What environmental factors reduce predation vulnerability for native fish?

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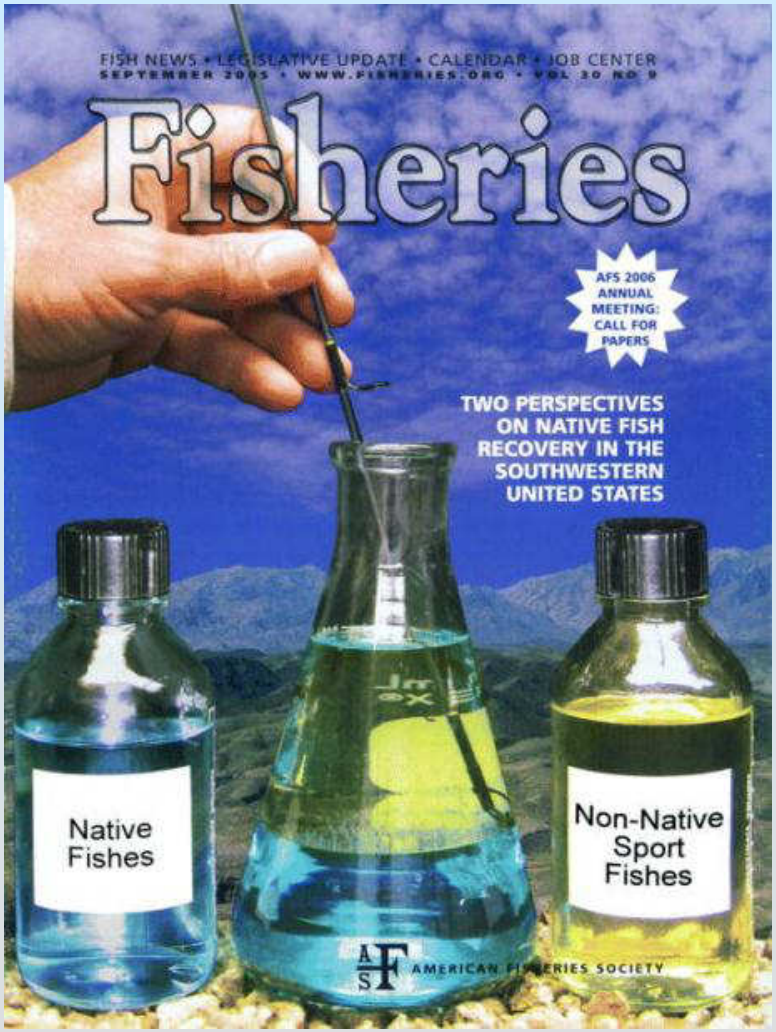
USGS
science for a changing world



Immiscibility of Native and Non-native Fishes, 2005

PAUL C. MARSH AND CAROL A. PACEY, *Fisheries*

Conflicts between Native Fish and Nonnative Sport Fish Management in the Southwestern United States, 2005

Robert W. Clarkson a , Paul C. Marsh , Sally E. Stefferud & Jerome A. Stefferud, *Fisheries*

Predatory Fish Removal and Native Fish Recovery in the Colorado River Mainstem, 2005

Gordon A. Mueller, ,*Fisheries*

Immiscibility

99 % of time this holds true

But not always when unique environments aid in native fishes survivability with non-native predators.

In a few very rare instances native fish survive and recruit indicating specific environmental conditions may help reduce predation vulnerability

Little Colorado River in Grand Canyon

Lake mead at the CR inflow

What environmental factors reduce predation vulnerability for native fish?

Turbidity

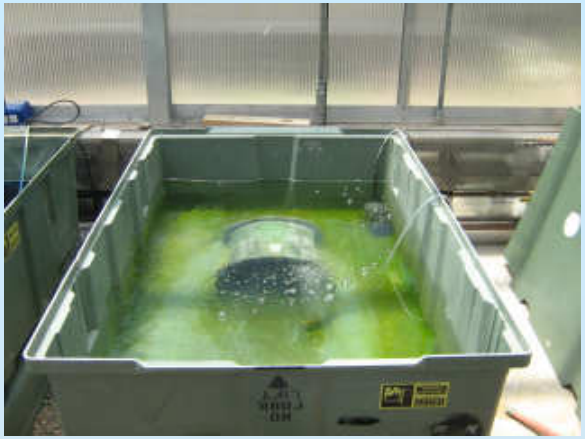
Vegetative Cover

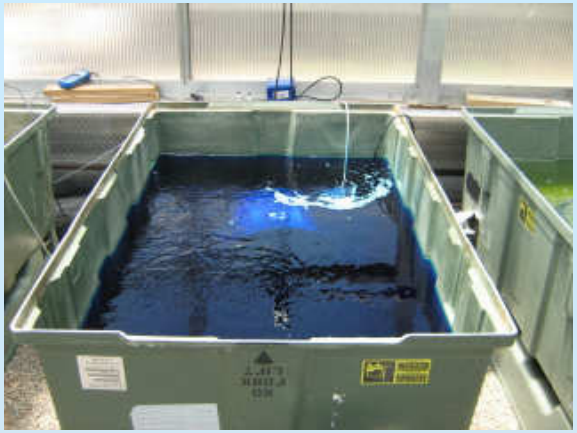
- **Aquatic plants**
- **Flooded terrestrial vegetation**

Rocky substrates

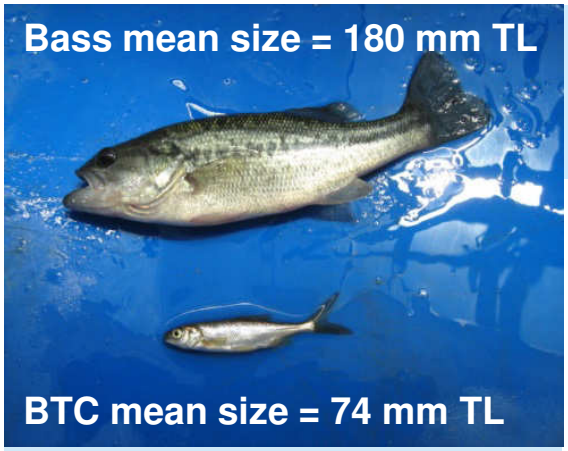
Laboratory Methods

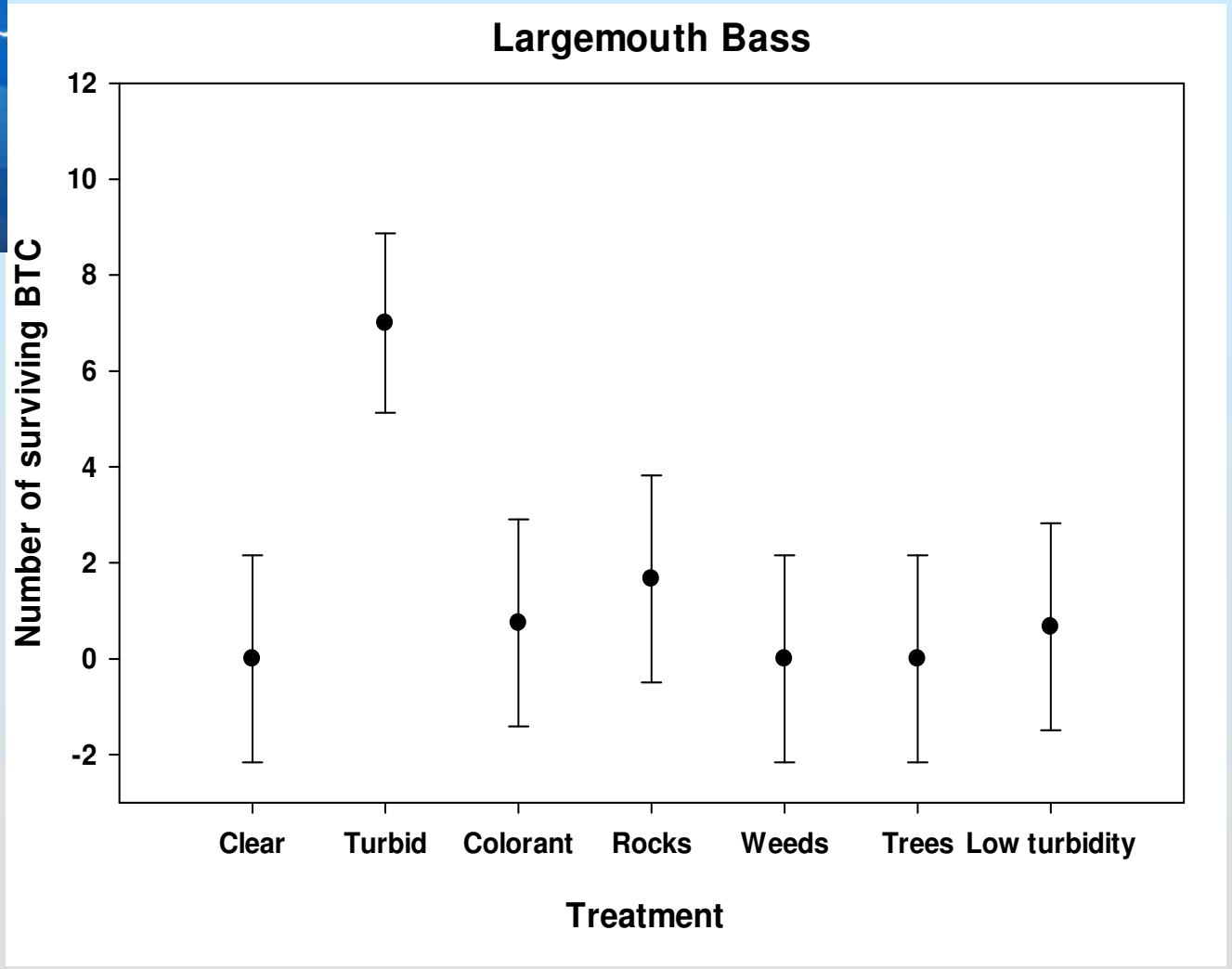
- 4 predators per tank
- 12 prey per tank (in baskets)
- Allowed to acclimate for 24- h
- Baskets tipped – Live fish counted 24 h later






Experimental treatments

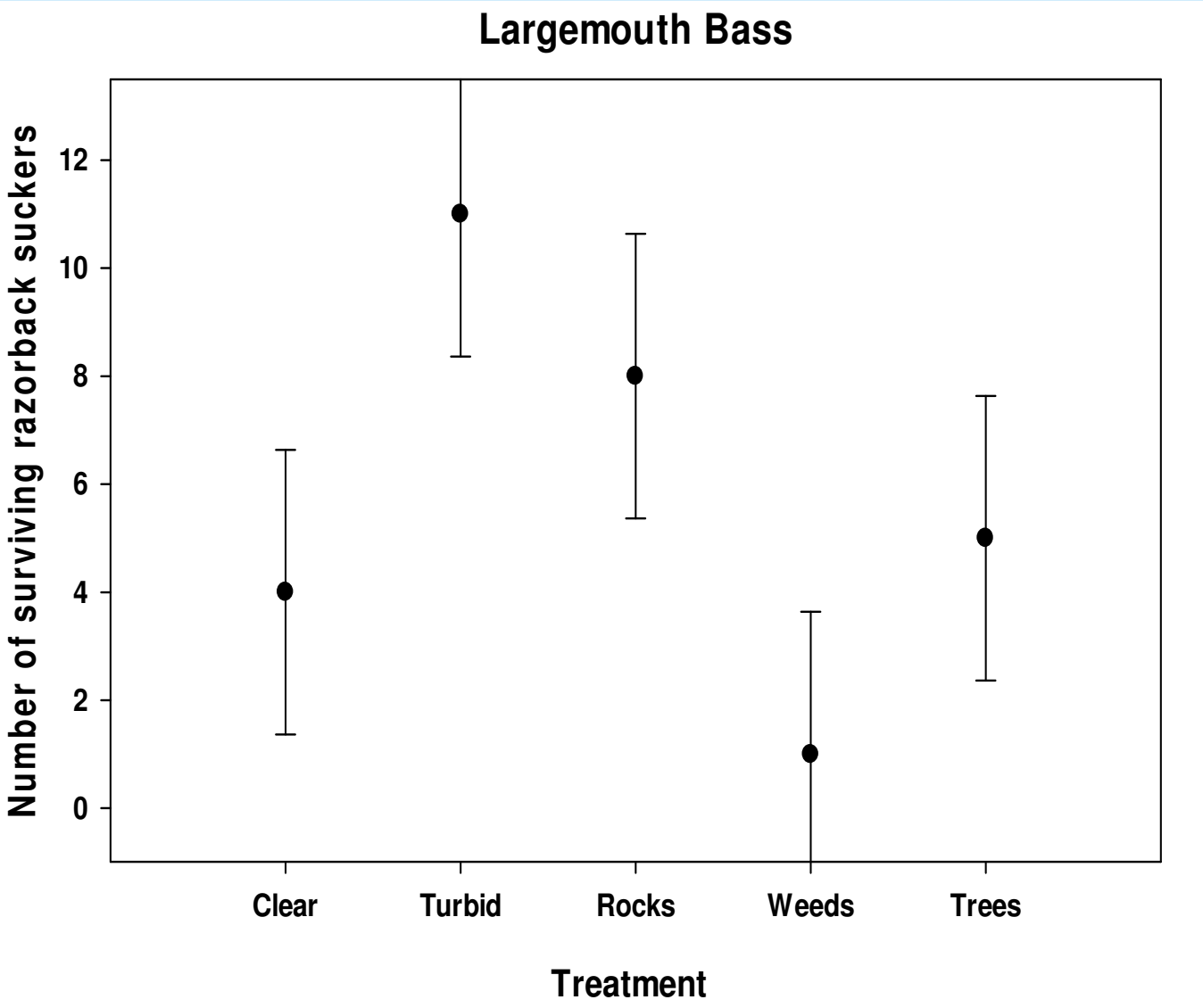


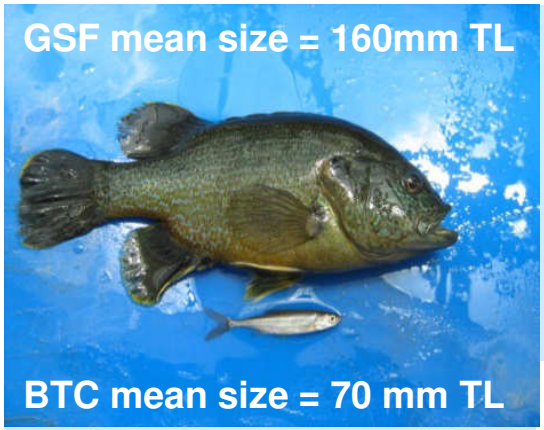


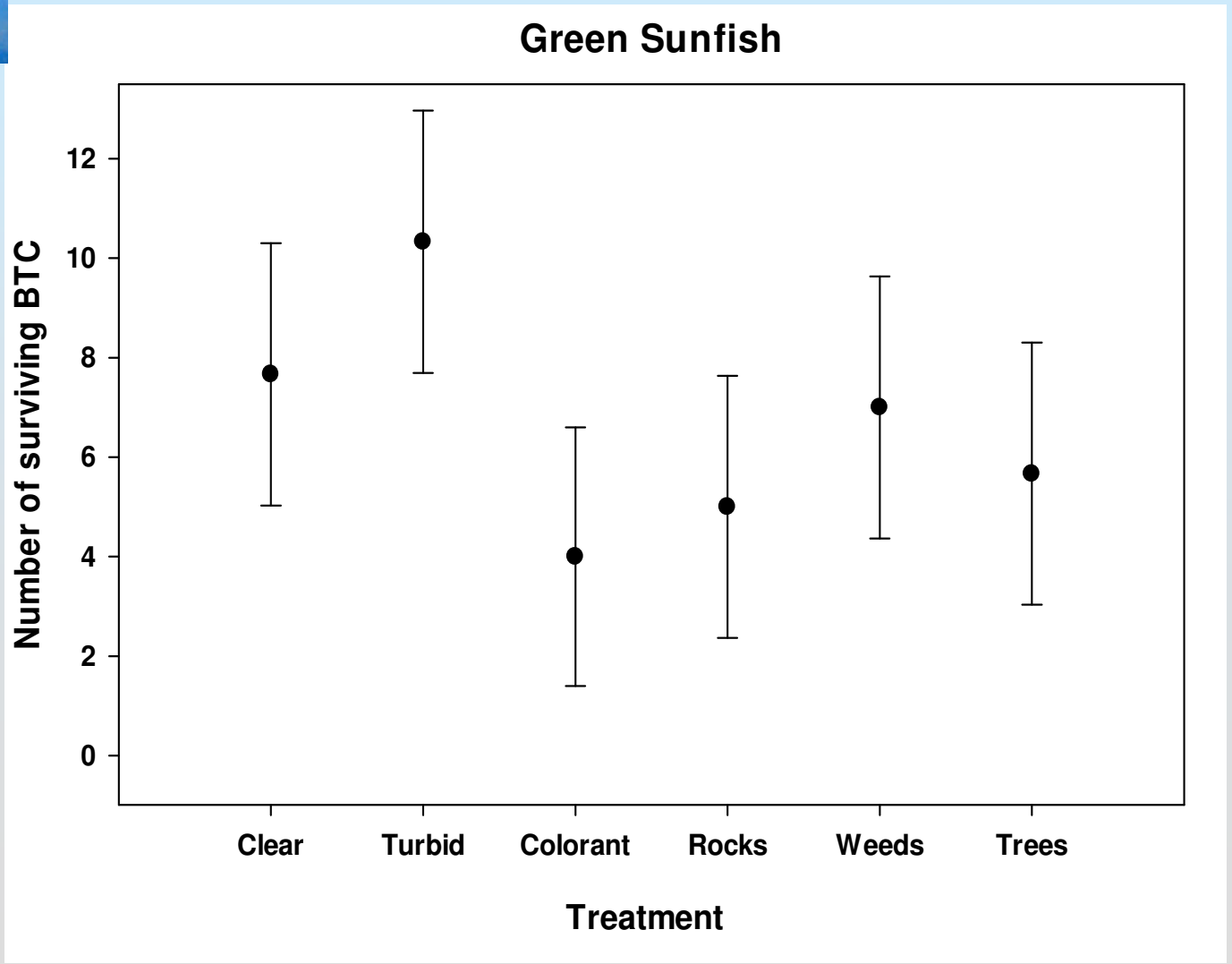
Each point = 3 overnight trials, error bars represent 95% confidence intervals, 4 predators and 12 bonytail per tank at 20 ° C

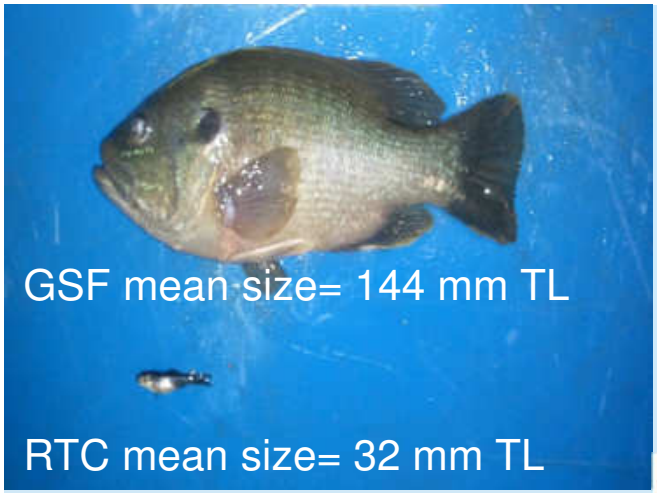
Bass mean size = 180 mm TL

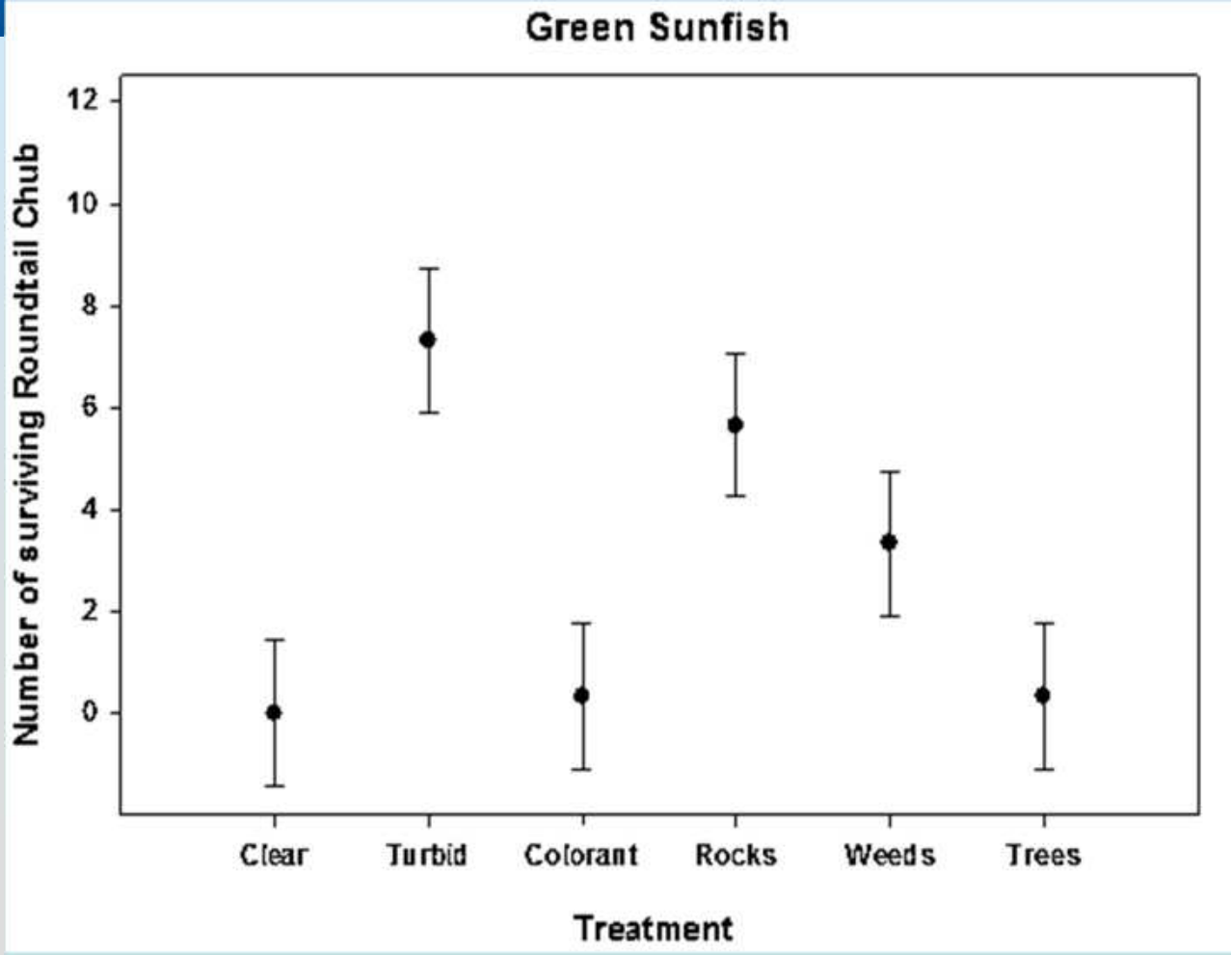
RZB mean size = 74 mm TL

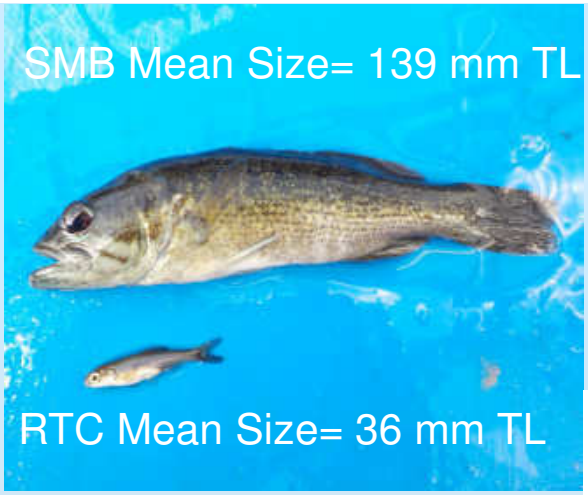


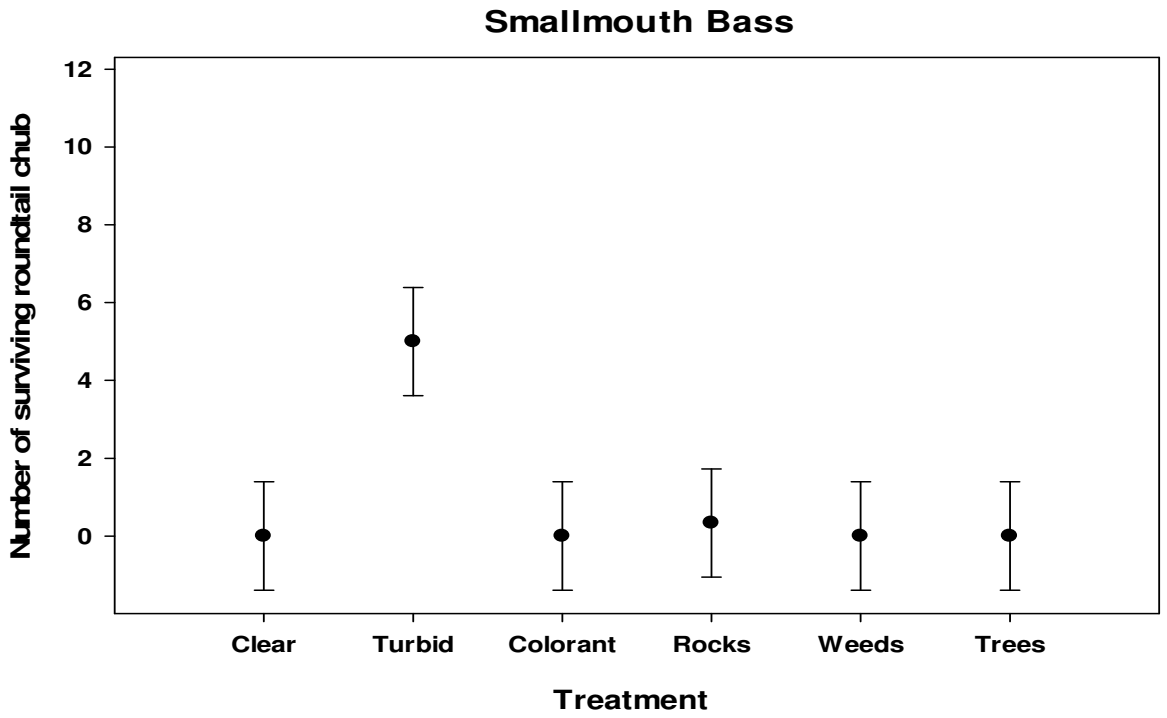

GSF mean size = 160mm TL
BTC mean size = 70 mm TL


Green Sunfish
Number of surviving BTC
0
2
4
6
8
10
12
Clear
Turbid
Colorant
Rocks
Weeds
Trees
Treatment


GSF mean size= 144 mm TL
RTC mean size= 32 mm TL

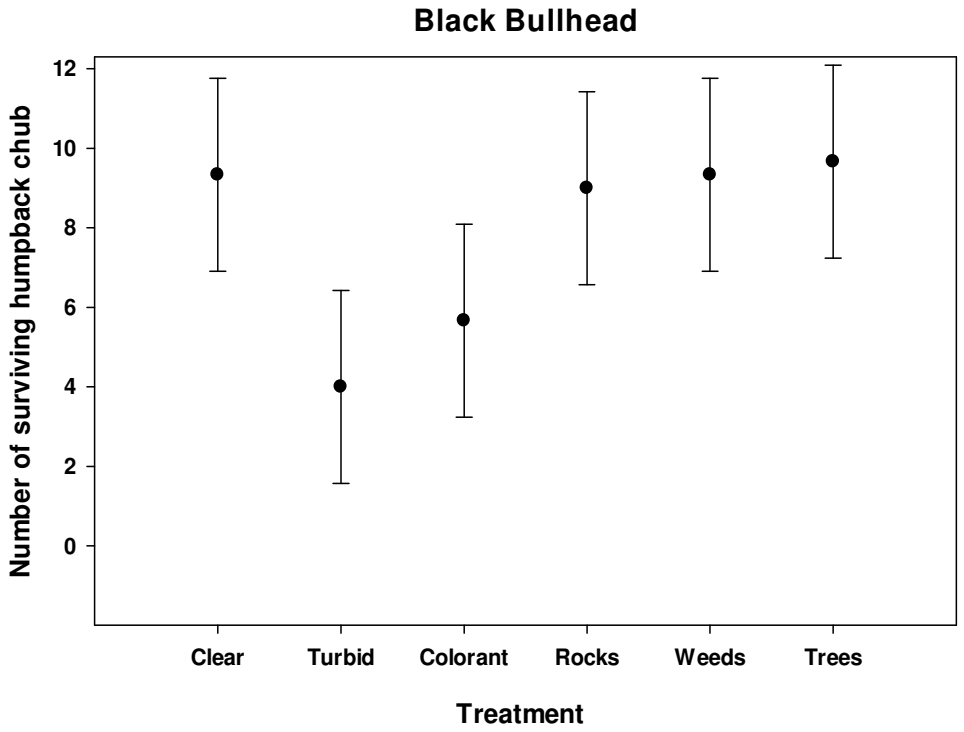

Green Sunfish
Number of surviving Roundtail Chub
12
10
8
6
4
2
0
Clear
Turbid
Colorant
Rocks
Weeds
Trees
Treatment

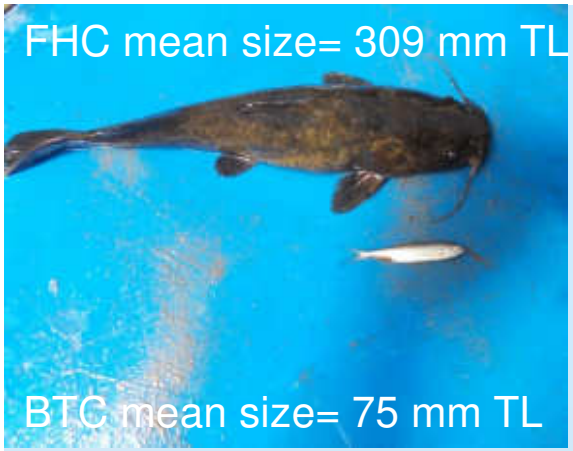

SMB Mean Size= 139 mm TL
RTC Mean Size= 36 mm TL

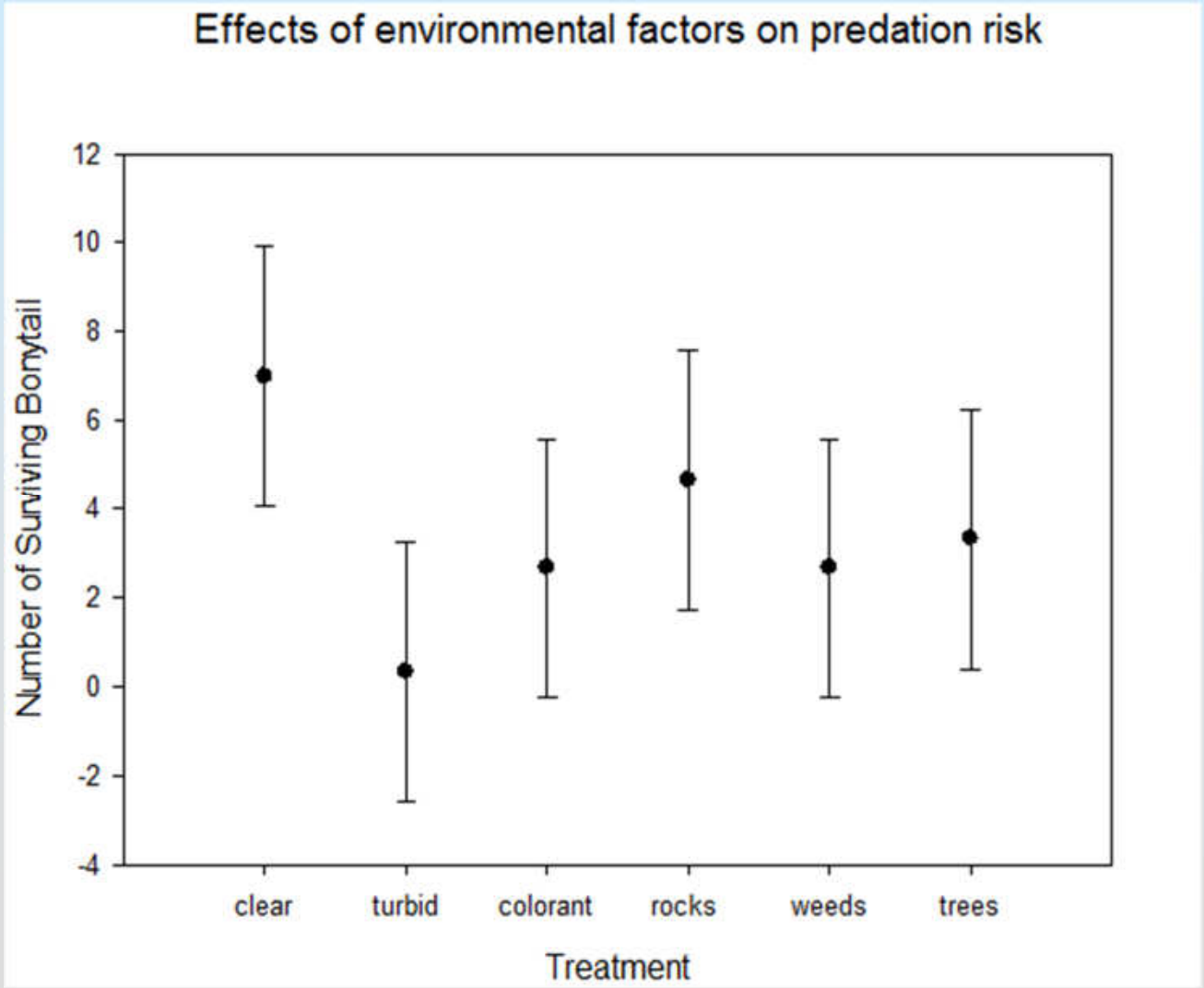

Smallmouth Bass
Number of surviving roundtail chub
12
10
8
6
4
2
0
Clear
Turbid
Colorant
Rocks
Weeds
Trees
Treatment

BH mean size= 194 mm TL

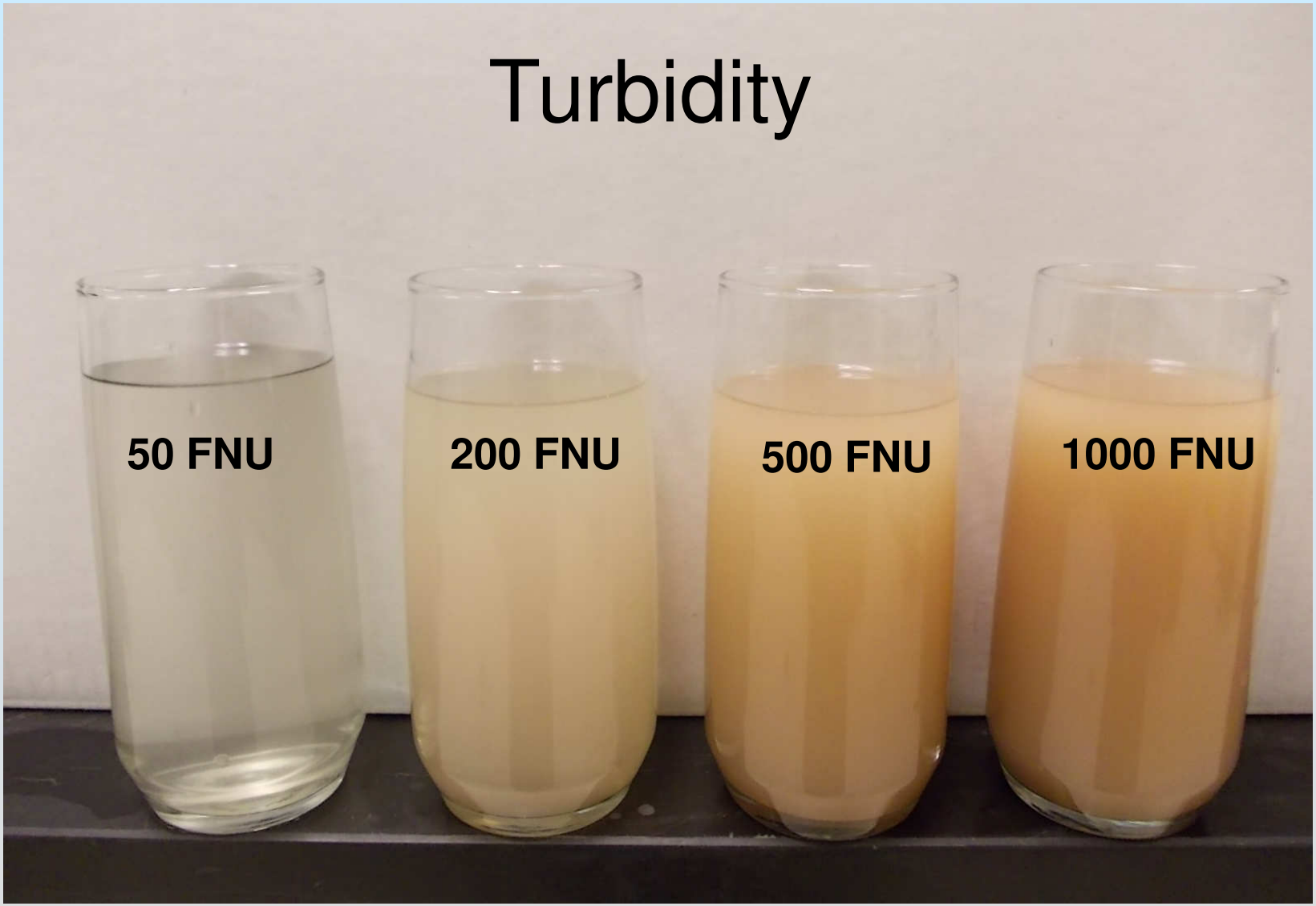
HBC mean size= 67 mm TL




FHC mean size= 309 mm TL
BTC mean size= 75 mm TL


Effects of environmental factors on predation risk
Number of Surviving Bonytail
12
10
8
6
4
2
0
-2
-4
clear
turbid
colorant
rocks
weeds
trees
Treatment

Turbidity



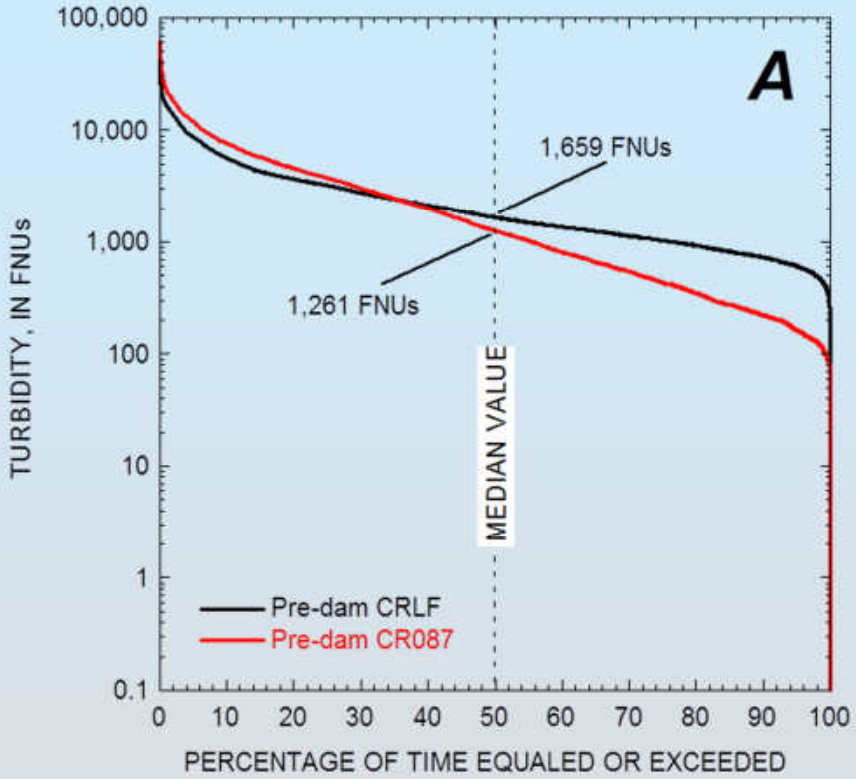
Rainbow Trout Summary

Clear trials: 0 % survival

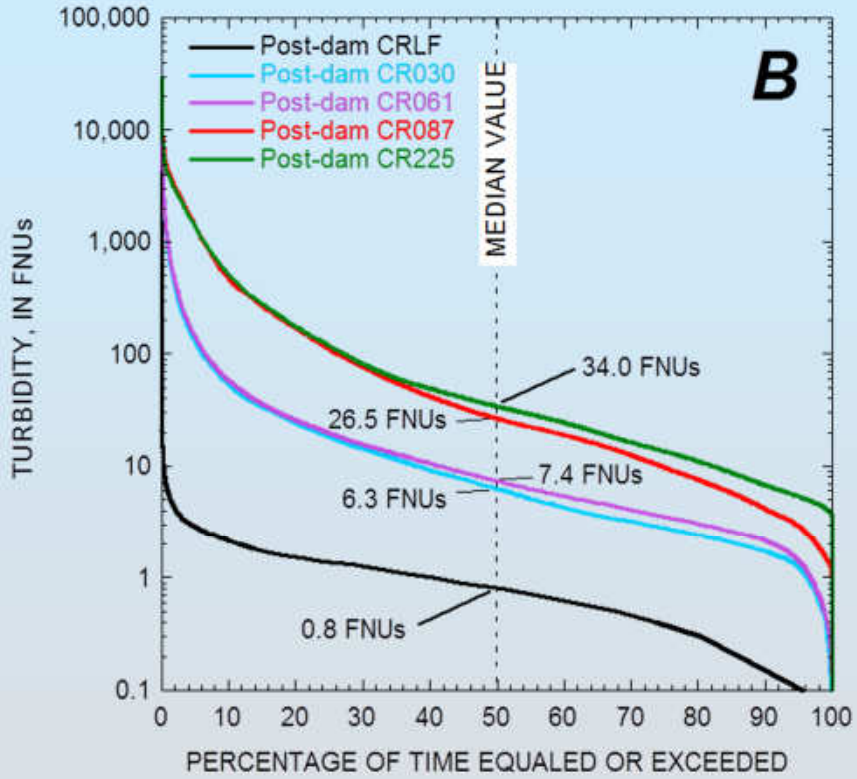
Photo by Bio-West

Turbid area of Lake Mead at Fish Island near the inflow of the Virgin and Muddy Rivers

PRE-DAM (10-1-1947 through 6-1-1956)



POST-DAM (1-29-2008 through 12-31-2011)



Conclusions

- **Relatively small changes in turbidity may be sufficient to alter predation dynamics**
- **Stocking fish into areas of high turbidity or creating areas with short term high turbidity may confer survival advantages**
- **Any ideas/questions?**