Factors that influence juvenile humpback chub survival

David Ward

U.S. Geological Survey Grand Canyon Monitoring and Research Center

Southwest Biological Science Center

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Fundamental Question?

- Why don't predators cause the extinction of prey in all cases?

- How do any prey persist?

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Answer

In co-evolved predator prey relationships the prey species have:

Morphology, Physiology and Behavior –

That render some individuals less vulnerable

Morphology Example - Portz and Tyus 2004, Fish Humps in Colorado River Fishes, *Environmental Biology of Fishes*

Behavior Example* - Gorman and Stone 1999, Ontogenesis of Humpback Chub, *American Midland Naturalist

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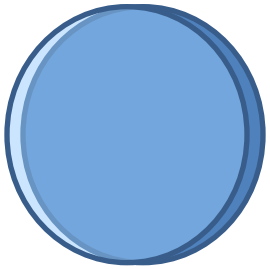
Matter and Mannan 2005, *Journal of Wildlife Management*

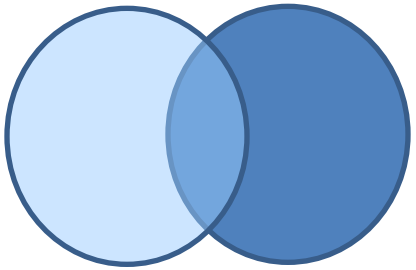
Possible outcomes for a prey species when a novel predator is introduced

Prey geographic range =

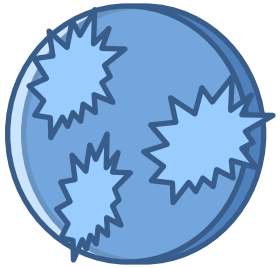
Predator geographic range =



Complete overlap = extinction of prey



Incomplete overlap = Restricted range of prey



Complete overlap - but coexistence occurs because Prey have morphologies/physiology/behavior that make them relatively invulnerable to predation

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Matter and Mannan 2005, *Journal of Wildlife Management*

Predation Vulnerability Depends On:

- Morphology
- Physiology
- Behavior

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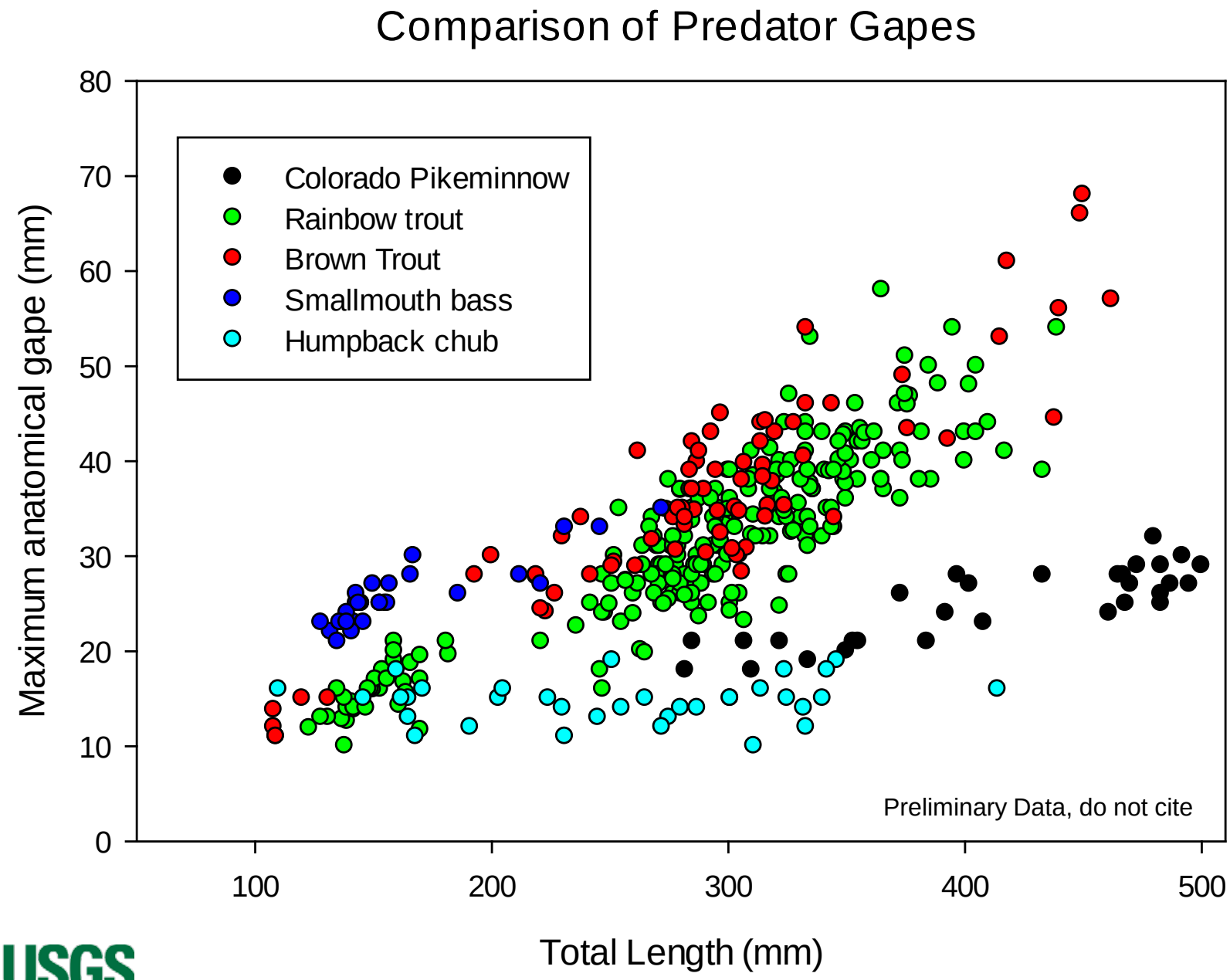

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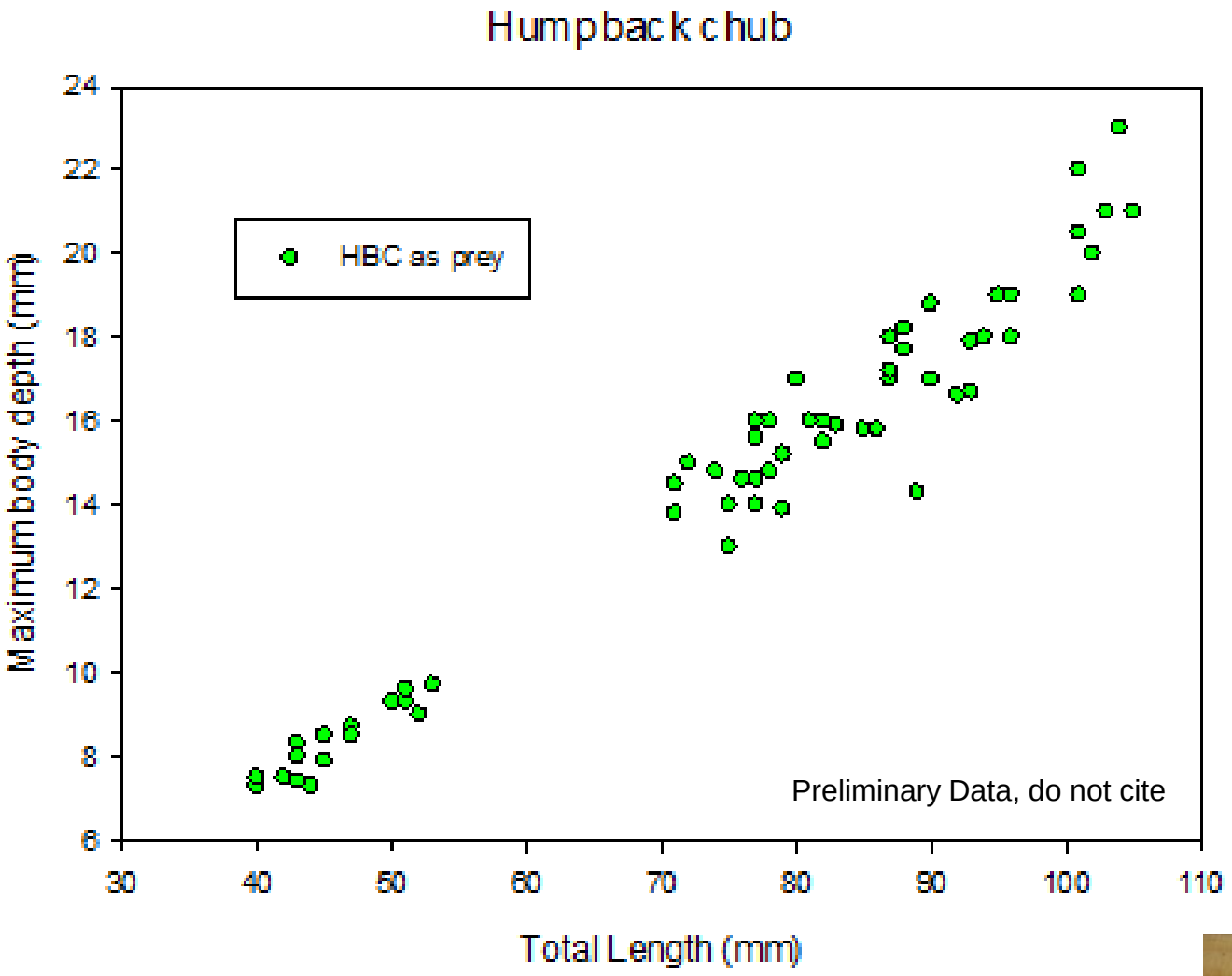

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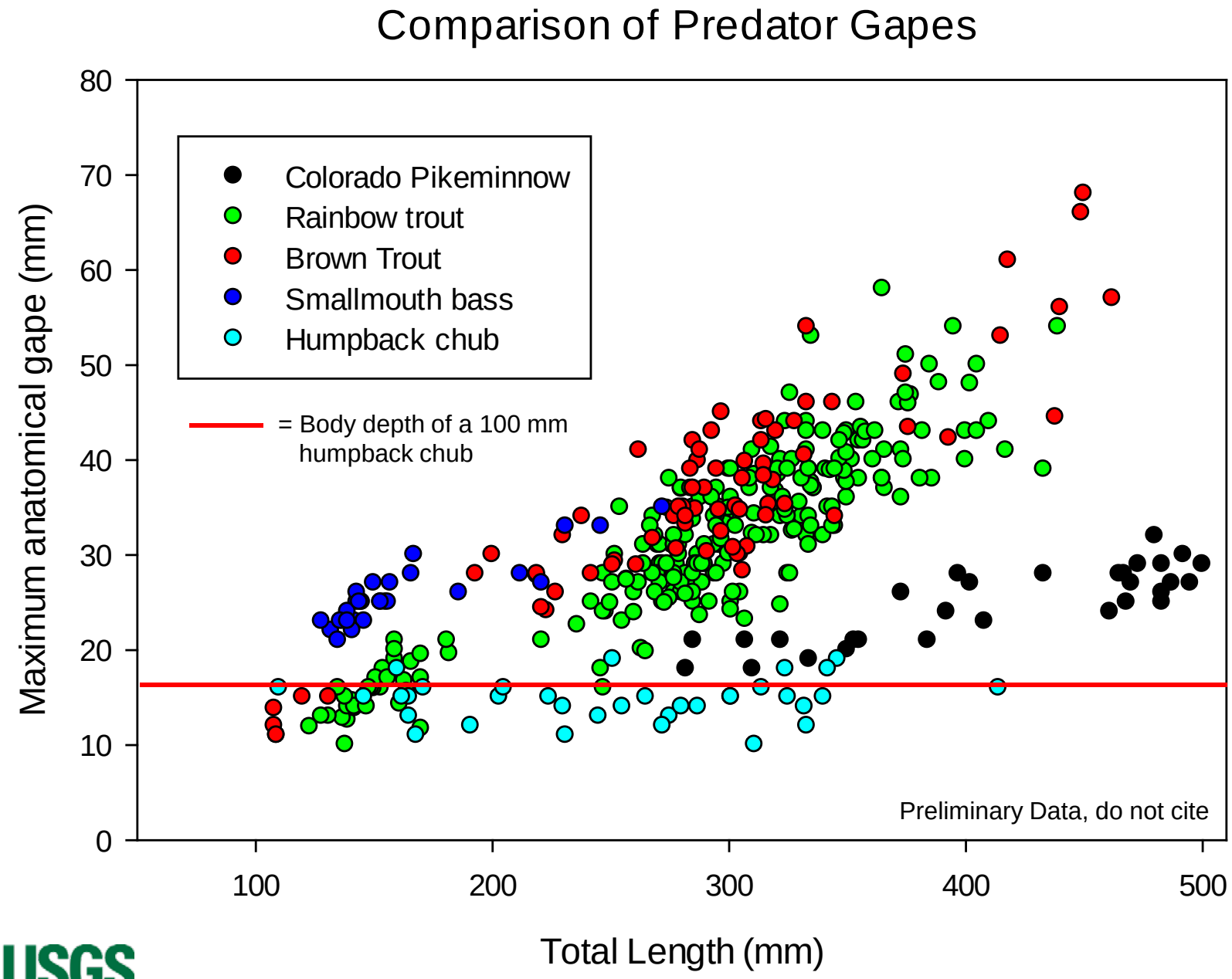

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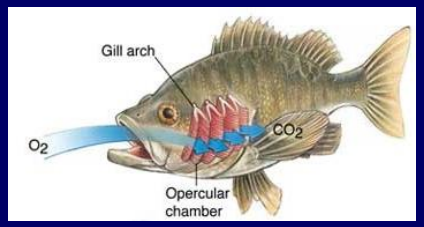
Physiology



Roundtail chub grown at three water temperatures in the laboratory for 9 months

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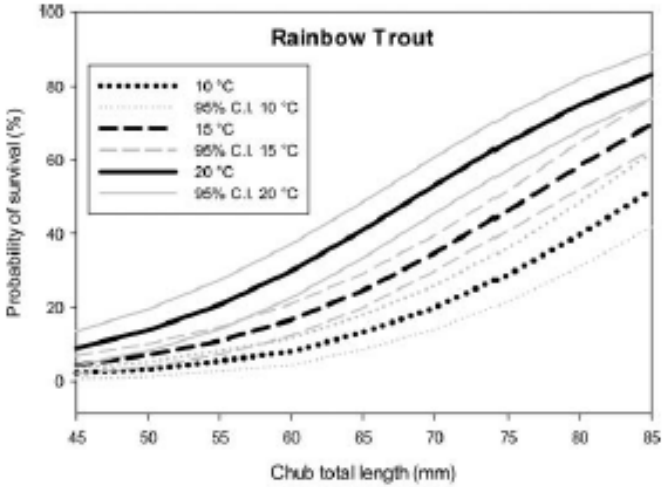
C. Moran – PhD Student at NAU – MS Thesis



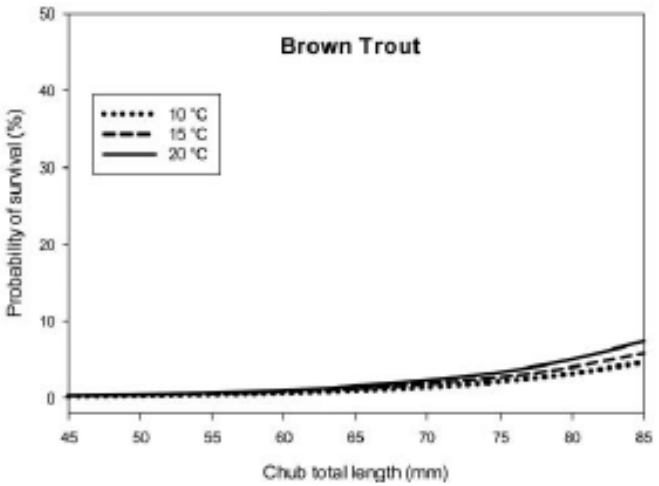
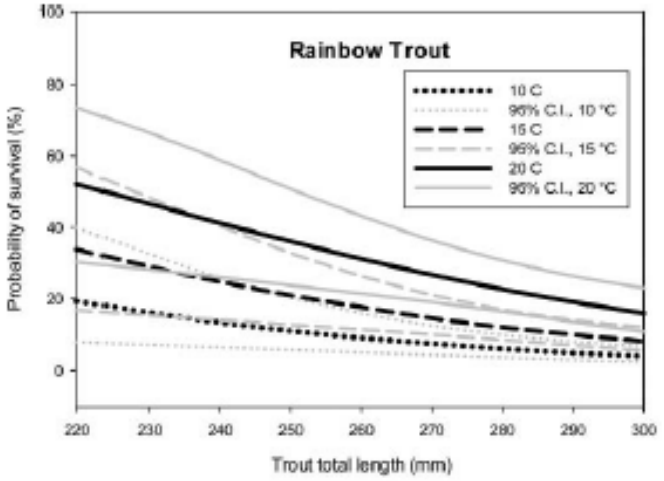


FIGURE 1. Percent (%) probability that a juvenile chub will survive predation by a 285-mm Rainbow Trout (top) or Brown Trout (bottom) as chub size increases from 45 to 85 mm TL at 10, 15, and 20°C. Note that the y-axis scale for Brown Trout is one-half that for Rainbow Trout. Confidence intervals for Brown Trout are not individually distinguishable and not shown.



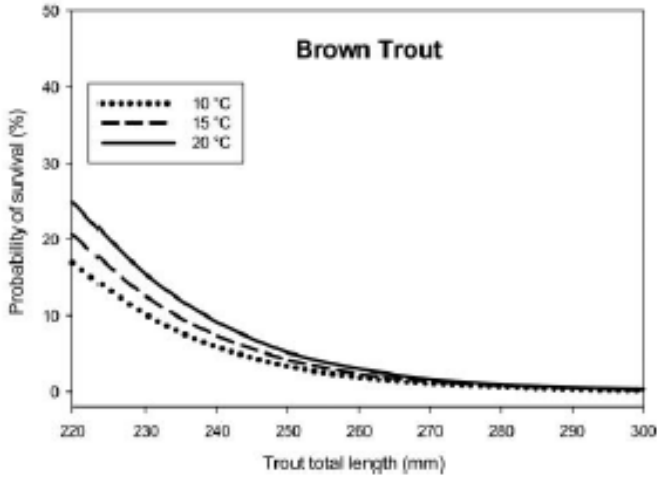


FIGURE 2. Percent (%) probability that a juvenile chub at 55 mm TL will survive predation by Rainbow Trout (top) or Brown Trout (bottom) as trout size increases from 220 to 300 mm TL at 10, 15, and 20°C. Note that the y-axis scale for Brown Trout is one-half that for Rainbow Trout. Confidence intervals for Brown Trout are not individually distinguishable and not shown.

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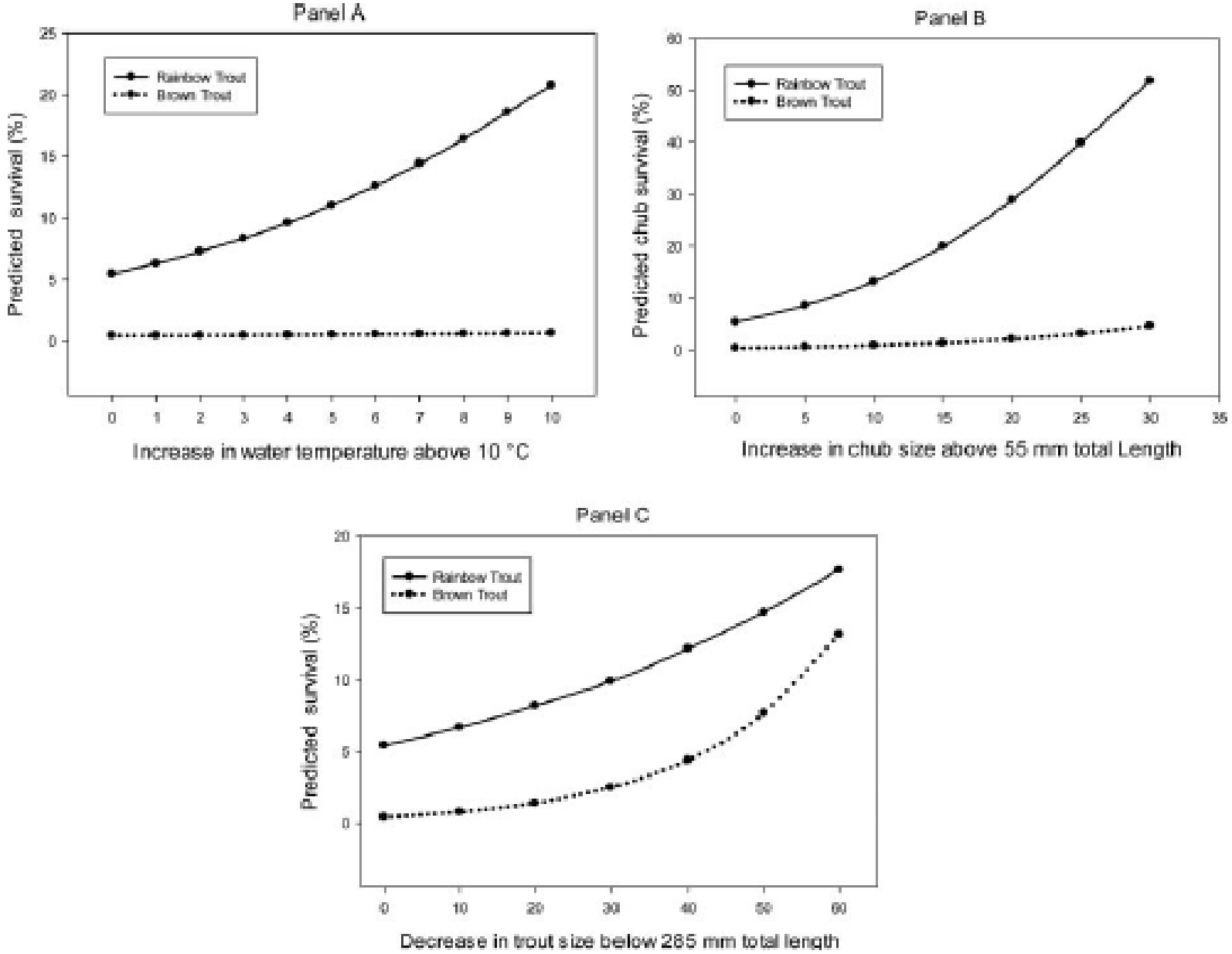
Ward and Morton-Starner 2015, *Transactions of the American Fisheries Society*



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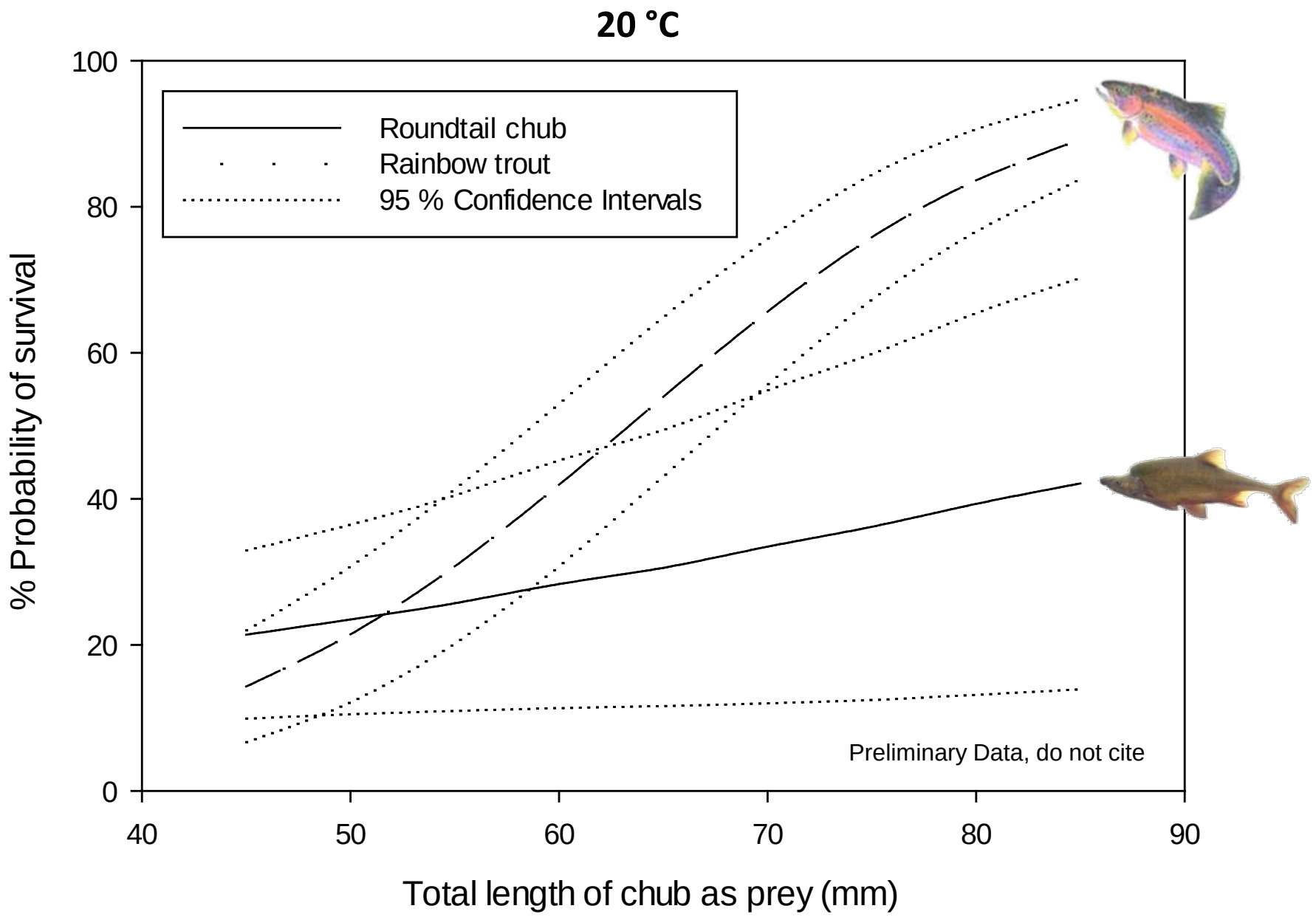
Ward and Morton-Starner 2015, *Transactions of the American Fisheries Society*



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Percent probability of survival for juvenile chub exposed to predation by adult roundtail chub (260 mm TL) or rainbow trout (260 mm TL) at 20° C.


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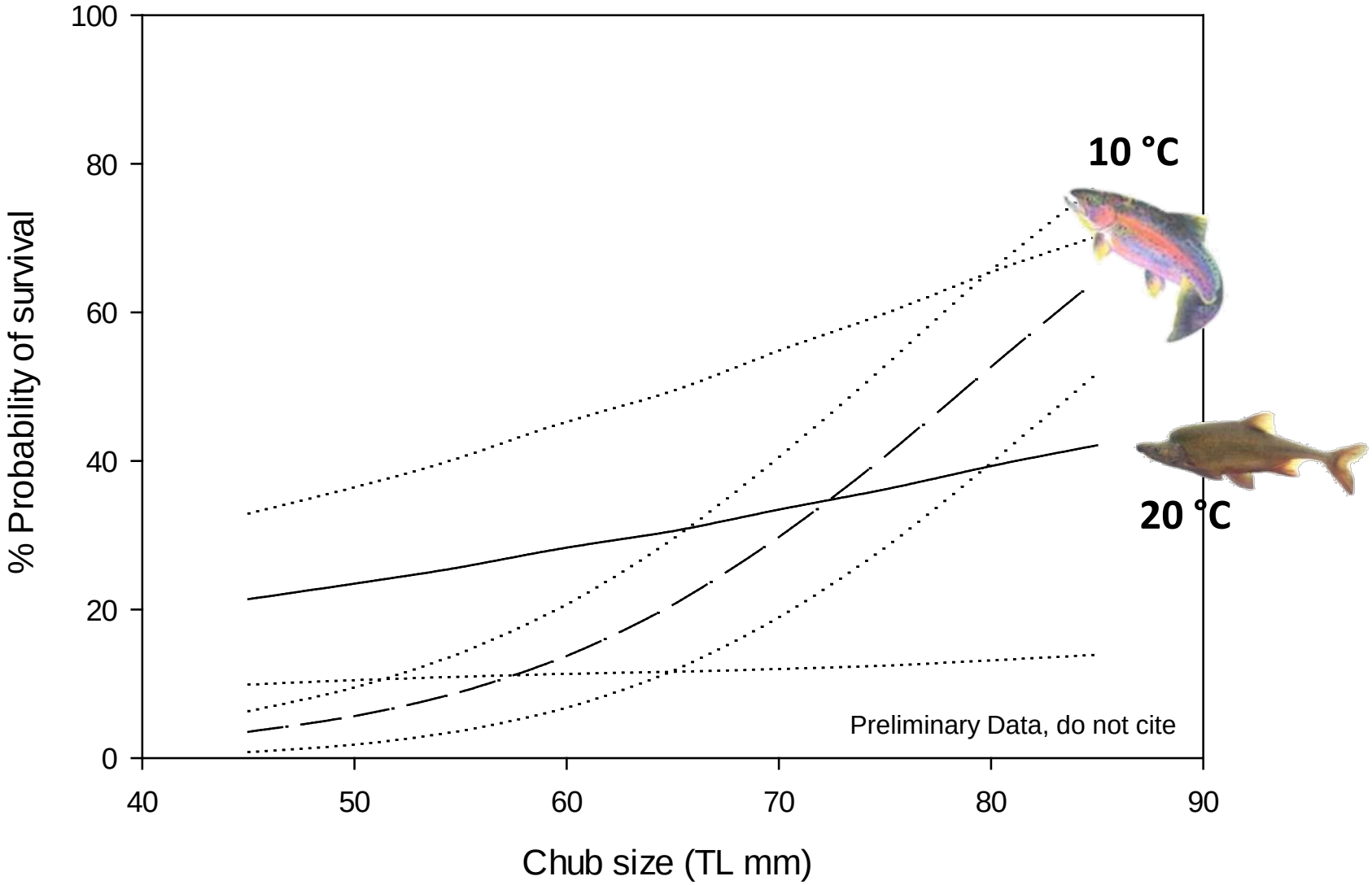

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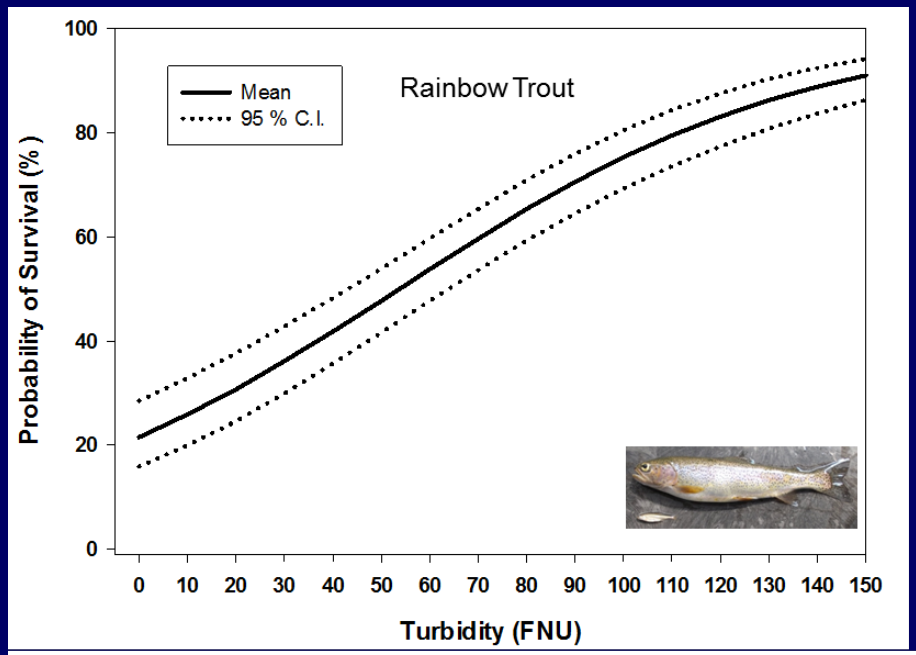
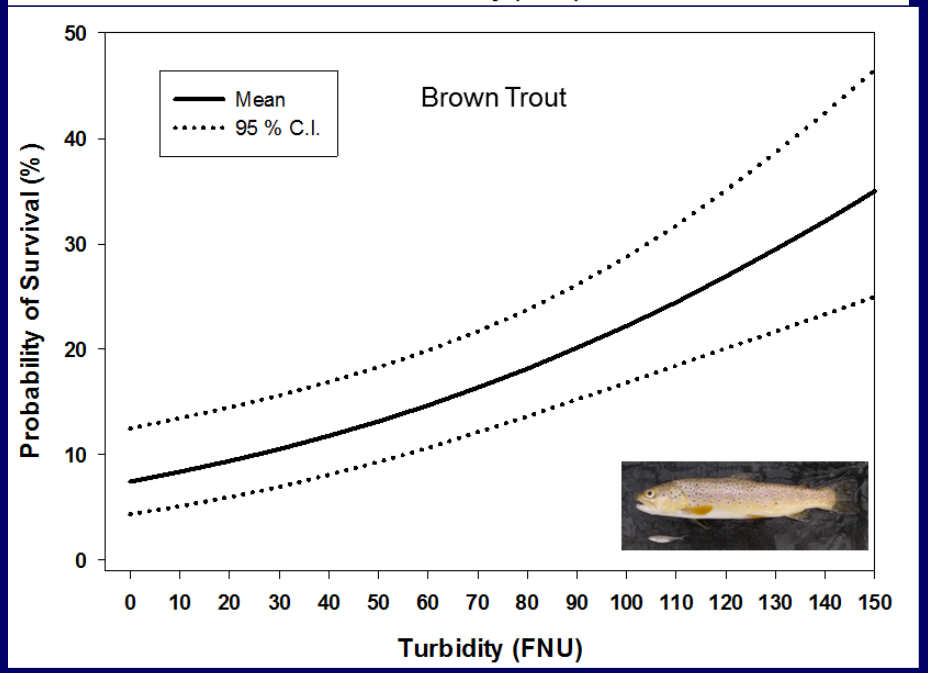
Percent probability of survival for juvenile chub exposed to predation by adult roundtail chub (260 mm TL) at 10° C or rainbow trout (260 mm TL) at 10° C.





Turbidity

Impacts physiology which impacts predation vulnerability

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Ward et al. 2016, *Journal of fish and Wildlife Management*

Behavior

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Differences in behavioral response

- chub move away from threat
- Razorback suckers avoid movement

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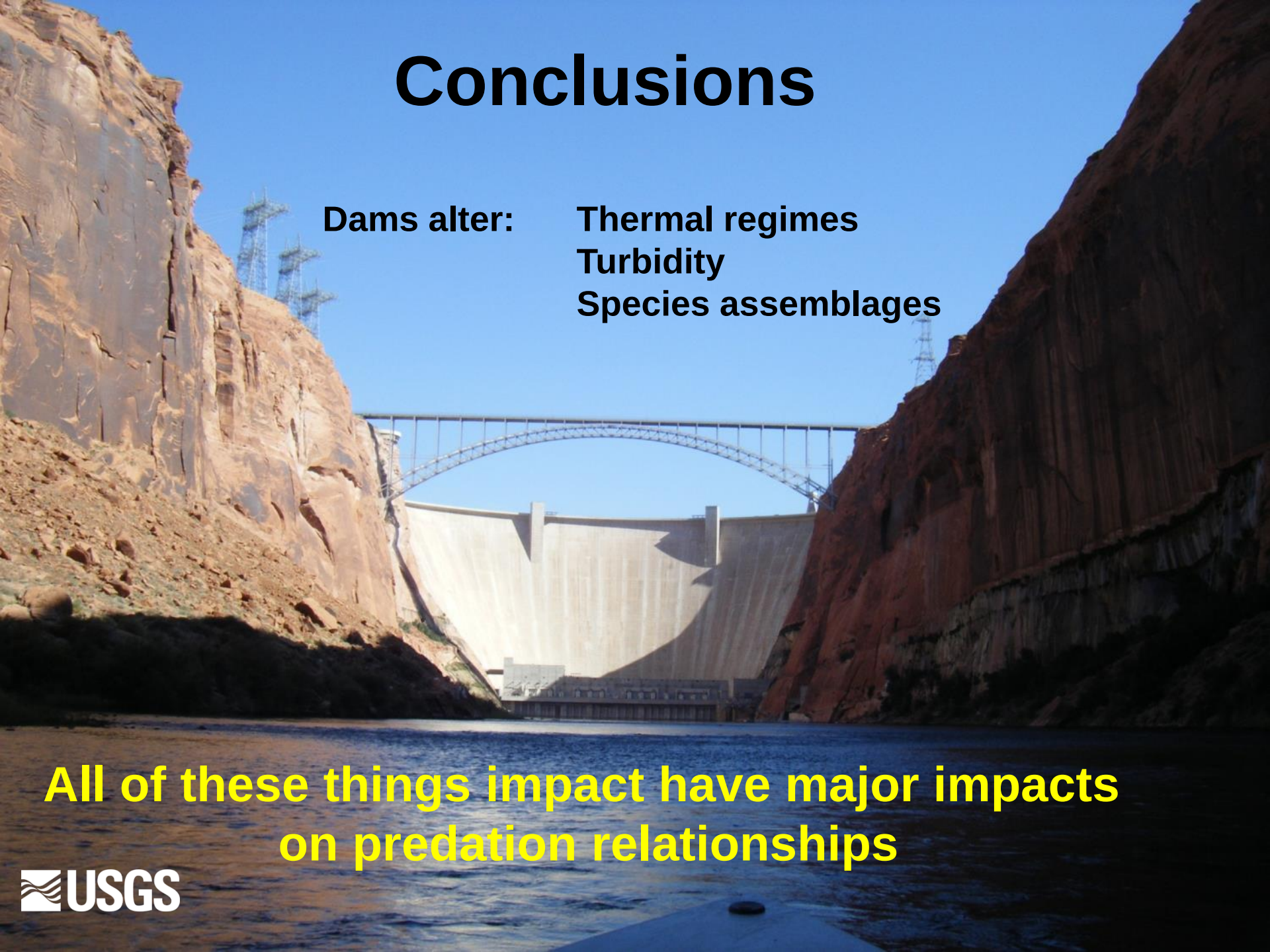
Ward and Figiel 2013, *Journal of Fish and Wildlife Management*

Conclusions



Dams alter:

- **Thermal regimes**
- **Turbidity**
- **Species assemblages**

All of these things impact have major impacts on predation relationships

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