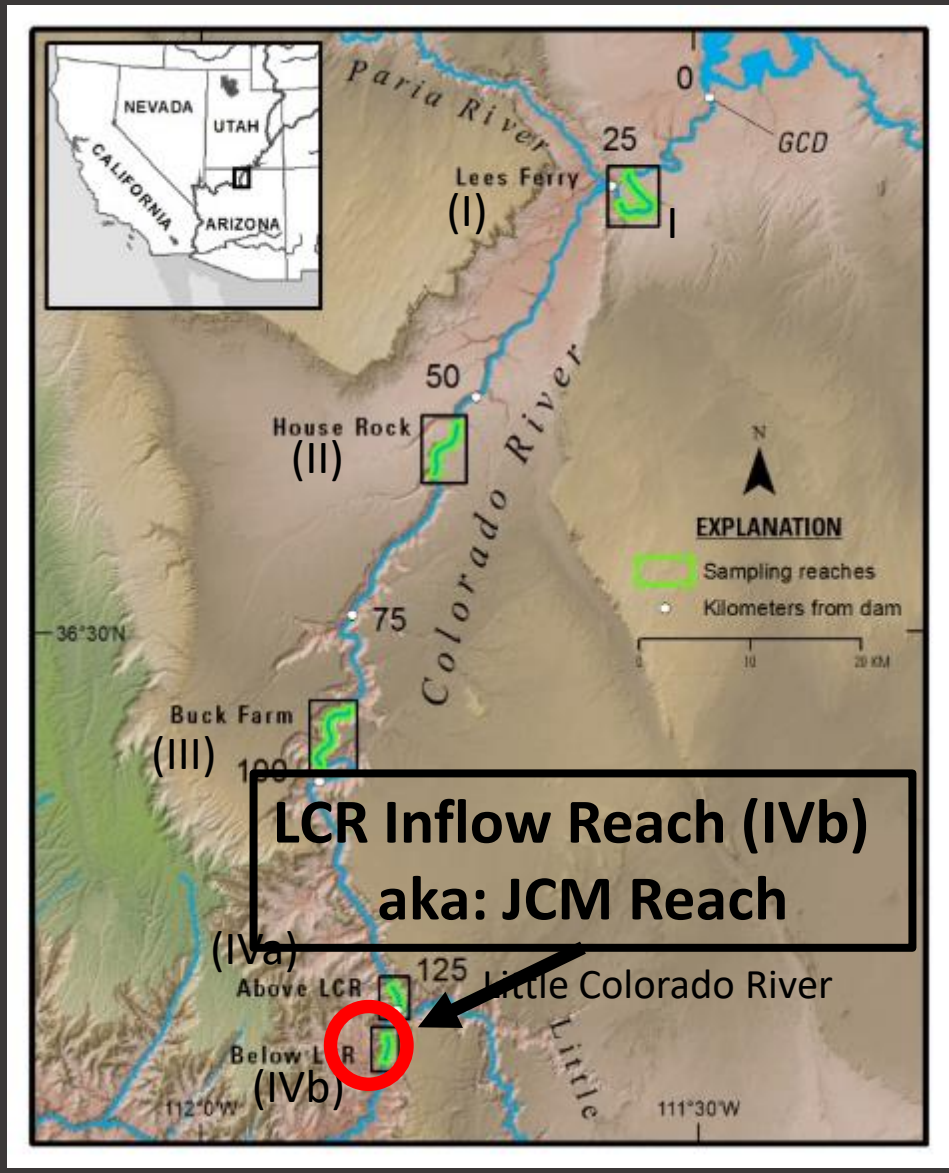
Rainbow Trout Abundance Downstream of the Little Colorado River Confluence

- 5 reaches sampled quarterly, 2012-2016 (Natal Origins)
- Glen Canyon (reach I) and LCR inflow reach (IVb), 2017-2019 (TRGD, JCM)
- No sampling in Marble Canyon (II-IVa) after 2016 except for one night in reach II on July and September trips
- Mark-recapture used to estimate:
  - abundance
  - survival rate
  - recruitment (births and immigration)
  - growth rate
  - movement
- Drift measured in each reach on each trip, 2012-2016



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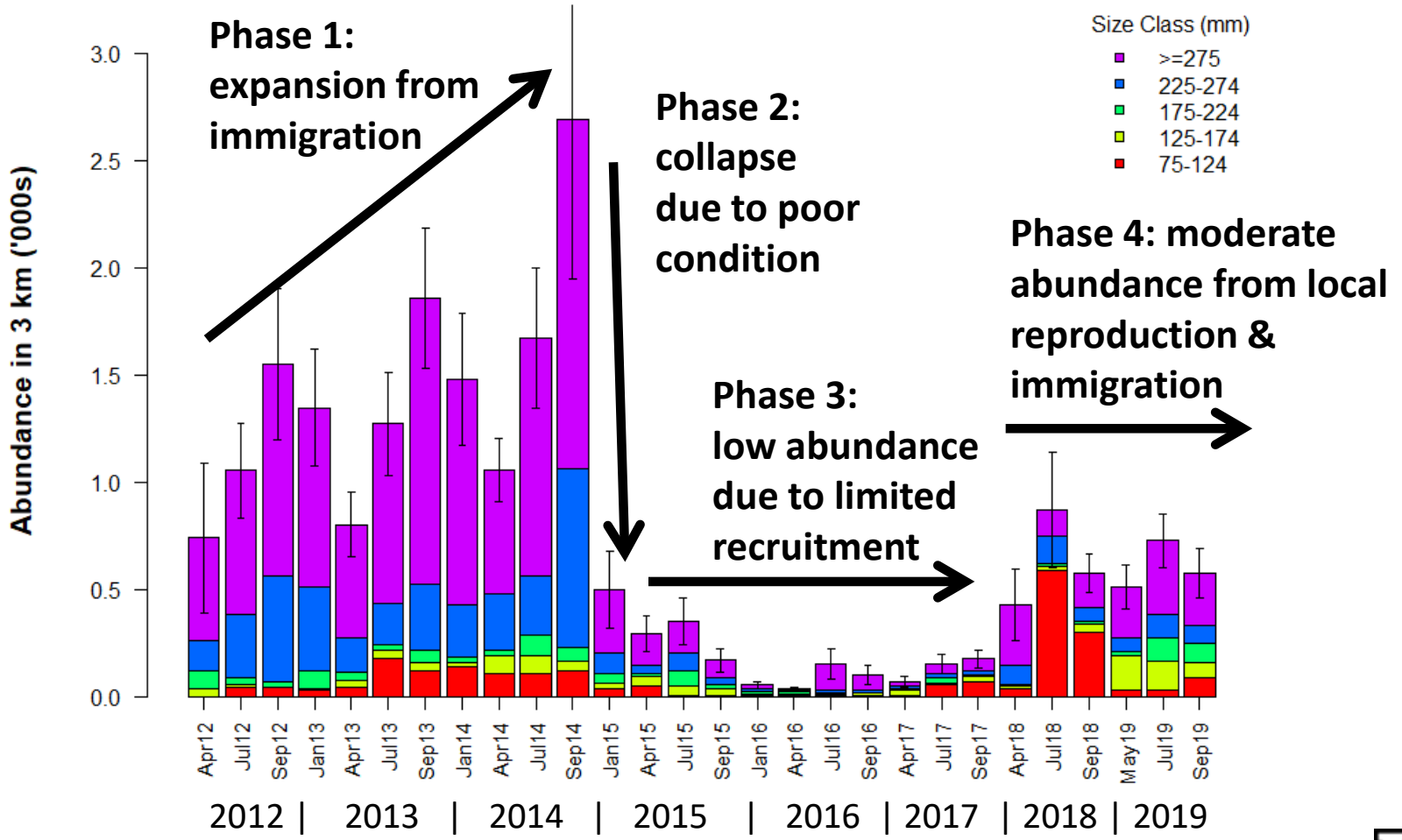
Trend in Rainbow Trout Abundance Downstream of the Little Colorado River (IVb, inflow reach)



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Acknowledgements

- US Dept. of the Interior, Bureau of Reclamation and the Glen Canyon Dam Adaptive Management Program
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- US Geological Survey-GCMRC

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