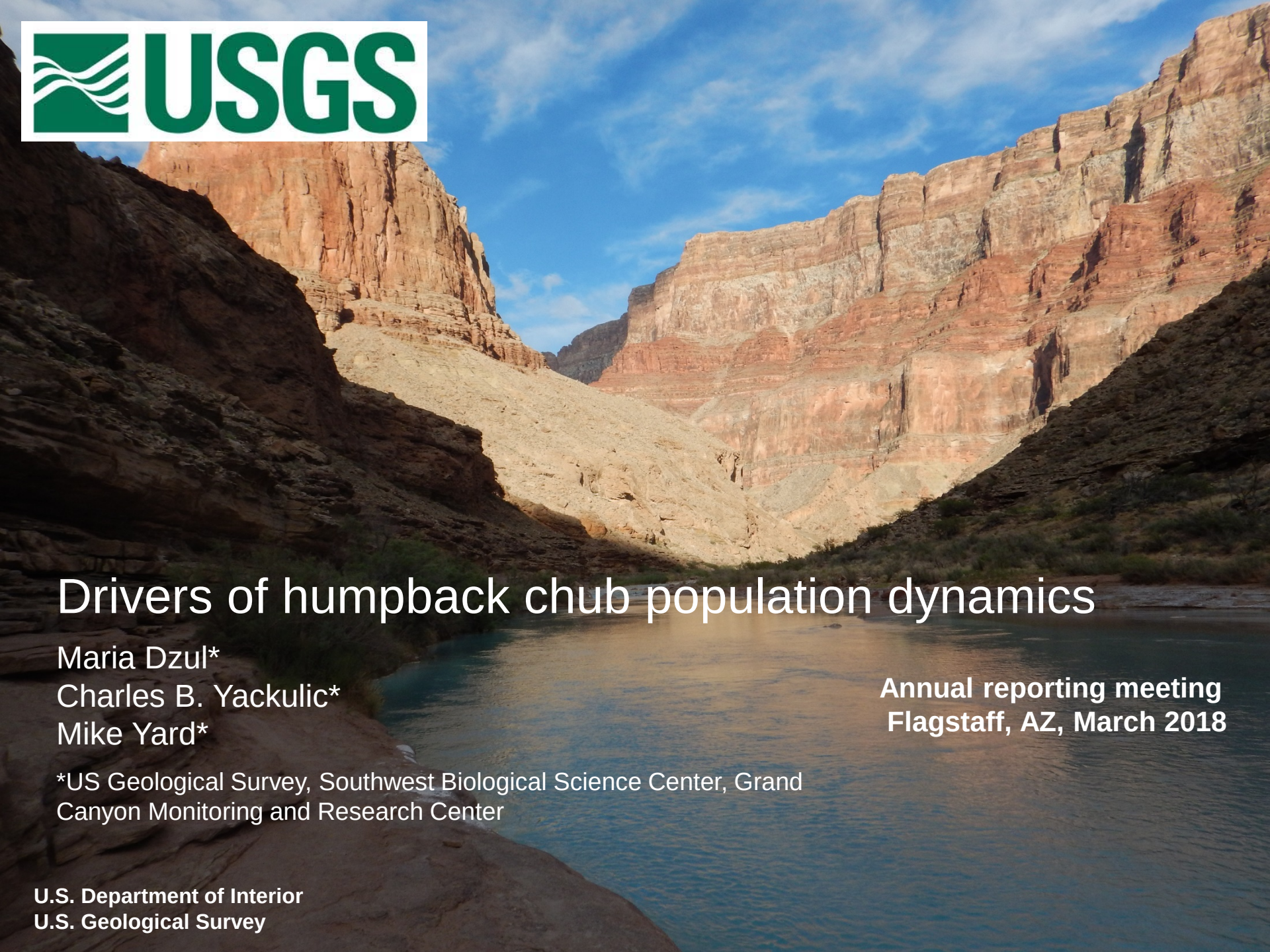


Drivers of humpback chub population dynamics

Maria Dzul*
Charles B. Yackulic*
Mike Yard*

*US Geological Survey, Southwest Biological Science Center, Grand Canyon Monitoring and Research Center

Annual reporting meeting
Flagstaff, AZ, March 2018

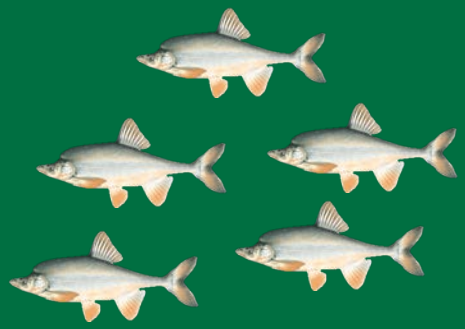
U.S. Department of Interior
U.S. Geological Survey

Presentation outline

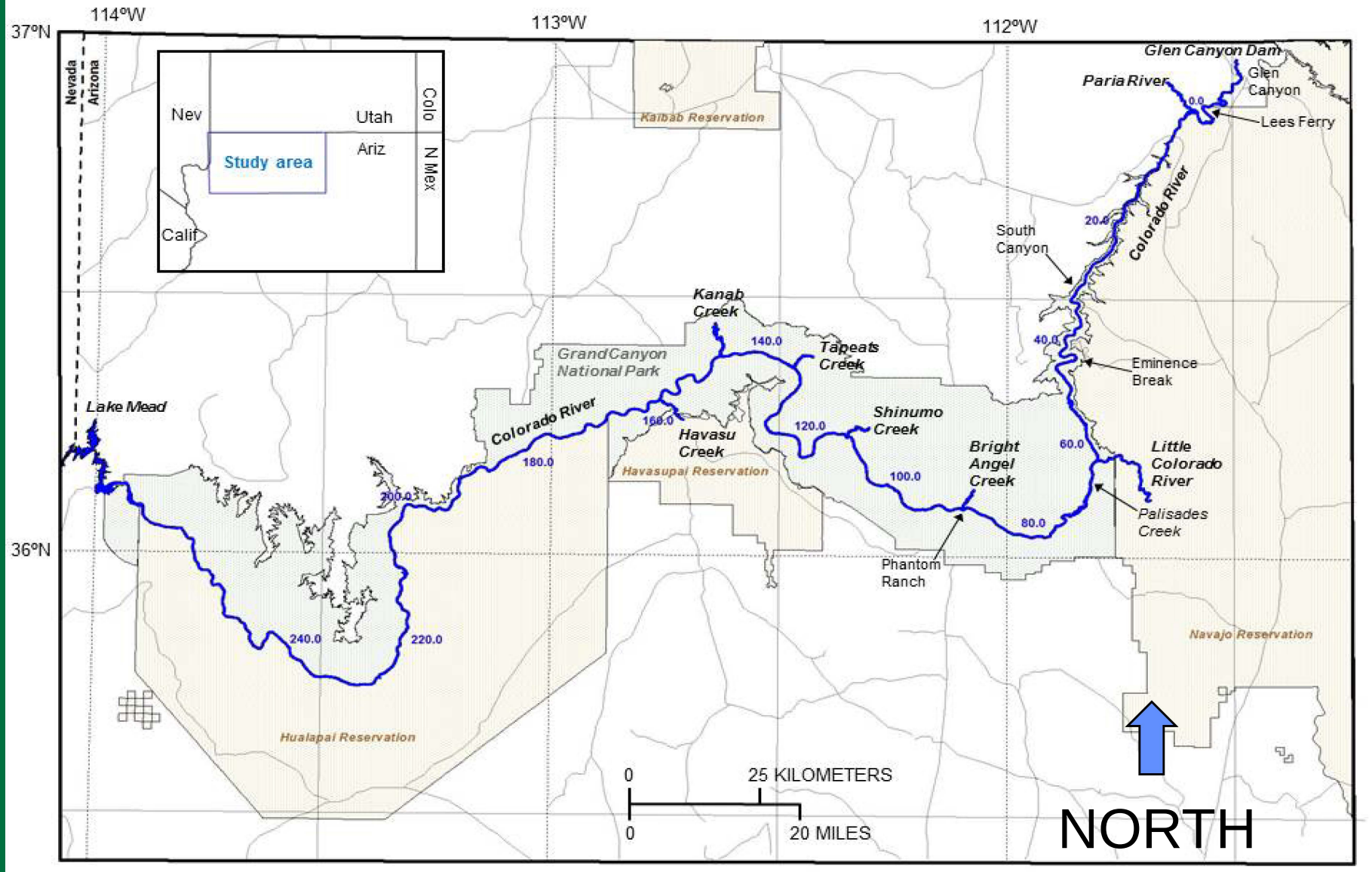
- 1) Two species mark-recapture model

- 2) Adult humpback chub population dynamics in eastern Grand Canyon

- 3) Humpback chub in western Grand Canyon (pilot year)



USGS


114°W
113°W
112°W
37°N
36°N
Nevada
Arizona
Nev
Utah
Colo
Ariz
N Mex
Calif
Study area
Kaibab Reservation
Glen Canyon Dam
Glen Canyon
Paria River
0.0
Lees Ferry
Colorado River
20.0
South Canyon
Kanab Creek
140.0
Tapeats Creek
40.0
Eminence Break
Grand Canyon National Park
Lake Mead
Colorado River
160.0
Havasu Creek
120.0
Shinumo Creek
60.0
Little Colorado River
180.0
Havasupai Reservation
Bright Angel Creek
100.0
Palisades Creek
200.0
80.0
Phantom Ranch
Navajo Reservation
240.0
220.0
Hualapai Reservation
0
25 KILOMETERS
0
20 MILES
NORTH

Two species mark-recapture model

Yard et al., 2011. Trout Piscivory in the Colorado River, Grand Canyon: Effects of Turbidity, Temperature, and Fish Prey Availability, Transactions of the American Fisheries Society

Ward et al, 2016. Effects of turbidity on predation vulnerability of juvenile humpback chub to rainbow trout and brown trout. *Journal of Fish and Wildlife Management*, *7*(1), 205-212.

Dzul et al, 2016. Incorporating temporal heterogeneity in environmental conditions into a somatic growth model. *Canadian Journal of Fisheries and Aquatic Sciences*, *74*(3), 316-326.

Covariates:

- Turbidity
- Temperature
- RBT density
- HBC density

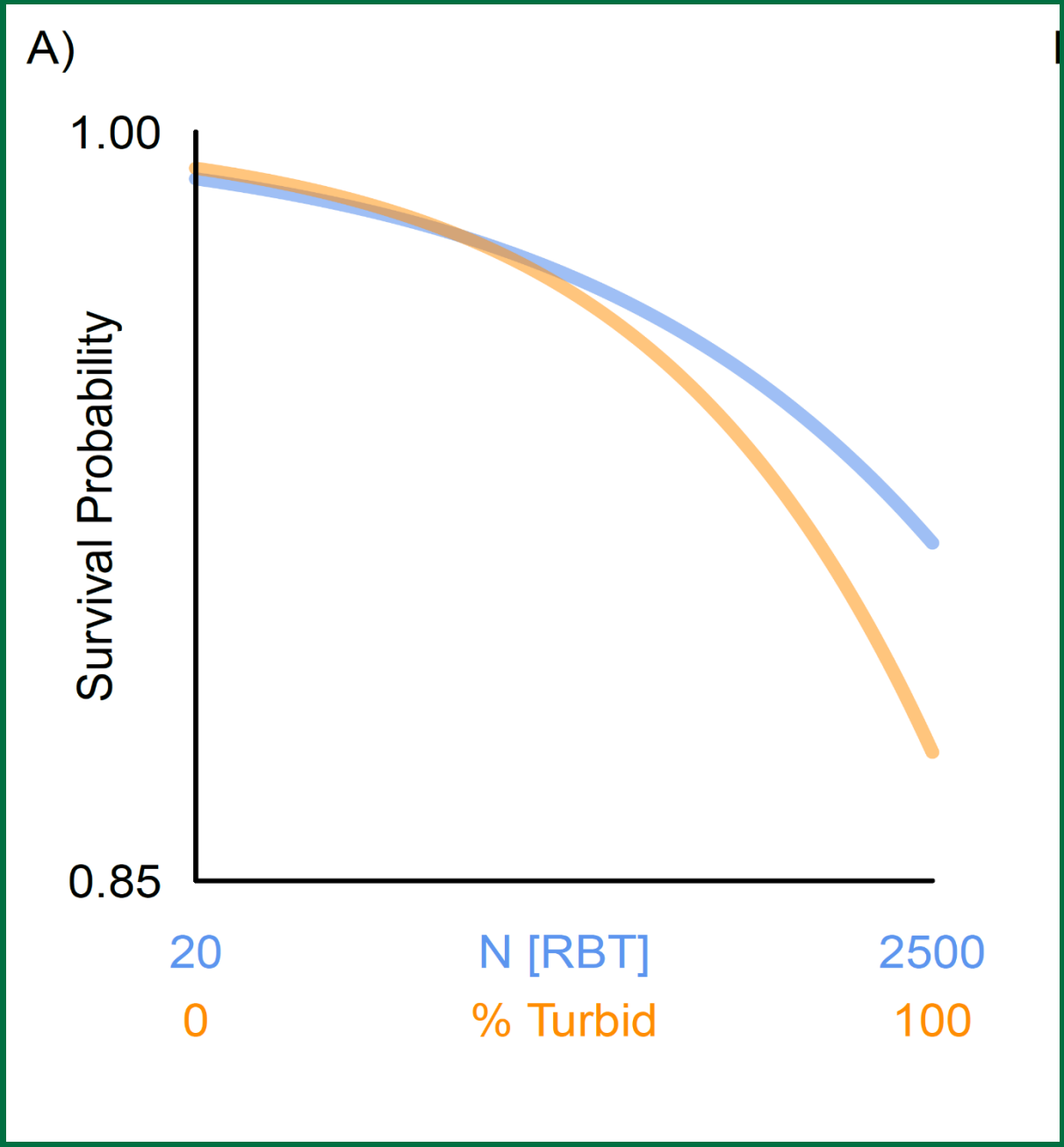
Responses:

- Survival
- Growth
- P-cap

USGS

Effect on survival:

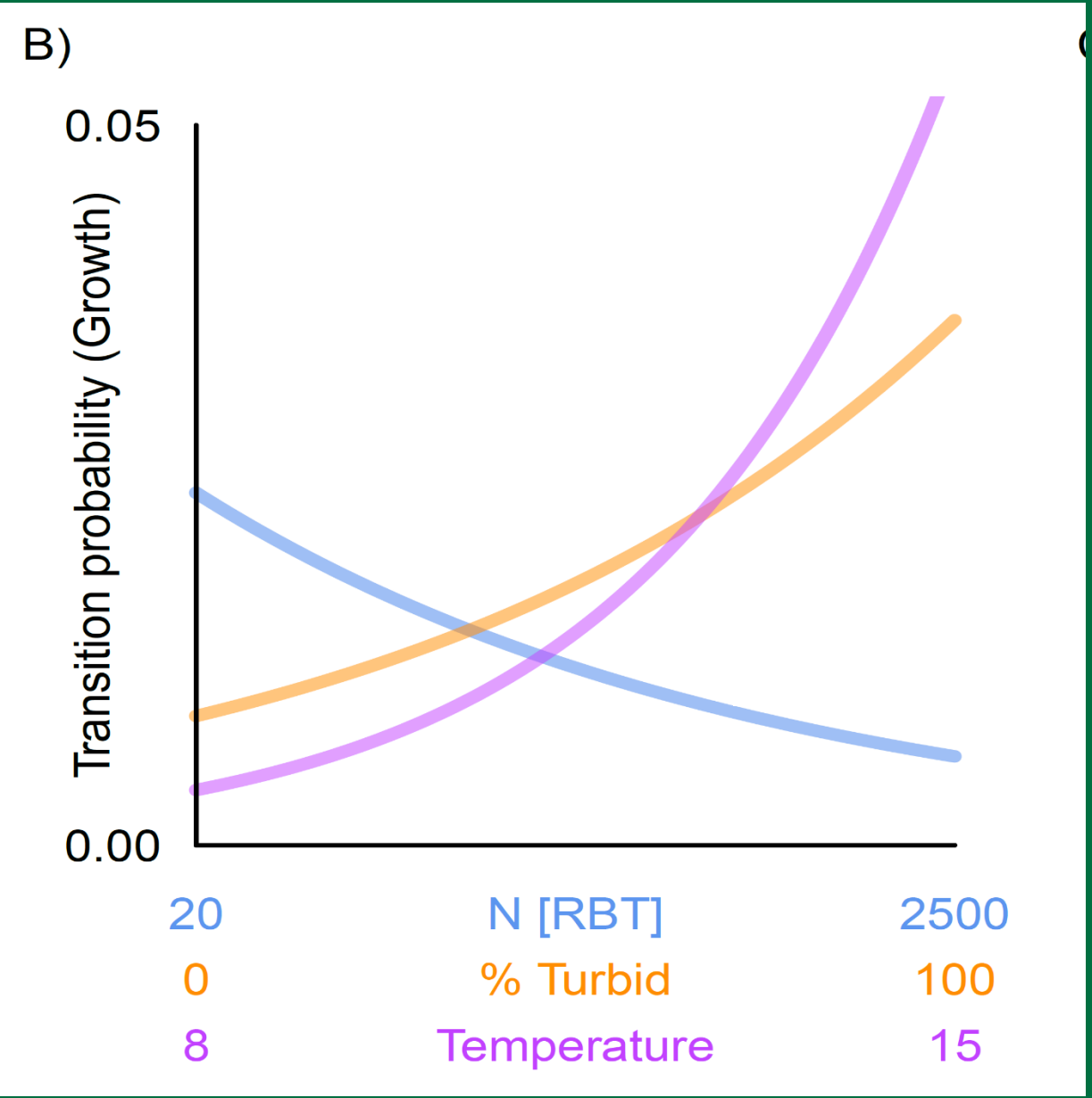
Turbidity (-)
RBT (-)
pseudo-R^2: 0.38



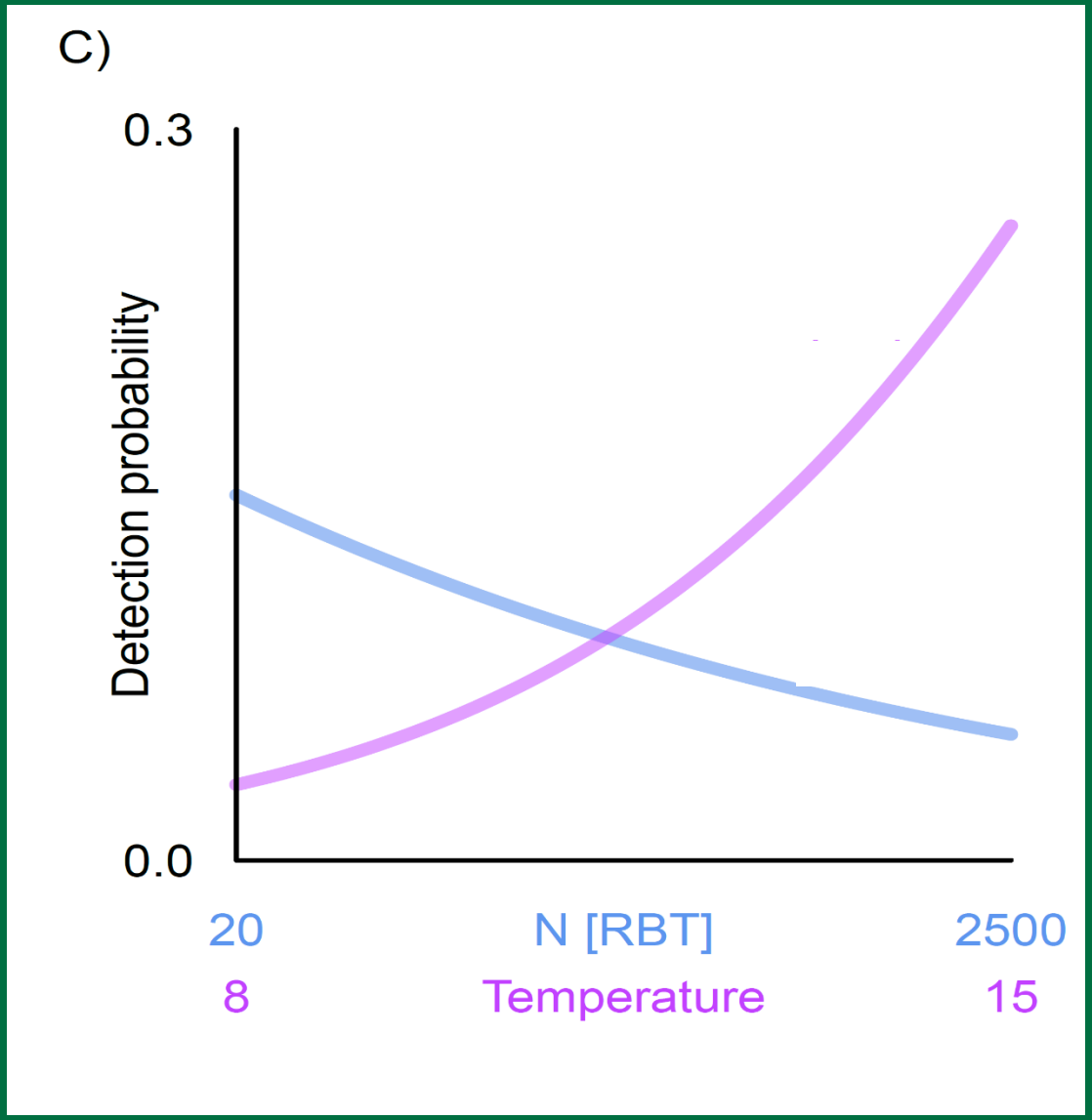
C. B. Yackulic, J. Korman, M.D. Yard, and M. Dzul. *2018.* Ecology.

Effect on growth:

Temperature (+)
Turbidity (+)
RBT (-)
pseudo-R^2: 0.43



C. B. Yackulic, J. Korman, M.D. Yard, and M. Dzul. *2018.* Ecology.



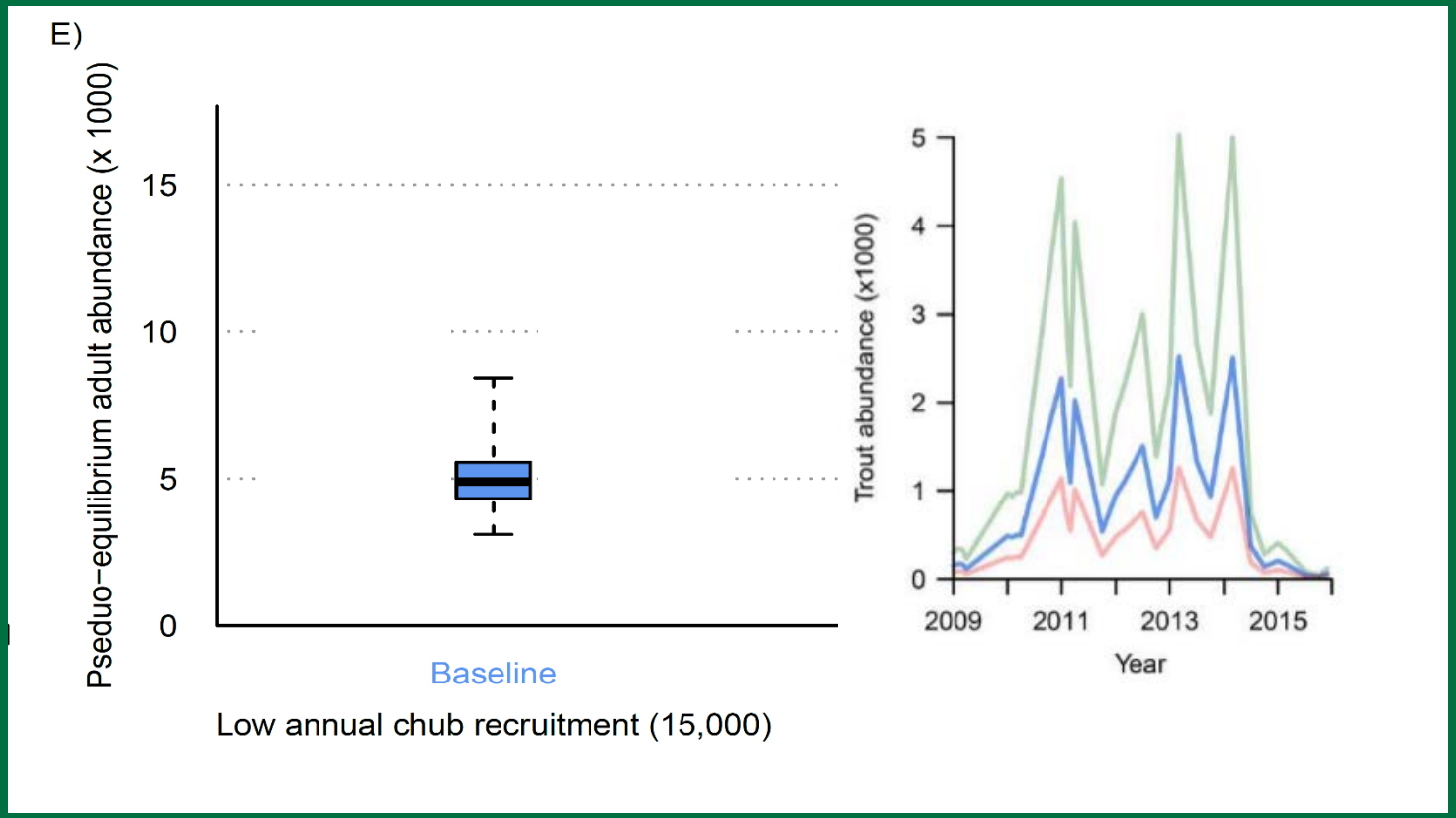
Effect on p-cap:

Temperature (+)
RBT (-)
pseudo-R^2: 0.59

USGS

C. B. Yackulic, J. Korman, M.D. Yard, and M. Dzul. *2018.* Ecology.

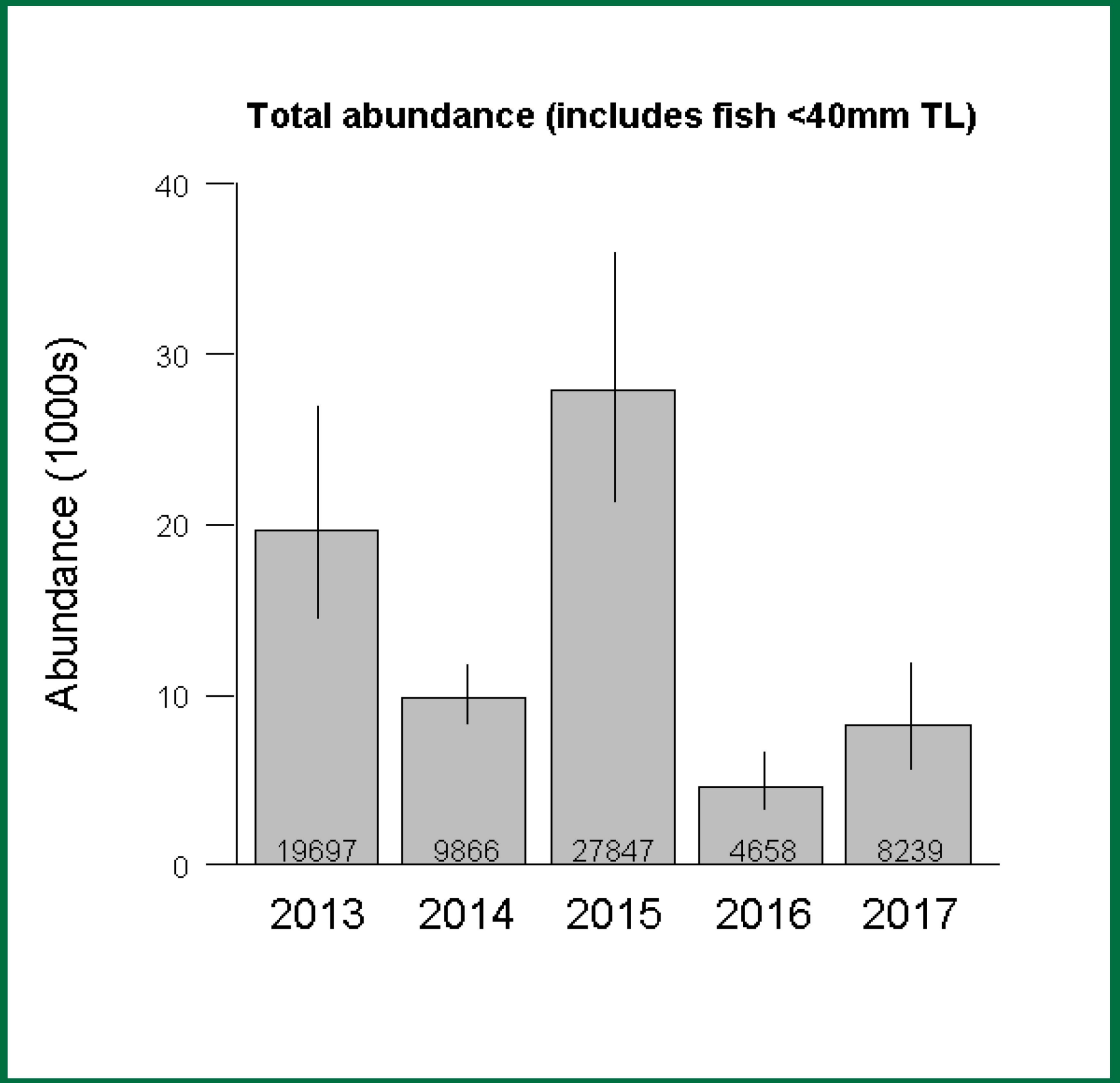
RBT negatively affect HBC recruitment in the Colorado River



C. B. Yackulic, J. Korman, M.D. Yard, and M. Dzul. *2018*. Ecology. Inferring species interactions through joint mark-recapture analysis.

July abundances of age-0 humpback chub in the LCR

Mean N = 14,061



Preliminary data. Do not cite.

Take-home messages

- RBT had negative effects on HBC survival, however, magnitude of this effect is still uncertain
- Environmental influences (temperature and turbidity) were stronger than RBT effect
- Lots of unexplained variability in survival and growth (e.g., food limitation)
- Temperature has a large effect on capture probability

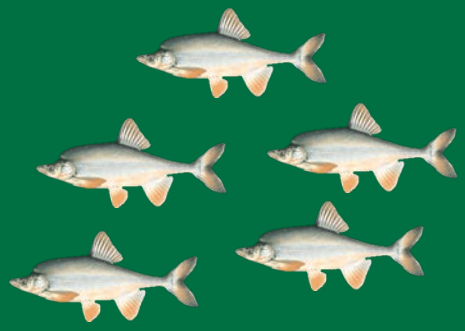
USGS

Presentation outline

- 1) Two species mark-recapture model

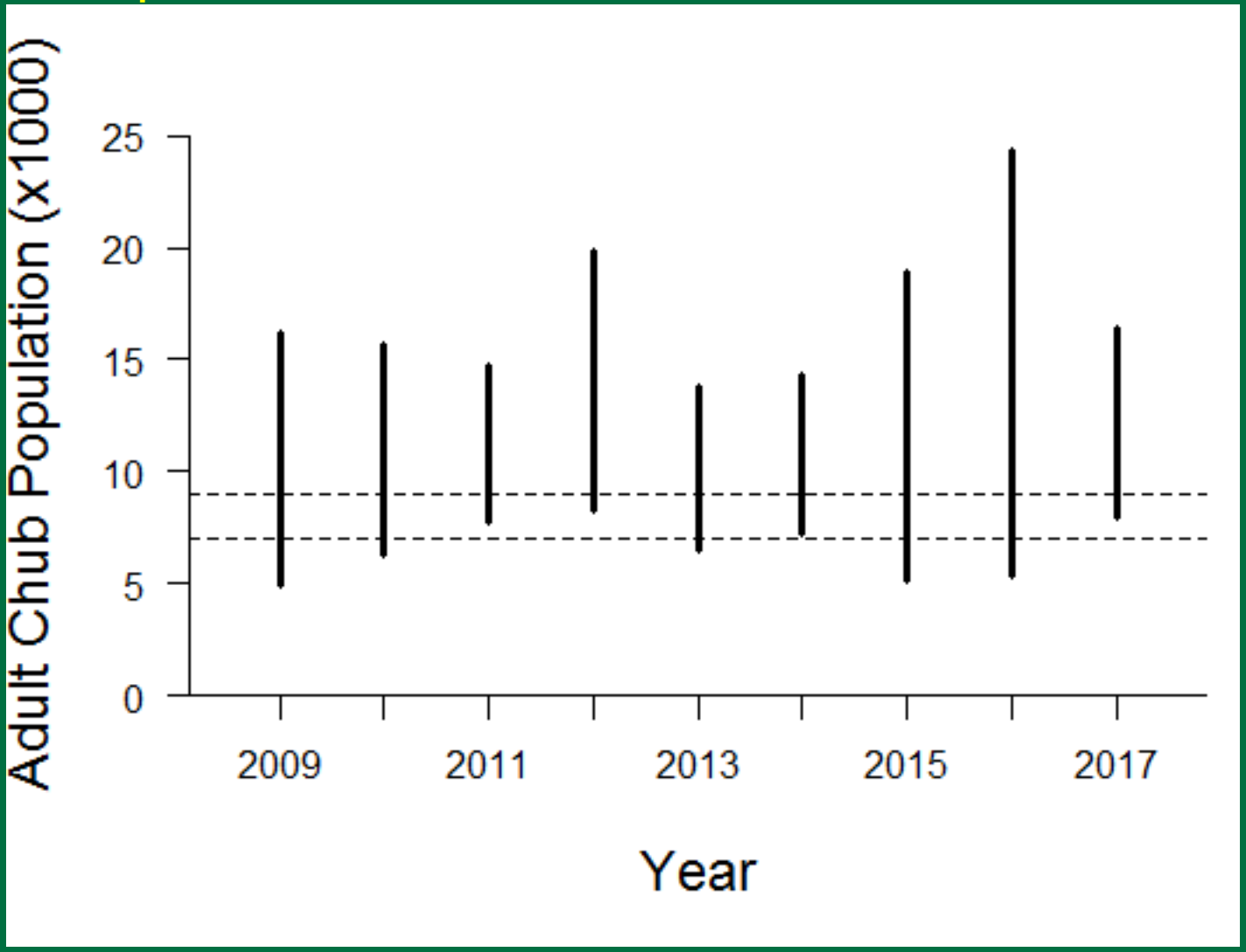
- 2) Adult humpback chub population dynamics in eastern Grand Canyon

- 3) Humpback chub in western Grand Canyon (pilot year)



USGS

Abundance of adult humpback chub
(≥ 200mm TL) that spawn in the LCR

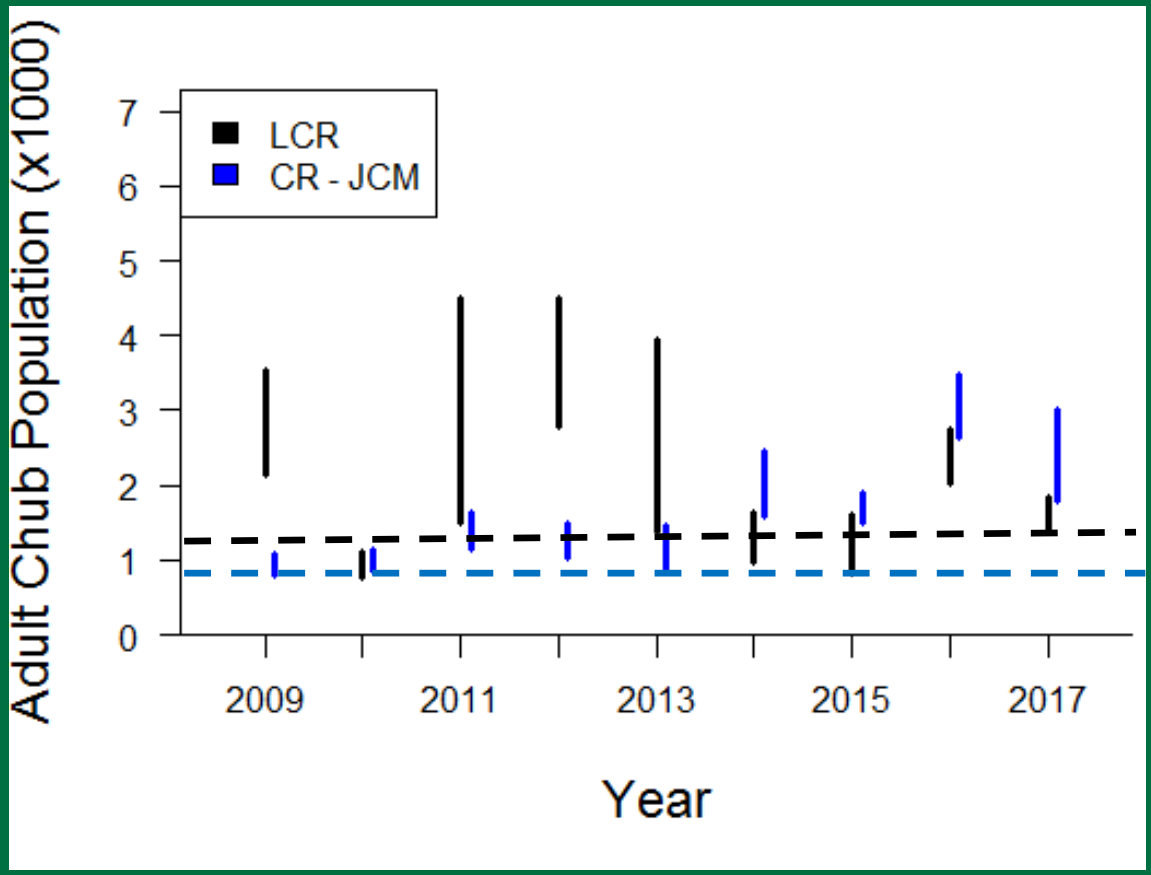


USGS

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.

Abundance of subadult humpback chub

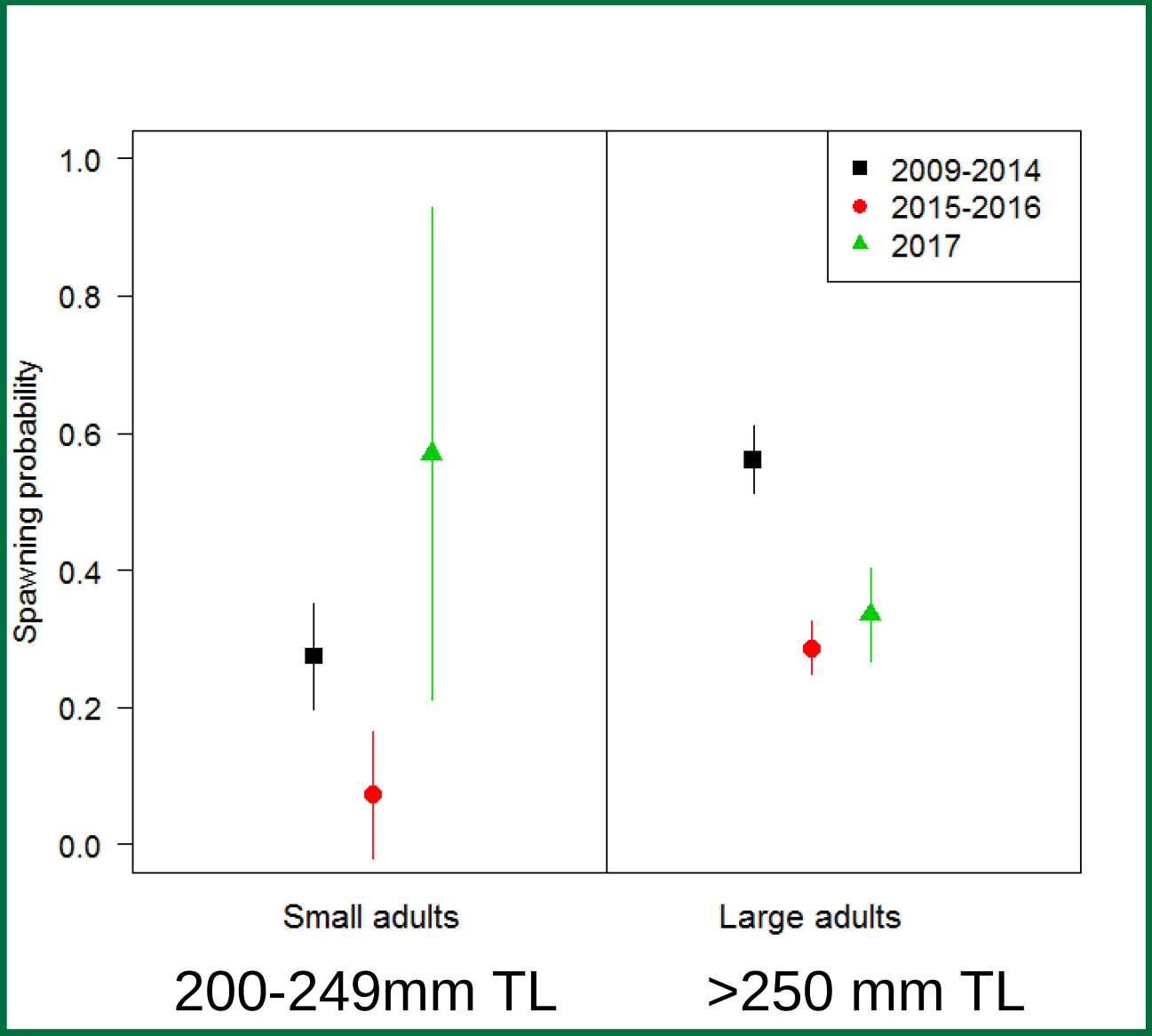
(150-199mm TL) in the Little Colorado River (LCR) and in the Colorado River juvenile chub monitoring (CR-JCM) reach



USGS

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.

Spawning probabilities of adult humpback chub



USGS

Preliminary data. Do not cite. Vertical lines represent 95% confidence intervals.

Take-home messages

- The adult humpback chub population in eastern Grand Canyon seems to be stable
- Subadult humpback chub numbers are more variable, potentially a decrease in numbers in the LCR since 2013 and an increase in JCM since 2016
- Spawning probabilities decreased from 2015-2016. Some evidence that the 2012 age-0 cohort is starting to recruit.

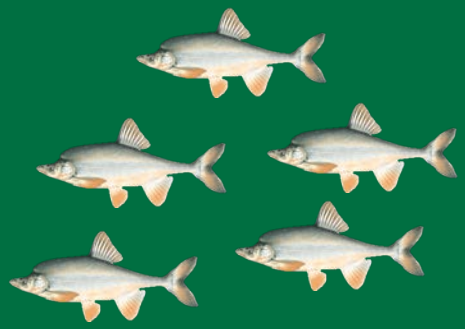
USGS

Presentation outline

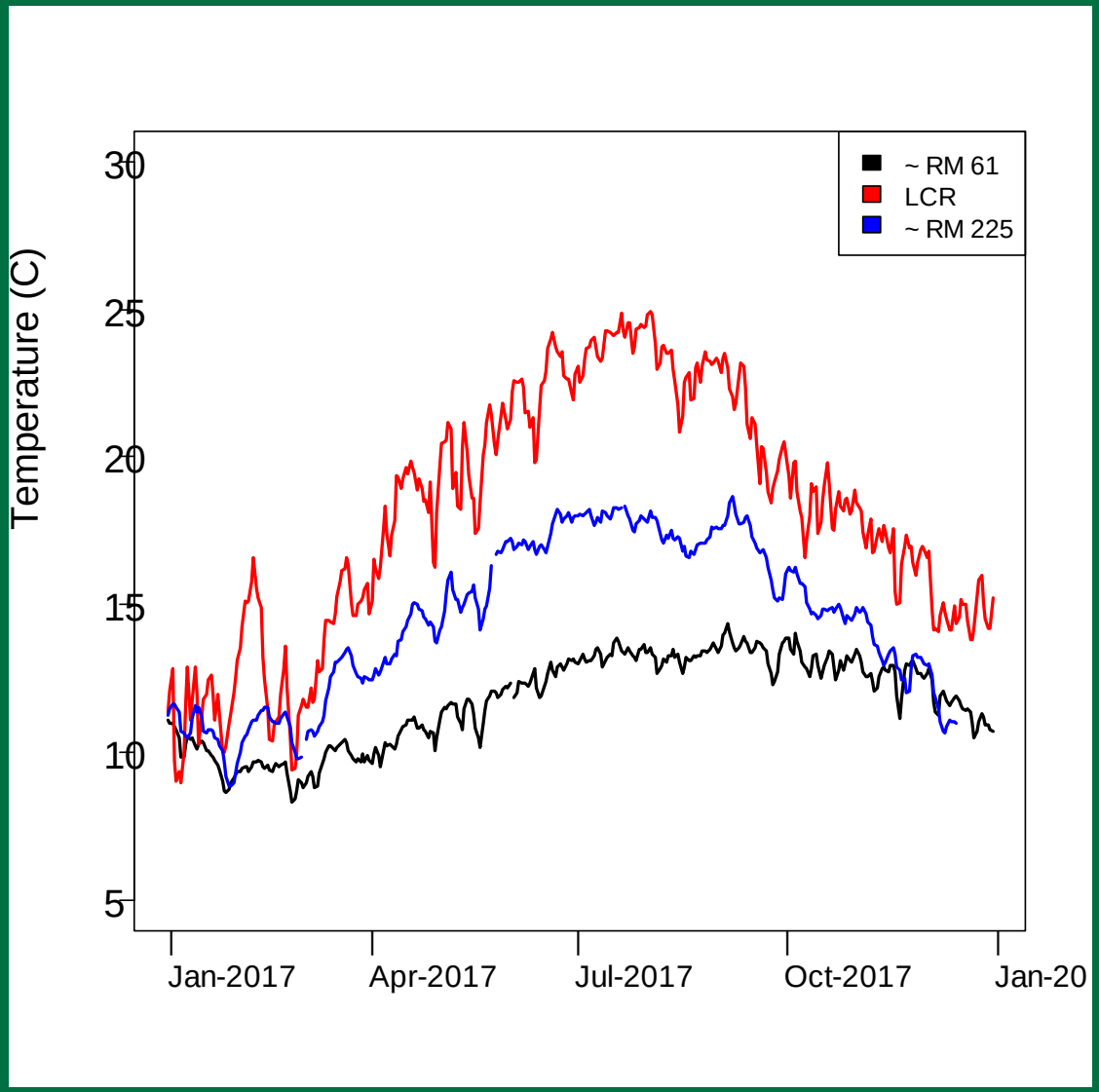
- 1) Two species mark-recapture model

- 2) Adult humpback chub population dynamics in eastern Grand Canyon

- **3) Humpback chub in western Grand Canyon (pilot year)**



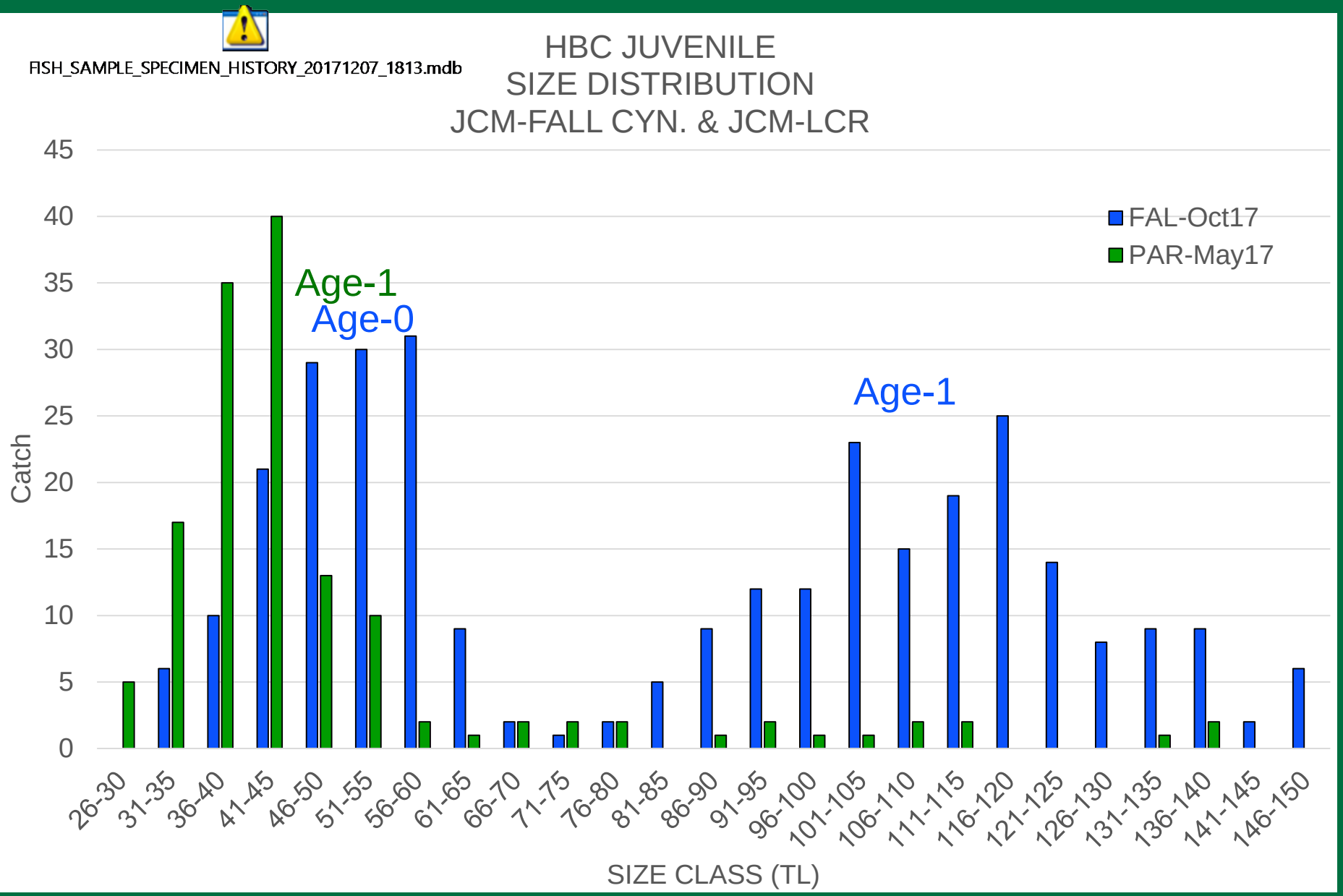
USGS



USGS

Preliminary data. Do not cite. Water temperatures of the Little Colorado River (LCR) and the Colorado River at river mile (RM) 61 and 225..

FISH_SAMPLE_SPECIMEN_HISTORY_20171207_1813.mdb



USGS

Preliminary data. Do not cite. Truncated length-frequency distributions of humpback chub captured near Fall Canyon (FAL) and Parashant (PAR).

Take-home messages

- Humpback chub were captured in all three sites in western Grand Canyon. We will probably choose Fall Canyon for our longer-term research.

- Growth patterns of juvenile humpback chub vary throughout Grand Canyon and seem to be mainly influenced by water temperatures.

USGS

Thanks!

Glen Canyon Dam Adaptive Management Group

US Fish and Wildlife Service
Kirk Young, Dennis Stone, Randy Van Haverbeke, Mike Pillow, Chad Baumler

US Geological Survey
Clay Nelson, Mike Yard, Ted Kennedy, Glenn Bennett, Ken Sheehan, Mike Dodrill, Dave Ward

Ecometric Research

University of Florida

AZ Game and Fish Department

Navajo Nation Department of Fish and Wildlife

Bureau of Reclamation

National Park Service

Also: Evan Anderson, Chelsie Arndt, Peter Atkinson, Luke Avery, Margeaux Bestard, Tanner Carothers, Mariah Giardina, Jake Hall, Ellie Johnson, Kyle Patterson, Kirk Burnette, Brian Dierker, Colin Evans, Dennis Harris, Jason Moore, Brett Stark, Jamie Townsend