Predation Risks Posed by Introduced Warm-water Predators

Annual Reporting Meeting, Jan 2023






David Ward, Eric Frye, Laura Tennant, Clay Nelson

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

USGS science for a changing world

Requested Elements

1. Project Title:
   Warm Water native and non-native fish research and monitoring

2. Project Elements
   Project I.3 FY 21-23 workplan

3. Project Objectives
   Quantify the potential impacts of channel catfish and other non-native predatory fishes on native fish in the Little Colorado River

4. Funding amount and Source
   FY 23 - $101,277 – GCDAMP

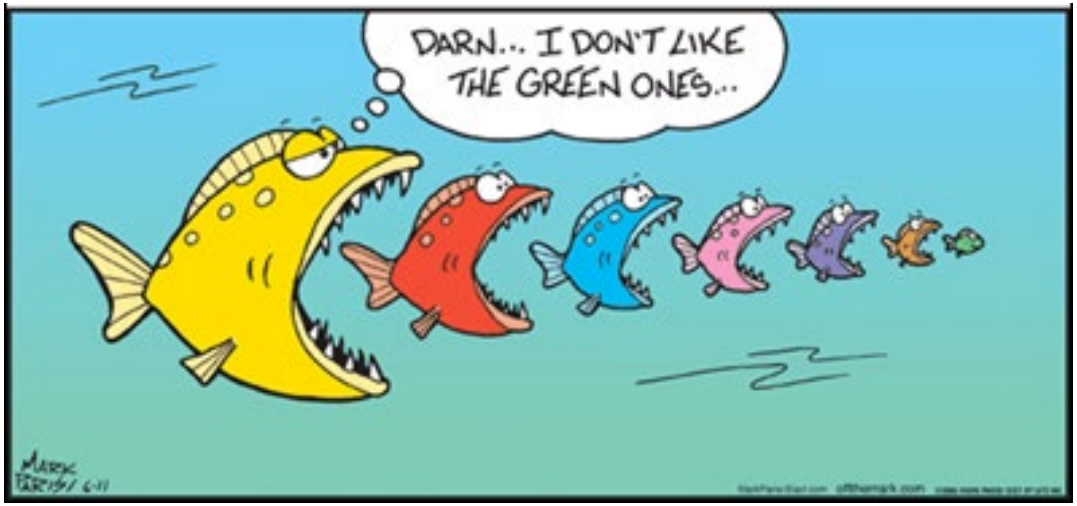
5. Cooperators
   AZ Game and Fish, U.S. Fish and Wildlife Service, Navajo Nation

6. LTEMP Resource Goals addressed
   Conserve and protect native fishes

USGS
science for a changing world

It's a Fish eat Fish World

What is eating what?



And how much?

At what life stage?

USGS
science for a changing world

USGS
science for a changing world

Common Carp Predation on Humpback Chub eggs

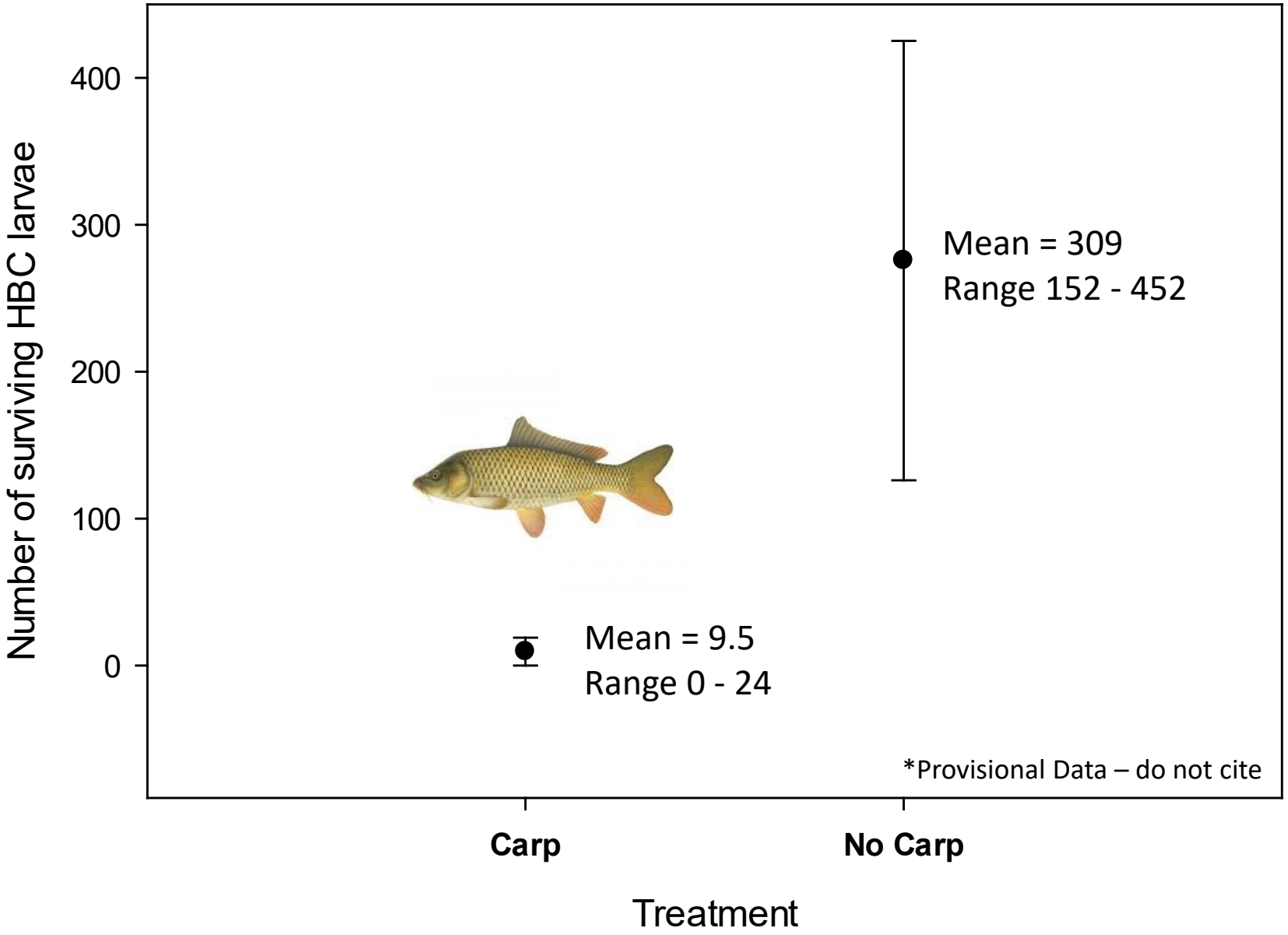
9 Replicates

Spring 2020

- 1 mL of Fertilized Eggs/tank
- Control = No Carp
- Variable = 2 Carp for 24 hours
- Compare Hatch in 10 days

USGS science for a changing world

Common Carp predation on HBC eggs



96 % average decrease in egg and larval survival

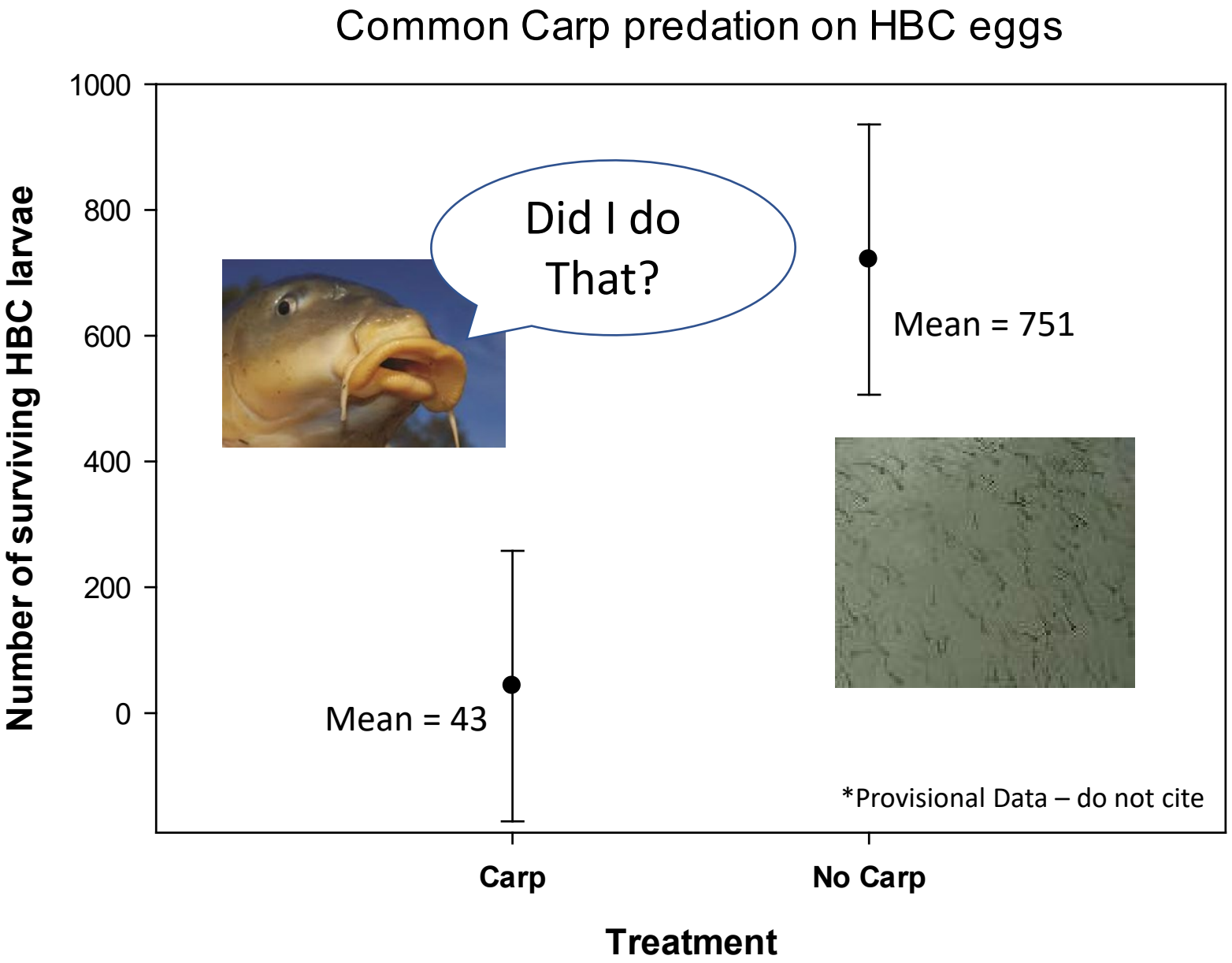
USGS science for a changing world

2021-2022

Scale up X 10

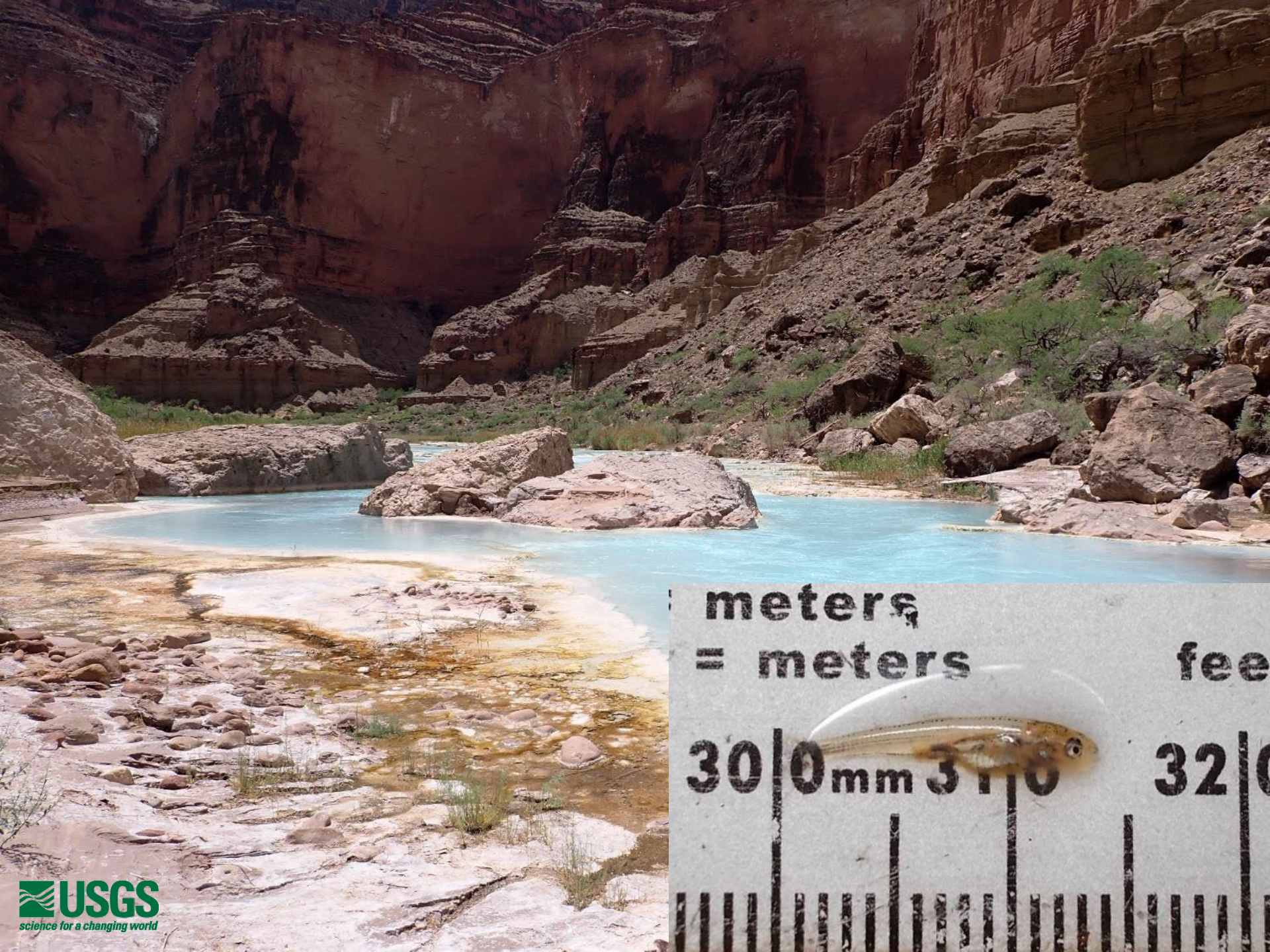
USGS science for a changing world

12 Replicates



94 % average decrease in egg and larval survival

USGS science for a changing world



USGS
science for a changing world

USGS
science for a changing world

Predation Methods

Carp x 4

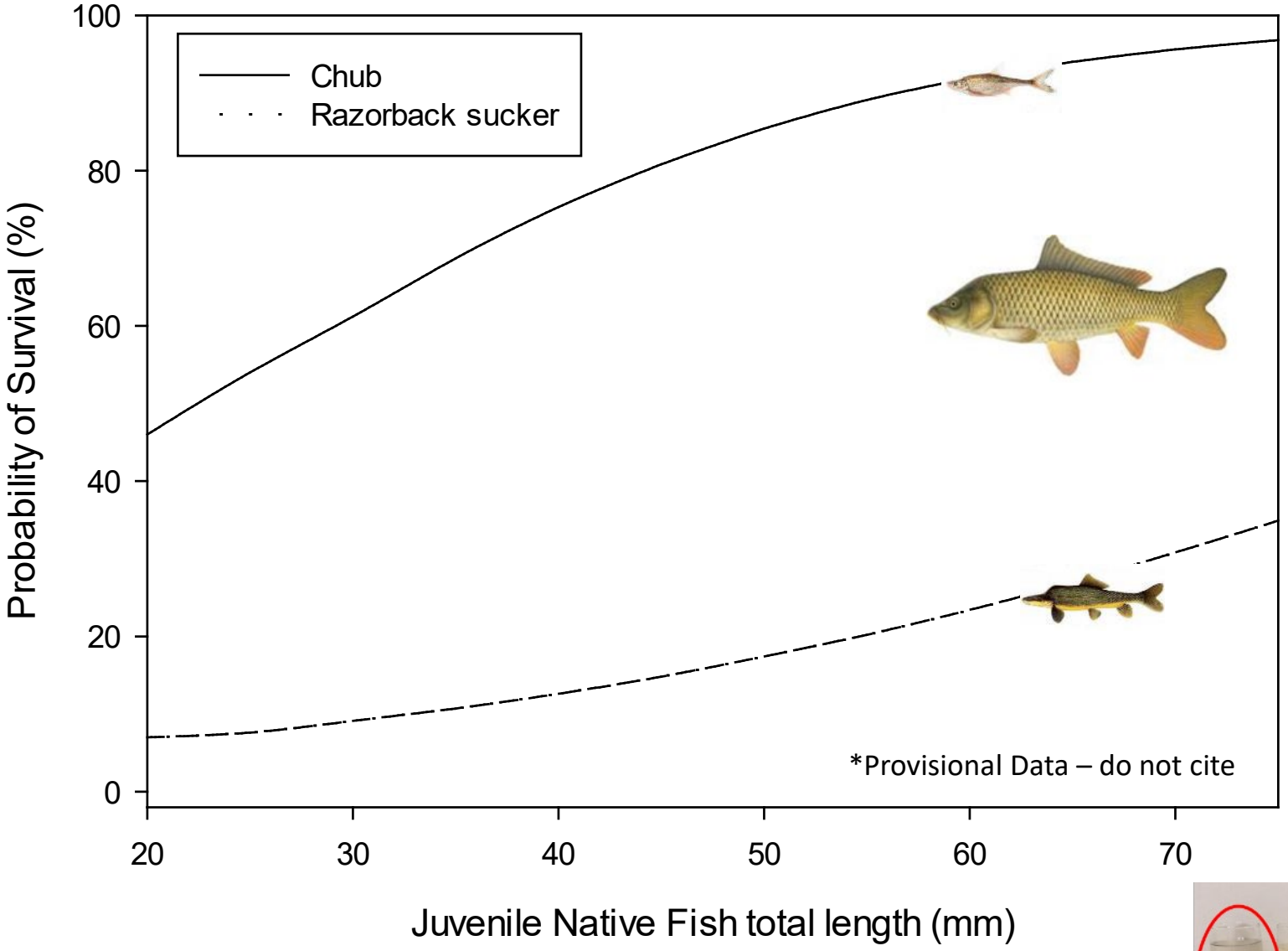
or

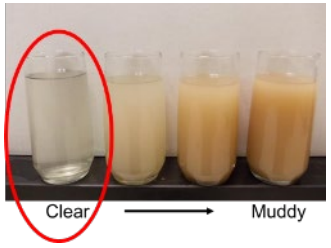
x 12

24 H

USGS
science for a changing world

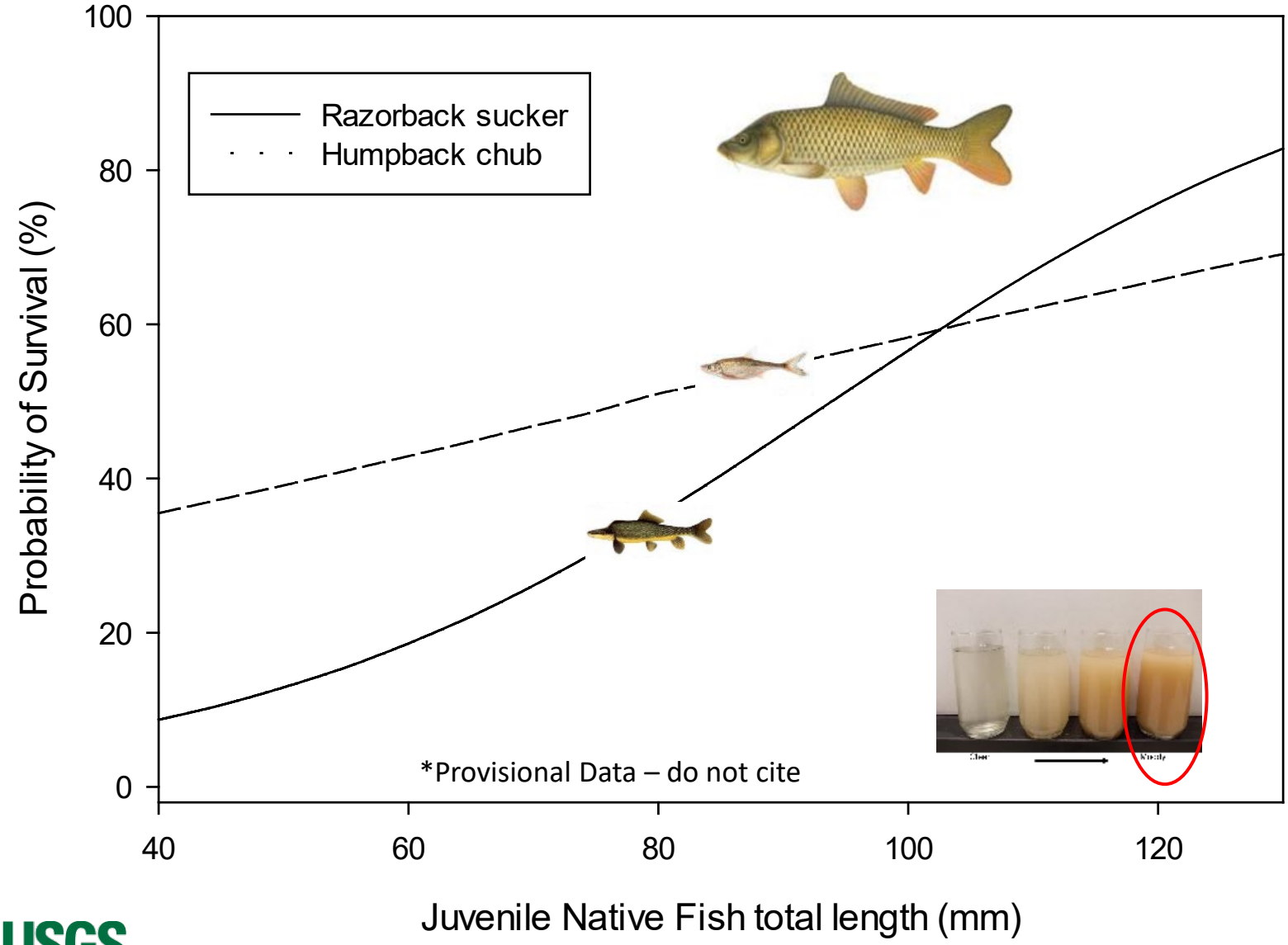
Predation on chub and suckers in clear water





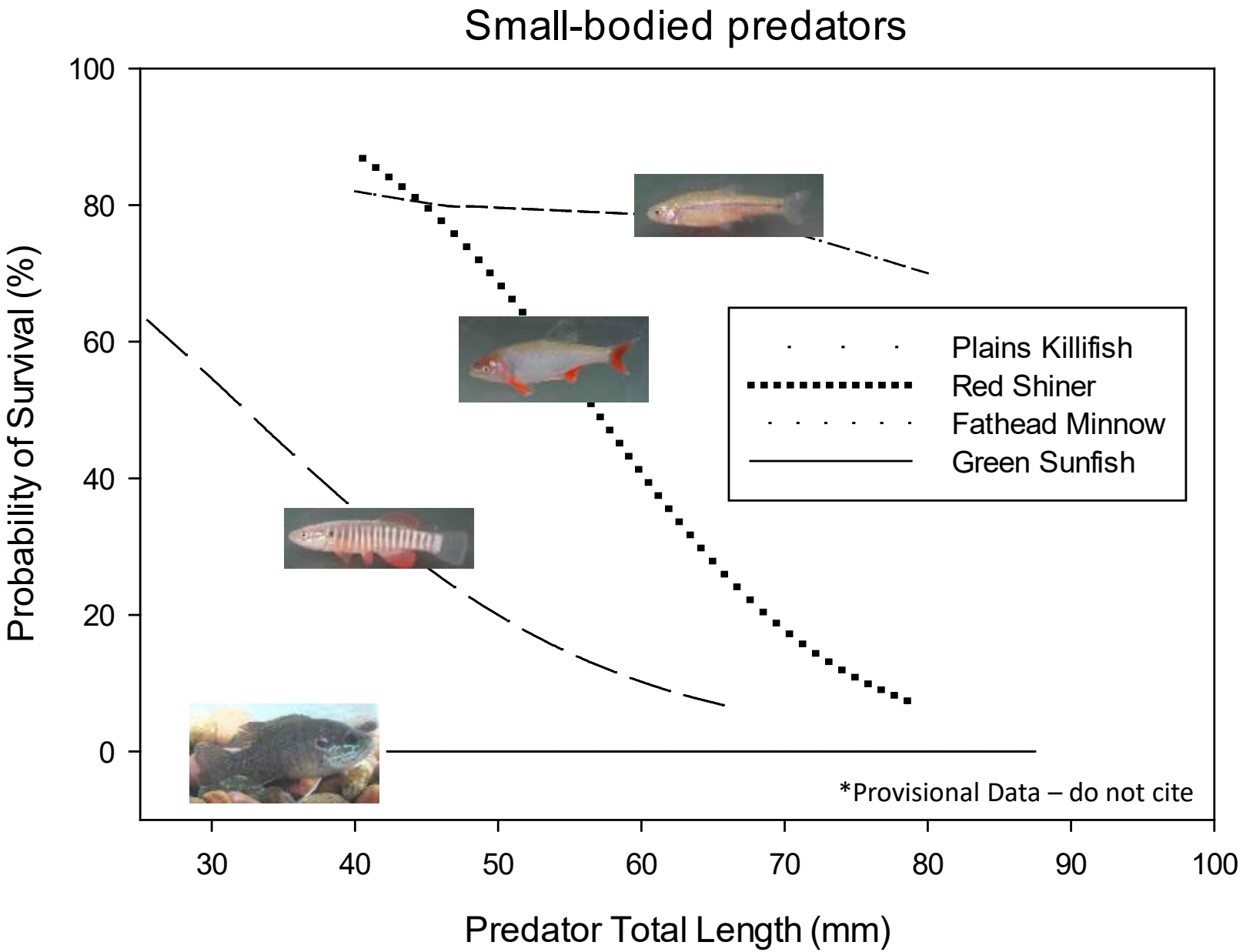
USGS
science for a changing world

Predation on chub and suckers in turbid water



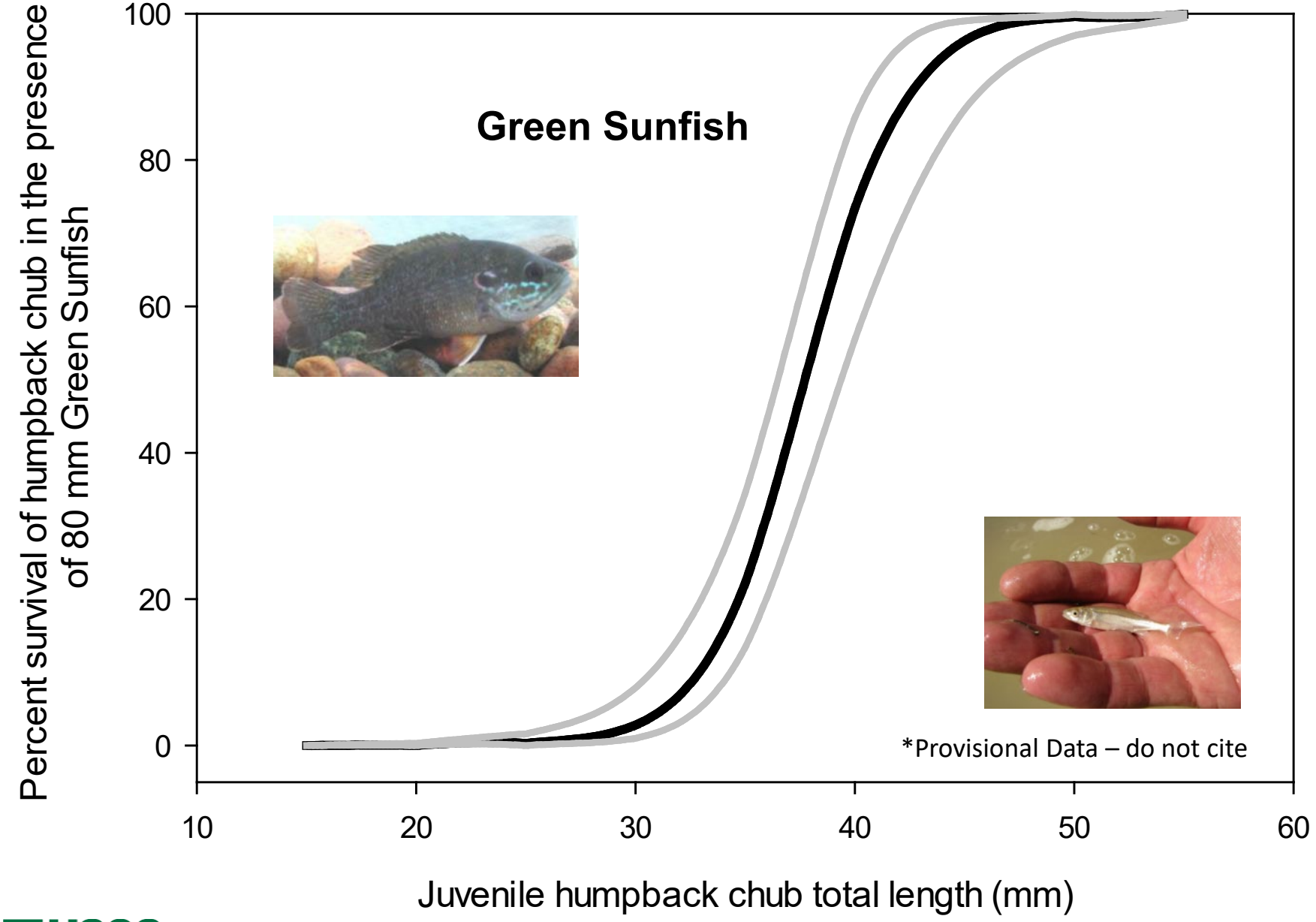
USGS
science for a changing world


USGS



Survival of larval humpback chub (12 mm TL) as predator size increases for four species of small-bodied predatory fish commonly found in the Little Colorado River. Probability of survival calculated using JMP Prediction Profiler, based on 10 replicated 24-hr laboratory trials for each predator species (4 predators and 12 prey in each trial).

USGS
science for a changing world



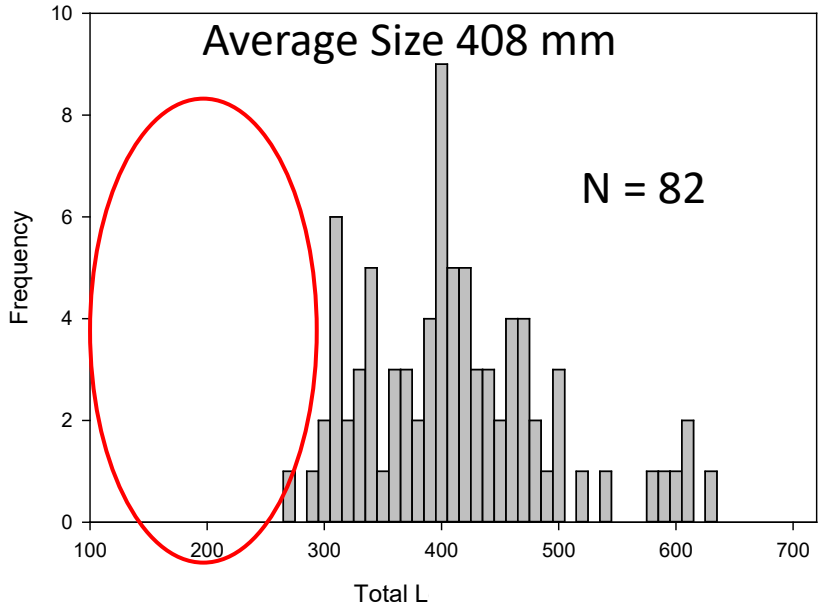
USGS
science for a changing world


USGS

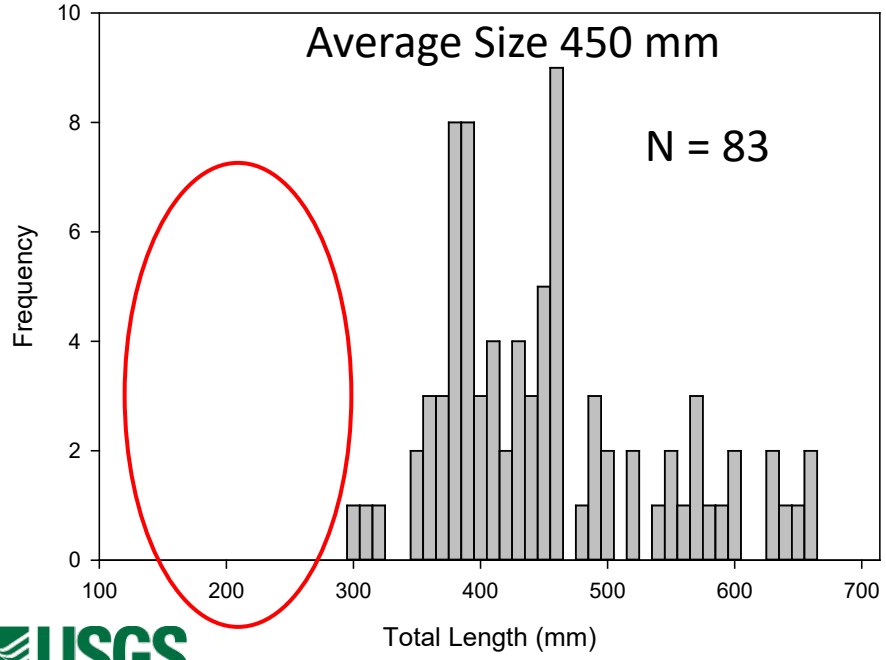
LCR Channel Catfish

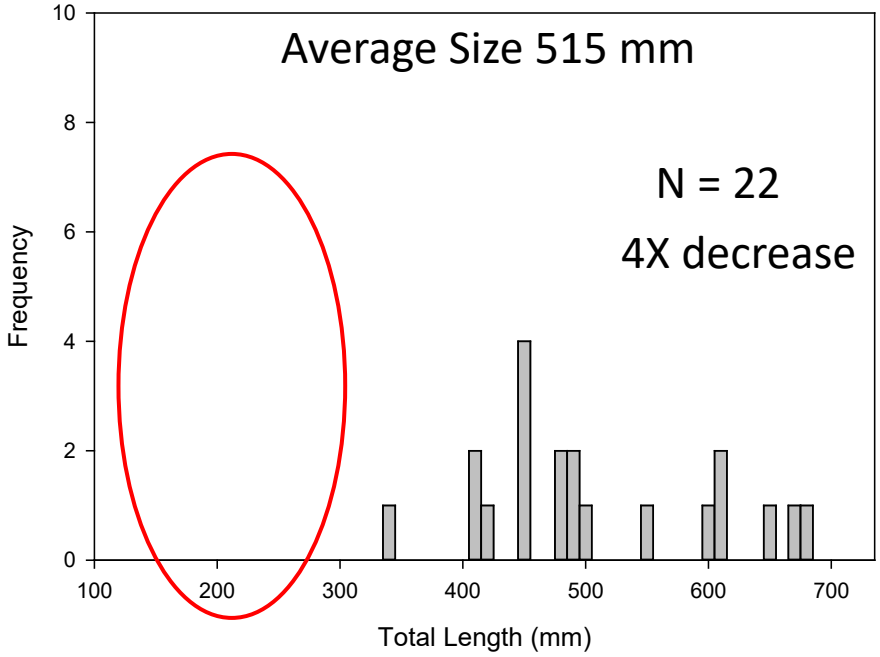
USGS
science for a changing world

2019



2021





USGS science for a changing world

*Provisional Data – do not cite

Channel Catfish in LCR

14.5 % - 27.3 % of fish caught across years had fish remains in stomach (from gastric lavage)

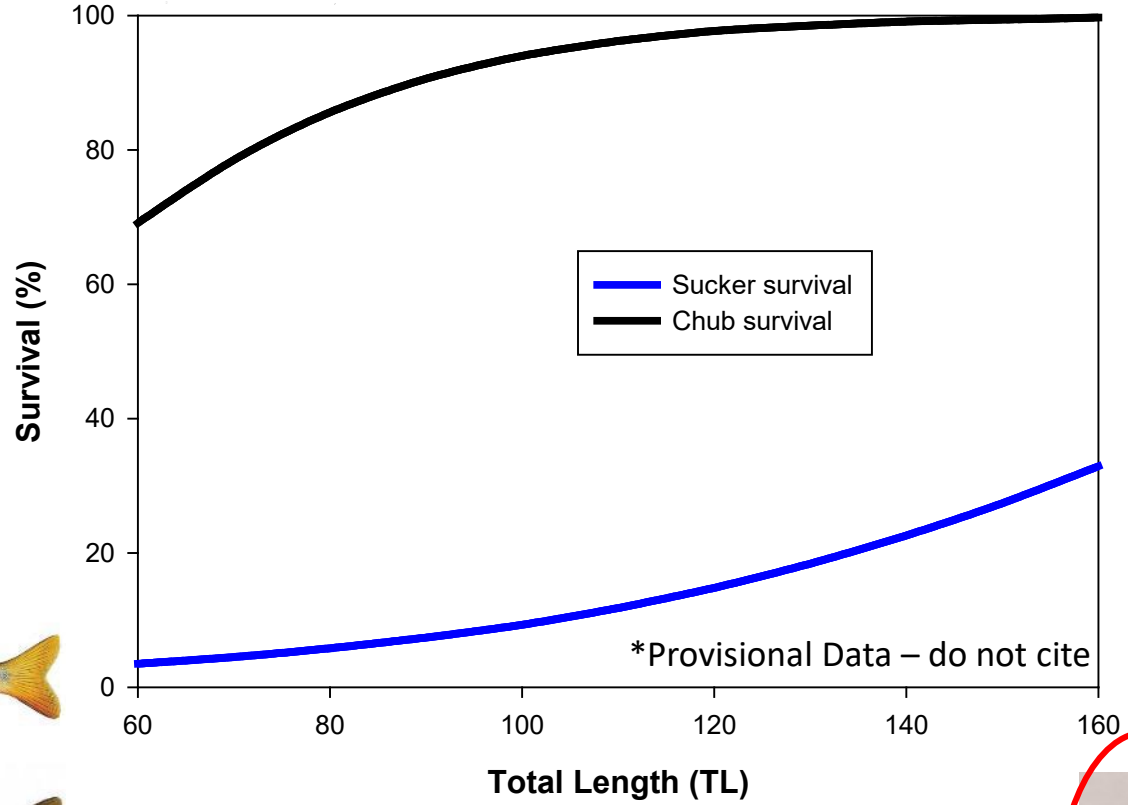
600 Channel Catfish (very conservative, low estimate)
10% eat a native fish every 24 hours

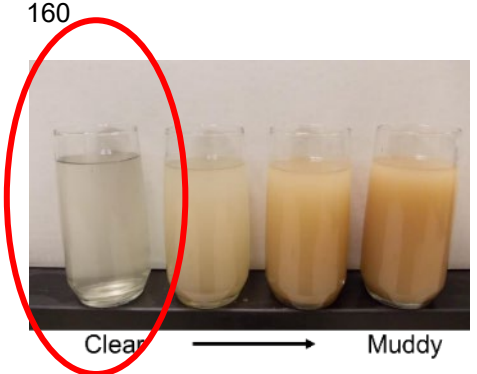
60 fish eaten/day X
100 days of warm water (above 20 C) = 6,000 fish eaten/year

USGS science for a changing world

Photo by Jan Boyer
AZGFD

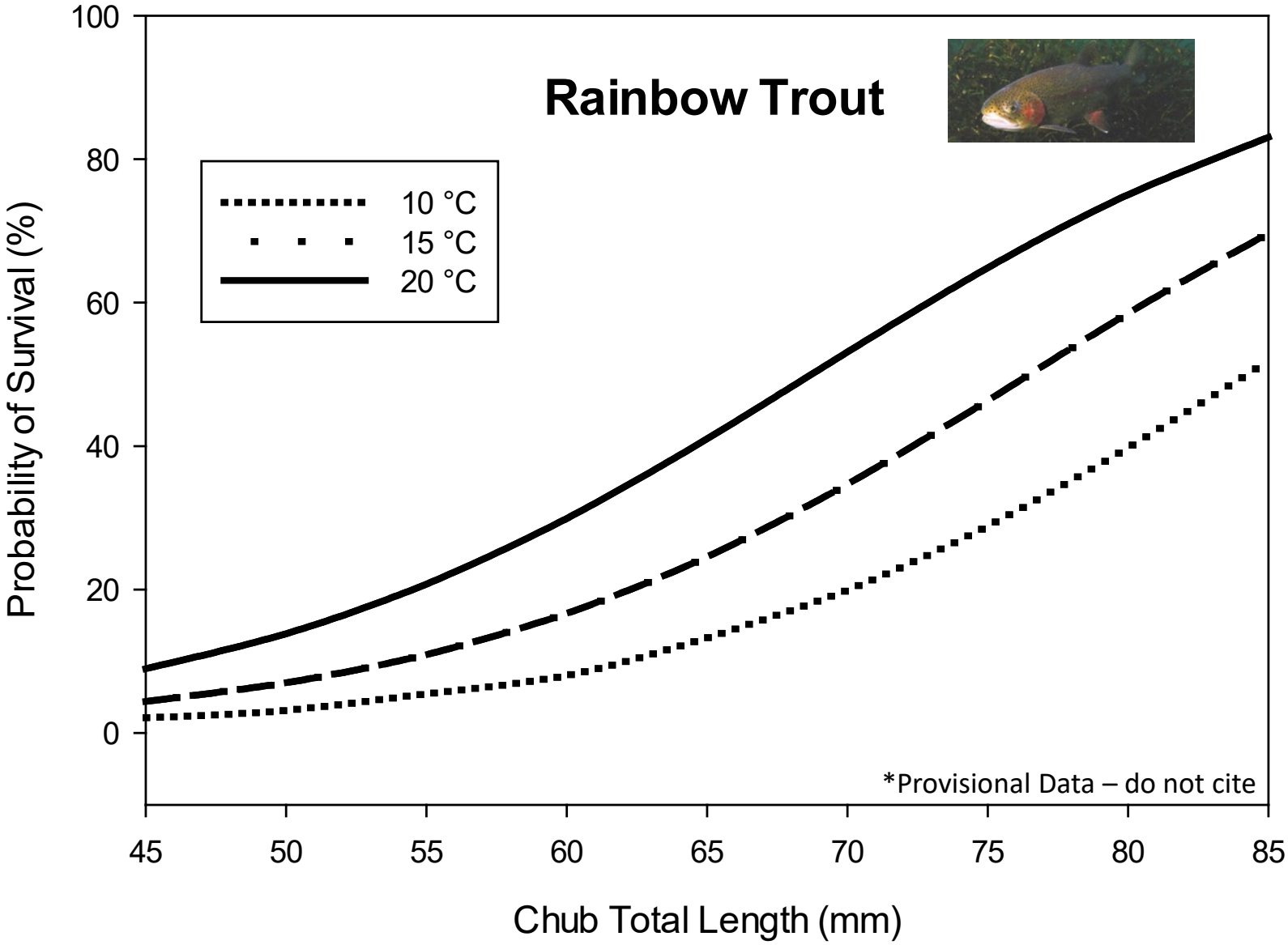
Sucker vs chub survival with Channel Catfish





USGS
science for a changing world

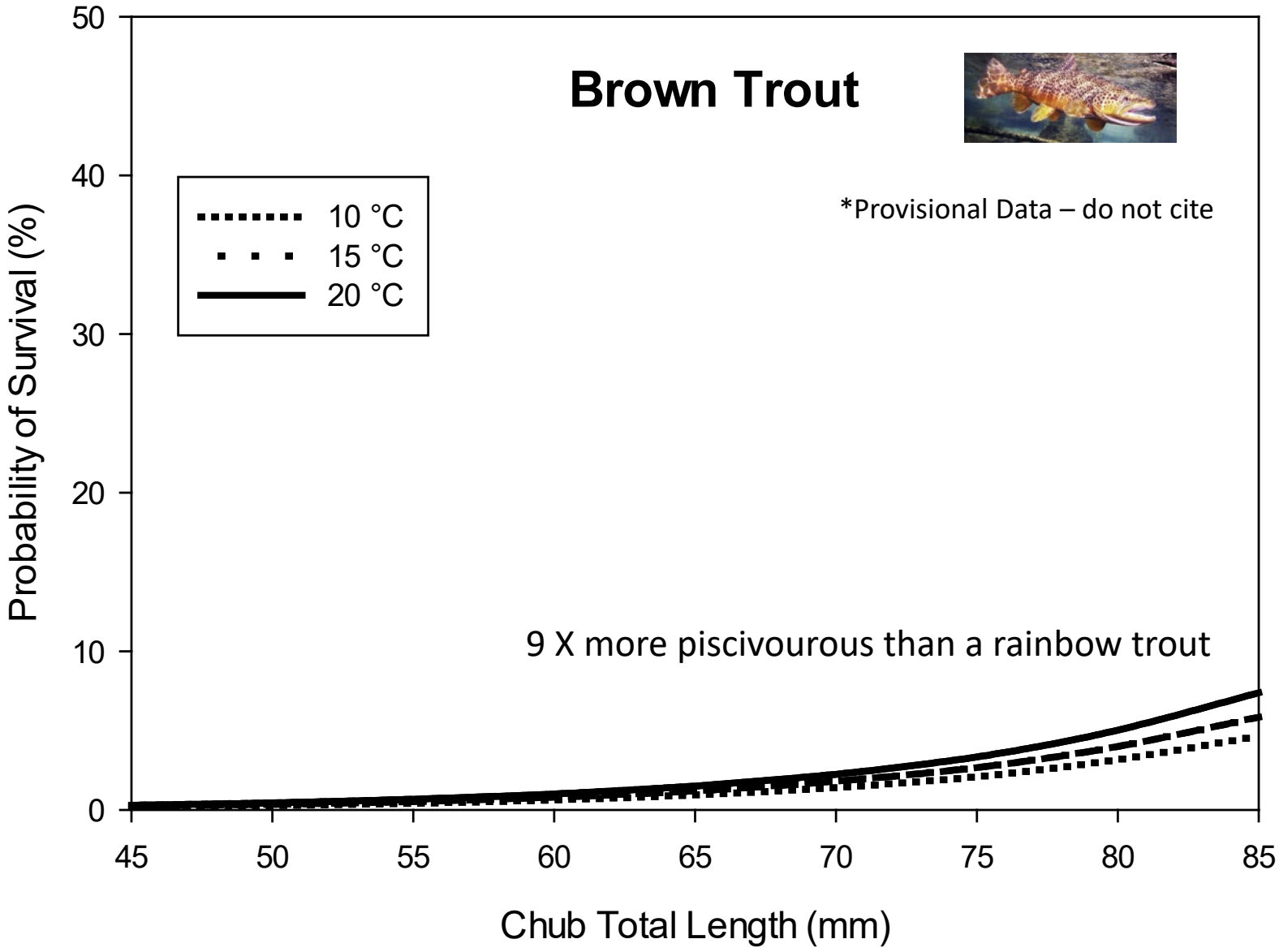
USGS
science for a changing world



Percent (%) probability that a juvenile chub will survive predation by a 285 mm rainbow trout as chub size increases from 45-85 mm TL at 10, 15 and 20 °C, with trout size held constant at 285 mm TL.

USGS
science for a changing world

USGS
science for a changing world



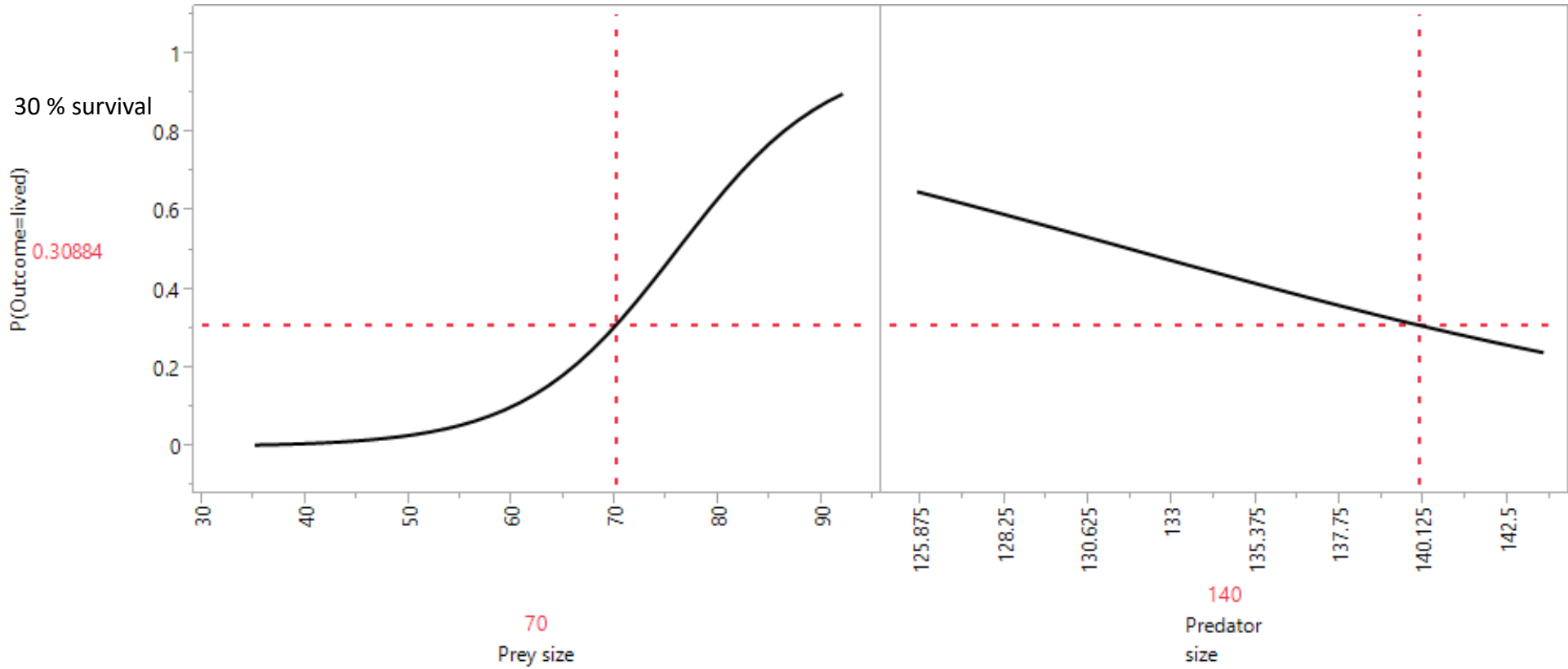
Percent (%) probability that a juvenile chub will survive predation by a 285 mm brown trout as chub size increases from 45-85 mm TL at 10, 15 and 20 °C, with trout size held constant at 285 mm TL. Note that the y-axis on the brown trout is reduced by half.

USGS science for a changing world

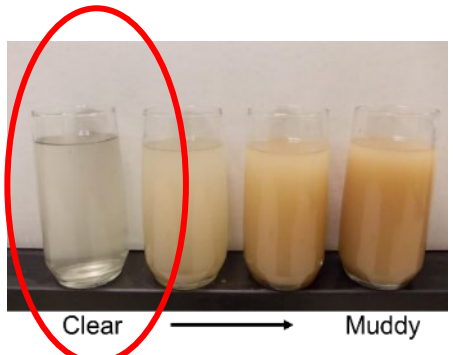
USGS
science for a changing world

Chub in Clear Water With Smallmouth Bass

30 % survival



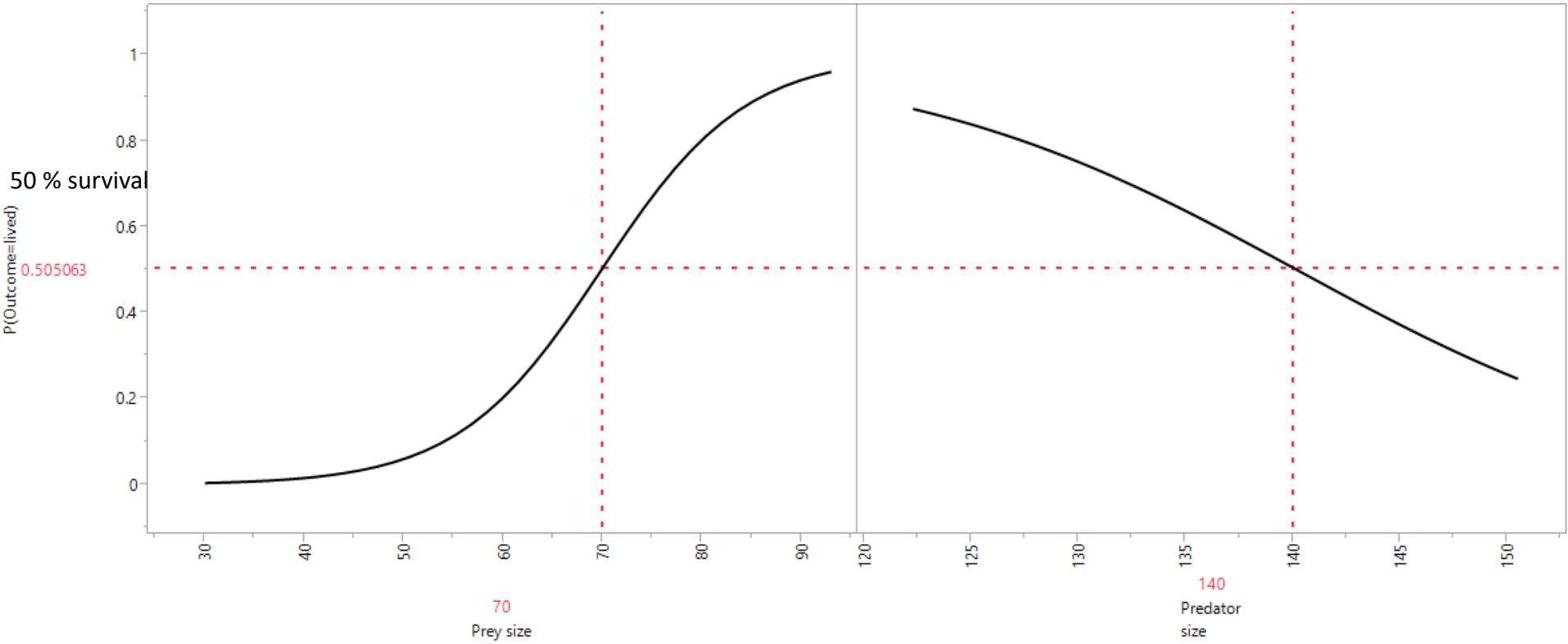
70 mm chub = 10 mm body depth
140 mm Bass = 20 mm Max gape

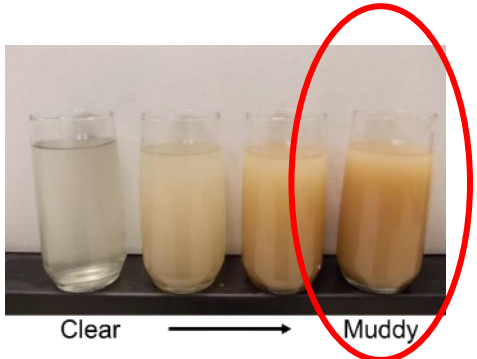


USGS science for a changing world

*Provisional Data – do not cite

Chub in Turbid Water (300 – 500 NTU)

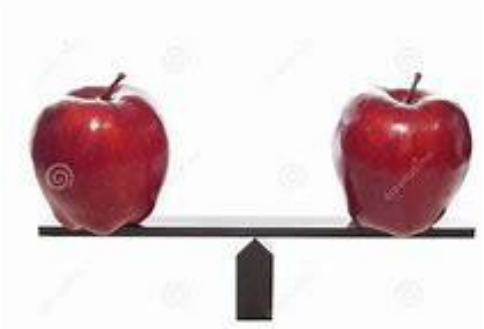




USGS science for a changing world

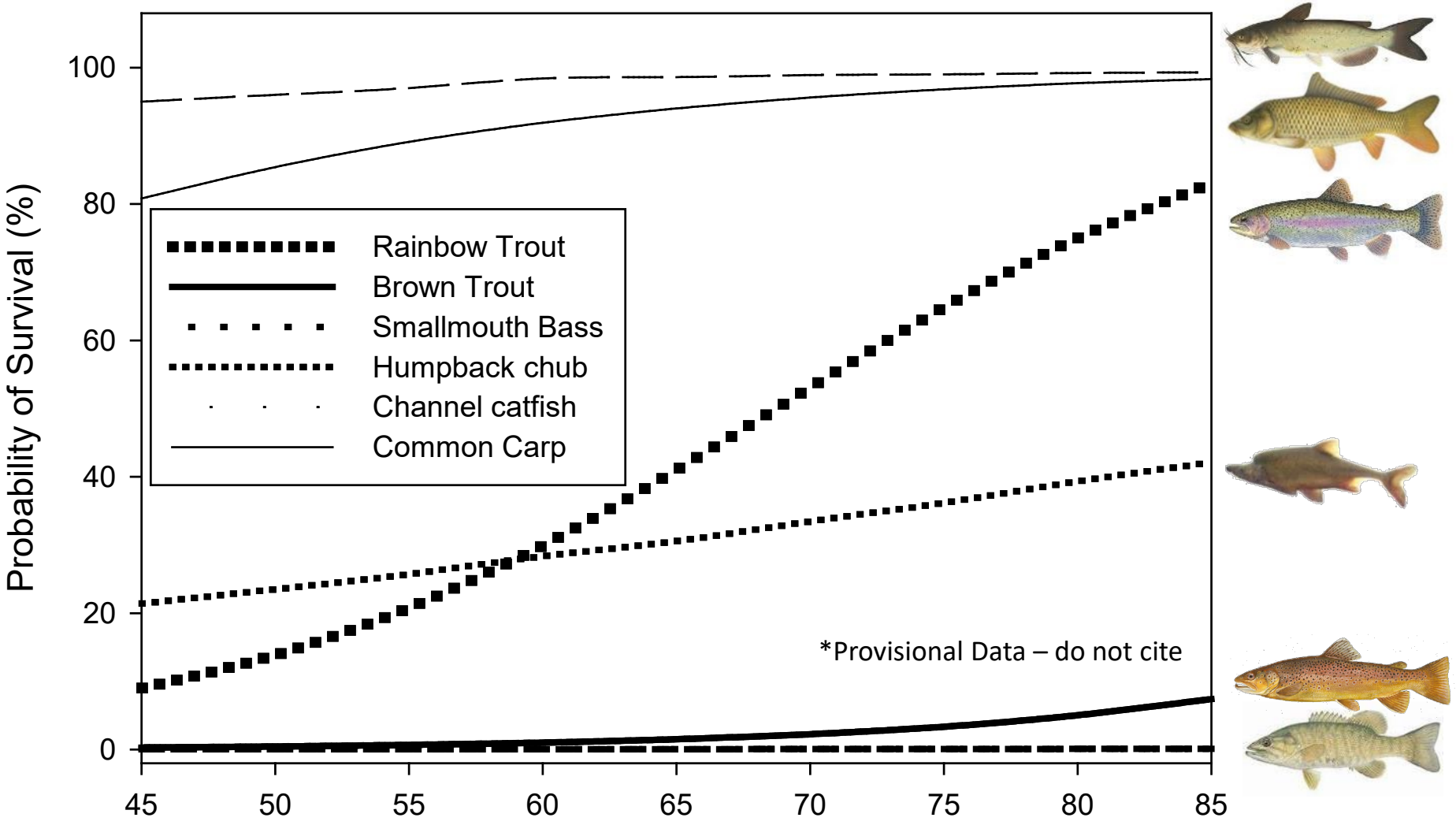
*Provisional Data – do not cite

We need a way to prioritize risk among these species



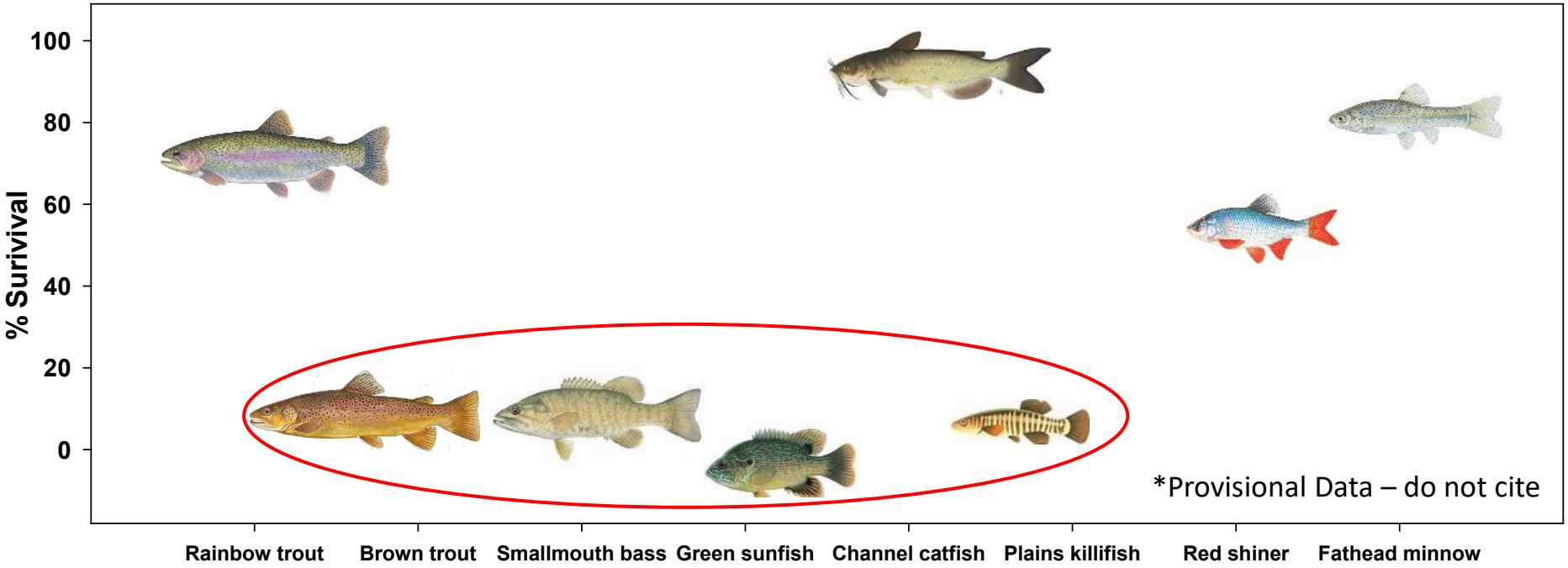
USGS
science for a changing world

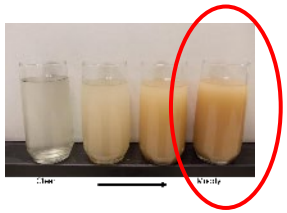
Comparison of Predators in clear water (285 mm TL)



USGS science for a changing world

Predation vulnerability of HBC at 30% of predator size



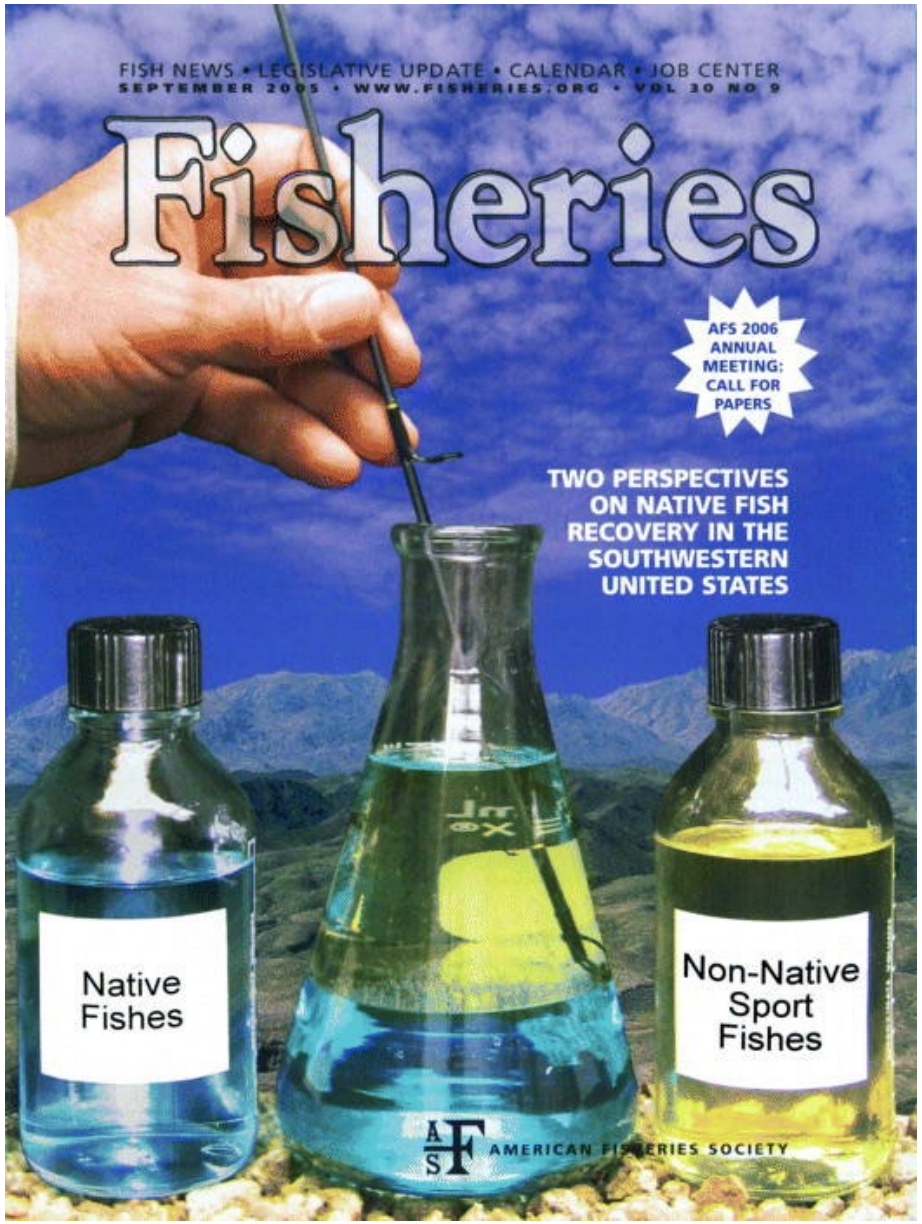


USGS
science for a changing world

Is the Sky Falling --- Yes!

USGS
science for a changing world

Incompatibility of native and nonnative fishes



Marsh and Pacey 2005
Clarkson et al. 2005
Mueller 2005

USGS
science for a changing world

Solutions

- Need to be community based

- Create/maintain areas or environments where some life stages are protected

USGS

Barriers to upstream fish movement in the Little Colorado River already exist

USGS
science for a changing world

Maybe we just need to work with what is already there