Rainbow Trout Growth, Condition, Population Dynamics and Modeling in Glen Canyon

Michael D. Yard [1]

Josh Korman [2]

[1] U.S.G.S., Southwest Biological Science Center
Grand Canyon Monitoring & Research Center
Flagstaff, AZ., USA

[2] Ecometric Research Inc.
Vancouver, B.C., V6S 1J3, Canada

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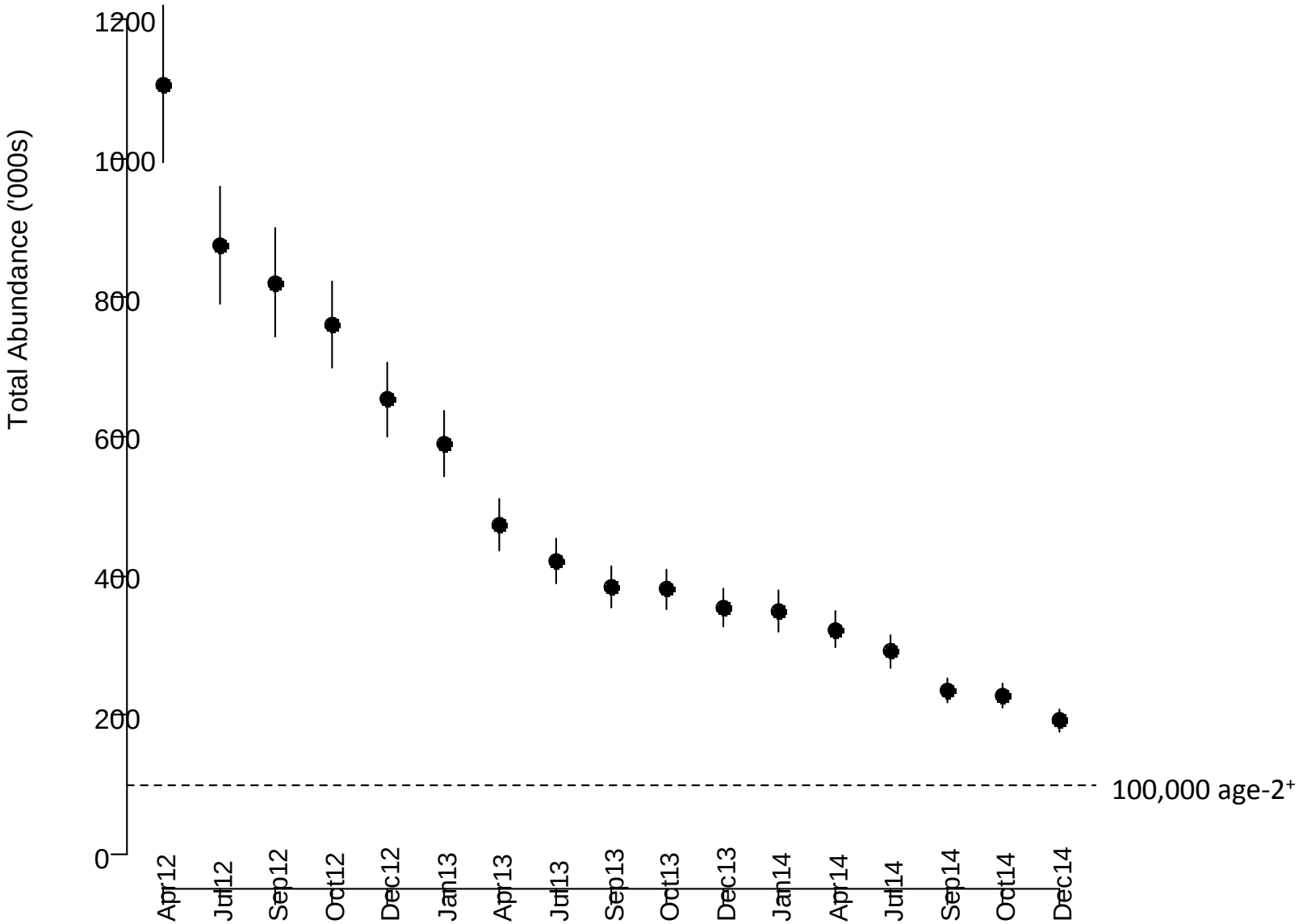
Overview- Glen Canyon (2012-2014).

1. Rainbow trout Abundance
2. Capture probabilities and Catch rates
3. Survival, Recruitment, and Biomass
4. Possible metrics and prescriptive measures
5. Growth rates and Condition
6. Possible mechanisms
7. Conclusions



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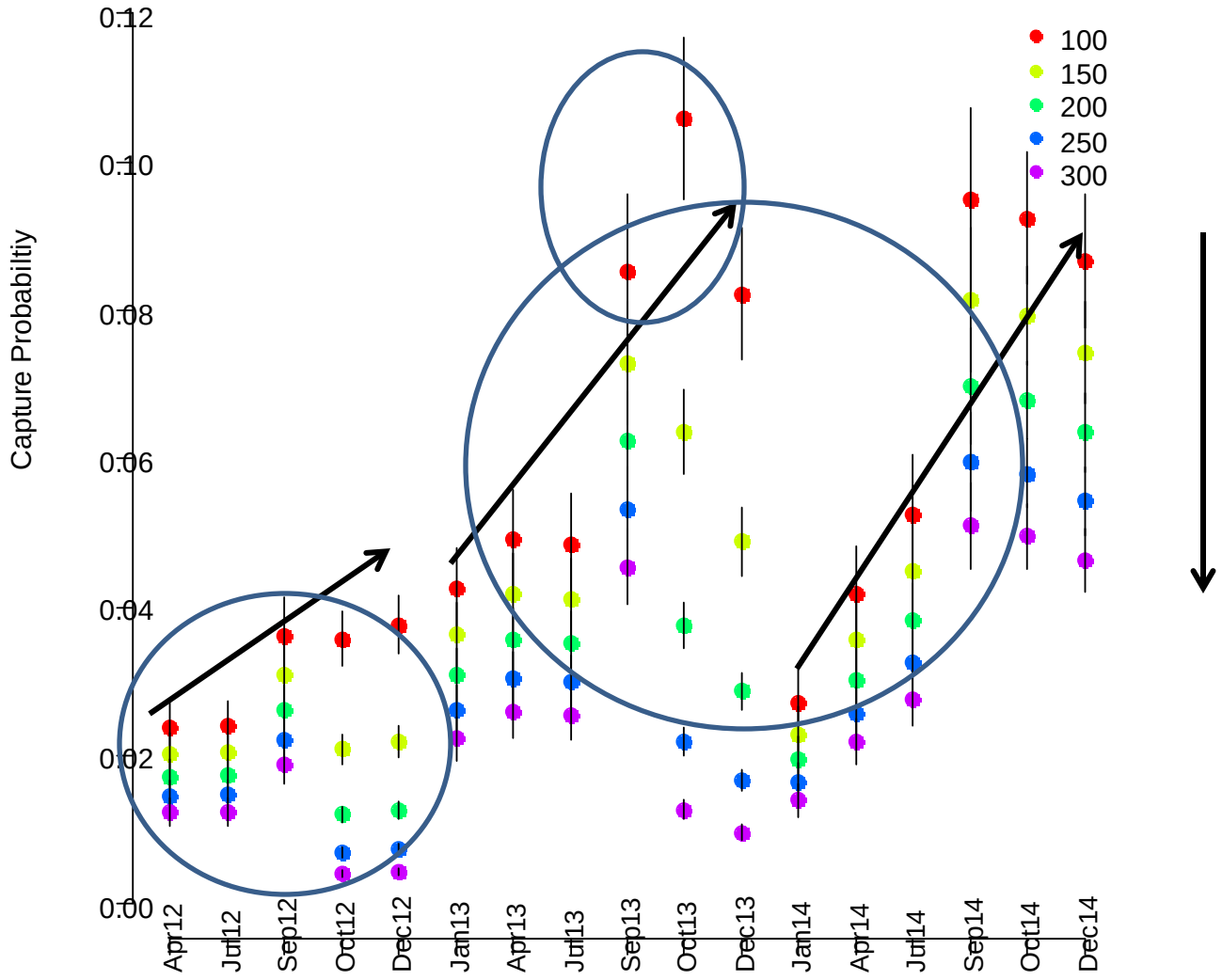

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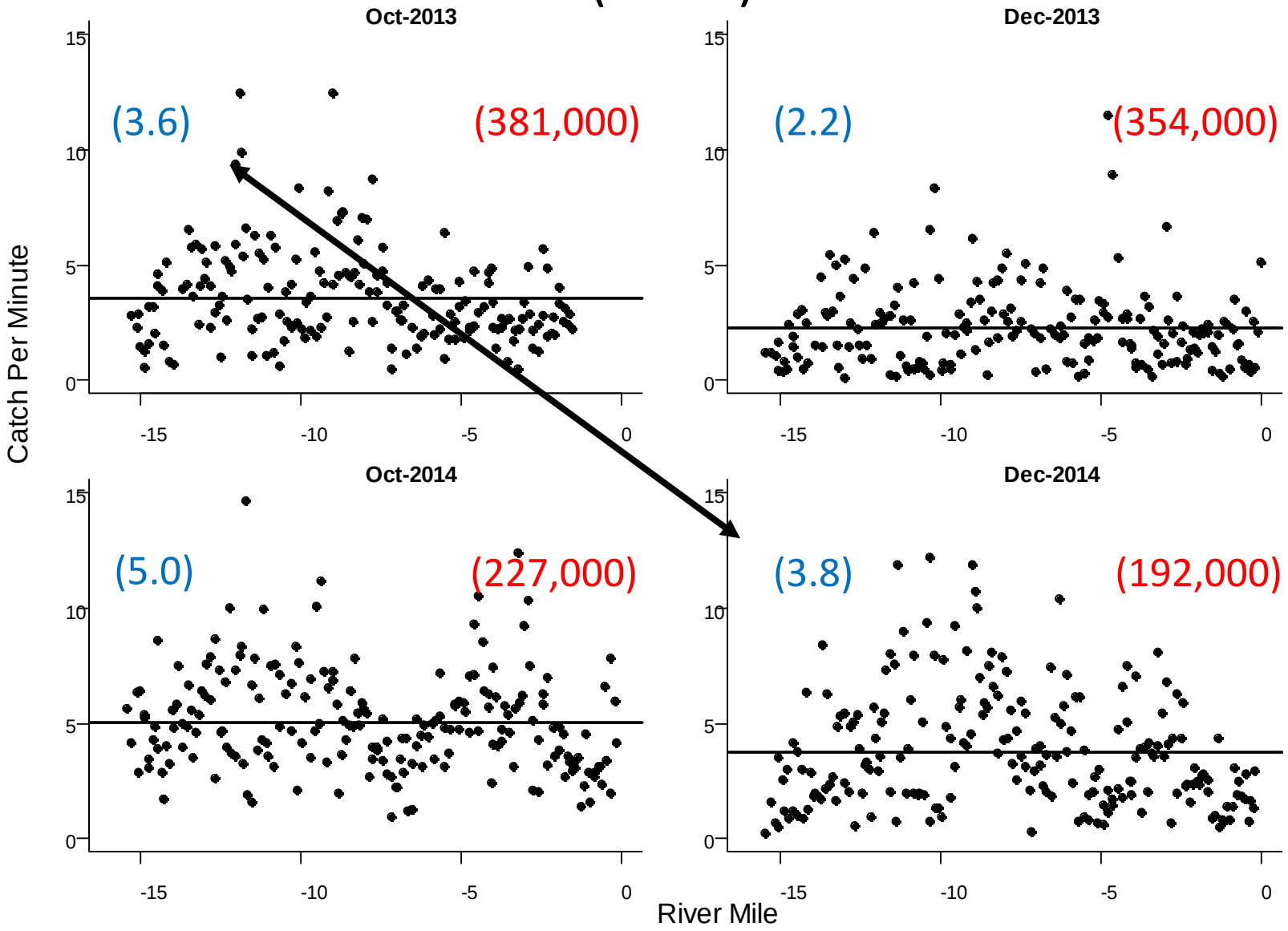
(CPUE)



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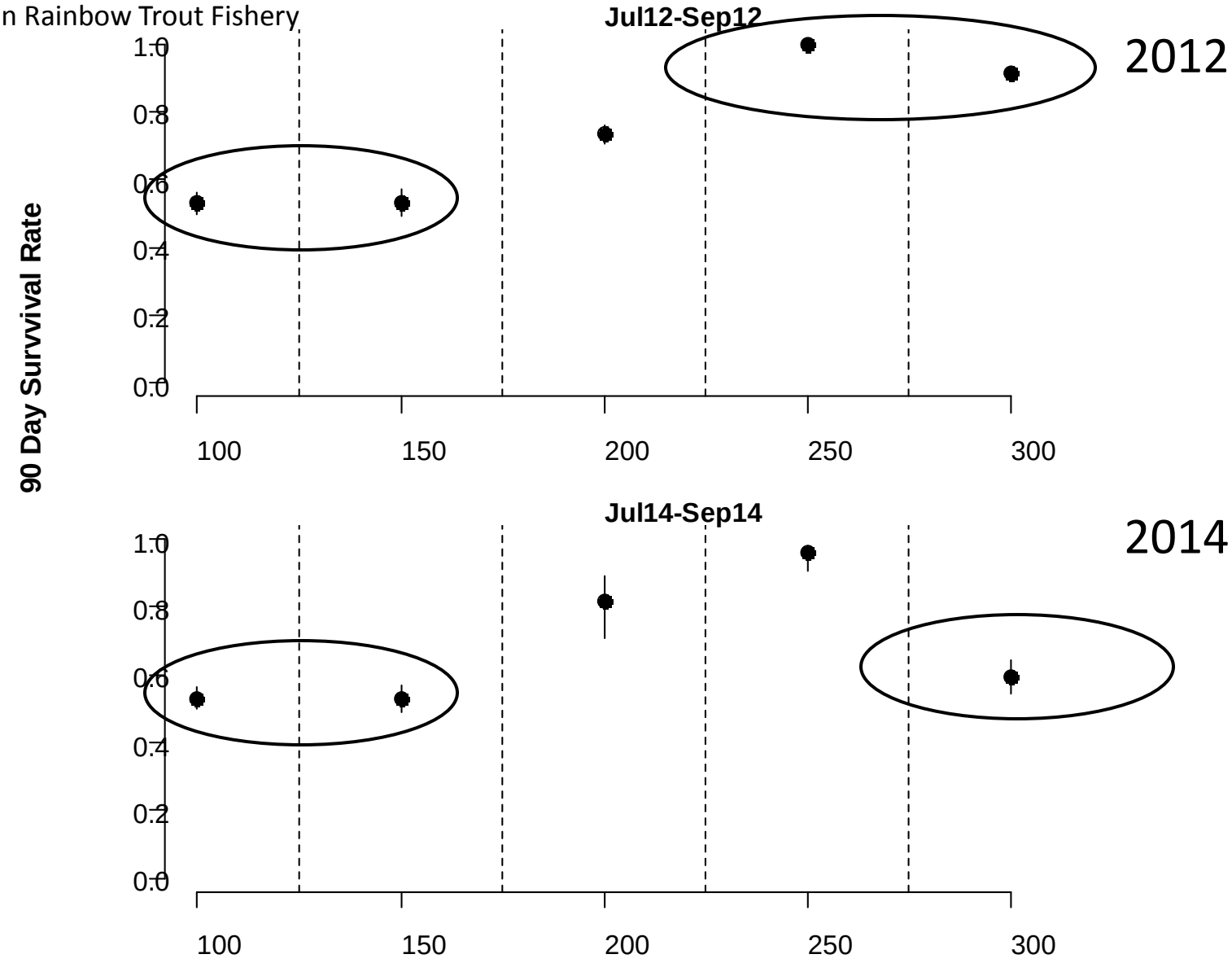
Glen Canyon Rainbow Trout Fishery



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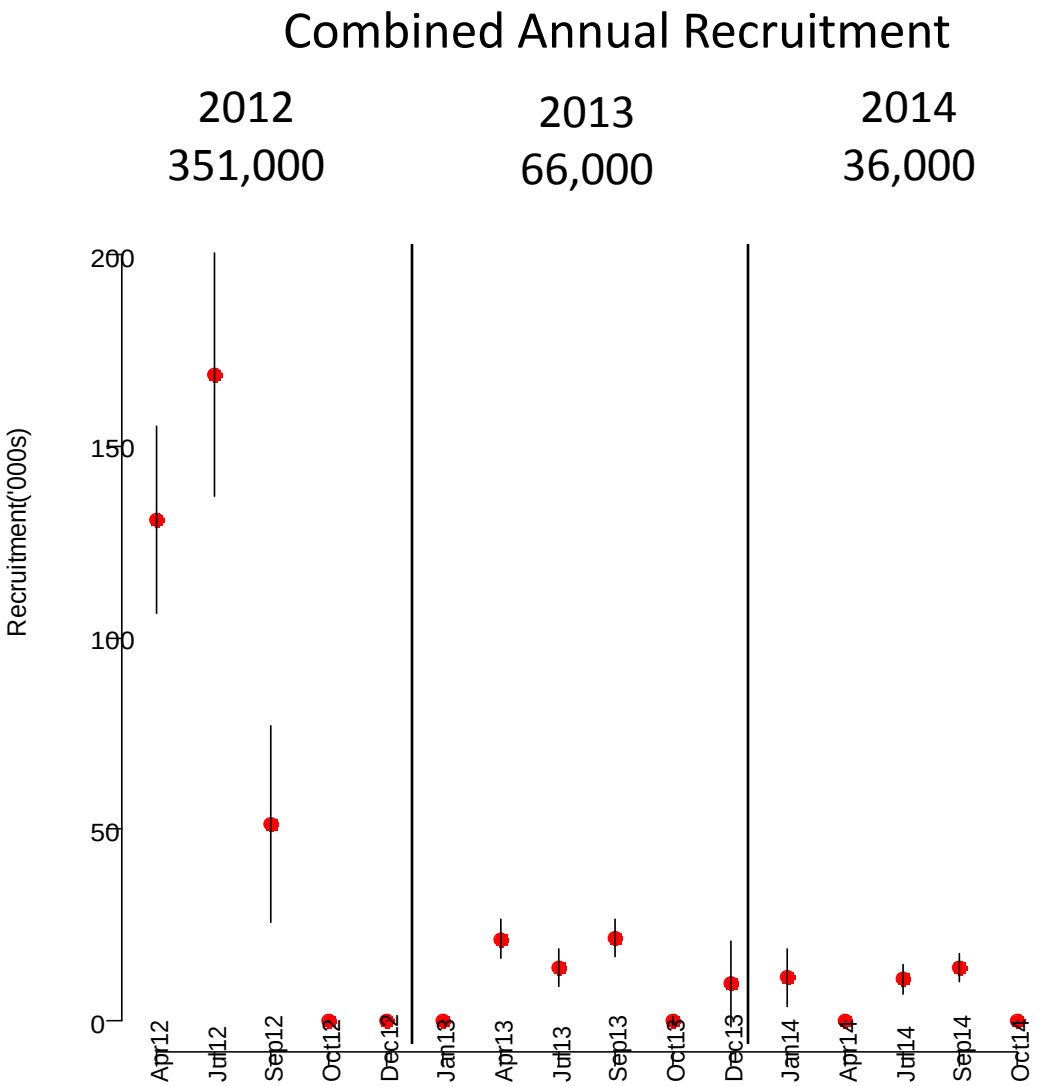

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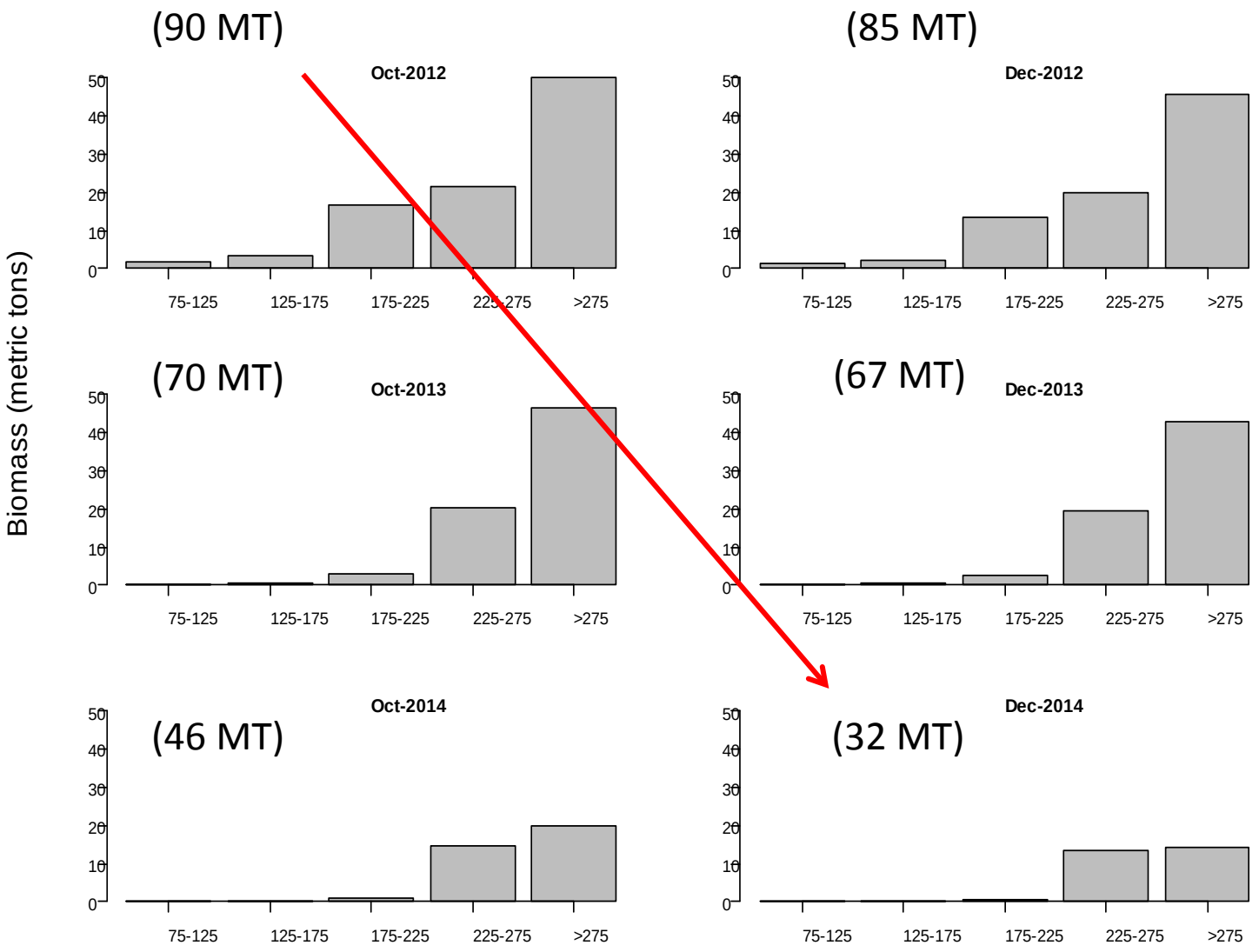
WHERE'S THE BEEF ?



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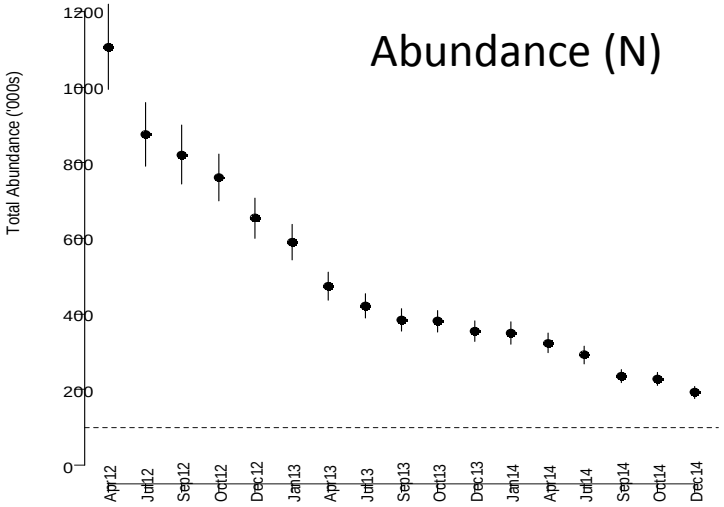
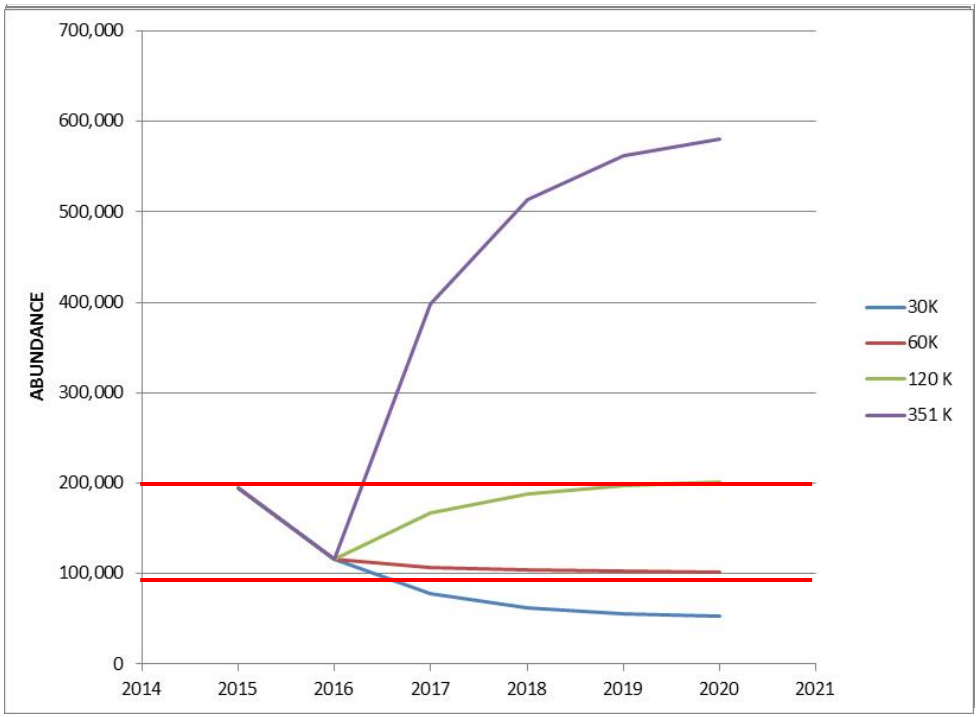
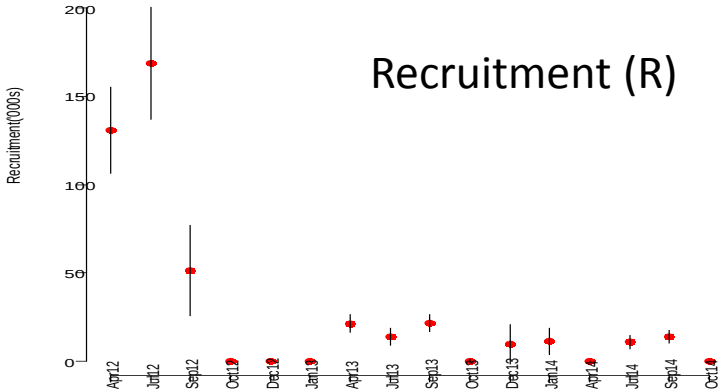
Abundance (N)

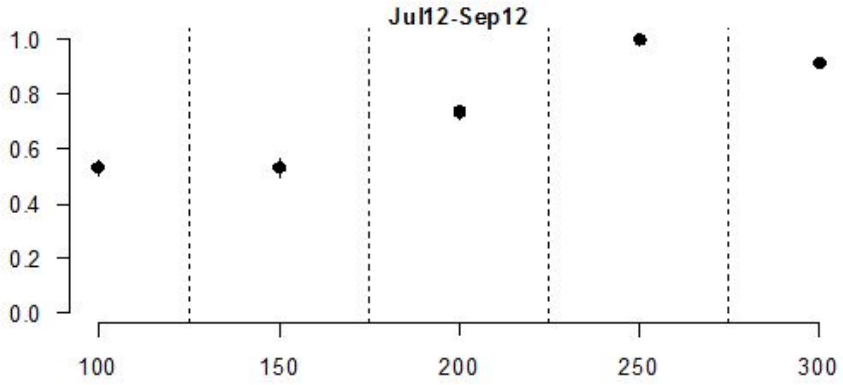




Survival (S)

Recruitment (R)





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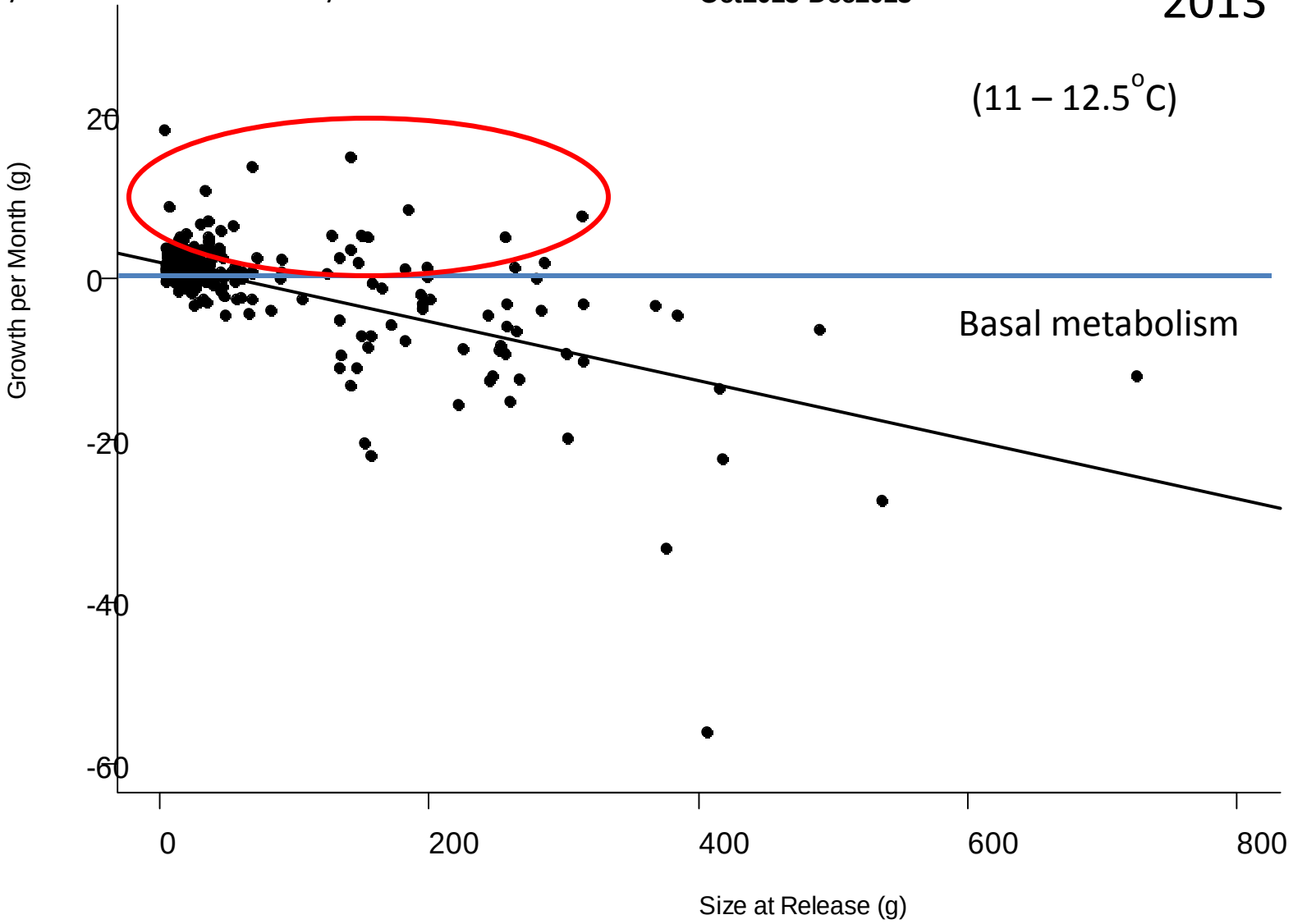
Glen Canyon Rainbow Trout Fishery

Oct2013-Dec2013

2013

(11 – 12.5°C)



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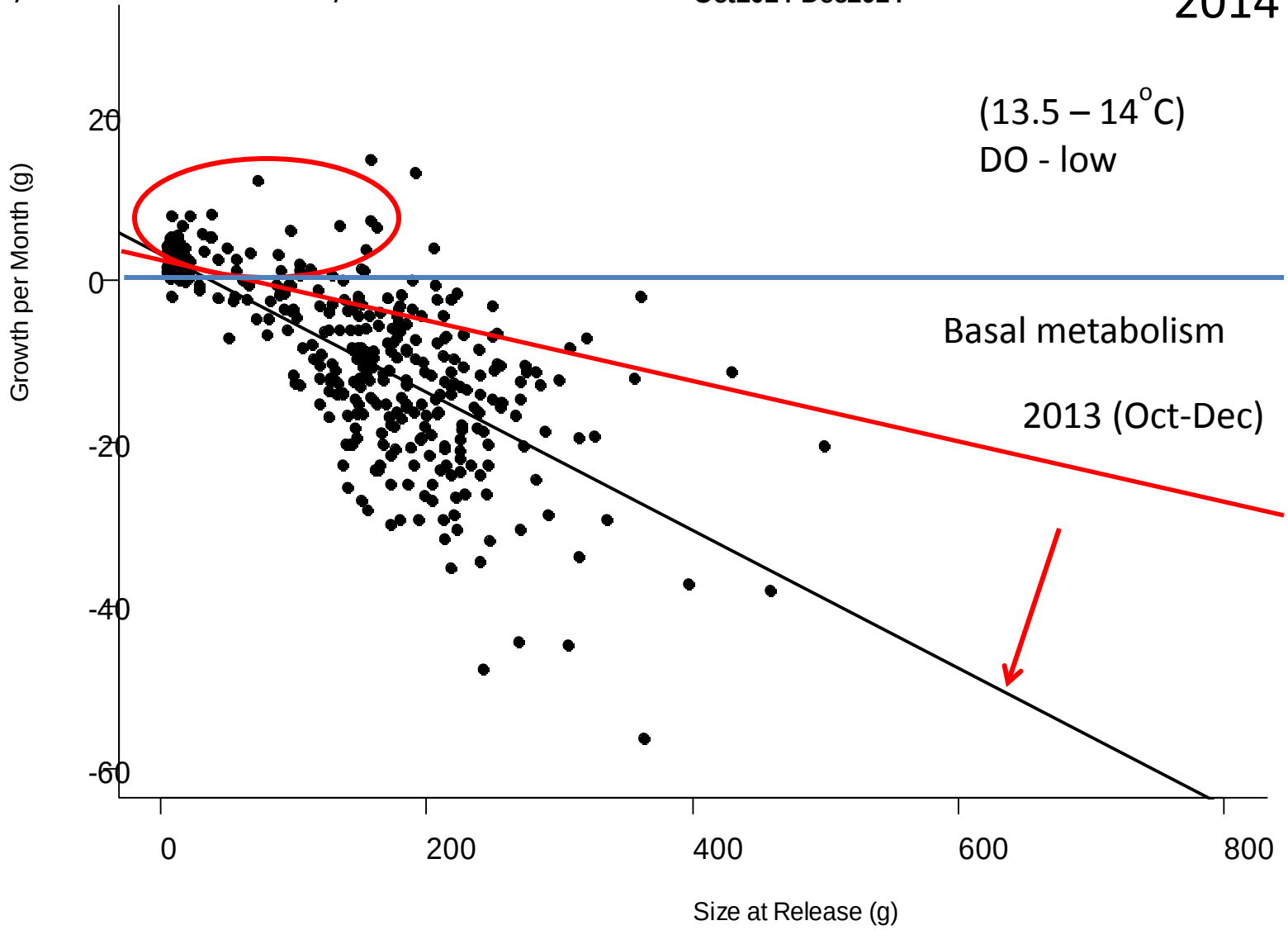
Oct2014-Dec2014

2014



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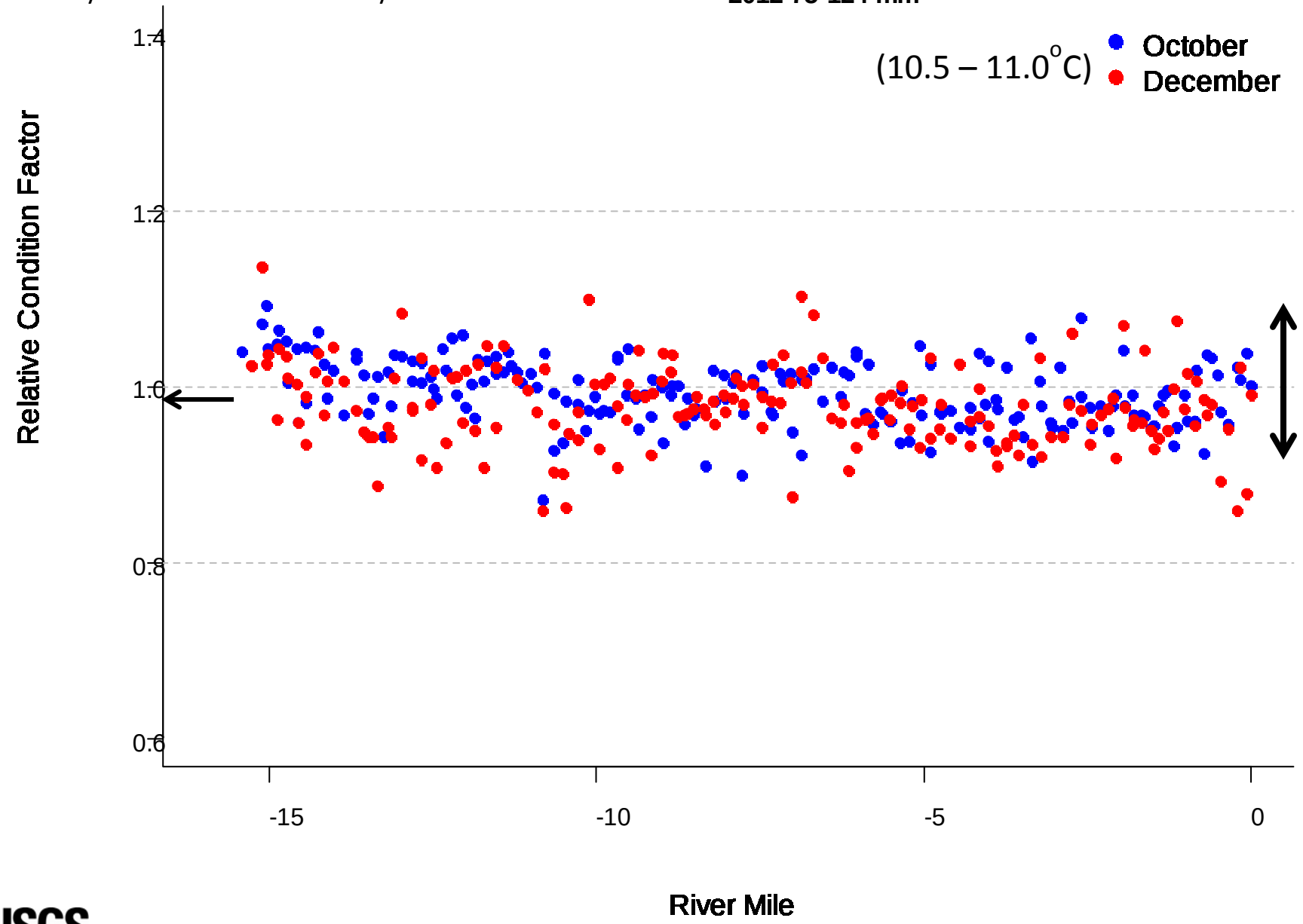
2012



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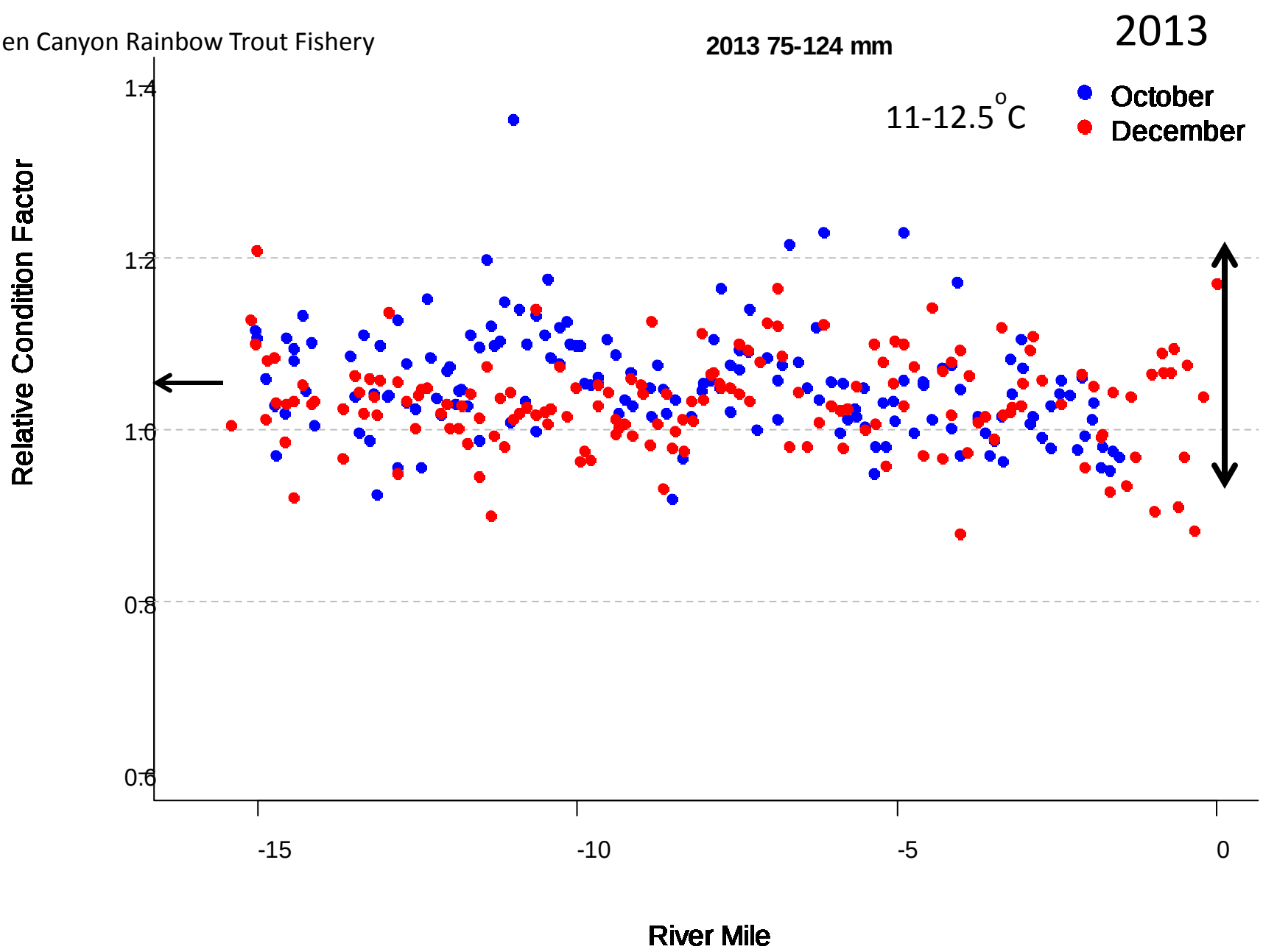

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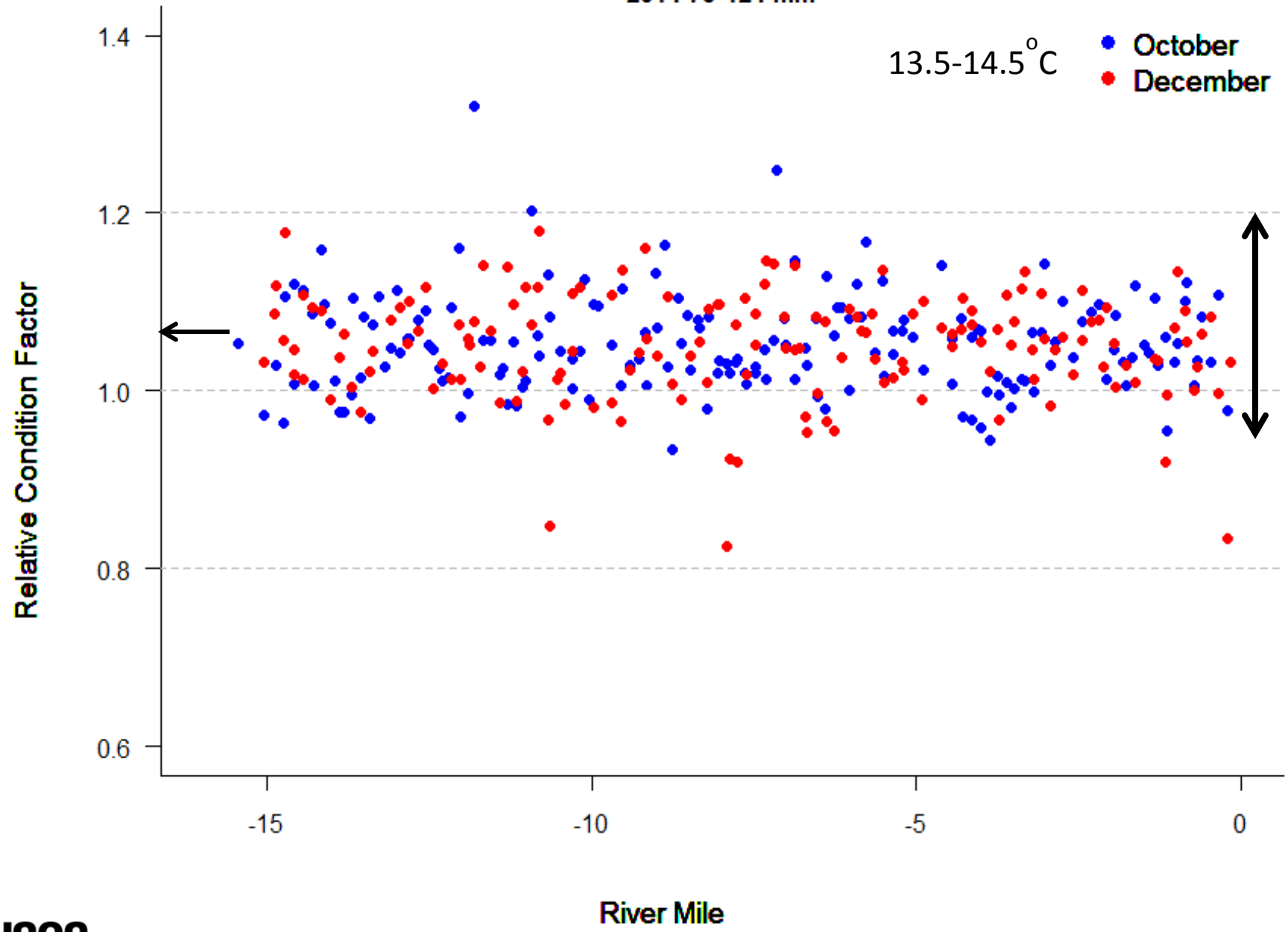
2014



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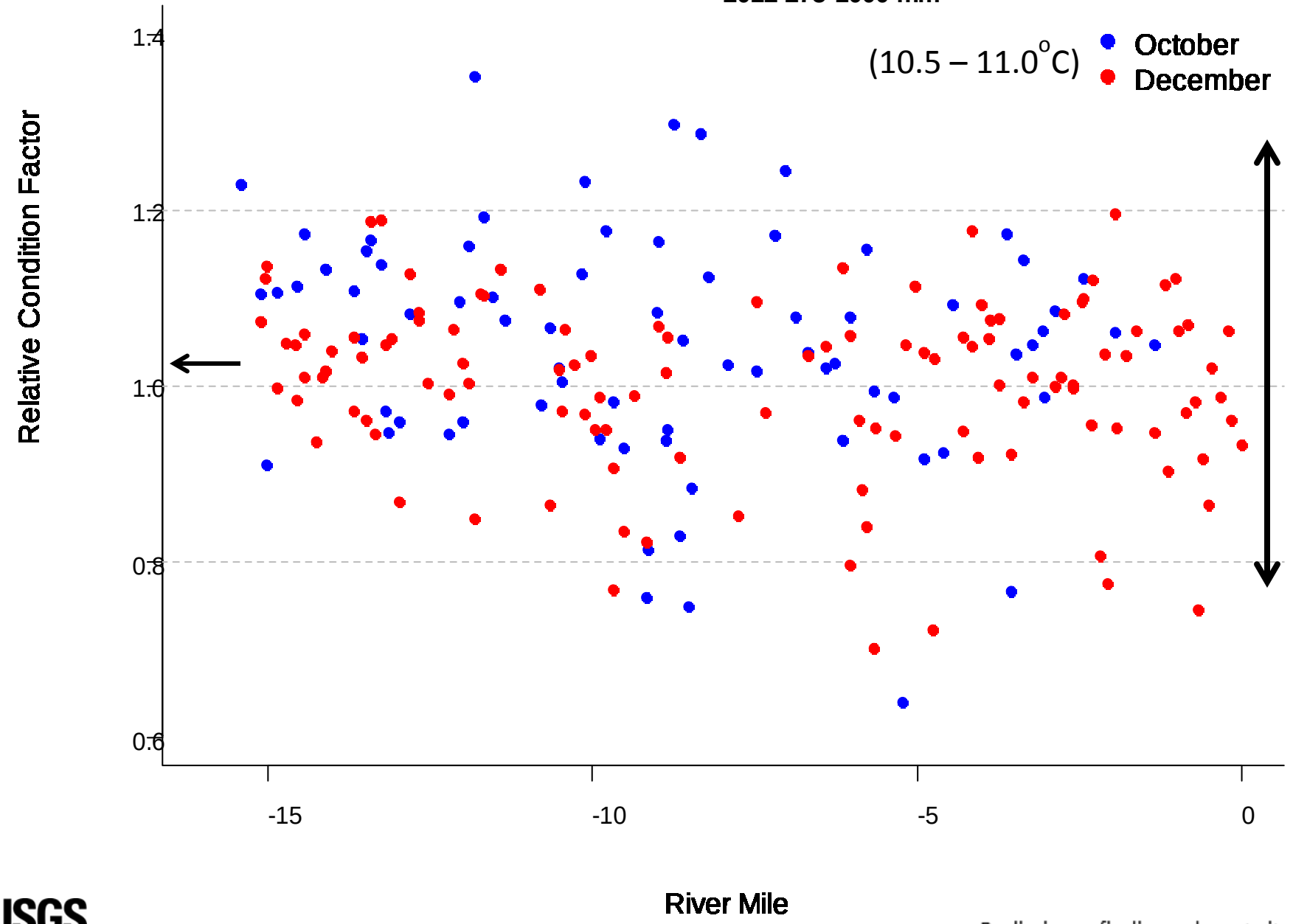
2012



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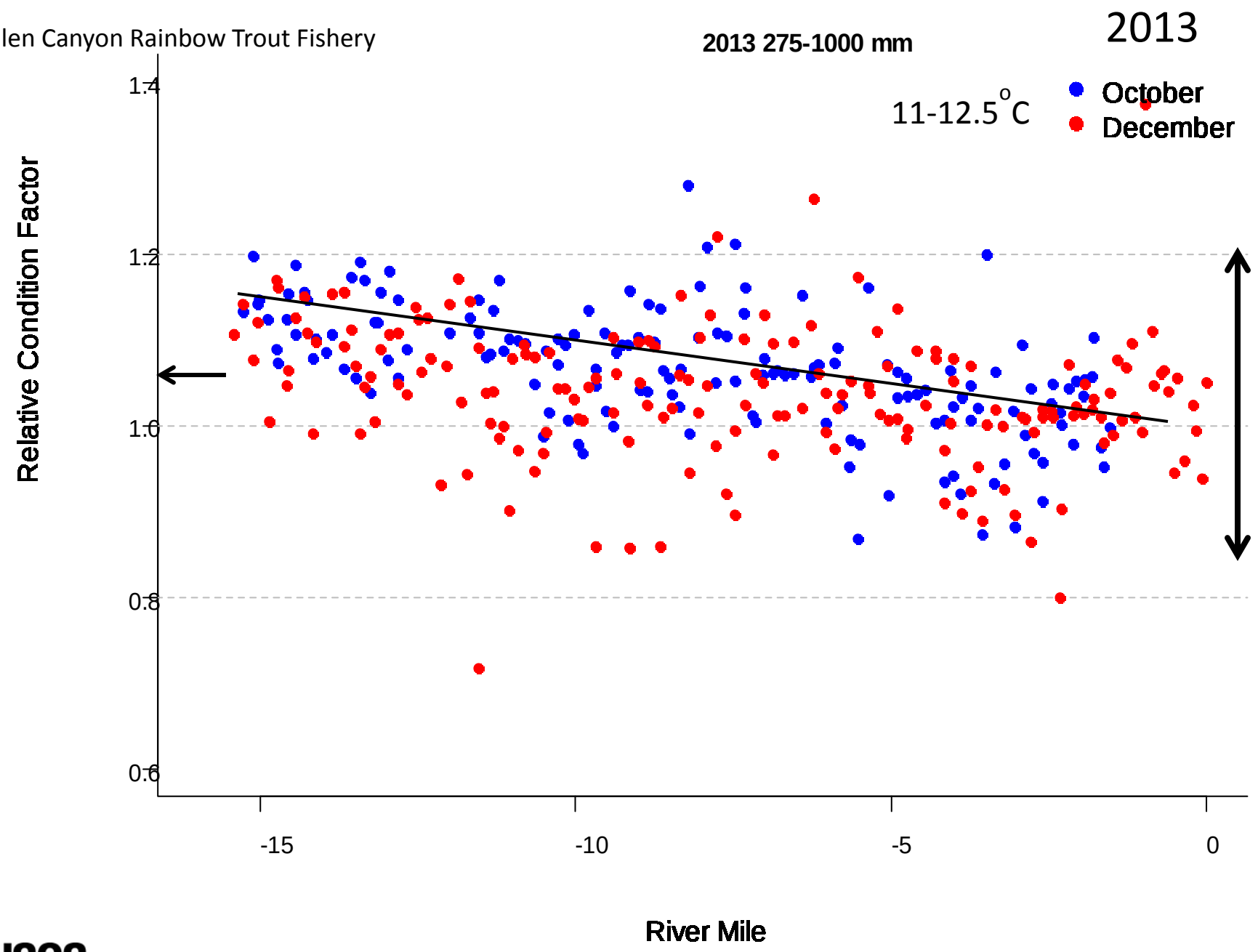

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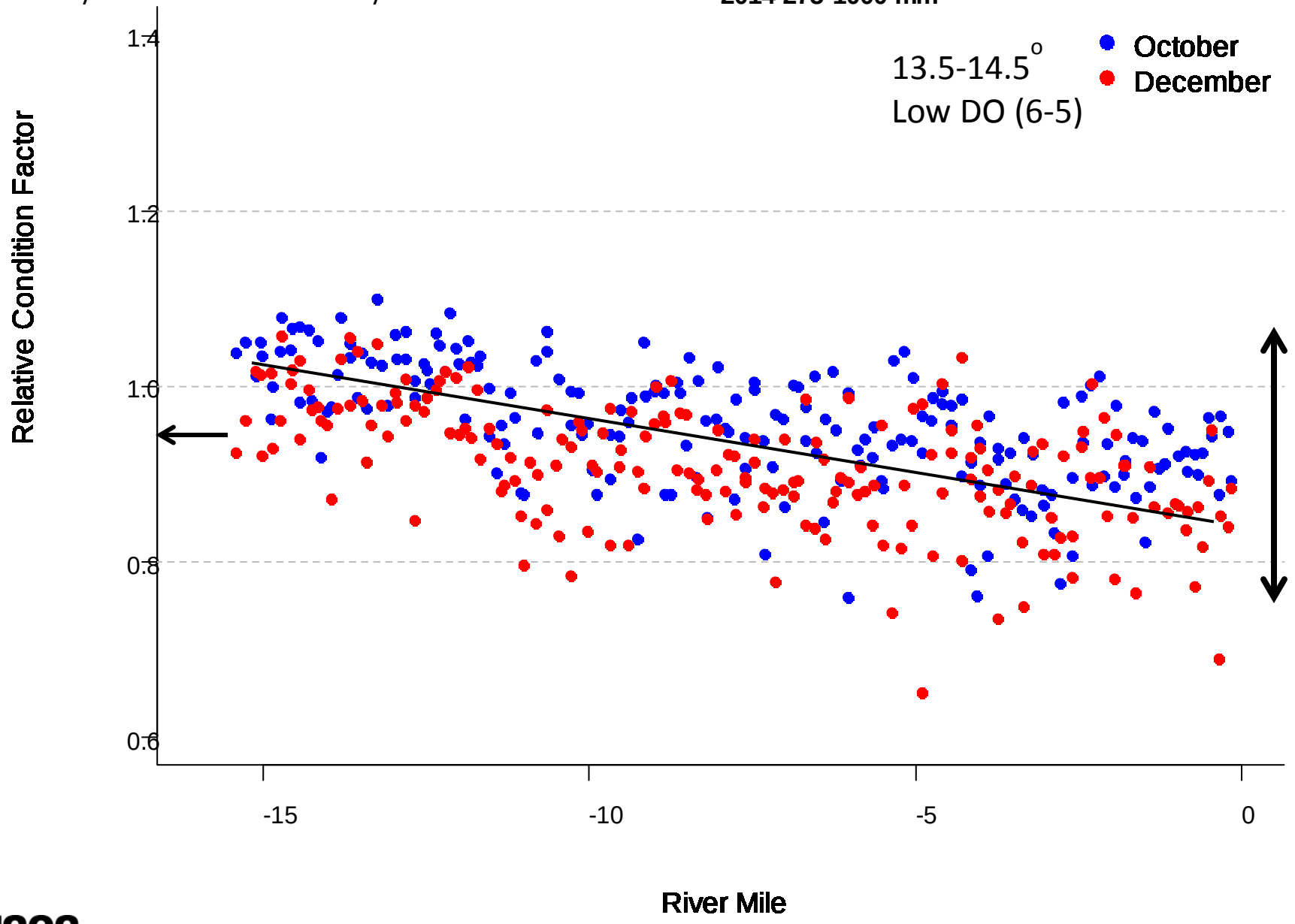

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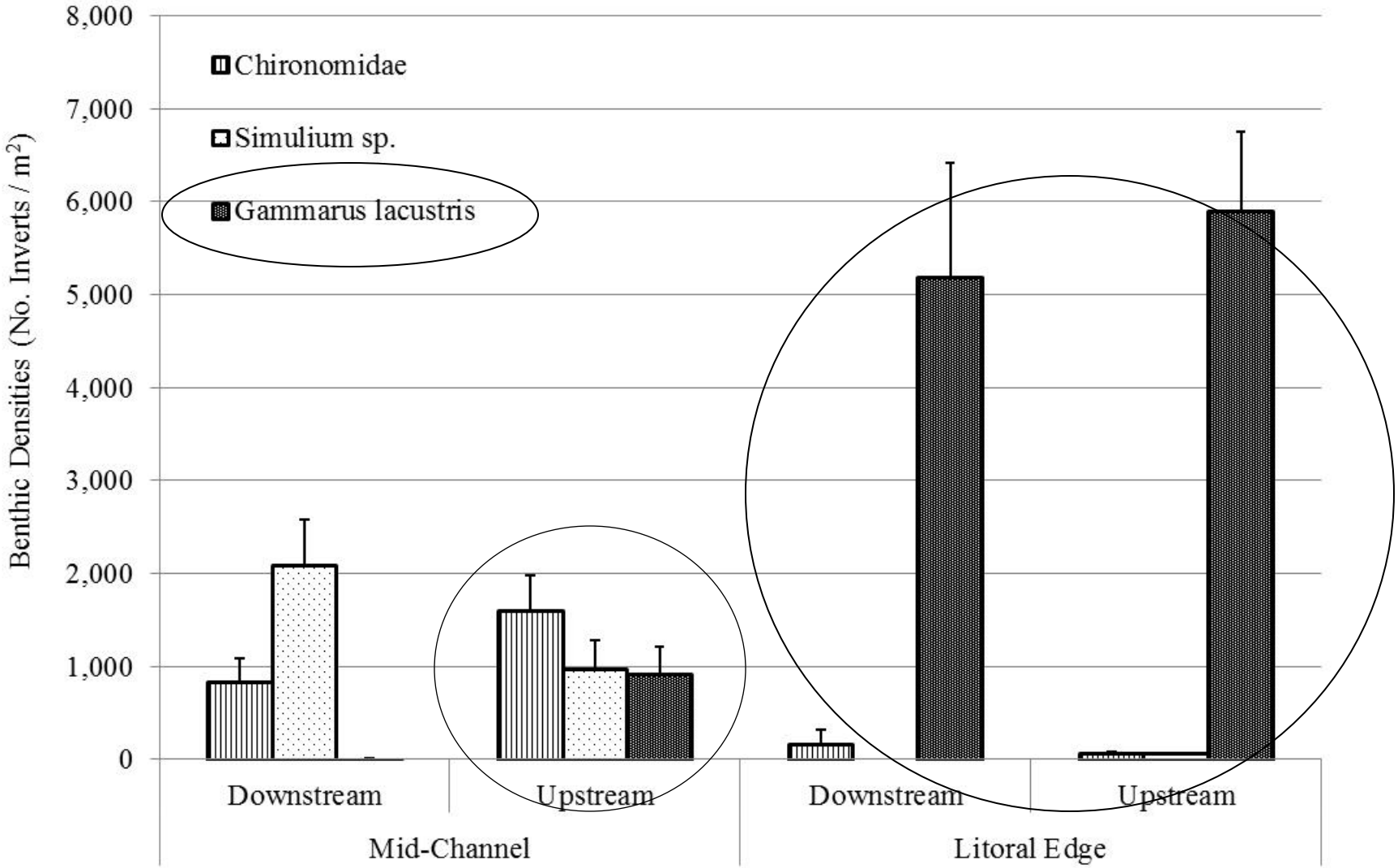
Basal Resource - Aquatic Invertebrates



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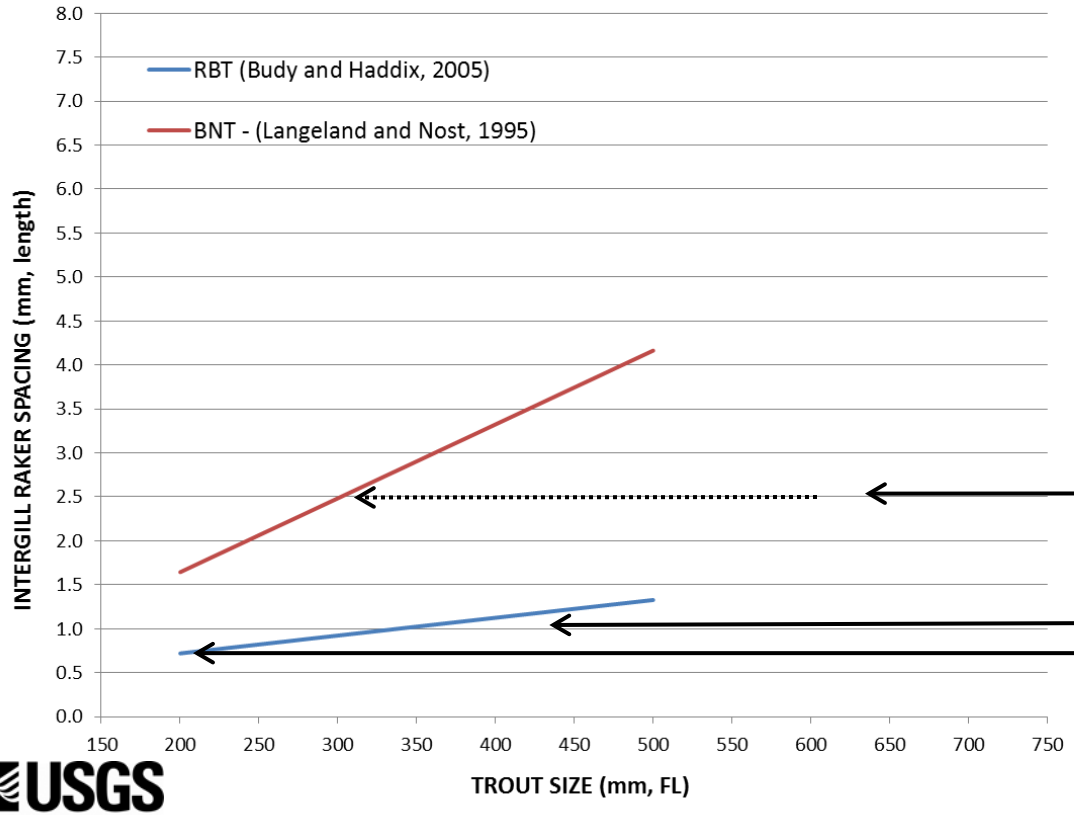
INTERGILL RAKER SPACING - FISH SIZE RELATIONSHIP



Prey Size Increase

0.3 – 5 mm (2.5)

0.3 – 1.5 mm (1.0)

0.3 – 1.2 mm (0.6)

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Conclusions

1. Glen Canyon rainbow trout population levels have declined since at least 2012 (April 2012), from 1.1 M to 200 K (December 2014).
2. Growth rates have declined in recent years, particularly for medium to large sized trout. Paradoxically, small fish have higher and more stable growth.
3. Survival rates for the largest size class (>275 mm FL) has declined (late summer & fall-2014).
4. Condition factors are highly variable (amongst size classes, spatially, and among and within years).
5. Trout biomass in Glen Canyon has declined by 2/3's.
6. The bio-energetic demand is not being met for larger fish.

Possible Explanations:

- Top-down effect on food resources from high trout densities & recruitment events (2011 & possibly 2008-2009 [increased survival??]) may have negatively affected the invert-community
- Longitudinal differences in food resources and fish condition cannot be explained by flows or water quality alone. One possibility is localized sediment inputs (August 2013) were then redistributed during the HFE's and may have influenced the downstream benthos (November 2013 & 2014).
- Low invertebrate diversity, favoring small prey may be effecting feeding inefficiencies (small prey size & allometric relationship of the inter-gill raker spacing) and foraging efficiencies
- Water quality differences between years (elevated temperature and depressed oxygen levels during the fall season) have likely increased bioenergetic demand when food was limited.

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Conclusions (cont.)

7. Large recruitment events (2011 and 2008-2009 [high survival?]) are the likely cause for instability in population.

8. Reduce instability in trout population cycles by actively managing for recruitment.
   - Recruitment can be determined for any desired population size.
   - Use trout management flows to reduce excessively large Age-0 cohorts
   - Reduce trout biomass levels (focused on catchable sizes) through managed fish harvesting
     - Change fishing regulations in response to changes in biological conditions, (unlimited take (narrow time window), encourage use by other types of anglers, fishing derbies, etc..)

10. Future monitoring will be improved by determining abundance, survival, recruitment, and growth
    - Capture probabilities are highly variable (across size classes, trout densities, seasons, and turbidity levels), which influences standard fishery metrics.
    - This will influence the observed catch rate metrics (CPU) and catch proportions.

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