



Monitoring Humpback Chub in the Little Colorado River and Colorado River, Grand Canyon

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— BUREAU OF —
RECLAMATION

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

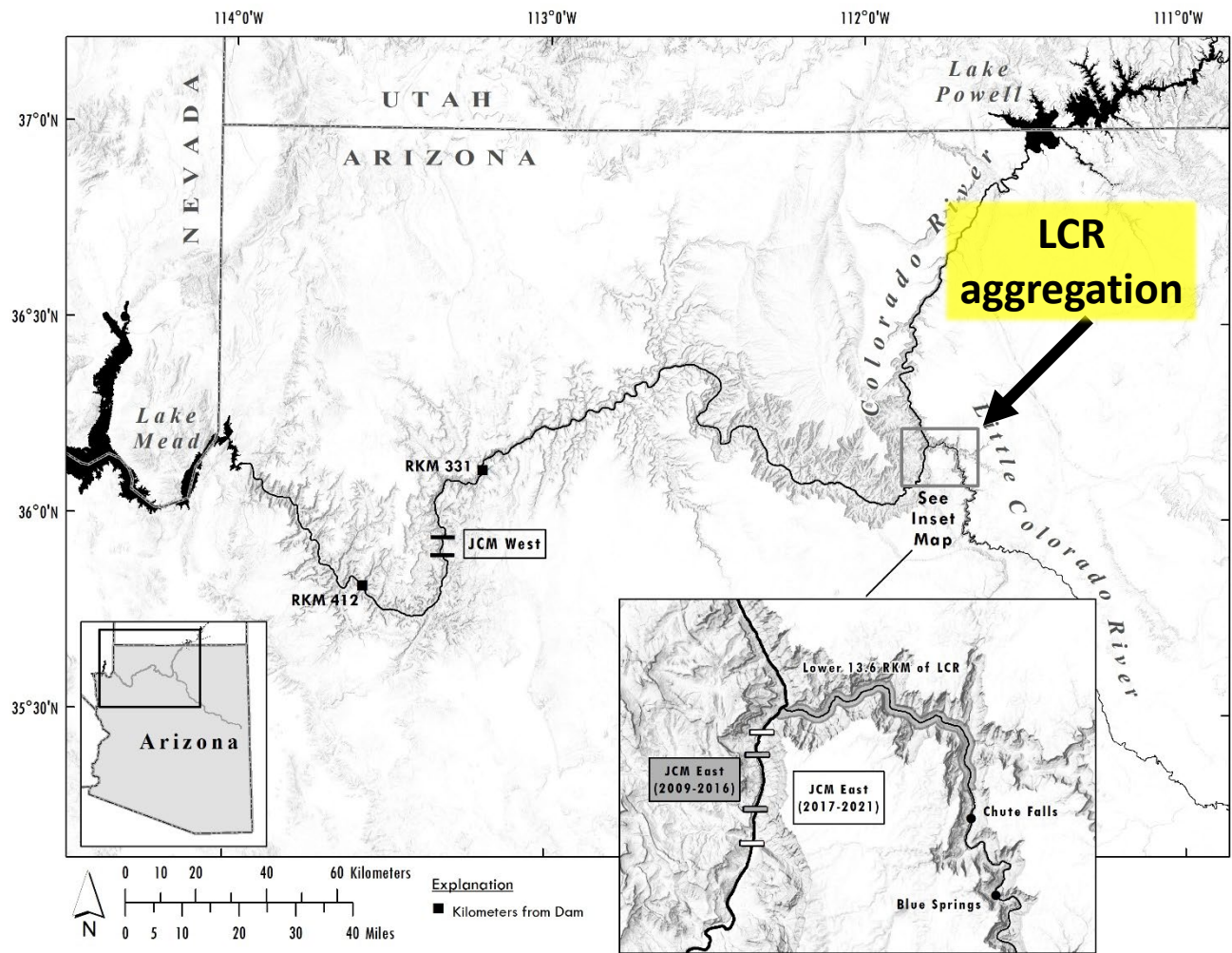


Presentation outline:

- Little Colorado River (LCR) aggregation
 - LCR
 - HBC abundance estimates
 - Juvenile Chub Monitoring (JCM) – east
 - HBC abundance estimates
 - Implications of warm temperatures & fast growth
 - Total adults & triggers
 - Chute Falls translocations
- Western Grand Canyon
 - Humpback Chub aggregations monitoring
 - Hoop net relative abundance
 - Abundance estimates in western Grand Canyon
 - JCM – west



Fixed site monitoring in eastern Grand Canyon








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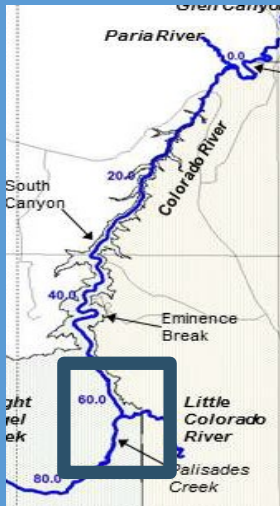


Size chart indicator

(sizes are mm total length)

Juvenile	<100	
Small subadult	100-149	
Large subadult	150-199	
Small adult	200-249	
Large adult	>250	

Life history of Humpback Chub in LCR aggregation:



Colorado River

outmigration

skipped spawning

migrants

resident

spring spawning migration

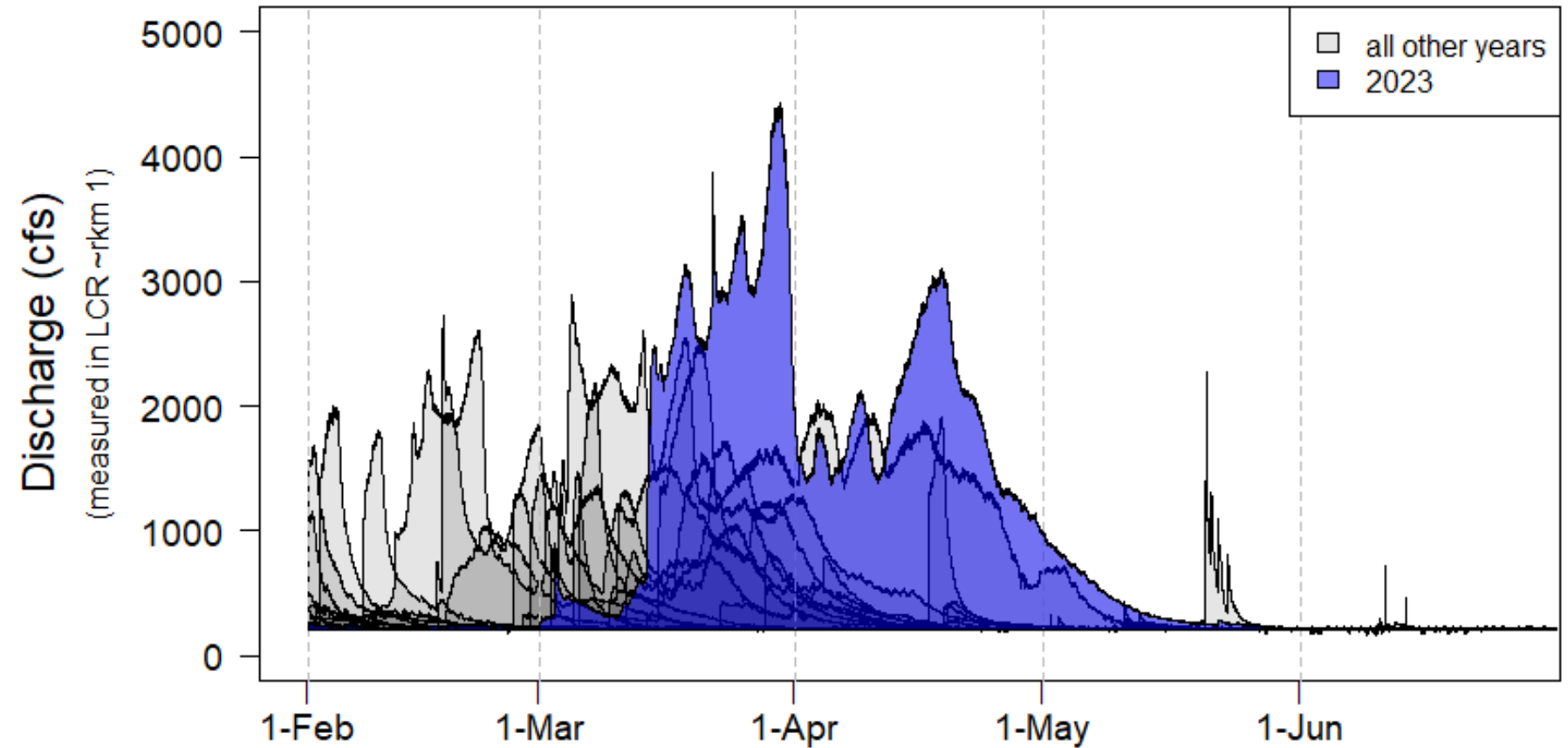
Little Colorado River

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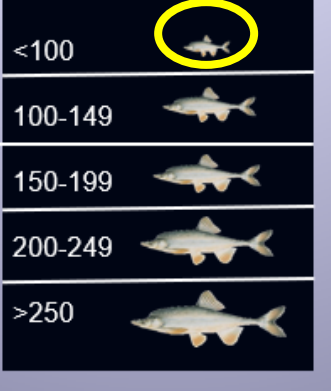
Large, prolonged flood in LCR in 2023

LCR hydrograph 2009 - 2023



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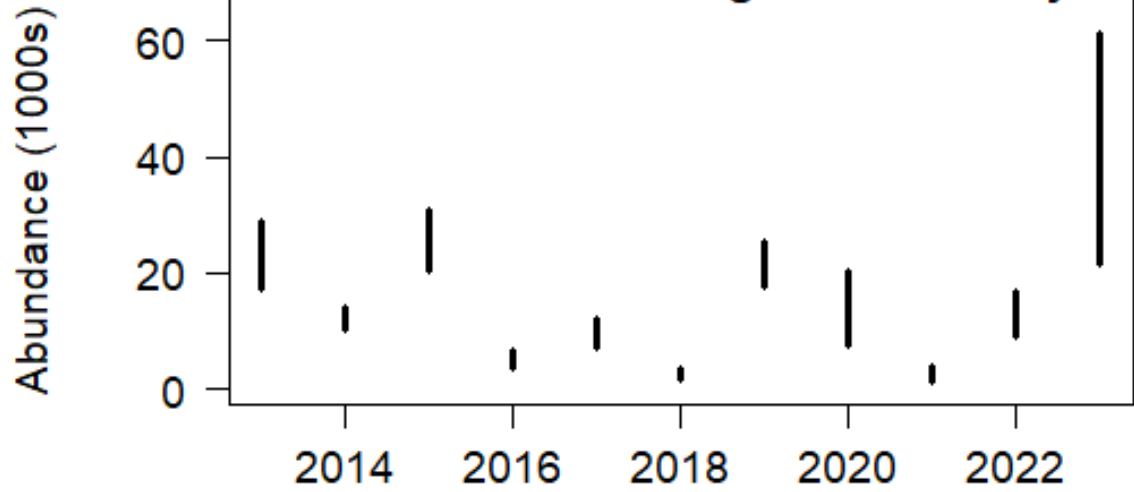




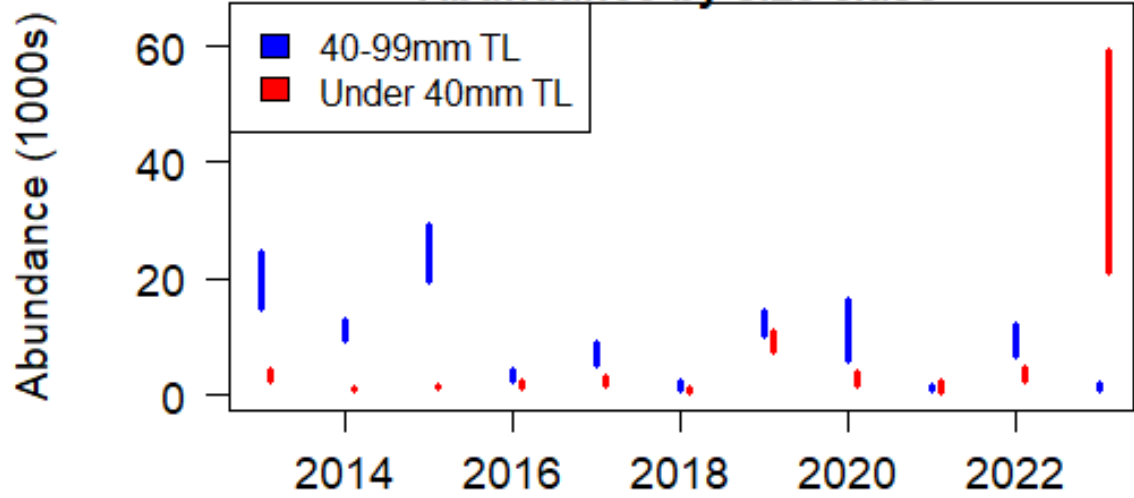
Age-0 abundances in the LCR

* Abundance estimate from 2020 is based on expanding from a small proportion of the spatial area (near the confluence) and may not be fully representative

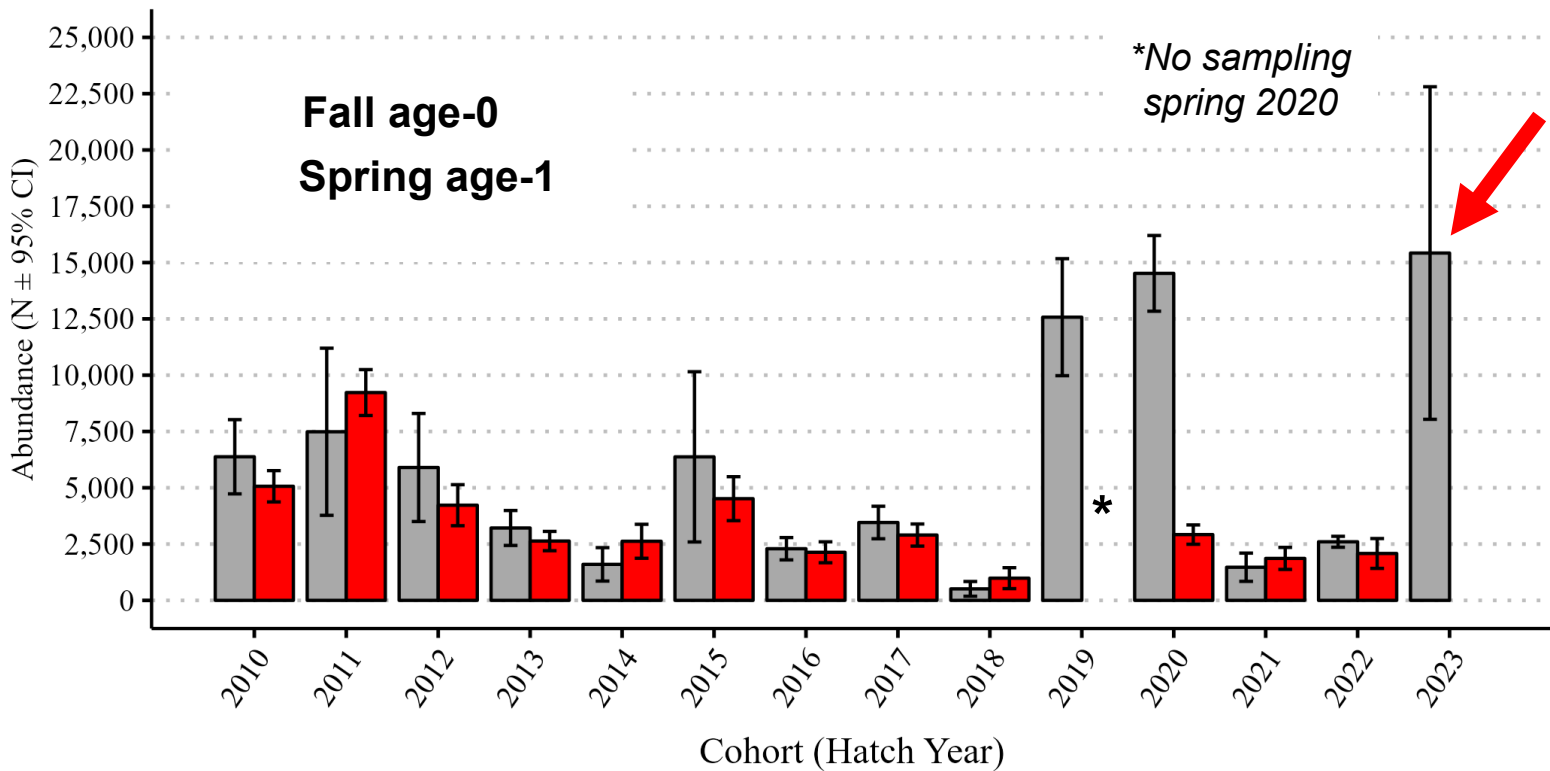
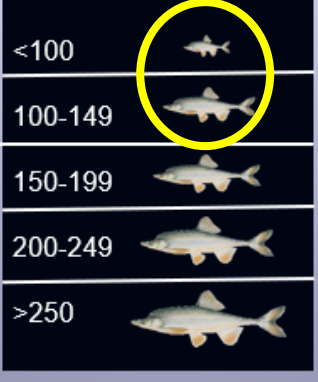
Total abundance of age-0 HBC in July



Abundance by size class

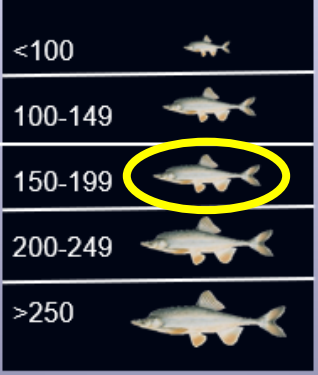


Annual Fall HBC age-0 (gray) and age-1 (red) abundance by hatch year shows a large 2023 cohort.

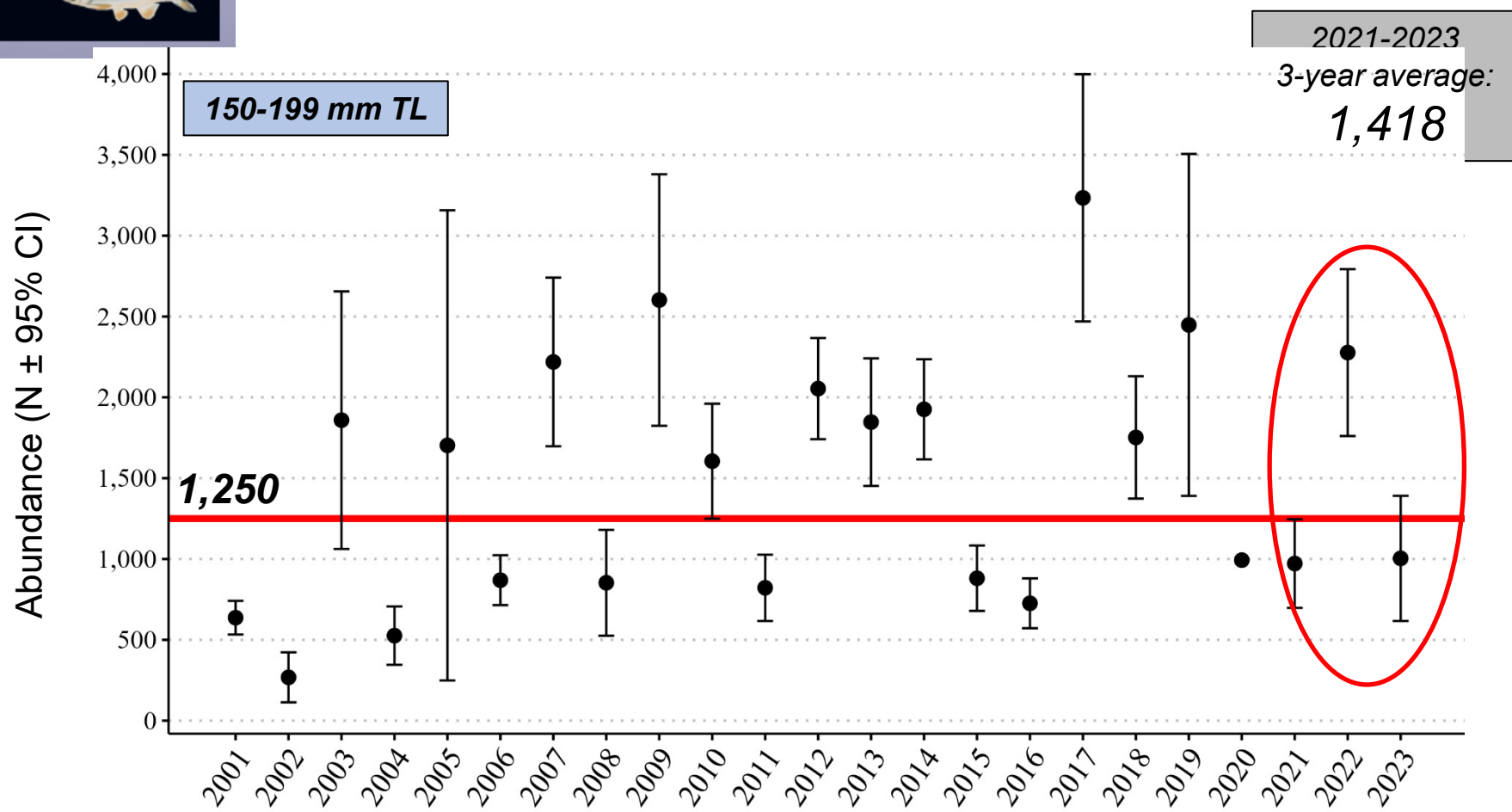


<106mm fall
 91-161mm the next spring

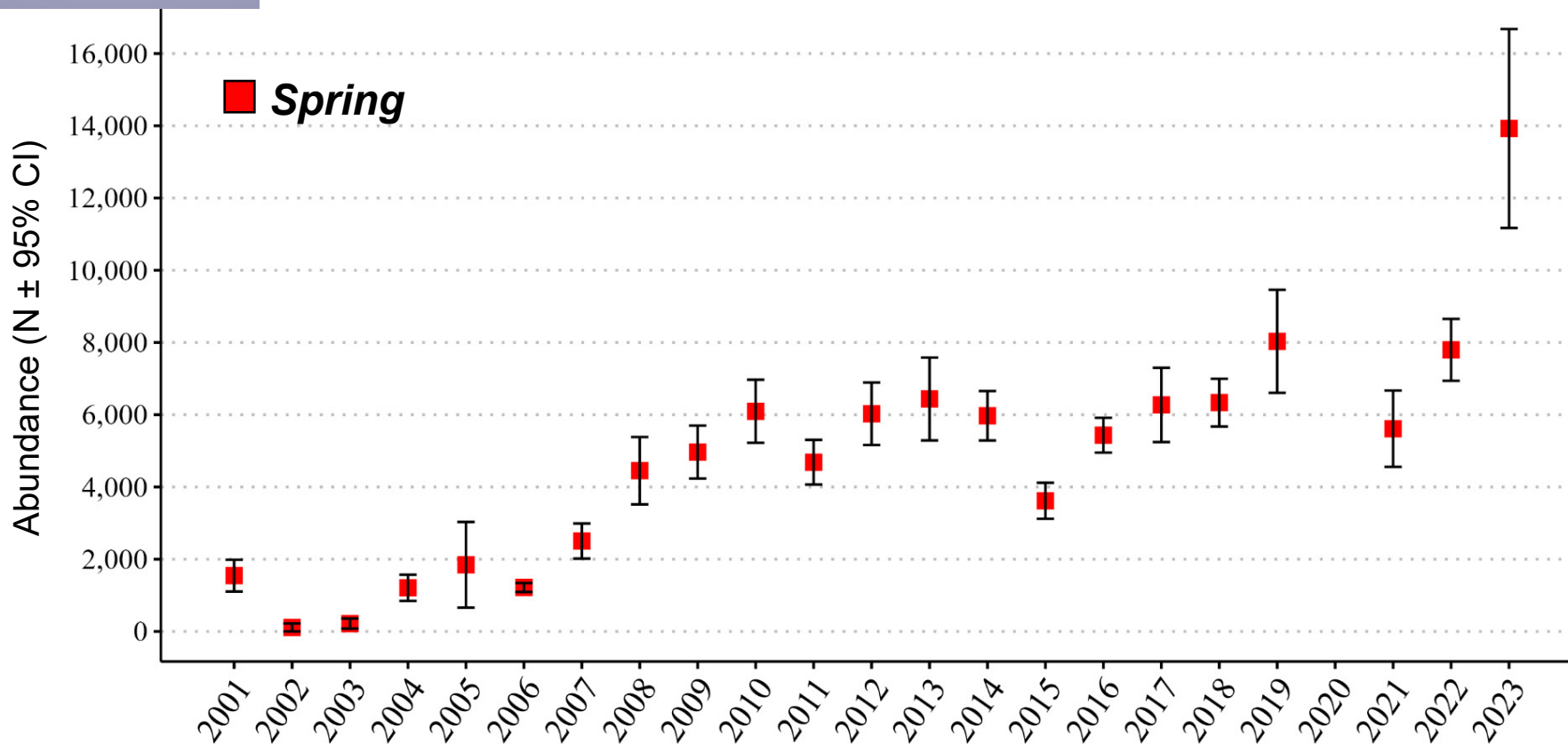
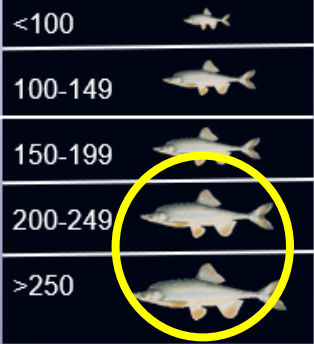




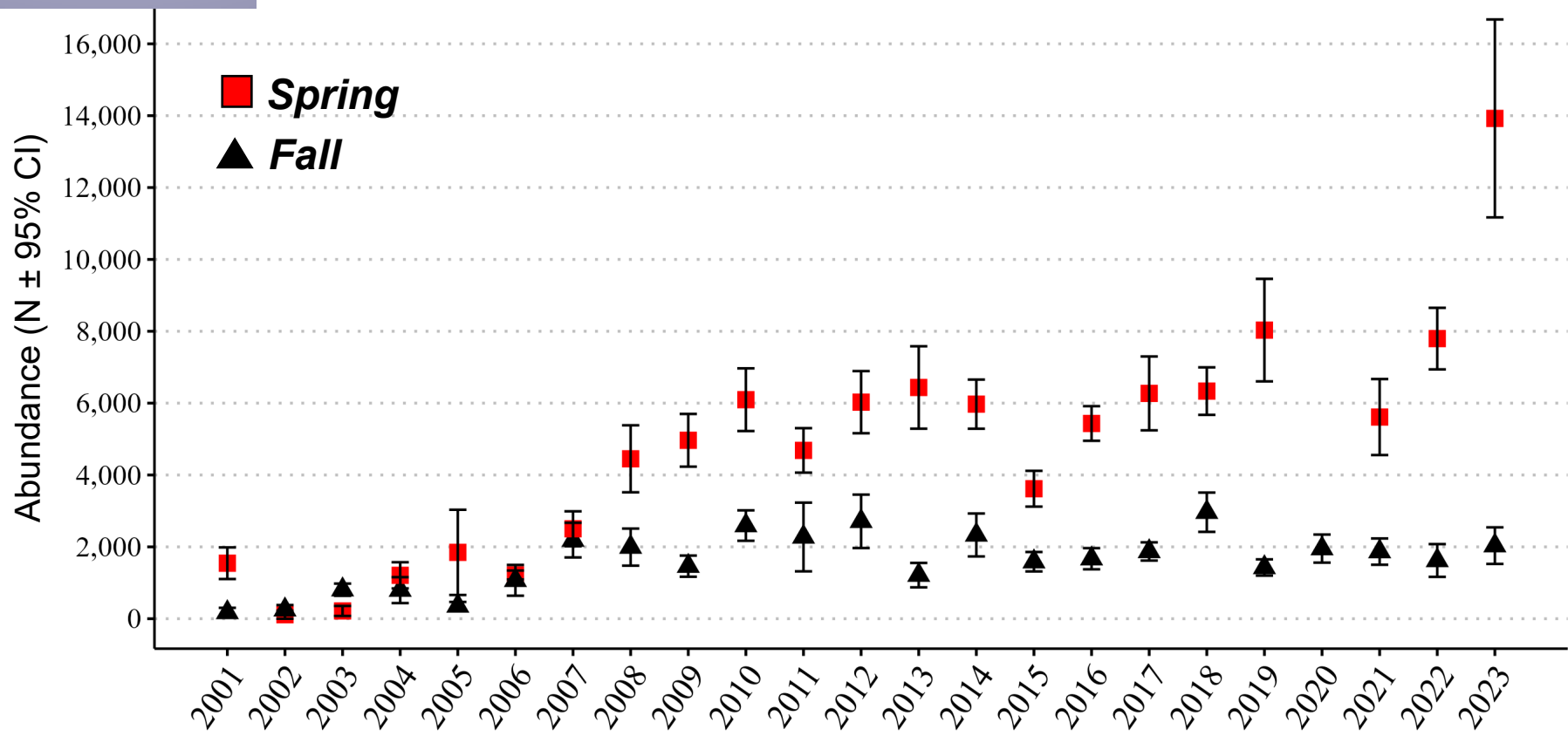
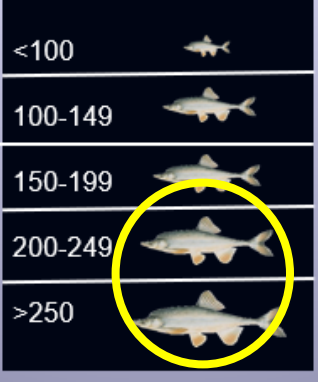
Annual spring abundances of large sub-adult HBC in lower 13.6 km of LCR remains above the trigger.



2023 spring adult (≥ 200 mm) abundance shows highest point estimate recorded in LCR



Fall adult (≥ 200 mm) abundance of LCR resident HBC in 2023 is stable in recent years



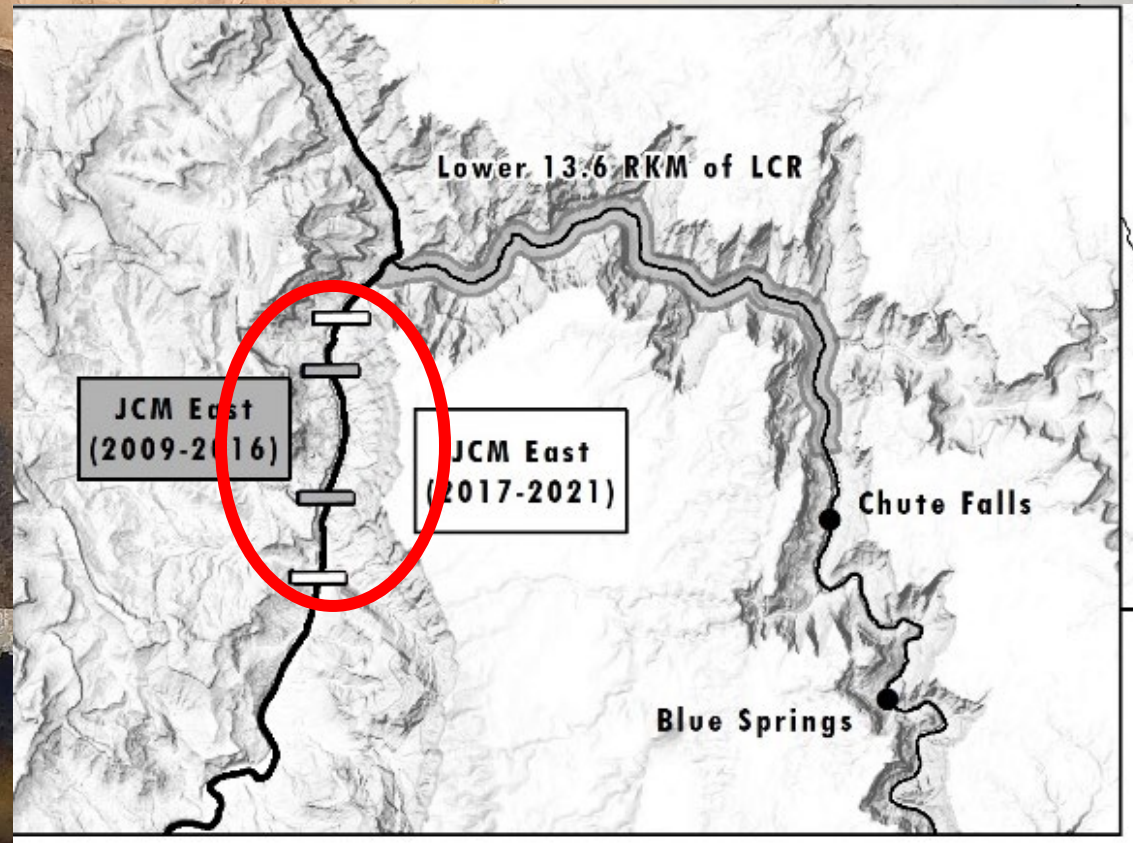
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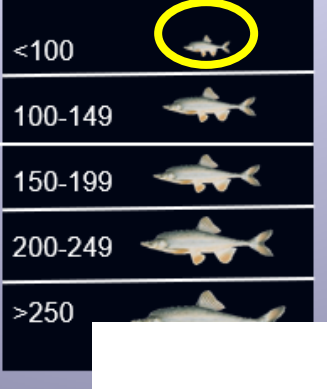
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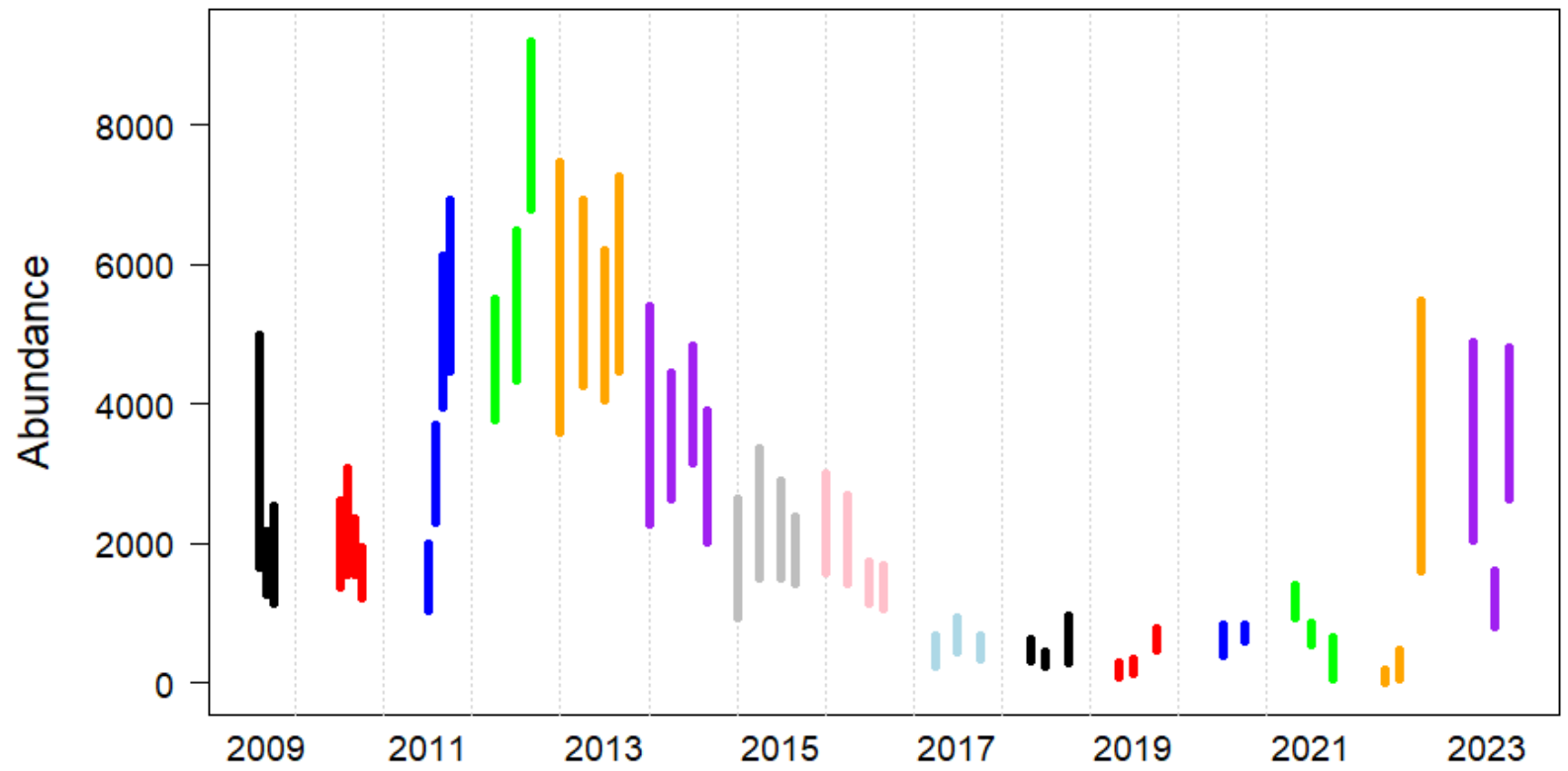
Juvenile Chub Monitoring - east



VanHaverbeke 9-5-21



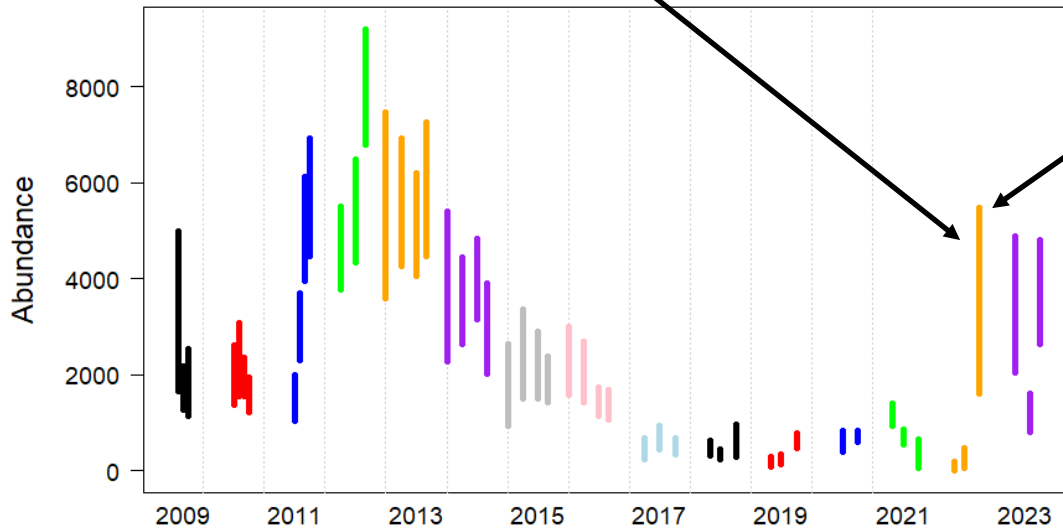
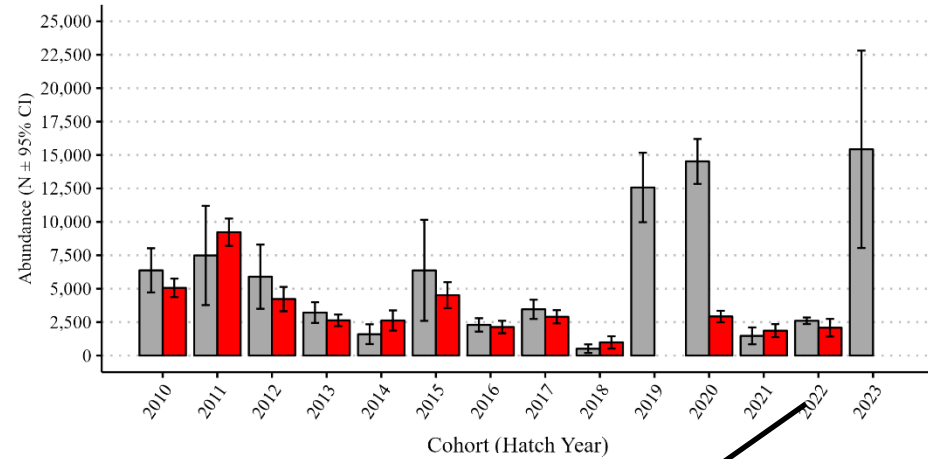
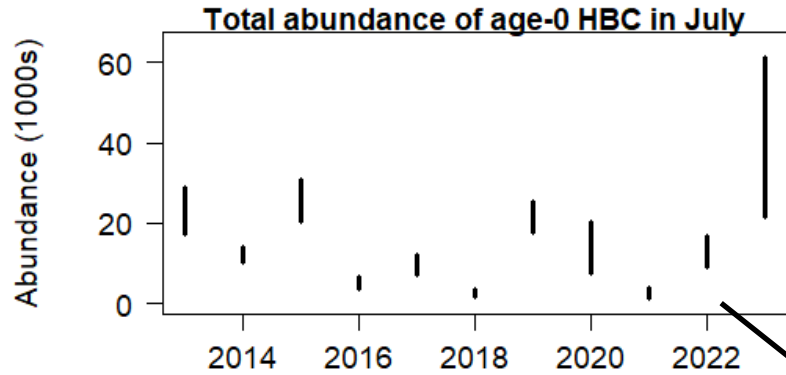
Juvenile abundance in the JCM East

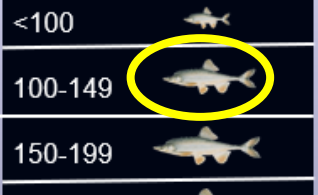


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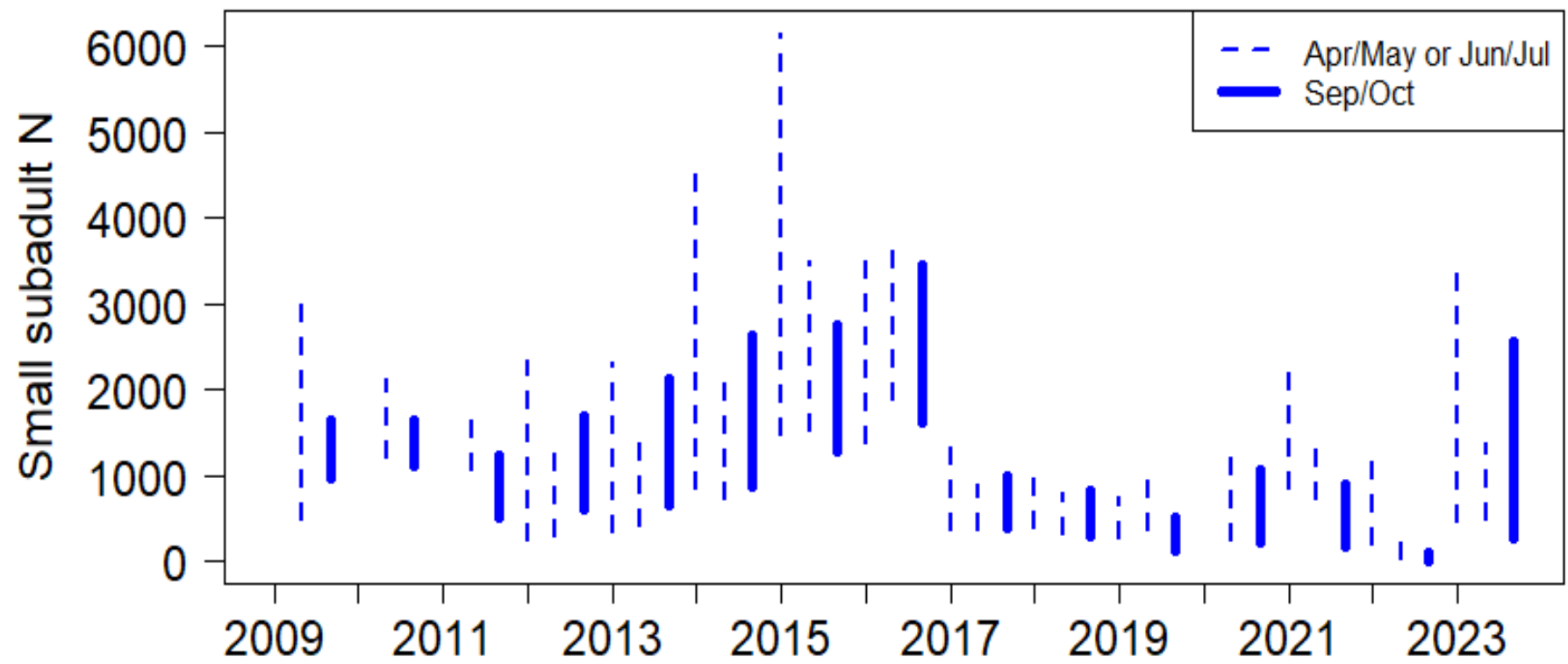


Was there mainstem production in Eastern Grand Canyon in 2022?



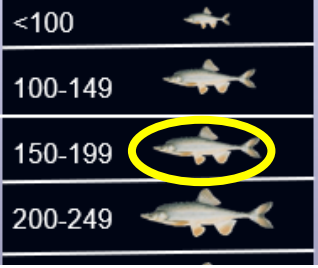


Small subadult abundances in JCM-east are higher than in years

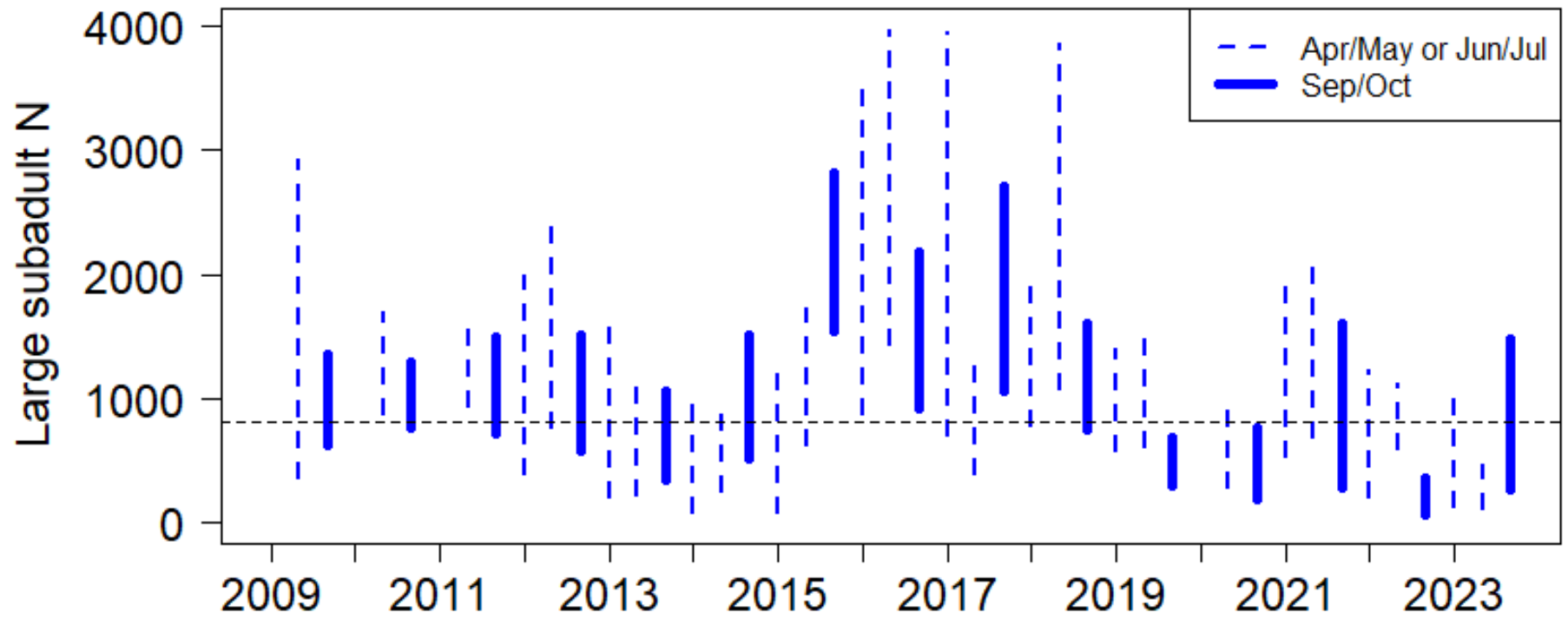


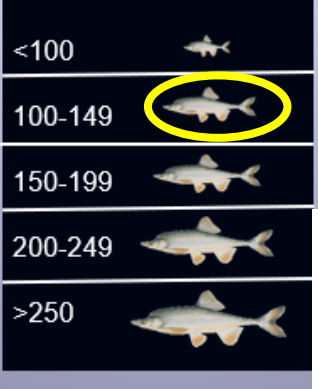
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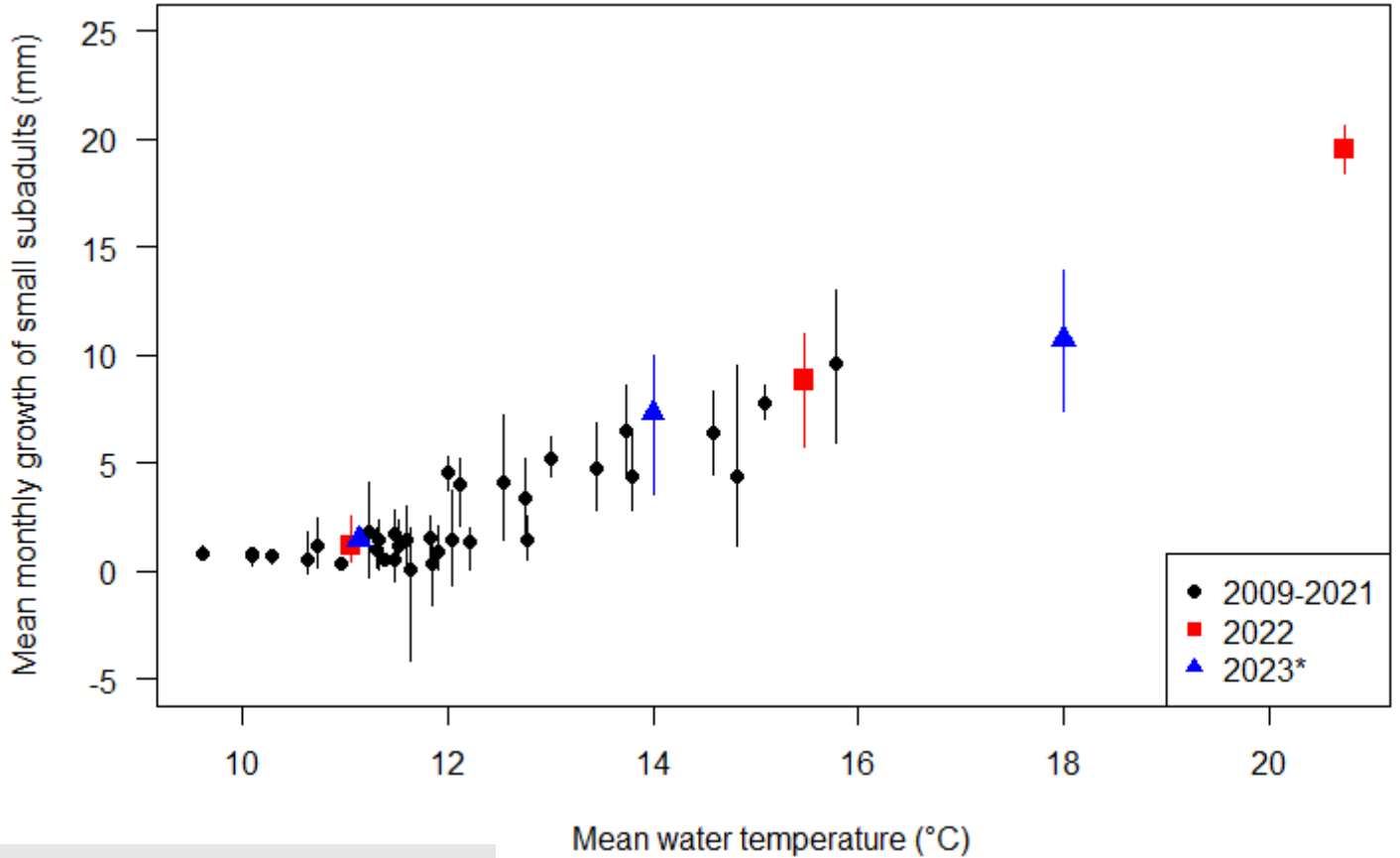


Large subadults in JCM-east are below the trigger





Small subadults grow fast when water temperatures are warm



Growth was high in 2023, but not as high as in 2022

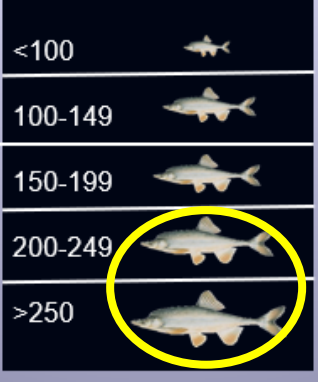
* Water temperatures in 2023 were approximated (no data available)



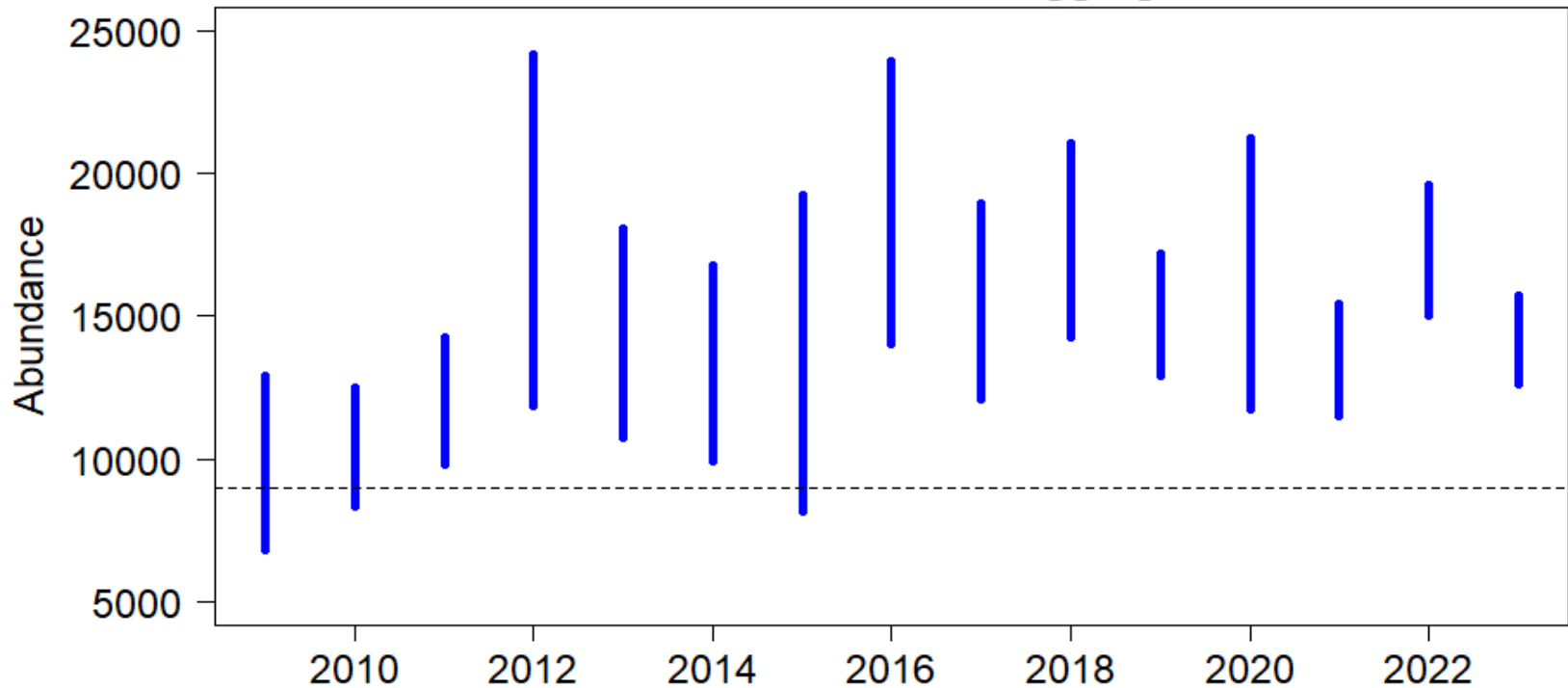
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Adult abundances in the LCR aggregation are above the trigger

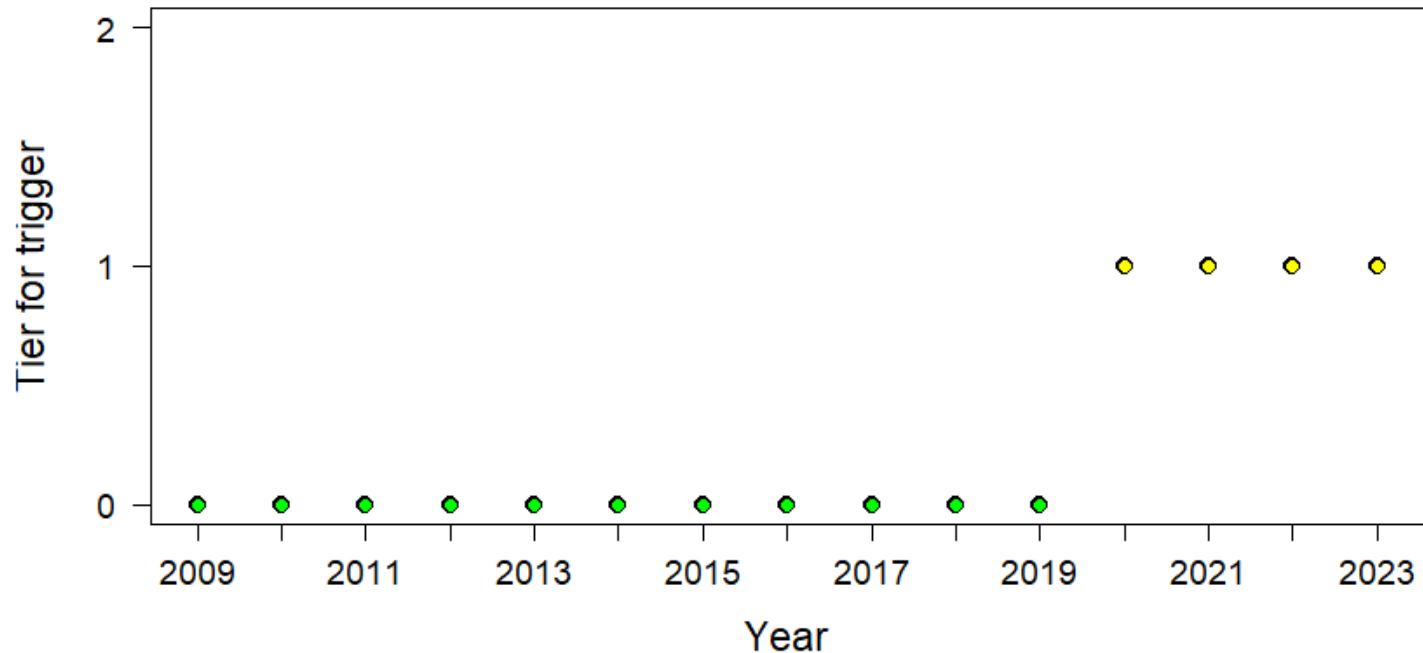


Adult abundance in LCR aggregation



Tier for Humpback Chub trigger*

(Metric 3.1)



*for more info on triggers, see: U.S. Bureau of Reclamation. 2016. Record of decision, Glen Canyon Dam long-term experimental and management plan, final environmental impact statement. U.S. Department of the Interior, Bureau of Reclamation, Salt lake City, Utah, National Park Service, Lakewood Colorado, Dec. Available at: https://ltempeis.anl.gov/documents/docs/LTEMP_ROD.pdf



Take-home points: LCR & JCM East

- 2023 was a good reproduction year in the LCR
 - Large, prolonged flood
 - Small body size of age-0 fish
 - High age-0 abundance in the Colorado River
- Subadult numbers are low BUT
 - Slight increases in the last few years
 - Partly due to warm water (fast growth)
- Adult estimates remain high

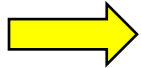


Artwork by Lindsay Hansen

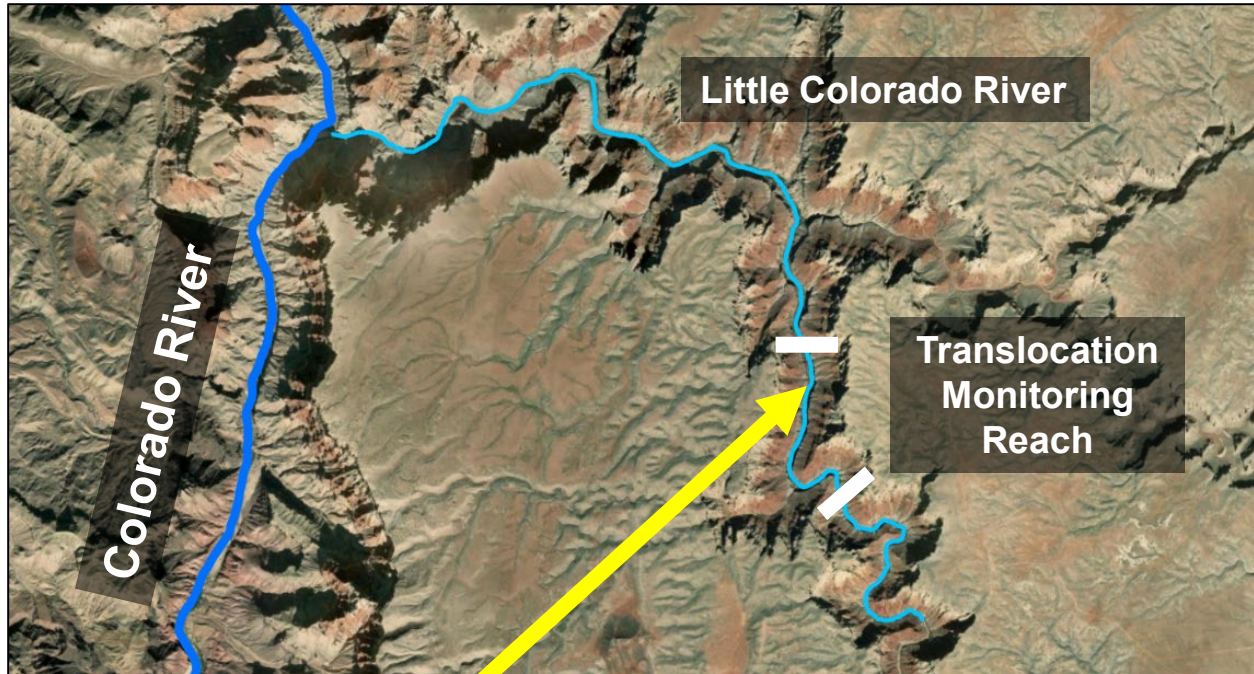


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Humpback Chub Translocation and Chute Falls Monitoring

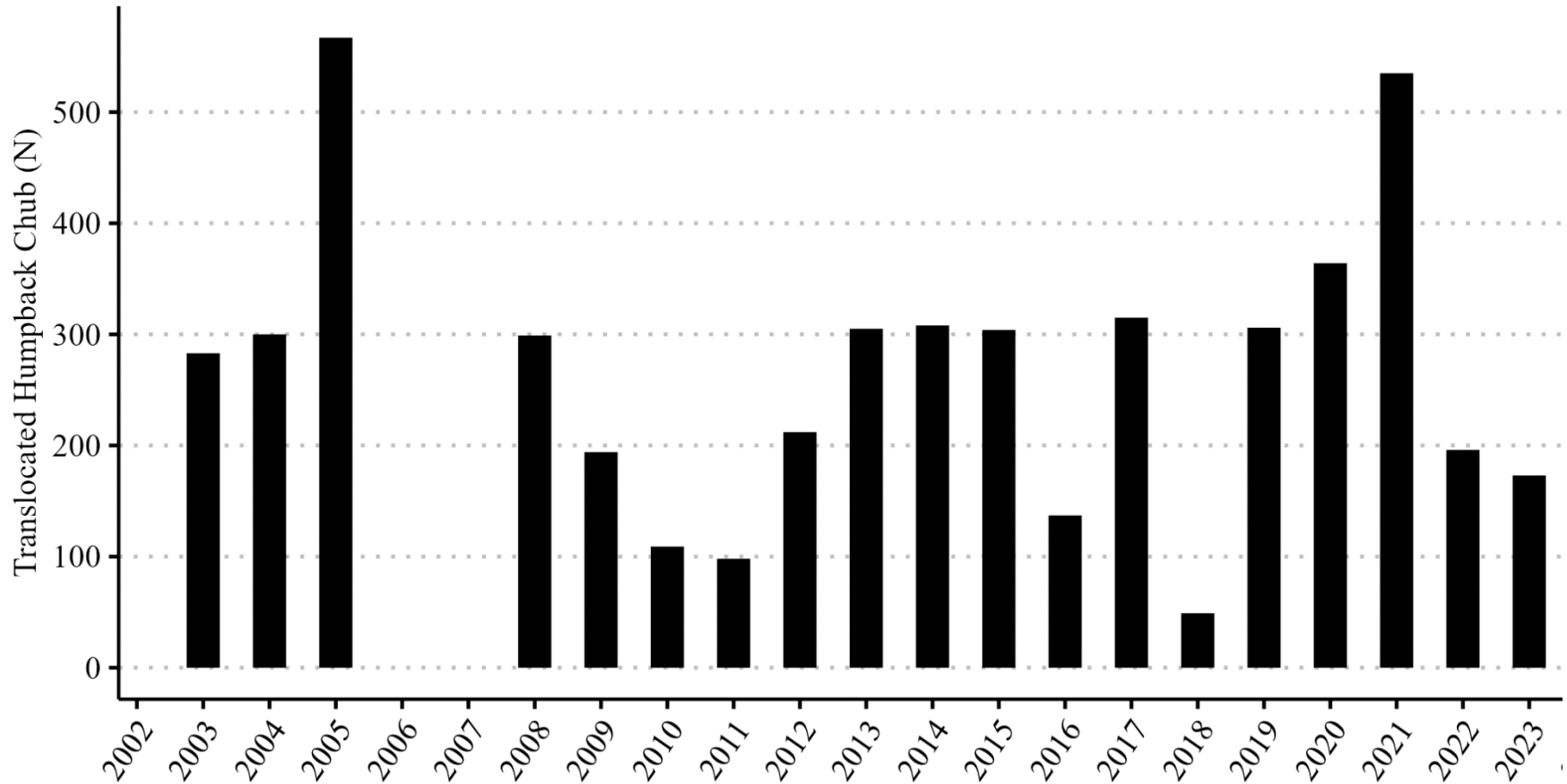


Chute Falls



Annual HBC Translocations above Chute Falls

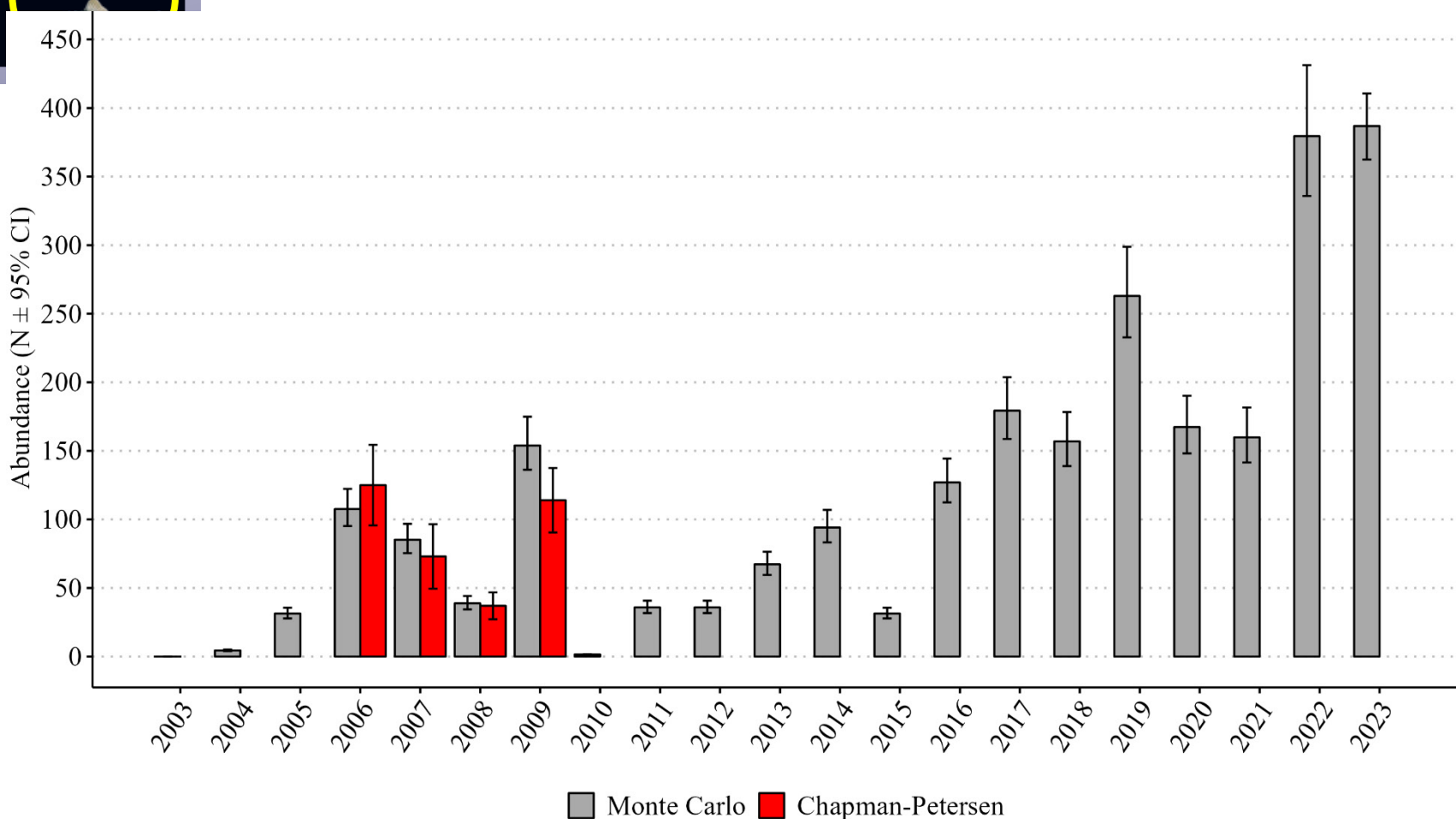
2023: 173 (63-117mm)
2003-2023: 4,871 (50-155mm)



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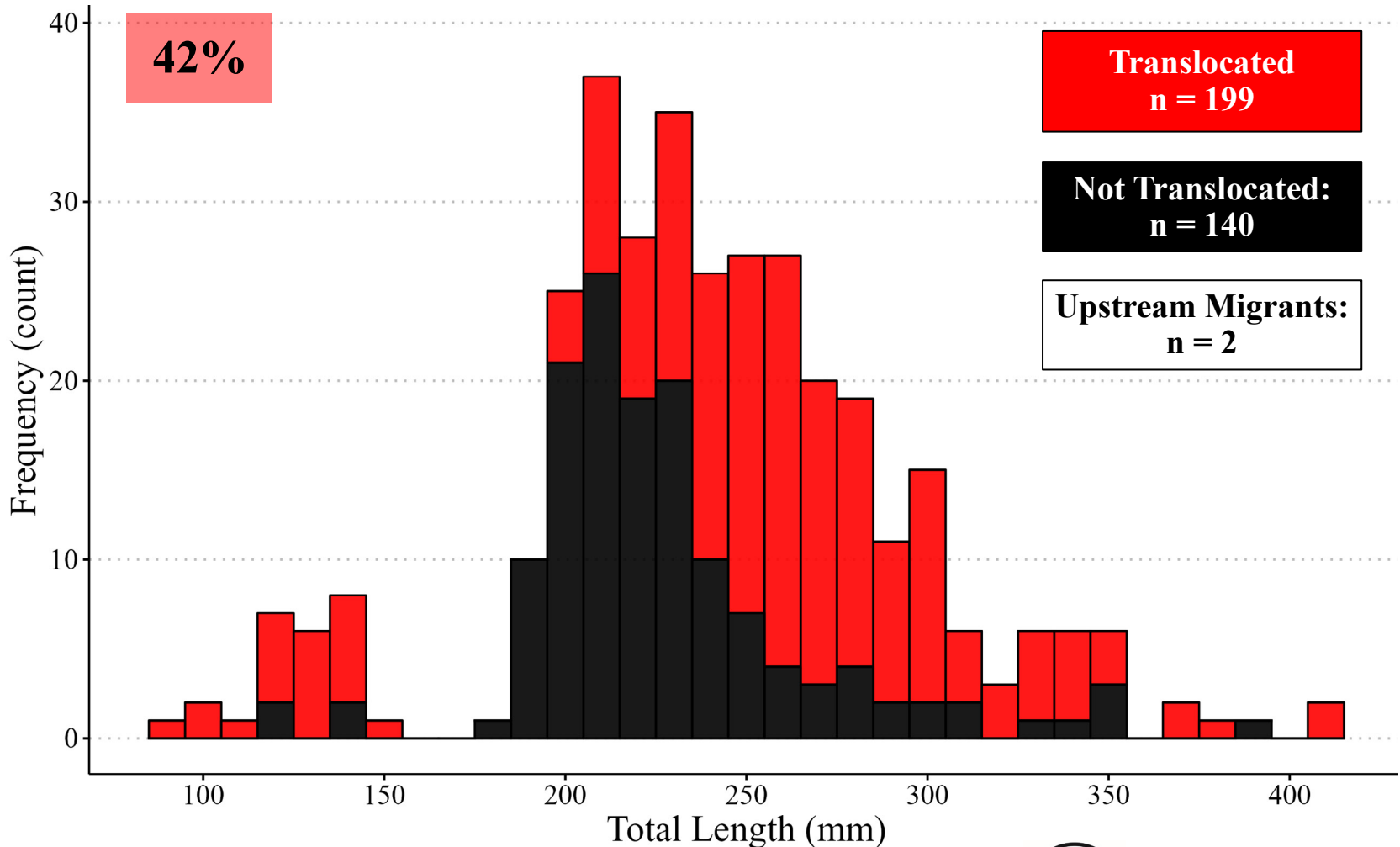
Spring adult abundance above Chute Falls shows increasing trend and highest estimates recorded in 2022-23



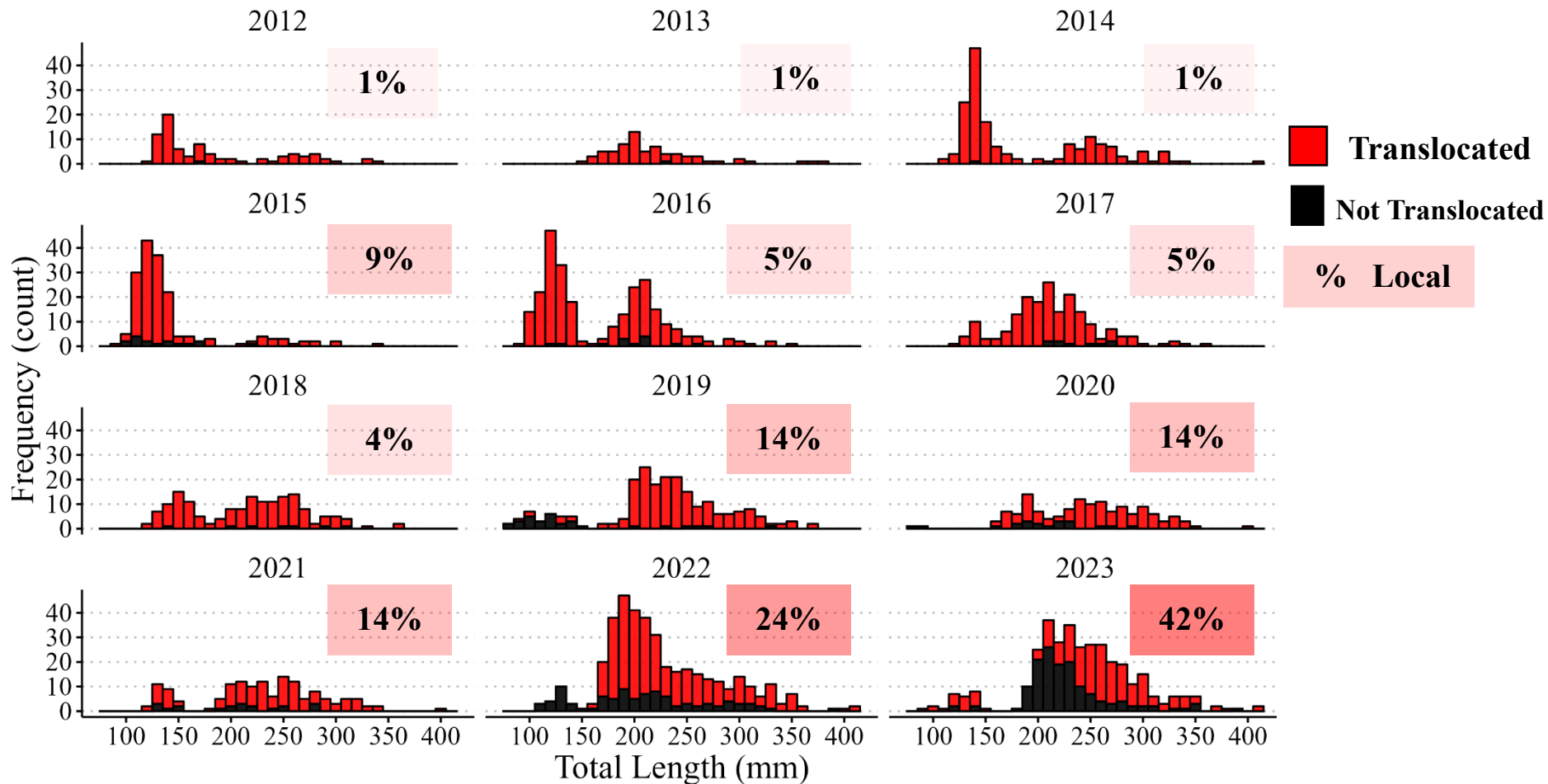
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42% of HBC captured above Chute Falls in 2023 were not translocated there



The proportion of local (not translocated) HBC above Chute Falls has increased substantially since 2011



***12** HBC have been documented moving above Chute Falls from below between 2007-2023

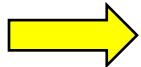
Summary: Chute Falls Translocations

- Adult HBC abundance in the translocation reach remains high.
- Some evidence of local reproduction and upriver expansion
- 173 HBC were translocated above Chute Falls in 2023
 - 4,871 total fish have been translocated since 2003
- To address reaching the “trigger” in the JCM reach in 2023, we suggest conducting two HBC translocations to above Chute Falls in 2024.
- Other options may need to be considered in the future (e.g., continue translocating higher #'s above Chute Falls, transporting juvenile HBC from western Grand Canyon?).

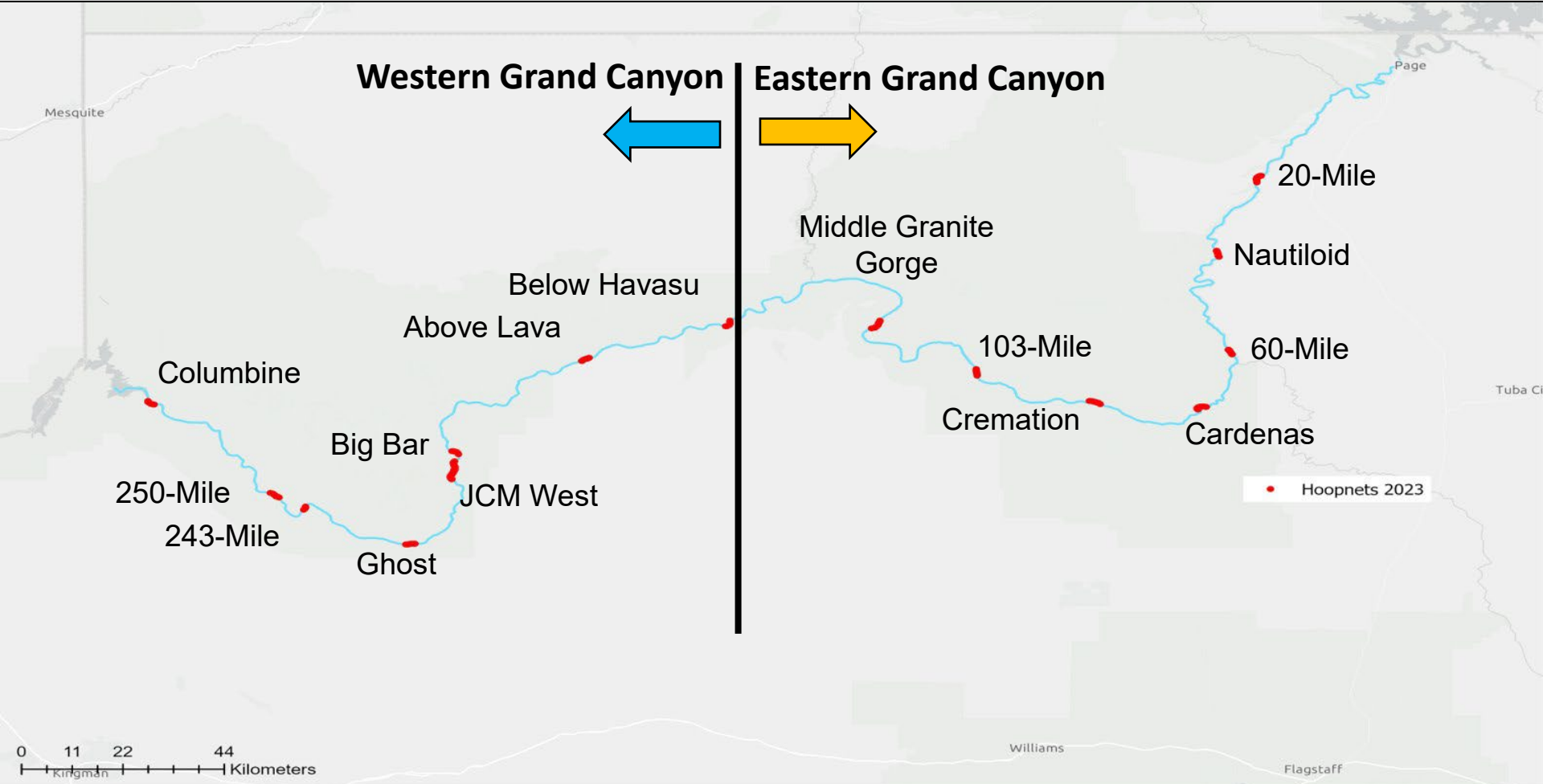


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2023 Mainstem HBC aggregation trip sampled 15 sites with hoop nets between 20-mile and Columbine Falls (RM 275) in the fall

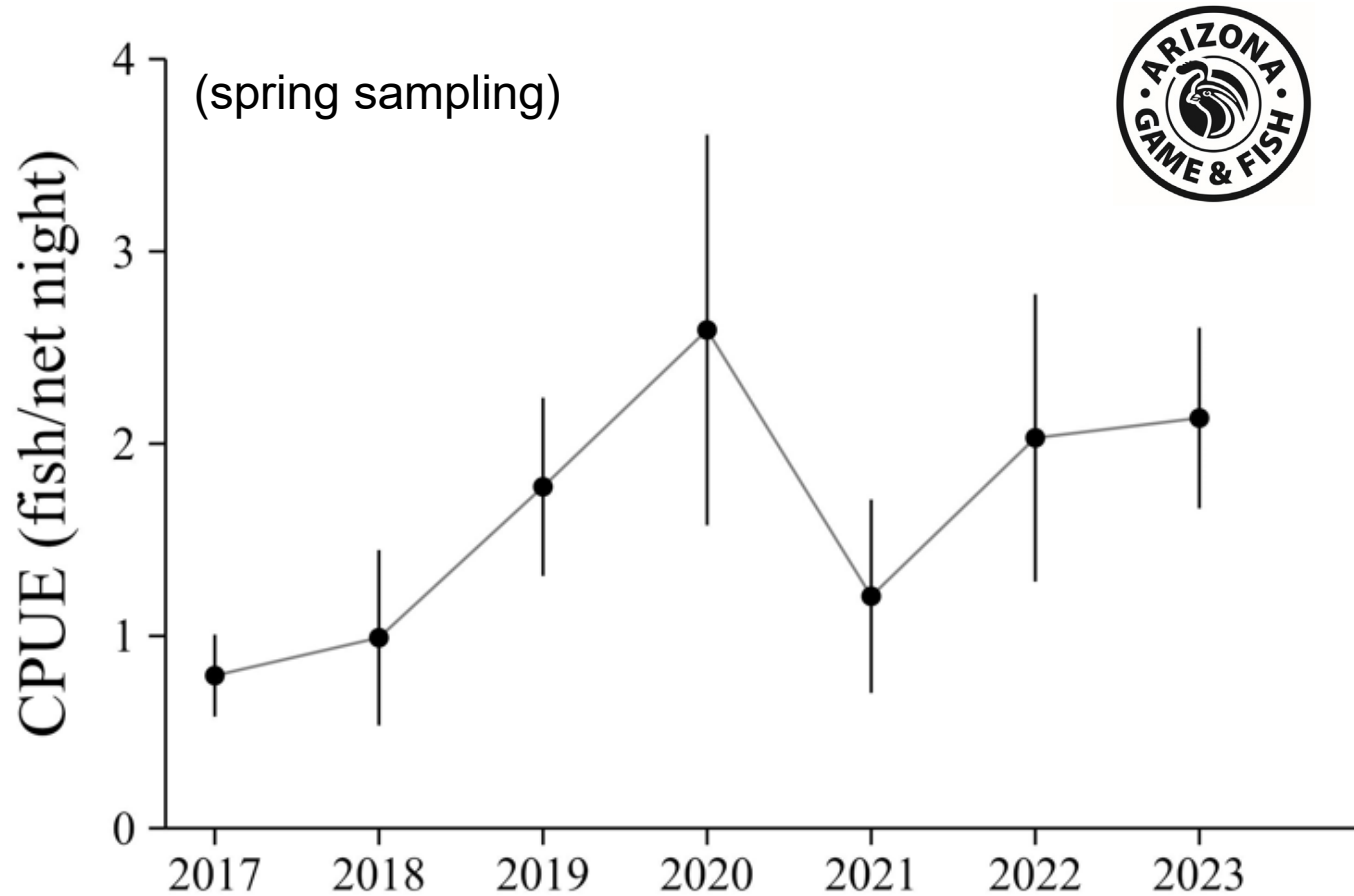


Aggregation Sampling 2023

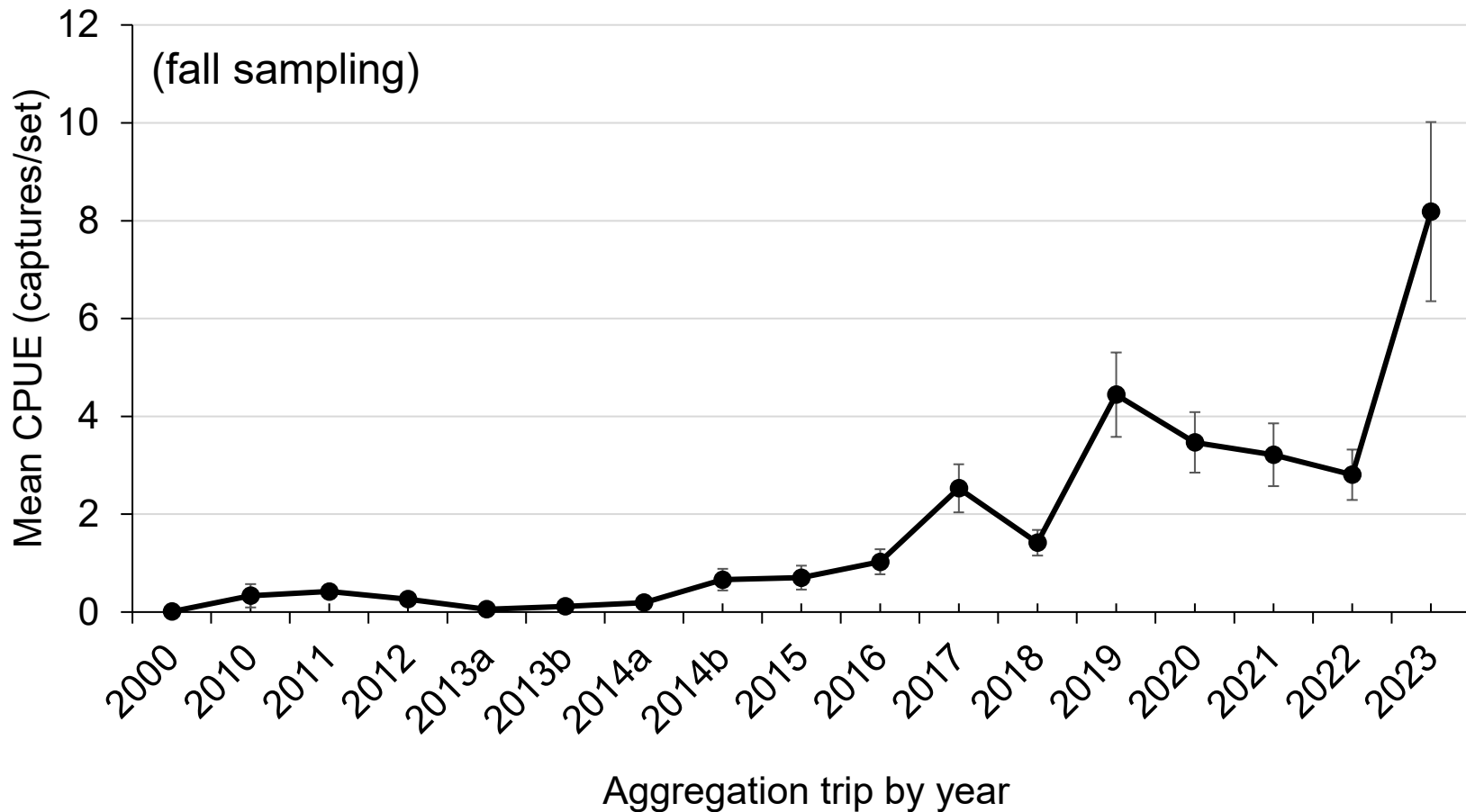
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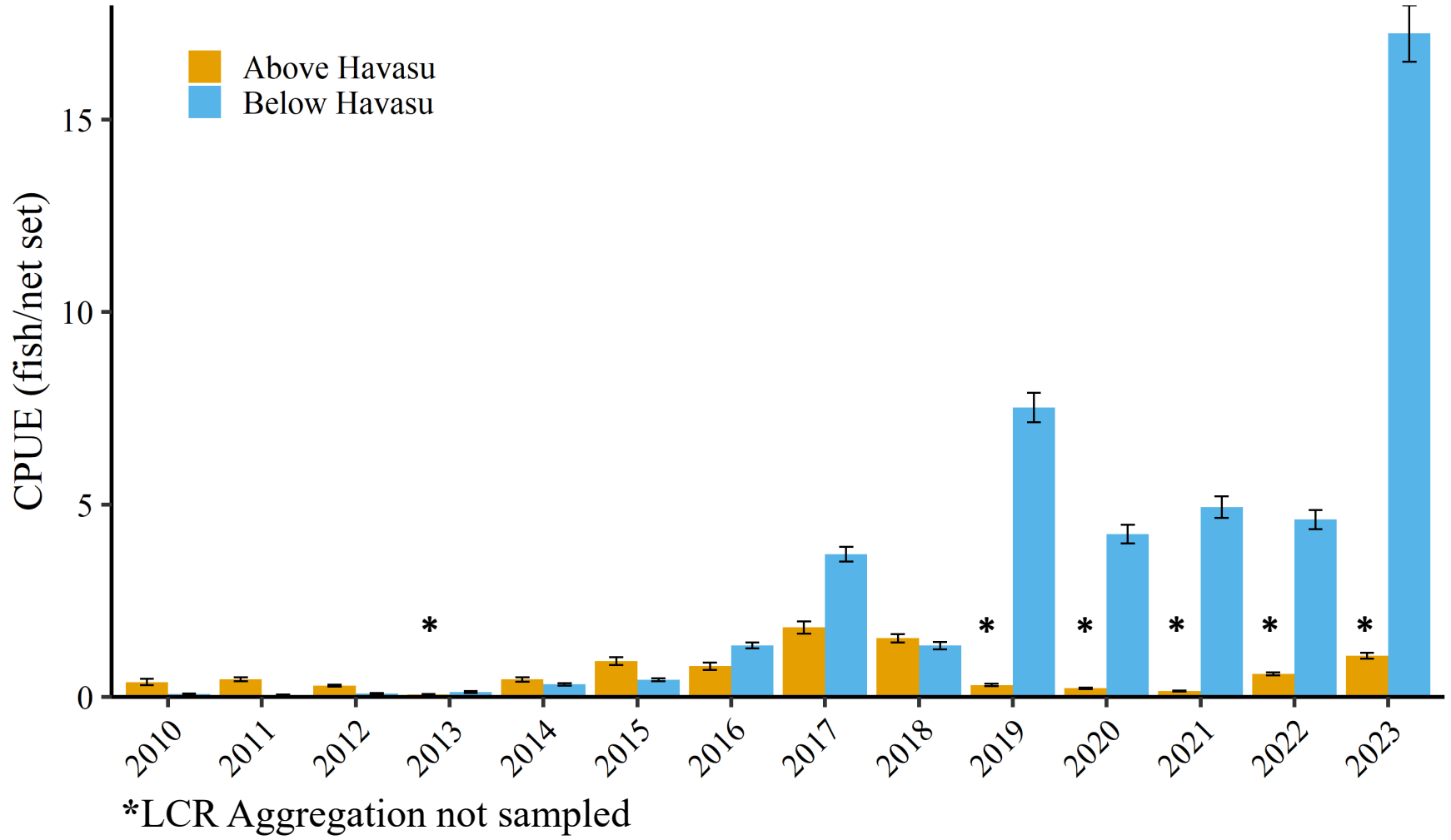
AGFD river-wide hoop net CPUE shows an increase in spring HBC relative abundance since 2017



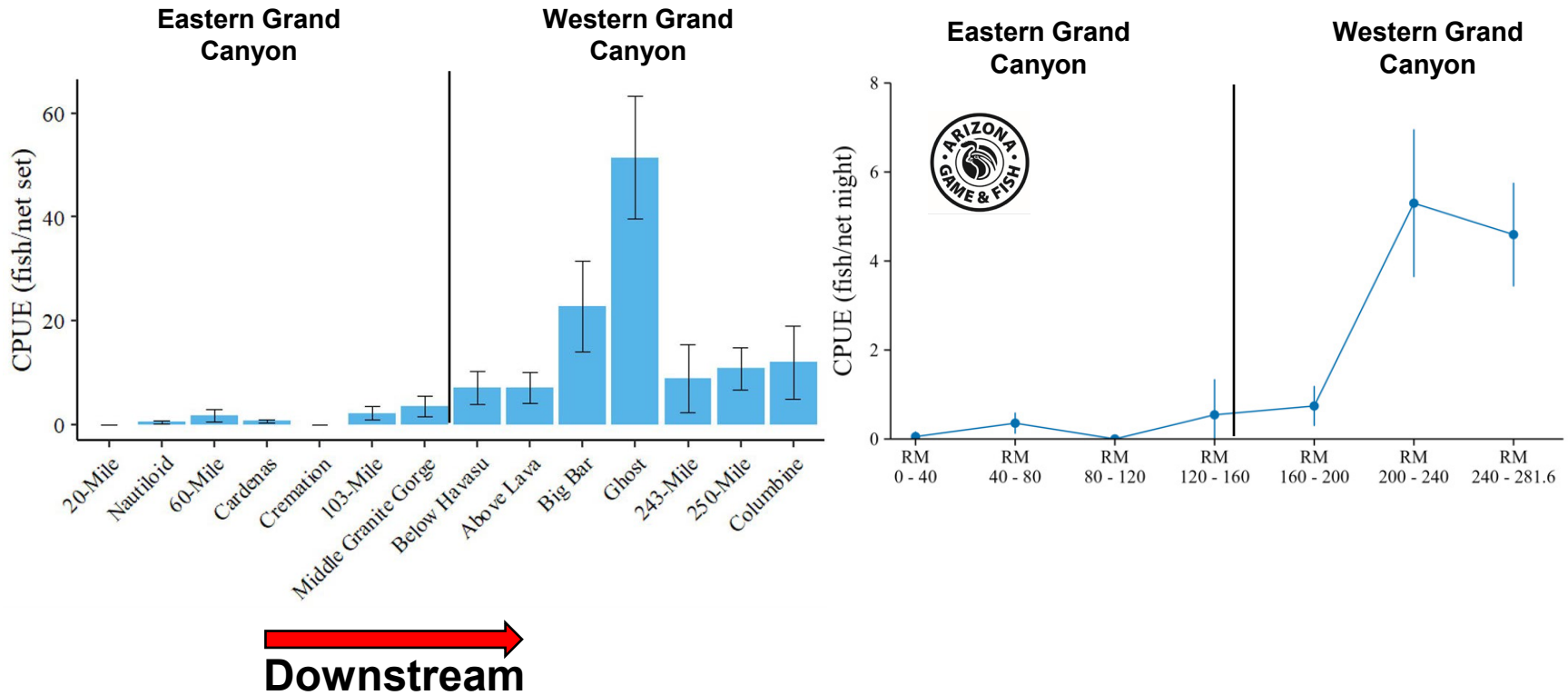
Overall HBC fall relative abundance at highest level on record, a large increase from 2022



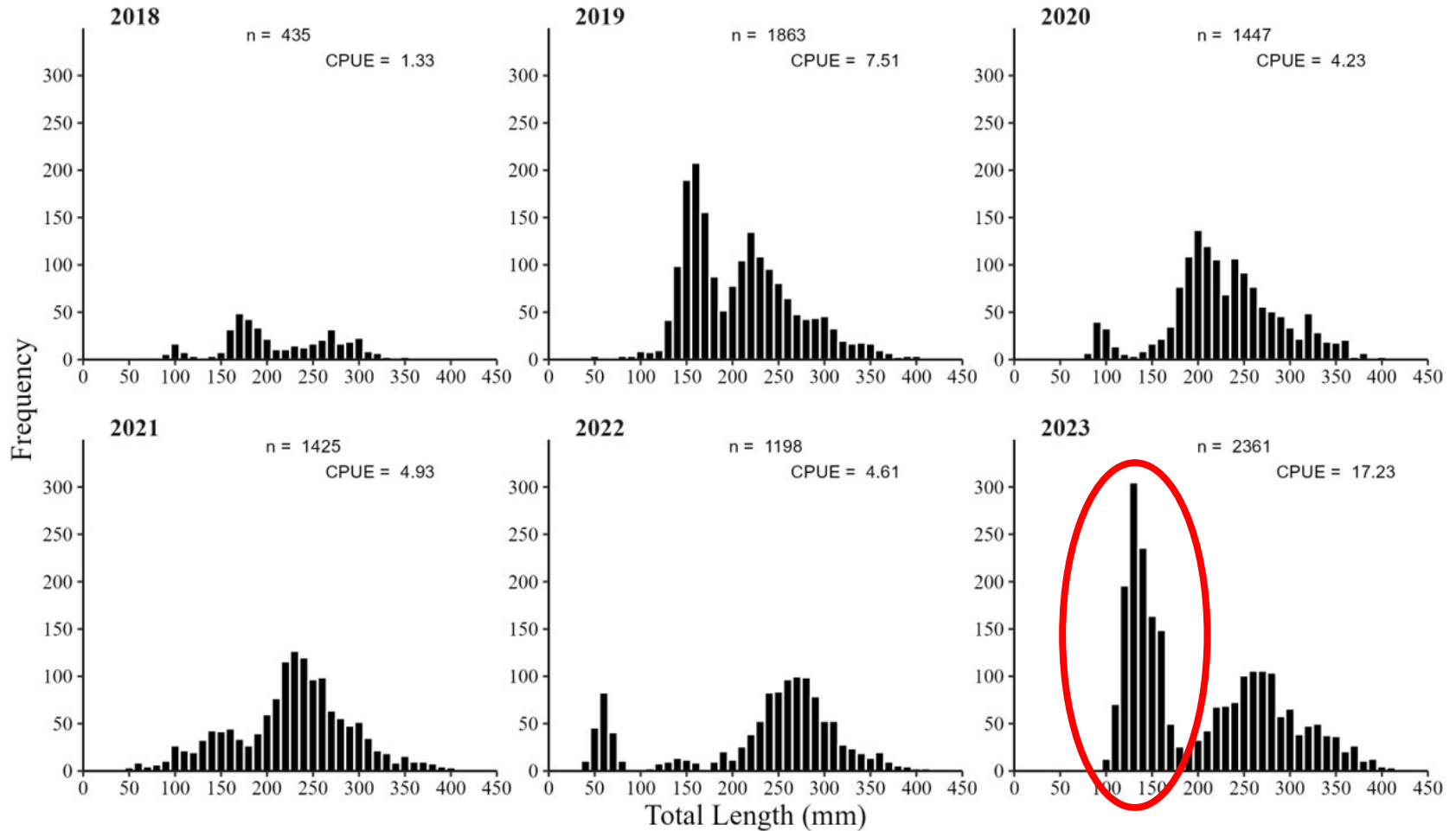
This increase is primarily driven by captures in the western Grand Canyon, below Havasu Creek

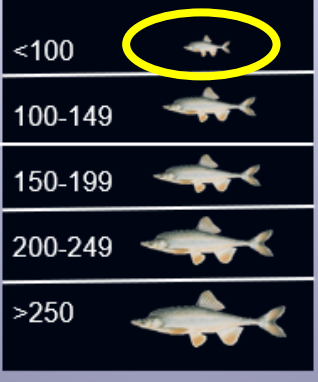


AGFD and HBC Aggregations find most HBC between 200-240 mile



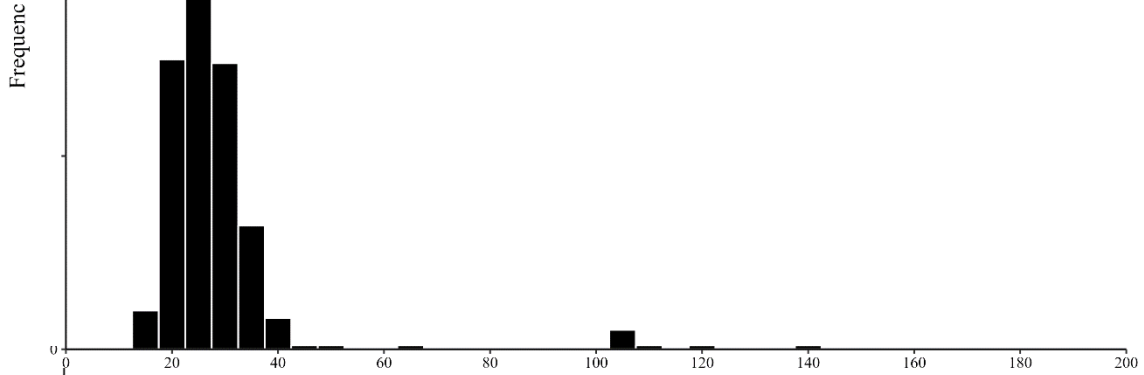
Relative abundance increase is driven primarily by small sub-adults



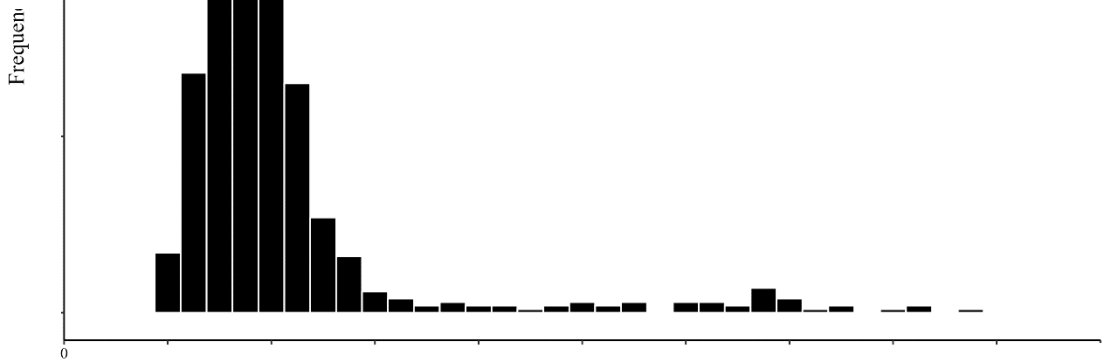


Age-0 HBC were found in backwaters along Colorado River in July (high water) and September (low water)

Summer Backwater Seining



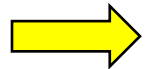
Fall Backwater Seining



Total Length (mm)

Presentation outline:

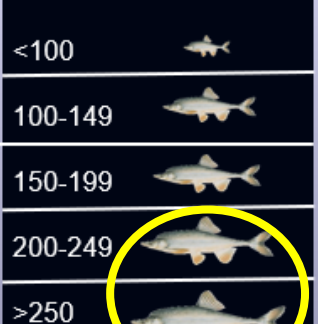
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 - JCM – west



Abundance estimation in western Grand Canyon (Havasu to Pearce Ferry)

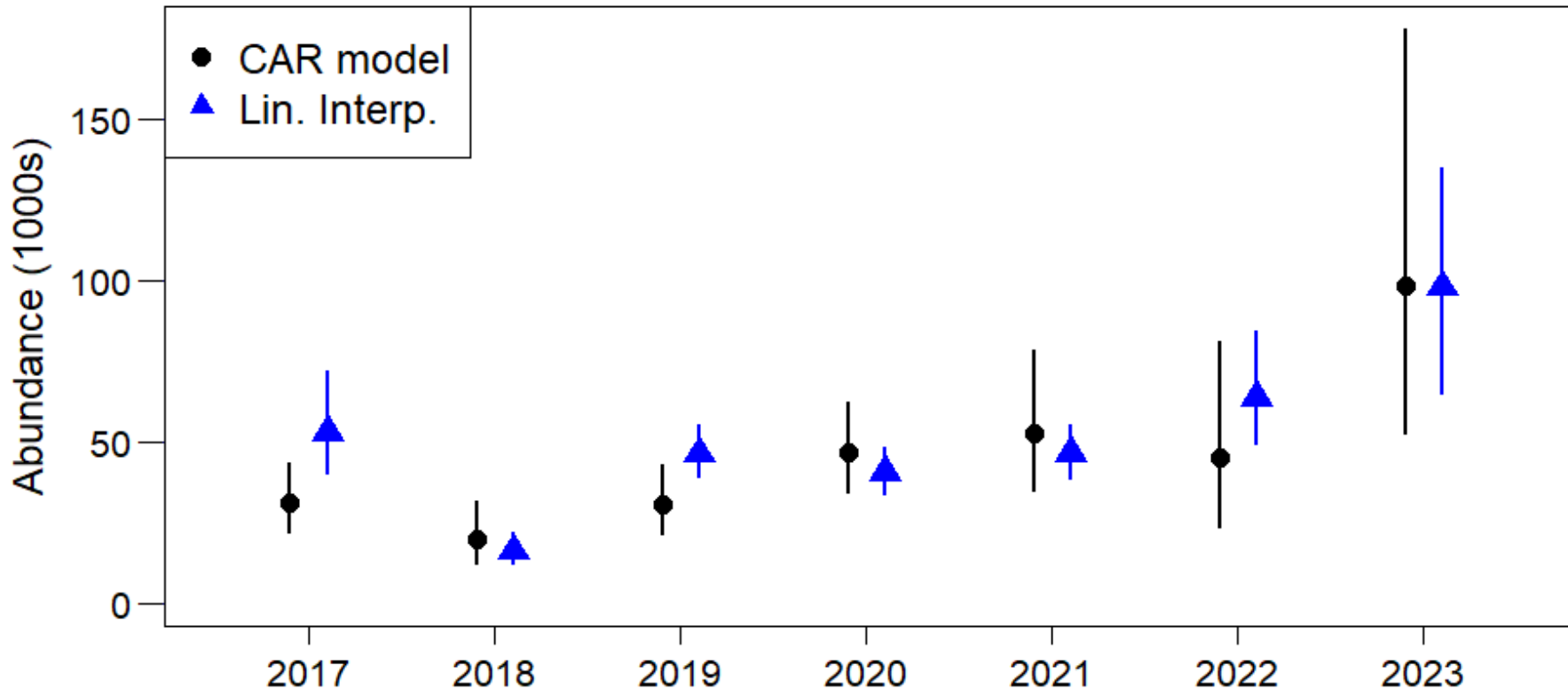
- 1) Mark-recapture to obtain capture probability
- 2) Capture probability & catch to estimate density
-effects of turbidity, temp, etc.
- 3) Spatial & habitat effects account for non-random sampling





HBC Abundance in western Grand Canyon 2017-2023 (Havasu Rapids to Pearce Ferry)

Total HBC adult (>199mm TL) abundance in western GC



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Summary: HBC Aggregations:

- HBC relative abundance in Grand Canyon increased substantially in 2023
 - Driven by small sub-adults (100-149 mm)
- Adult abundance below Havasu Rapid has also been increasing since 2018
- In order to update our capture probabilities with the changing river conditions, we suggest conducting two-pass mark-recapture event in 2024

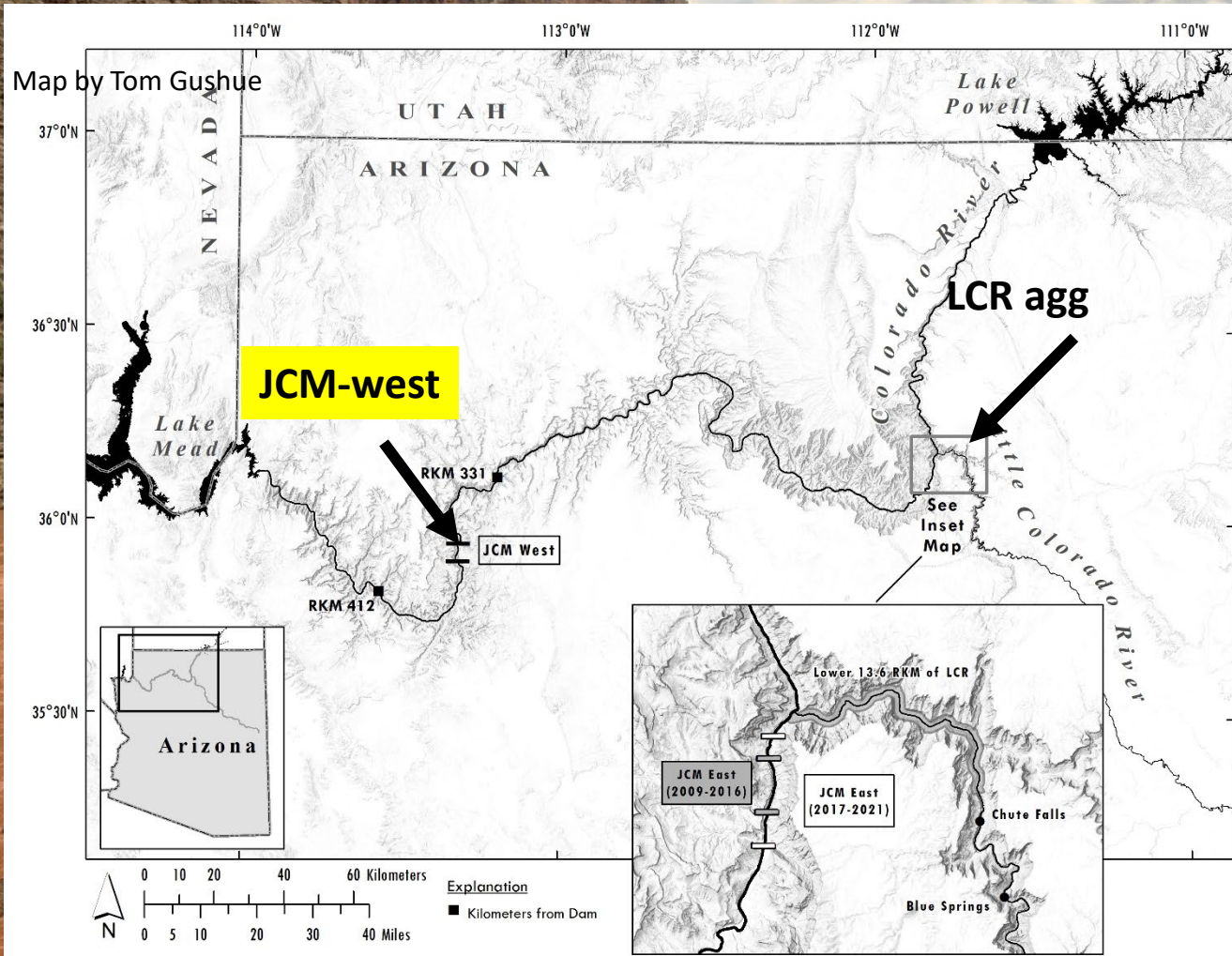


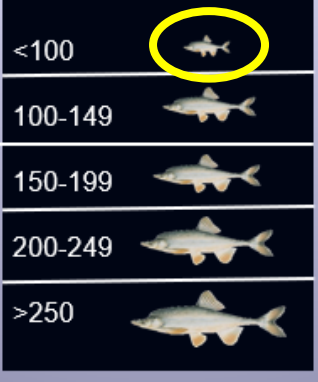
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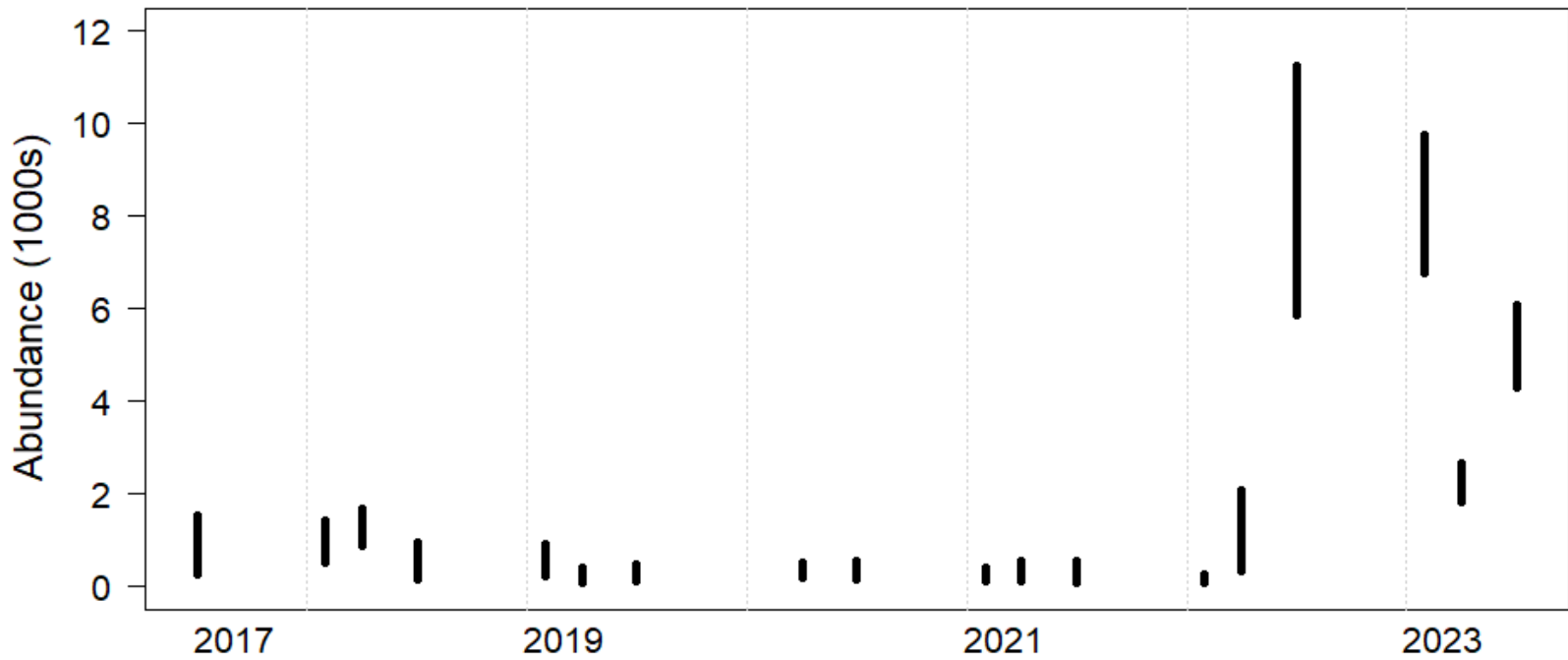


Fixed site monitoring in western Grand Canyon (JCM-west)



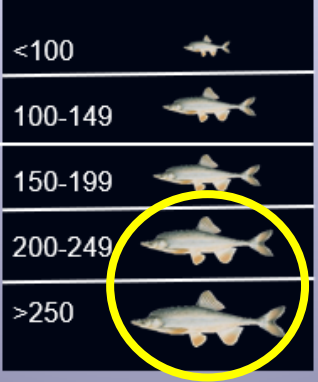


High juvenile abundance in JCM-west in 2022 & 2023



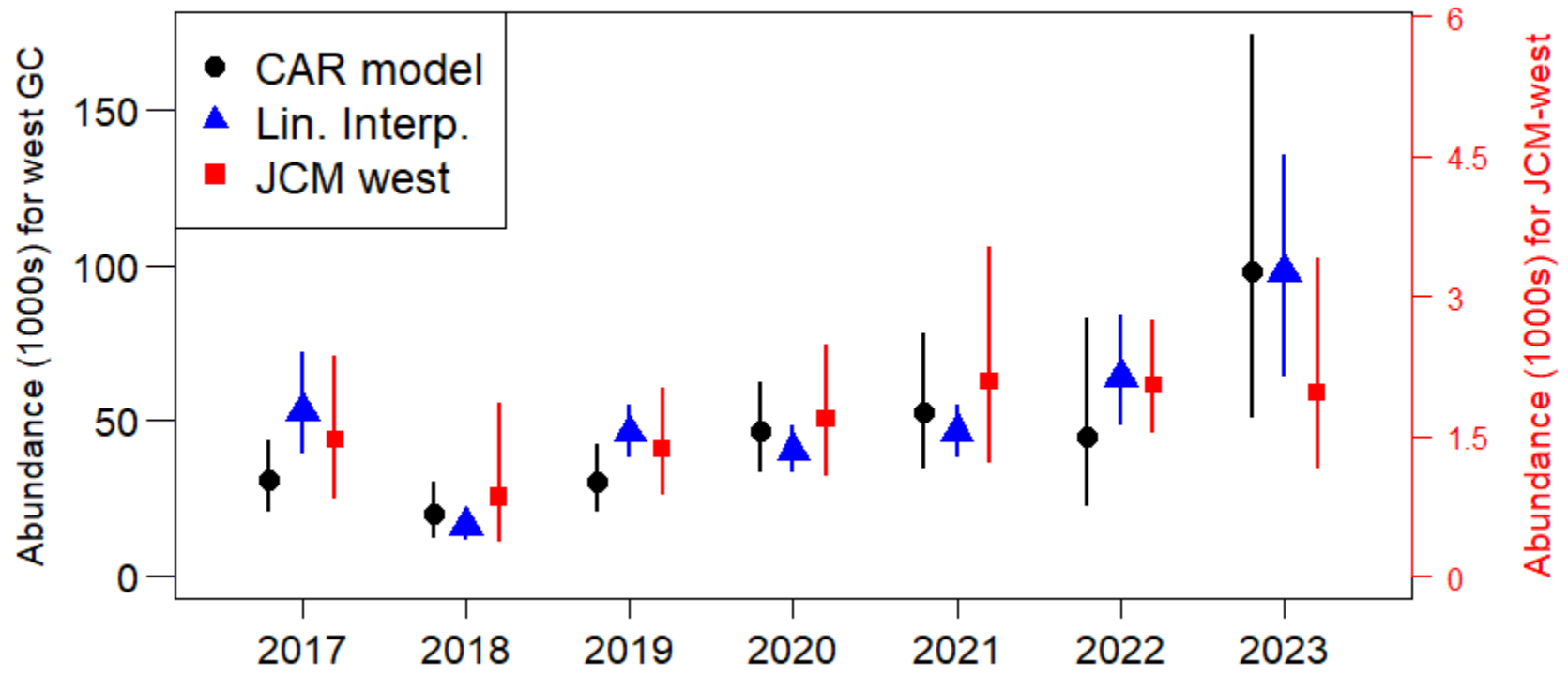
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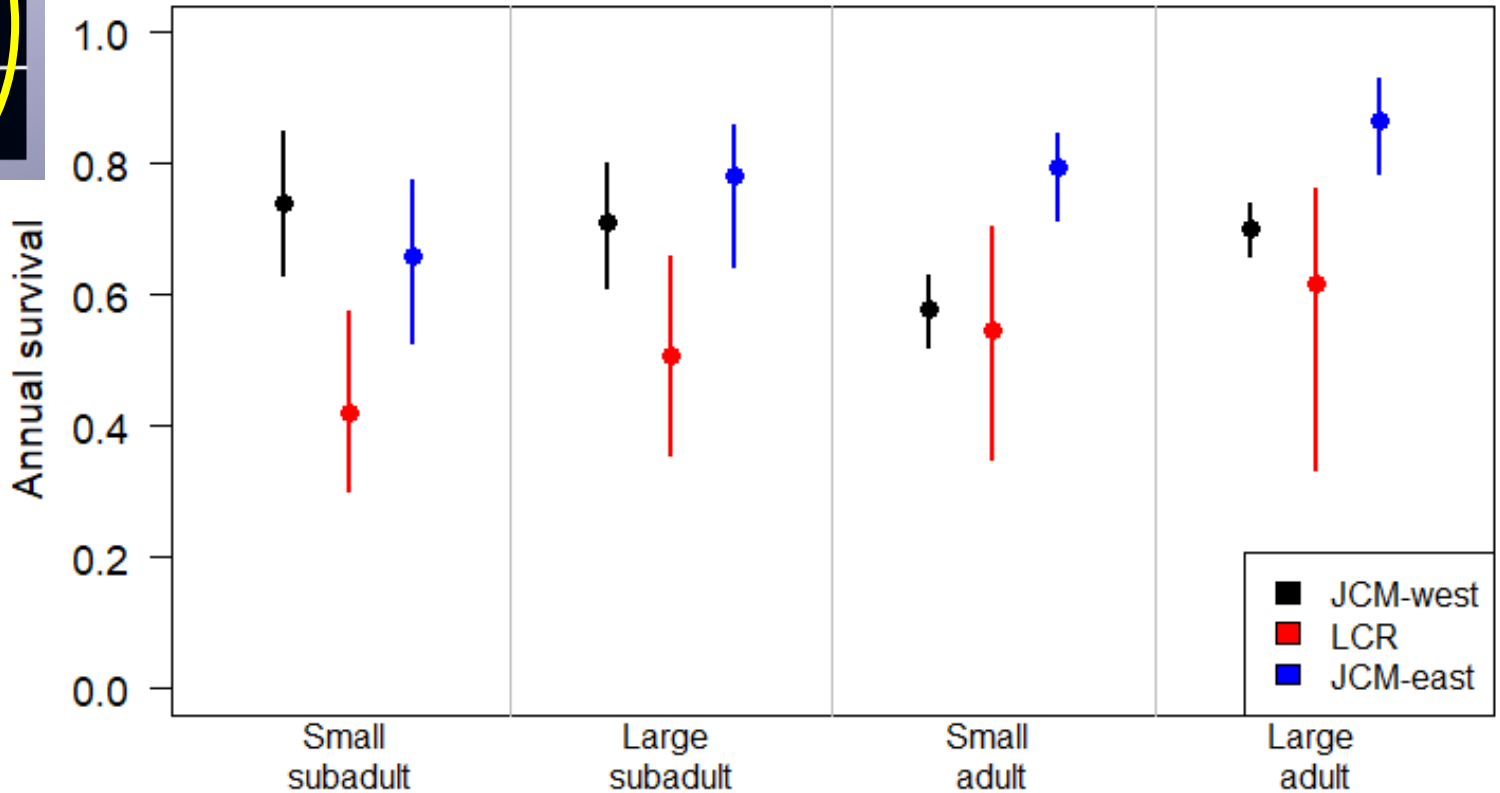


HBC adult abundance in JCM-west compared to western Grand Canyon

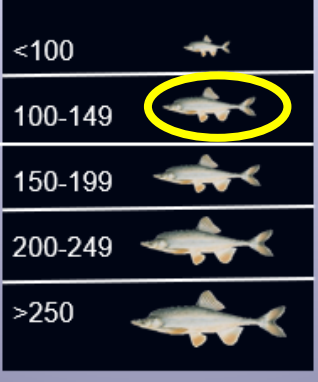
Total HBC adult (>199mm TL) abundance in western GC vs. JCM-west



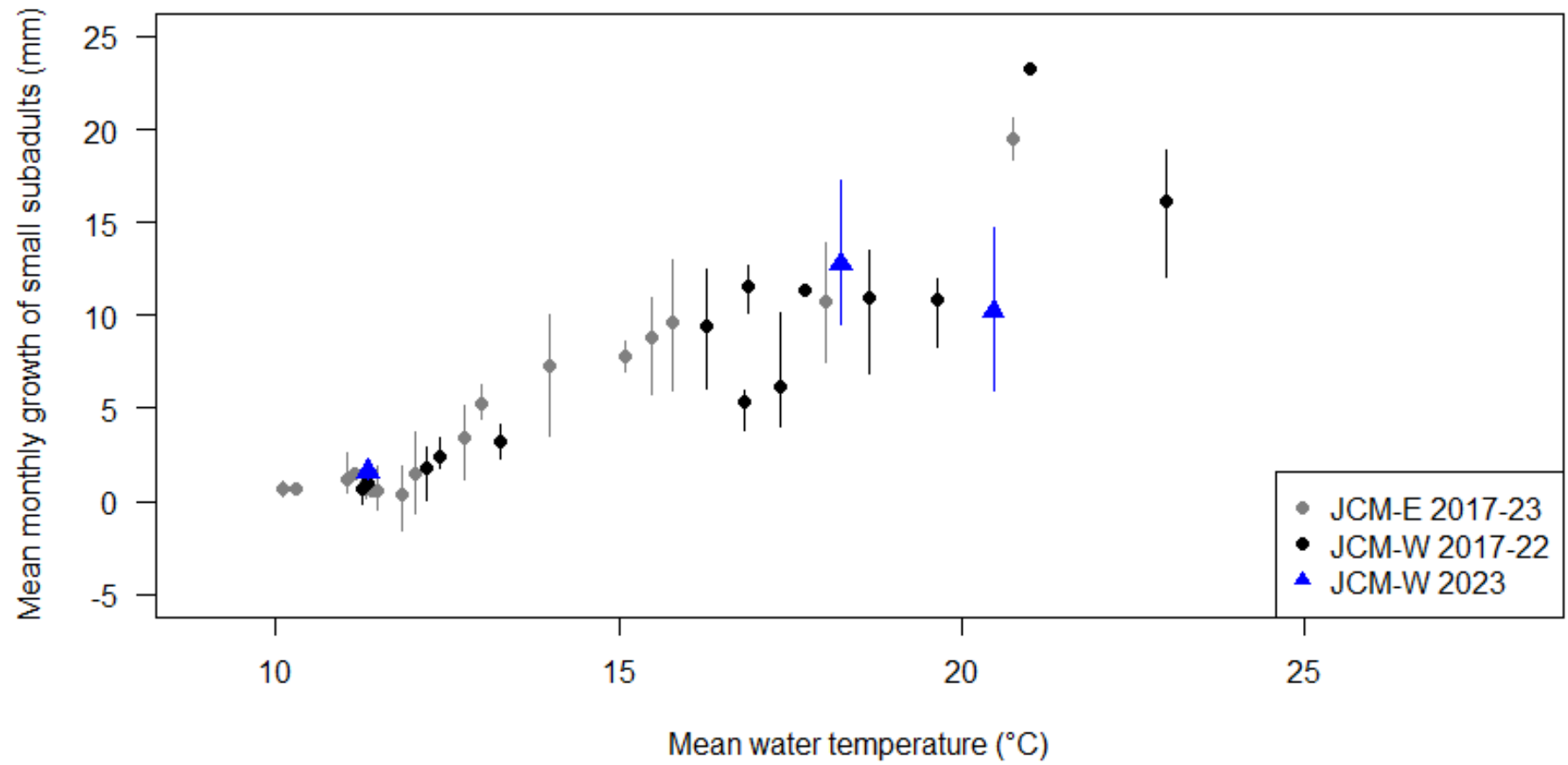
Apparent survival of HBC



Apparent survival = probability of survival and not emigrating from the study site



Growth of HBC is faster in JCM-W than JCM-E



* Water temperatures in 2023 were approximated (no data available)

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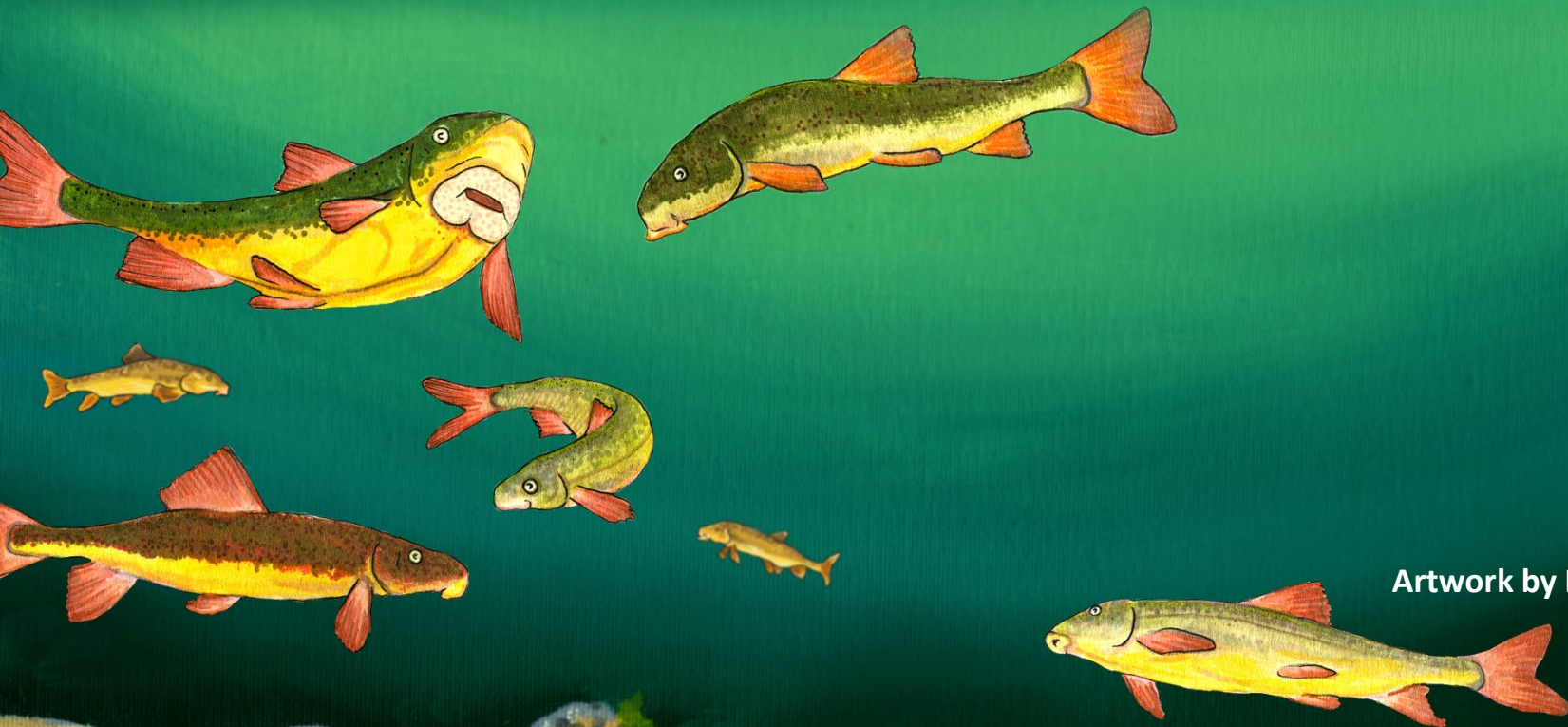


Summary: Humpback Chub in Grand Canyon

- Eastern Grand Canyon
 - High abundance of small, age-0 fish in the LCR & JCM-East
 - Subadults low, but faster growth
 - High abundance of adults
 - Chute Falls translocations: some evidence of reproduction?
- Western Grand Canyon
 - Adult abundance at its highest
 - High age-0 abundance in 2022 & 2023
 - Growth & survival different from Eastern Grand Canyon



Thank You



Artwork by Lindsay Hansen

