

ORANGE CREEK BASIN

Newnans Lake Shad Harvest Experiment

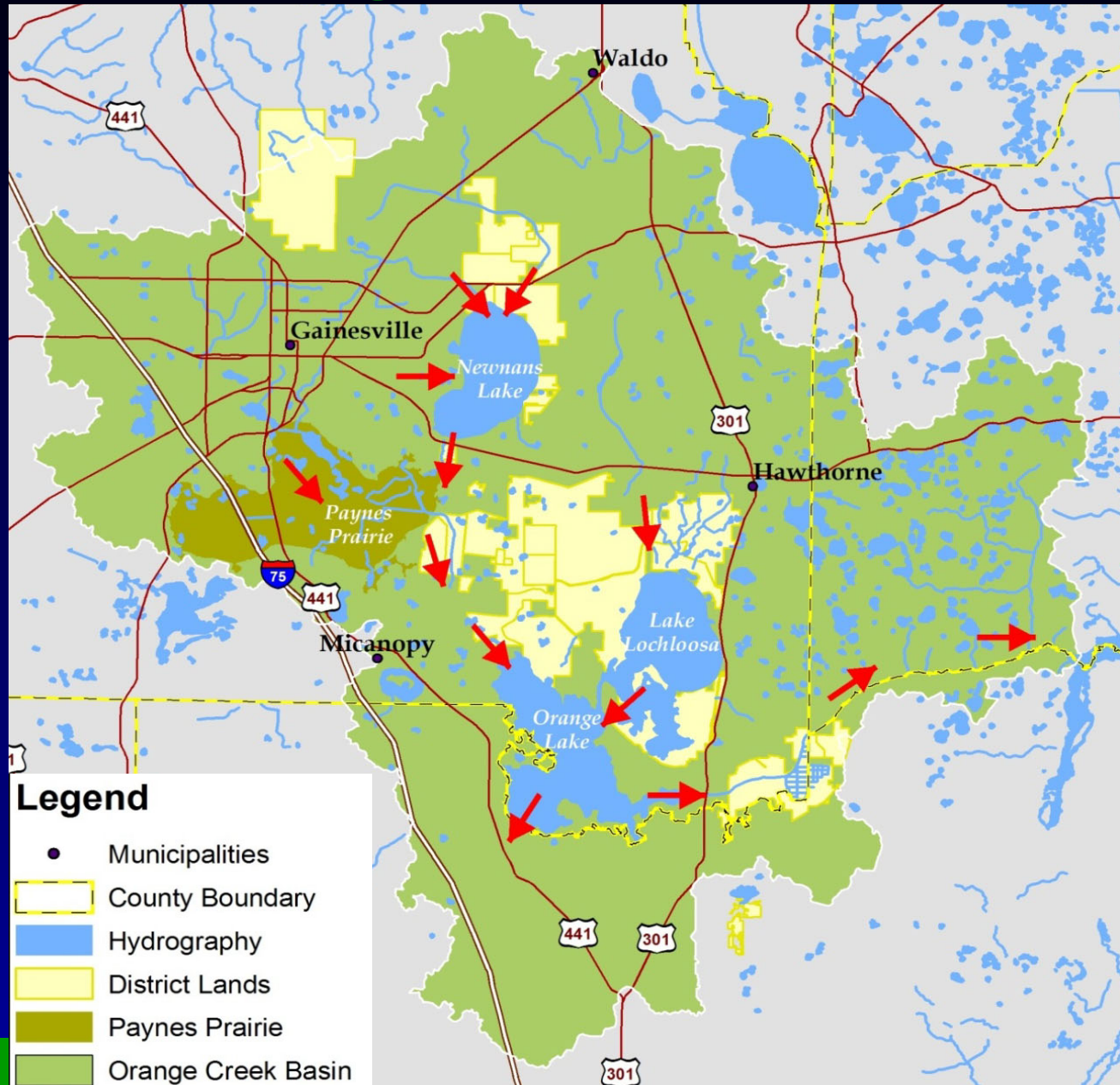


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Erich Marzolf, Environmental Sciences Division

Orange Creek Basin



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Orange Creek Basin Goals

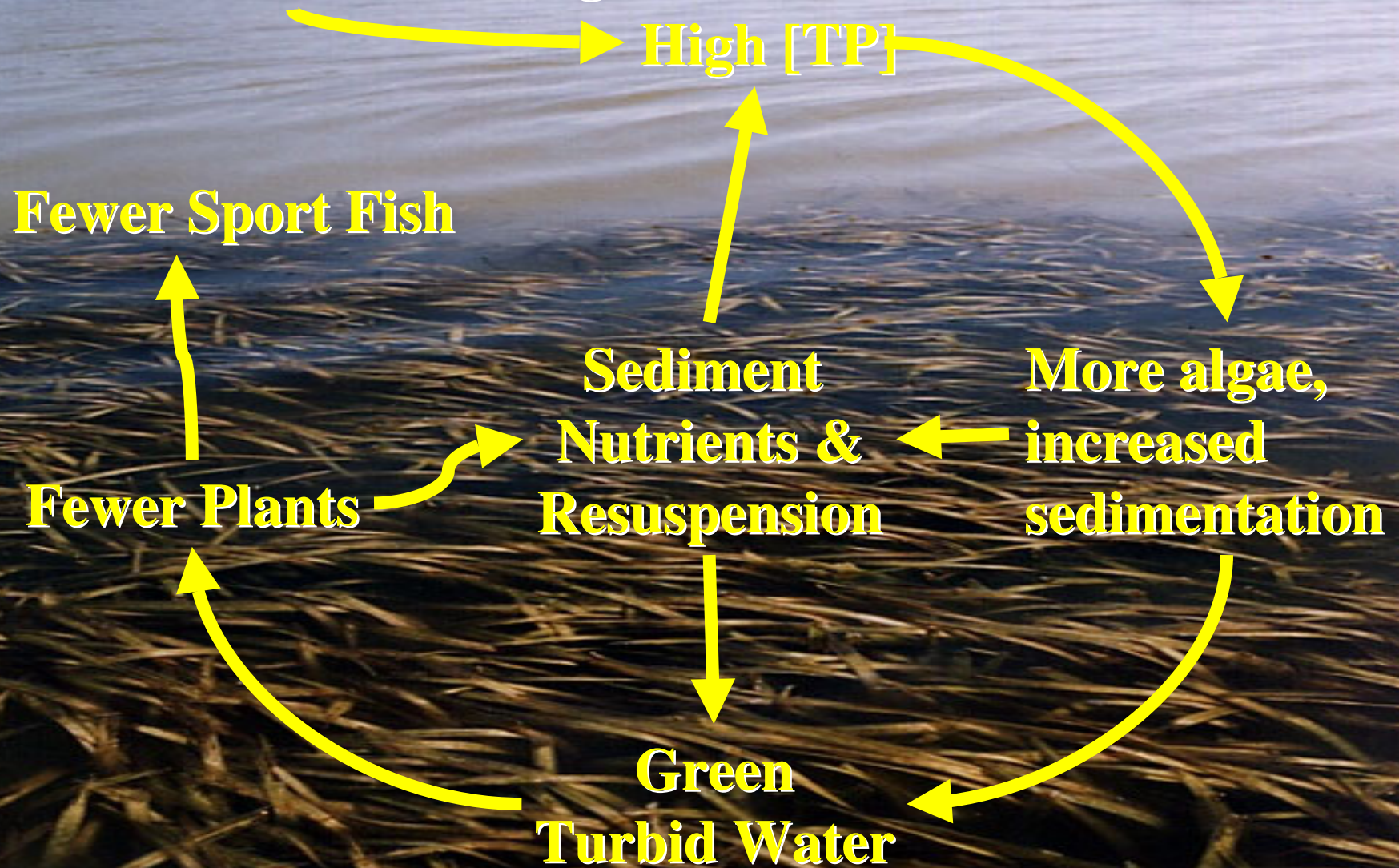
- Restore and maintain the basin's natural hydrology to the extent practicable and desirable
- Restore and protect aquatic and wetland communities and their habitats
- Protect and enhance water quality
- Rehabilitate and maintain fisheries
- Enhance recreational and aesthetic values



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Water Quality & Habitat Linkages

Excess Nutrient Loading



Water Quality Comparison

Total Phosphorus; 2000 to present

Waterbody Comparison for Total Phosphorus
(Average + SE; - StDev)

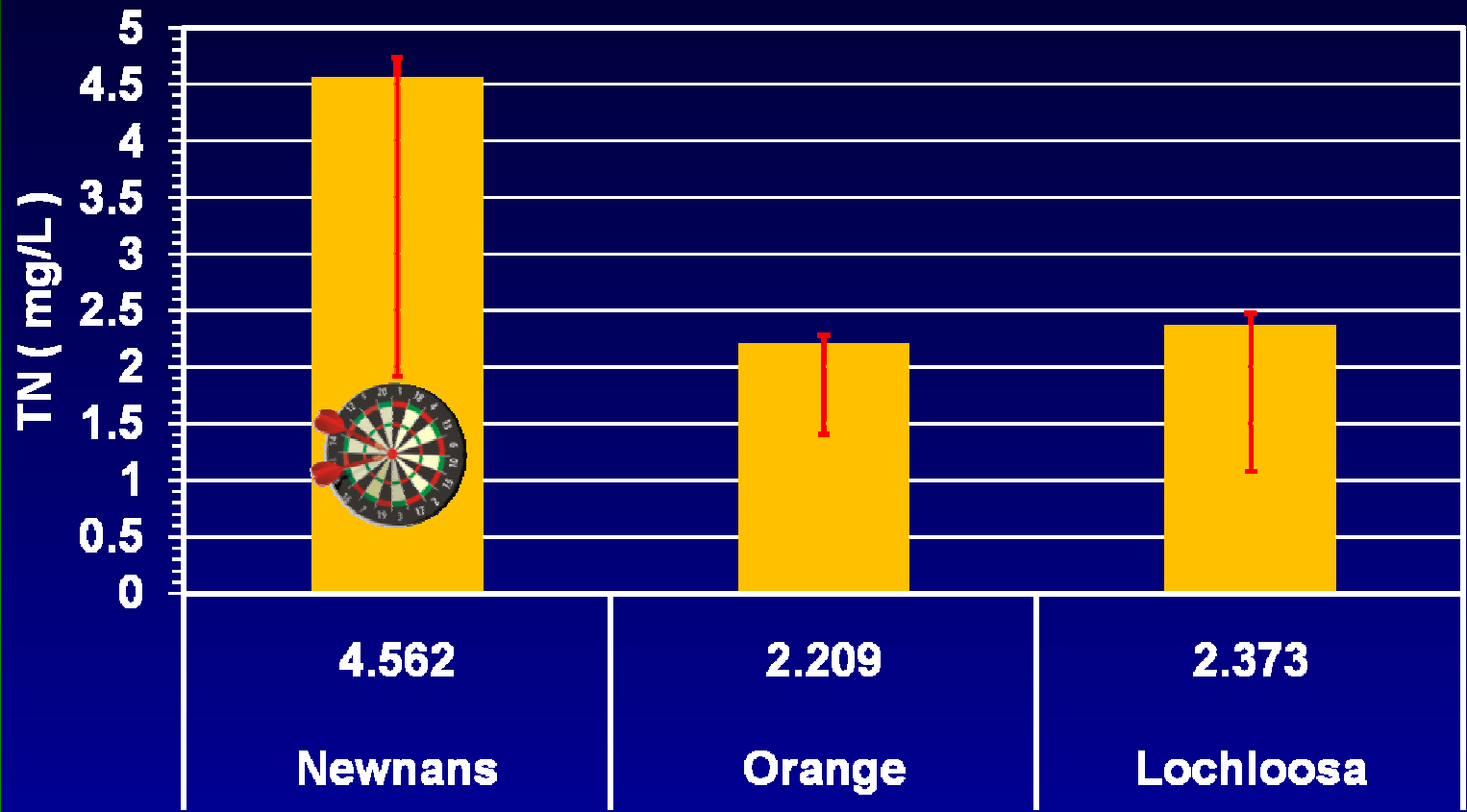


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Water Quality Comparison

Total Nitrogen; 2000 to present

Waterbody Comparison for Total Nitrogen
(Average + SE; - StDev)

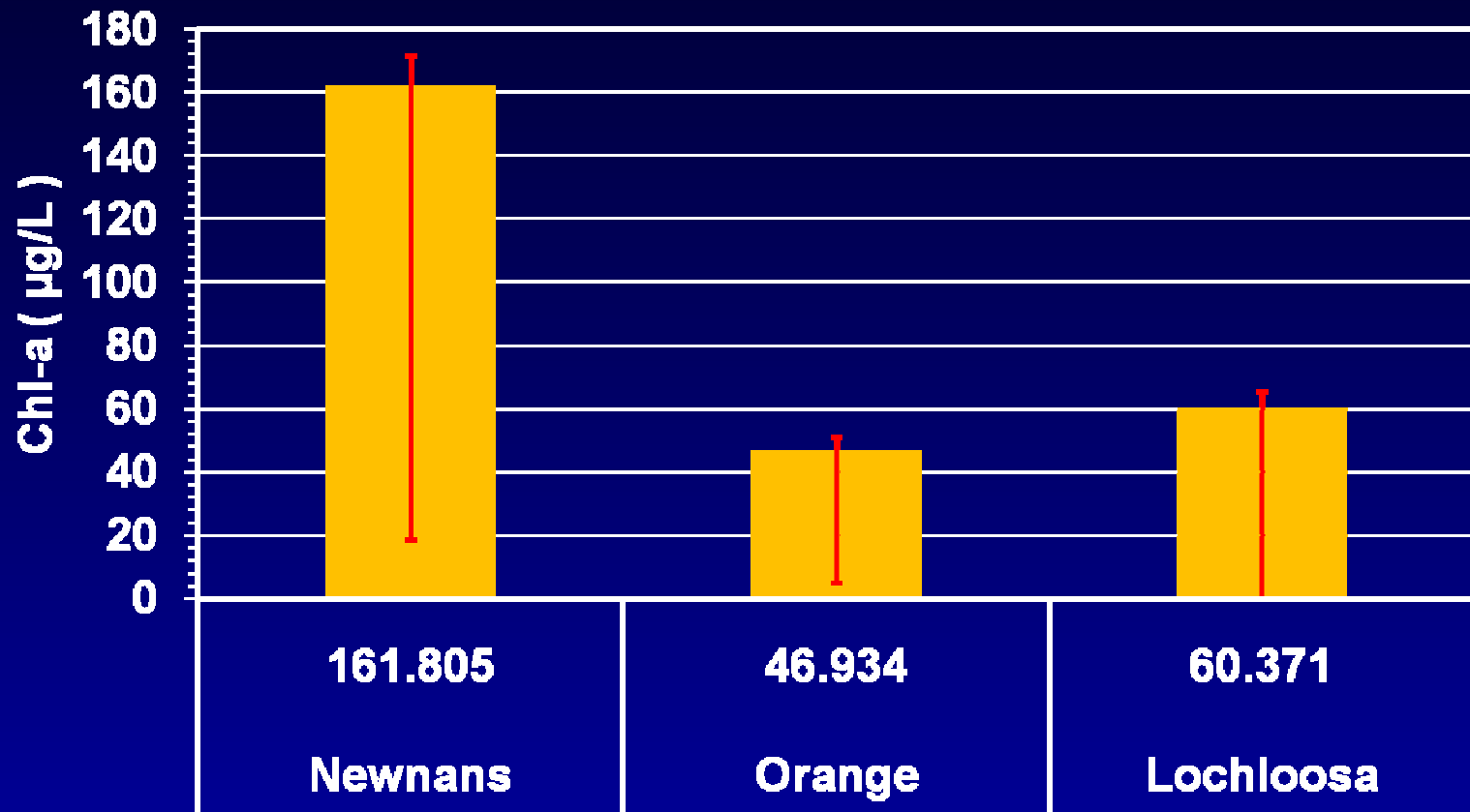


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Water Quality Comparison

Chlorophyll; 2000 to present

Waterbody Comparison for Chlorophyll-a
Uncorrected (Average + SE; - StDev)

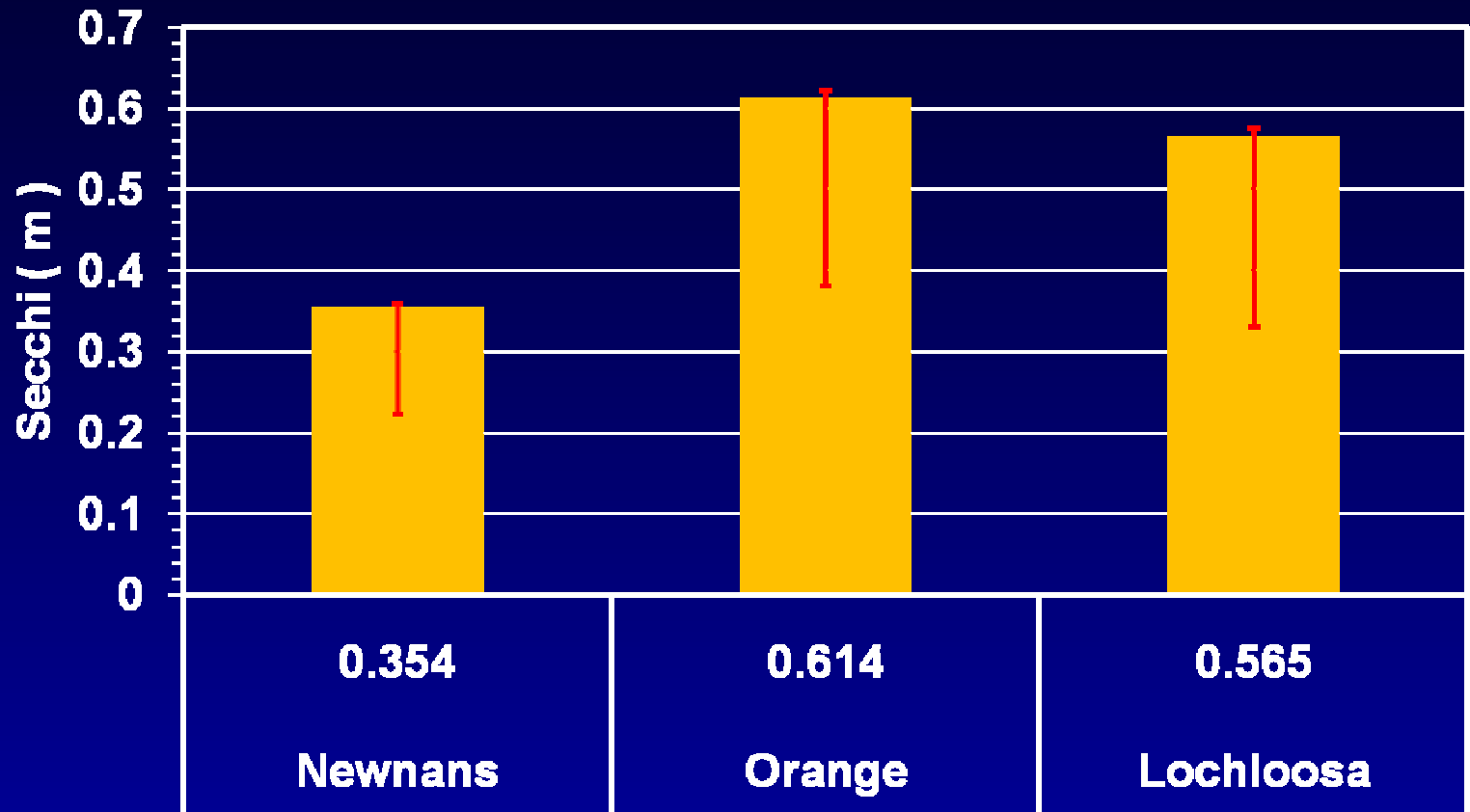


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Water Quality Comparison

Water Transparency; 2000 to present

Waterbody Comparison for Secchi Depth
(Average + SE; - StDev)



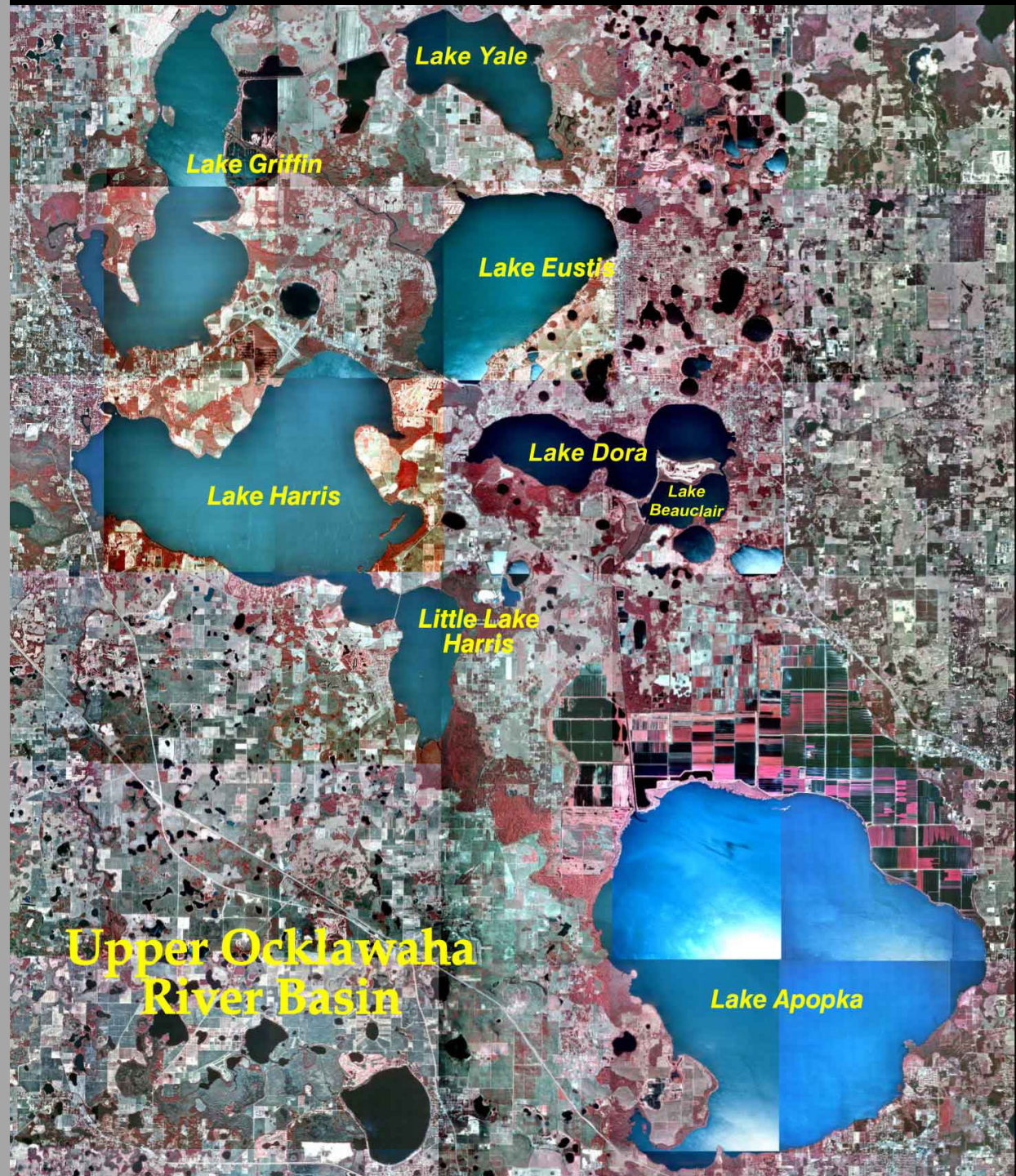
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A Fishy Tale



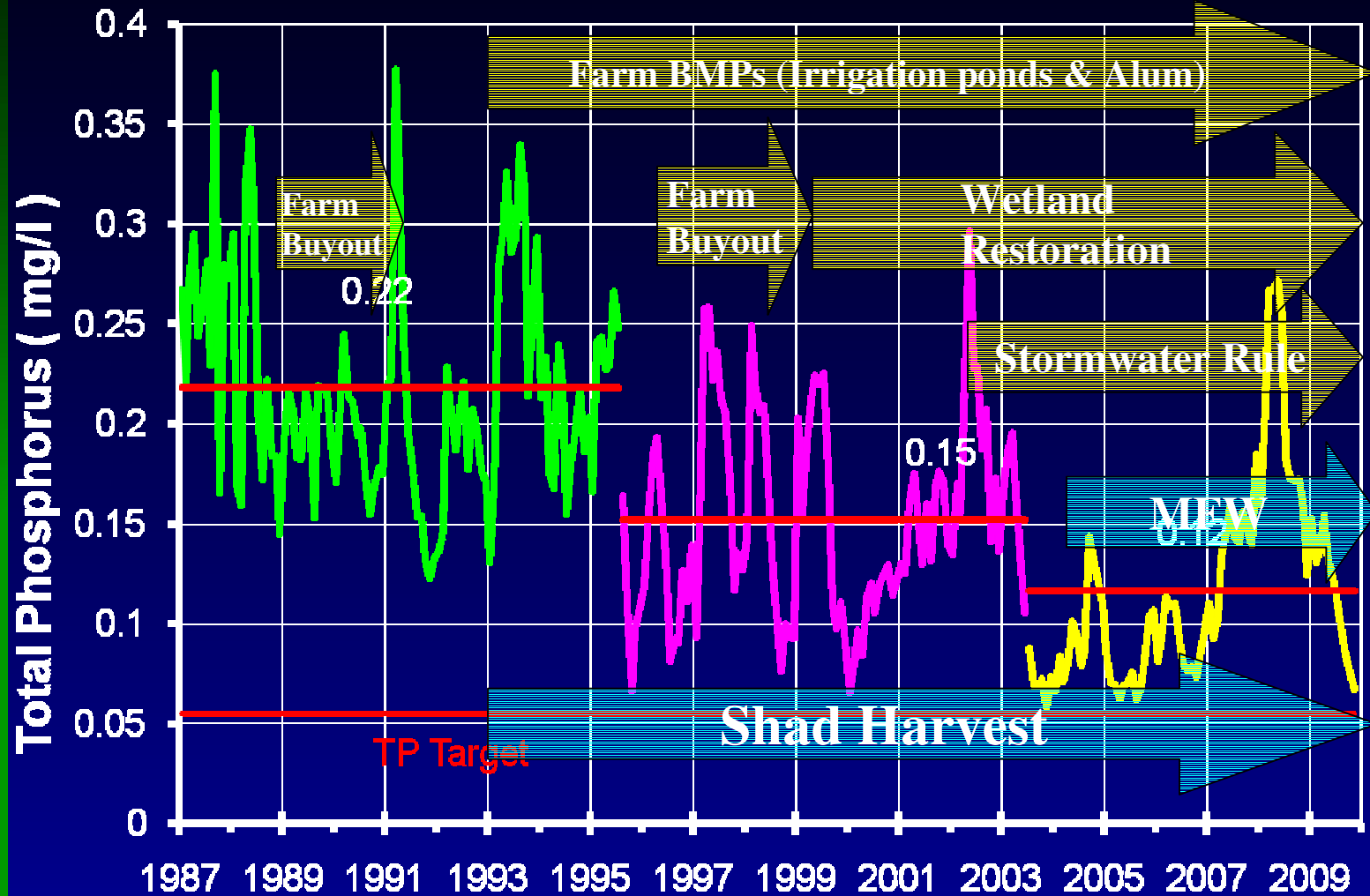
Restoration Progress in the Upper Ocklawaha Lakes:

A Multi-faceted
Restoration
Approach
including Rough
Fish Harvests



Lake Apopka

L. Apopka Mean Monthly Total Phosphorus. 1987 through November 2009



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In response to water quality improvements, grass beds have expanded in Lakes Apopka, Griffin & Beauclair



This bed is in 3.8 ft (1.2 m) of water

Rough Fish Harvests

- Internationally recognized as a useful water quality improvement tool in lakes
- However, few examples in subtropical lakes
- Why does it work?
 - Direct nutrient removal in fish bodies
 - Reduction of nutrient recycling
 - Nutrient excretion by fish
 - Sediment disturbance by fish
 - Increased sediment resuspension vulnerability due to wind & waves
 - Food web effects



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Gizzard Shad

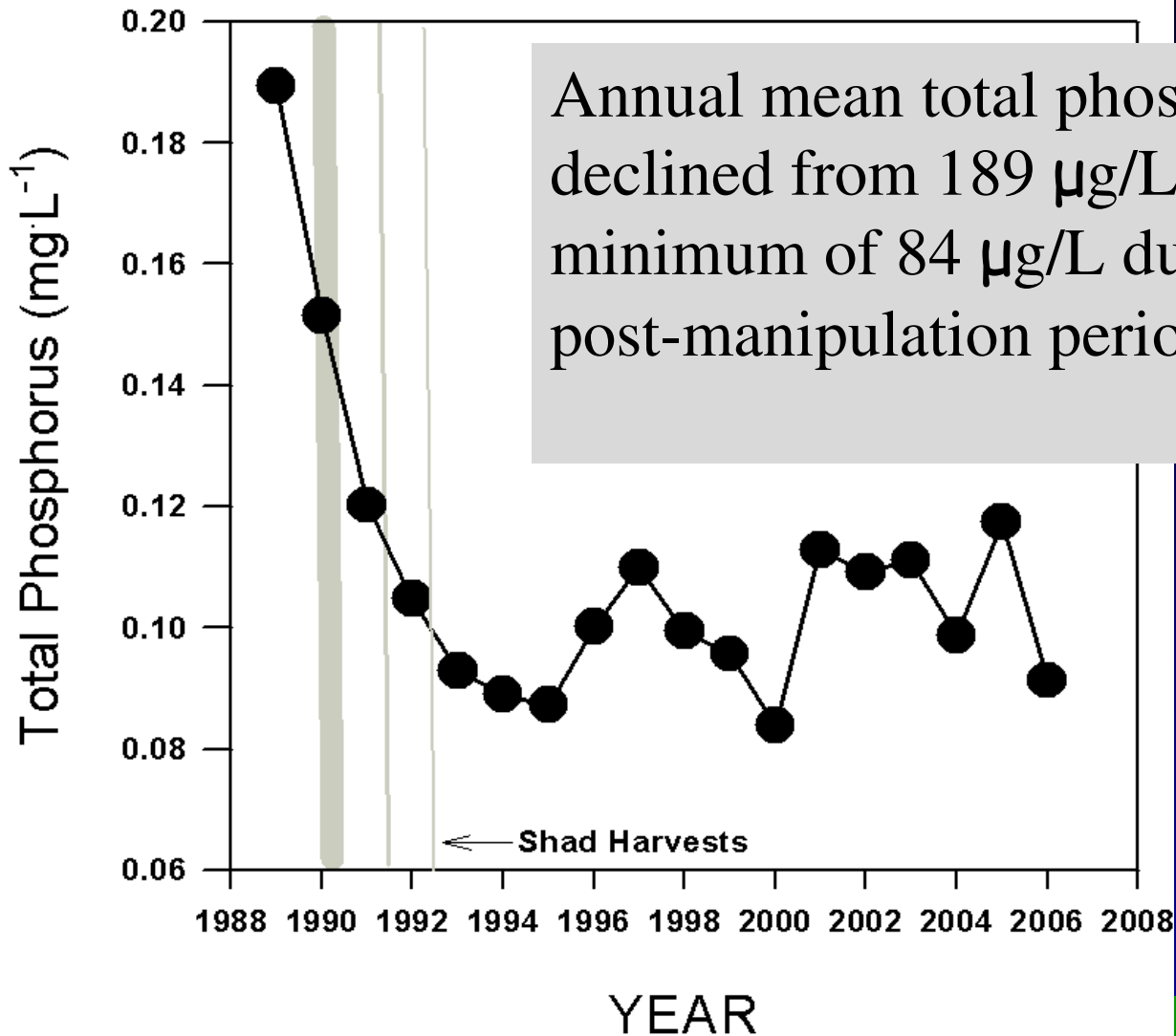


- Grow up to 16+ inches and 1.7 lb
- Abundant in Florida lakes, especially in nutrient-rich lakes
- Not valued for human consumption or sport
- Feed on algae, zooplankton and sediments
- Can dominate the total fish biomass of particularly nutrient-impaired lakes. Indicative of poor water quality and sport fish habitat



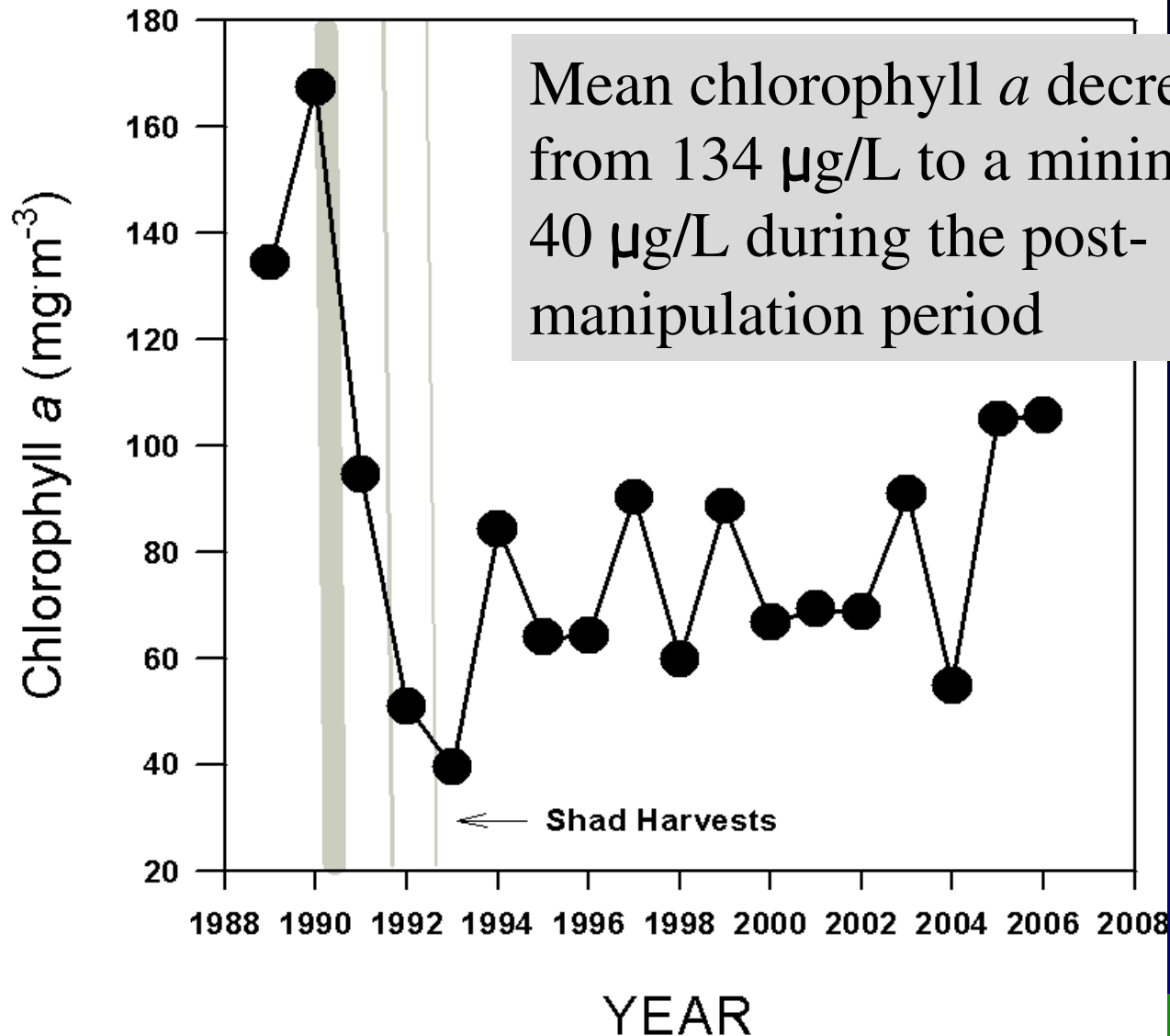
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Lake Denham Experimental Harvest



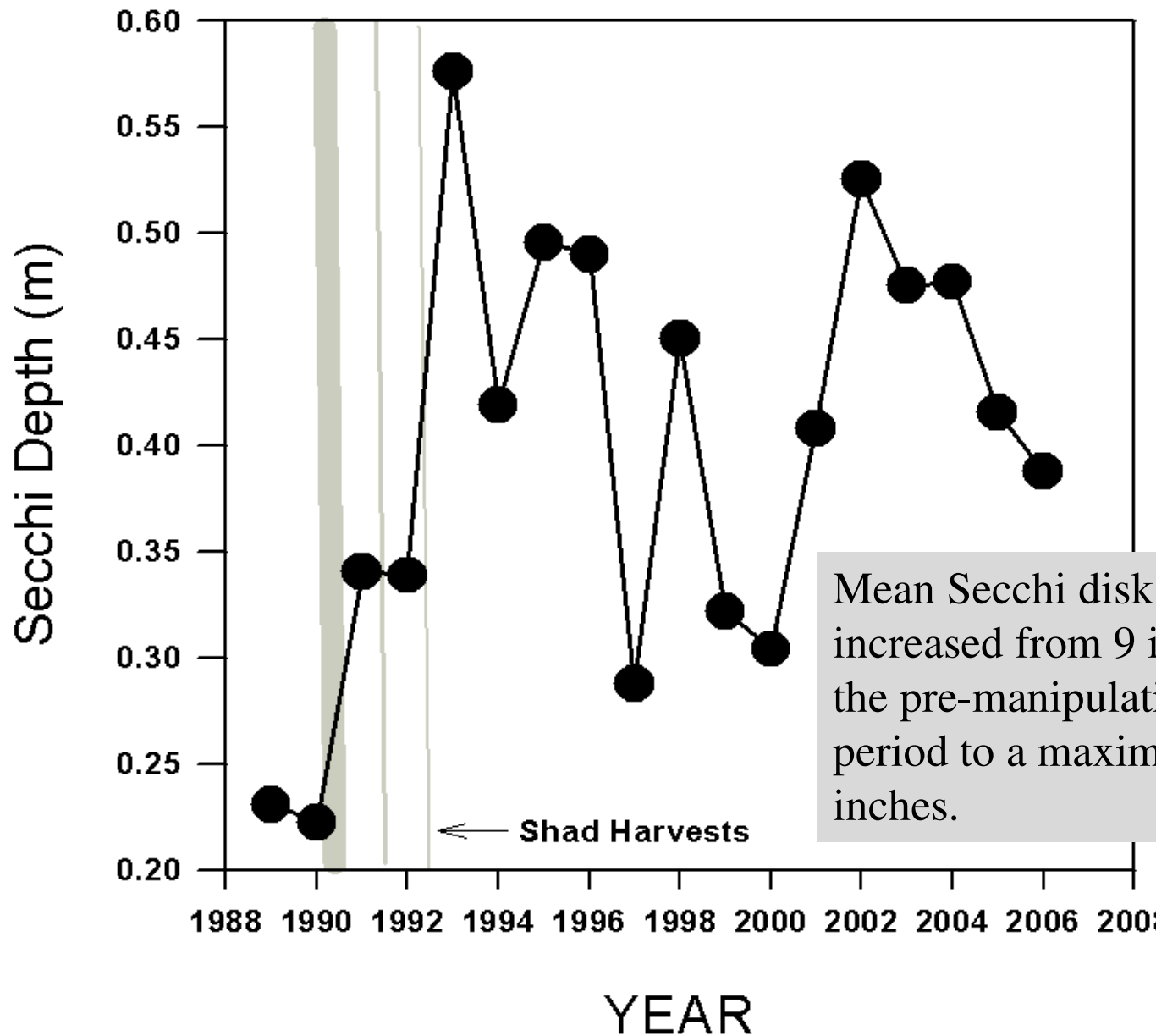
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Lake Denham Experimental Harvest



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Lake Denham Experimental Harvest



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Lesson Learned in Lake Denham

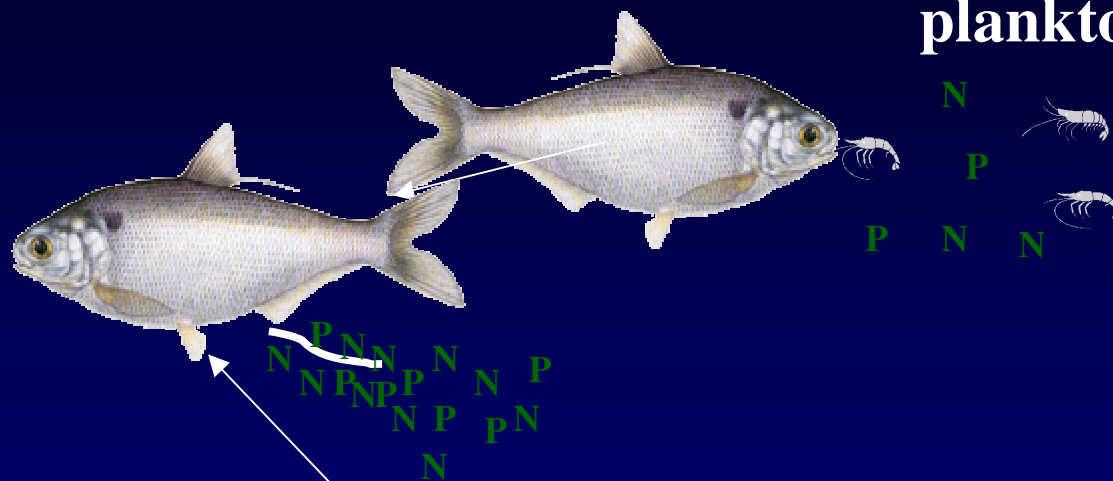
- Shad harvests alone, with no watershed nutrient load reductions were sufficient to improve water quality for several years following the harvest



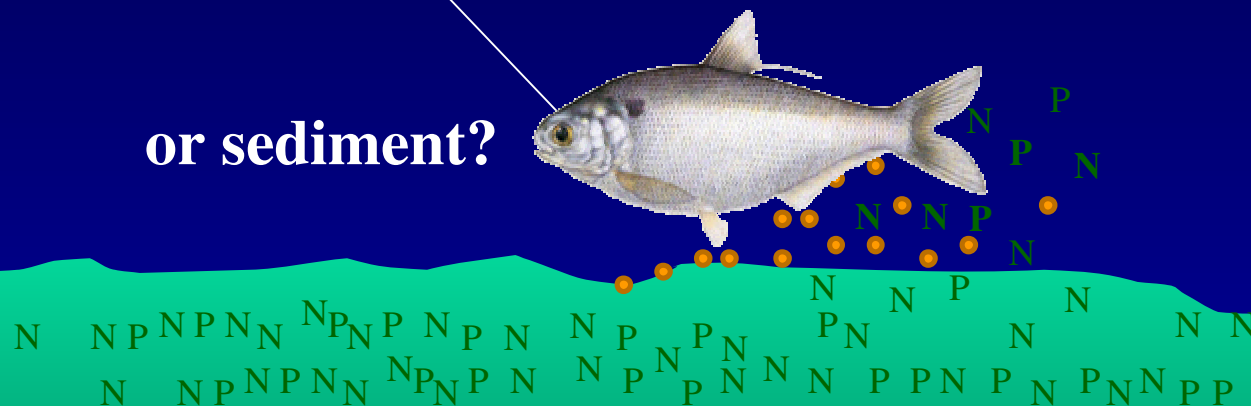
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Impact of gizzard shad on water quality depends on where shad do most of their feeding...

plankton?



or sediment?

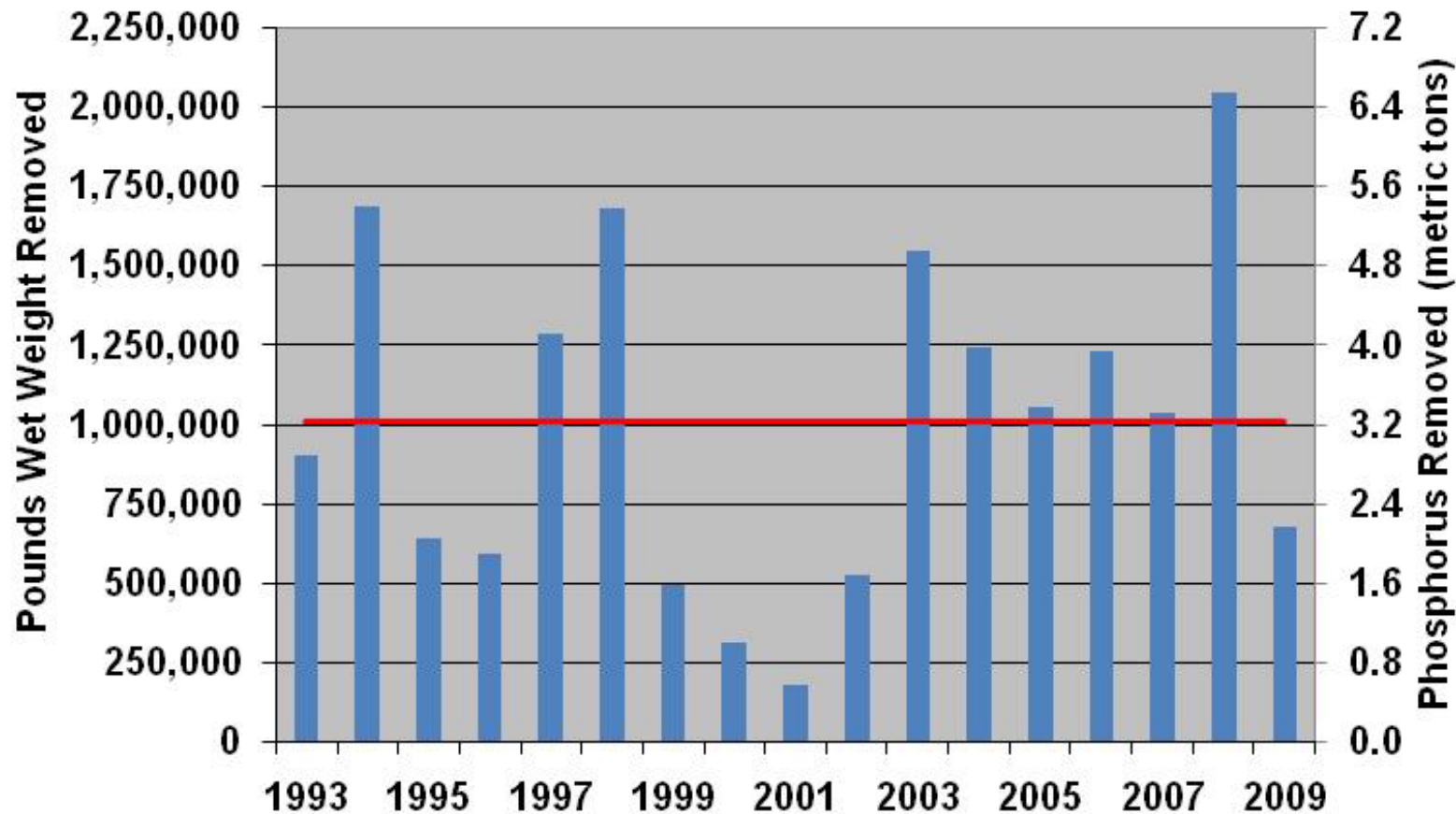


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Lake Apopka

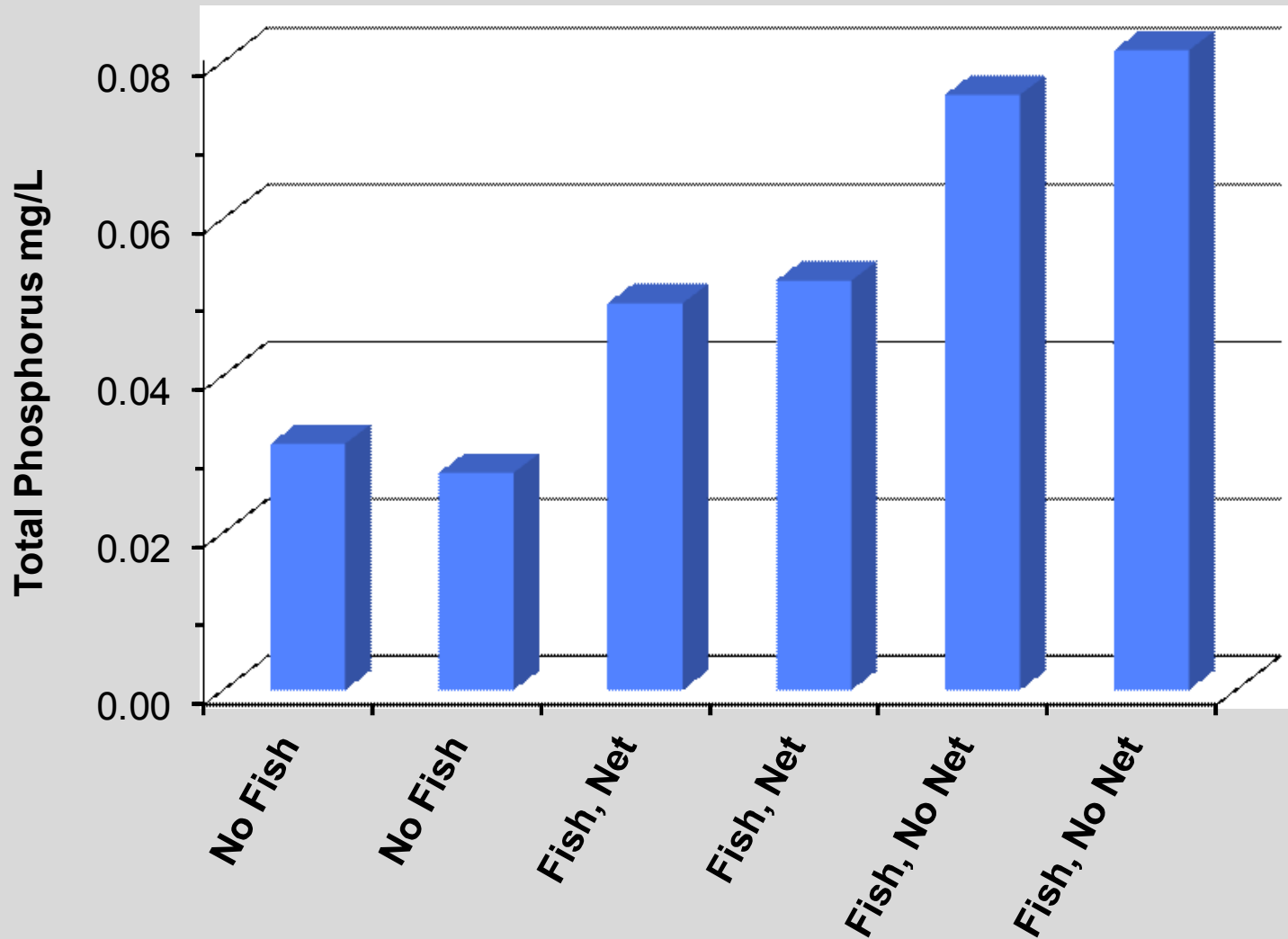
Rough Fish Harvest Totals

Lake Apopka Rough Fish Harvest - Pounds of Fish



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Phosphorus Concentration in Gizzard Shad Tank Experiment



May 2007 Experiment, Mean days 1 – 3, large and small fish labels not shown



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Tank with shad shows greatly elevated turbidity and solids

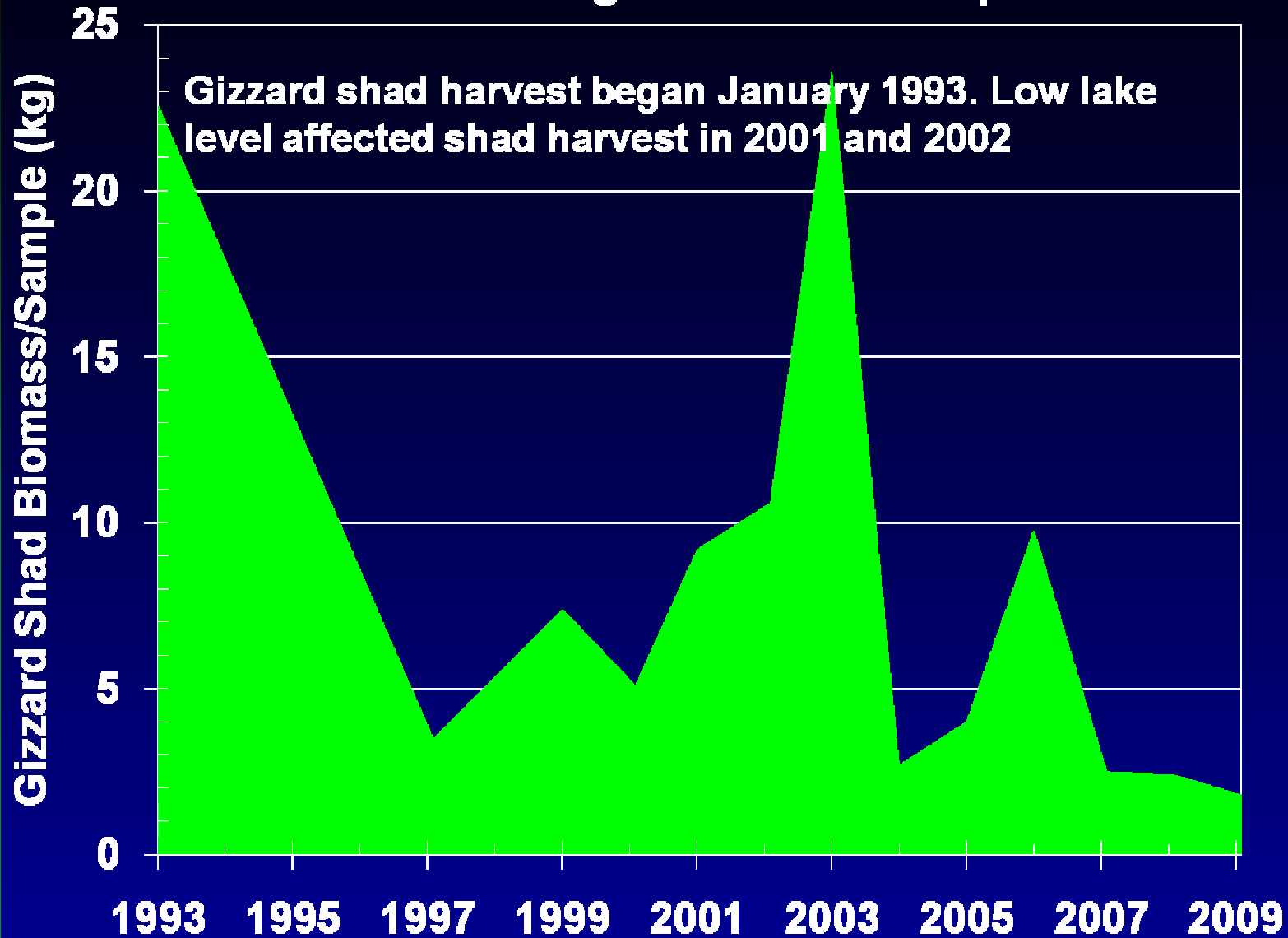
Tank with shad

Tank without shad



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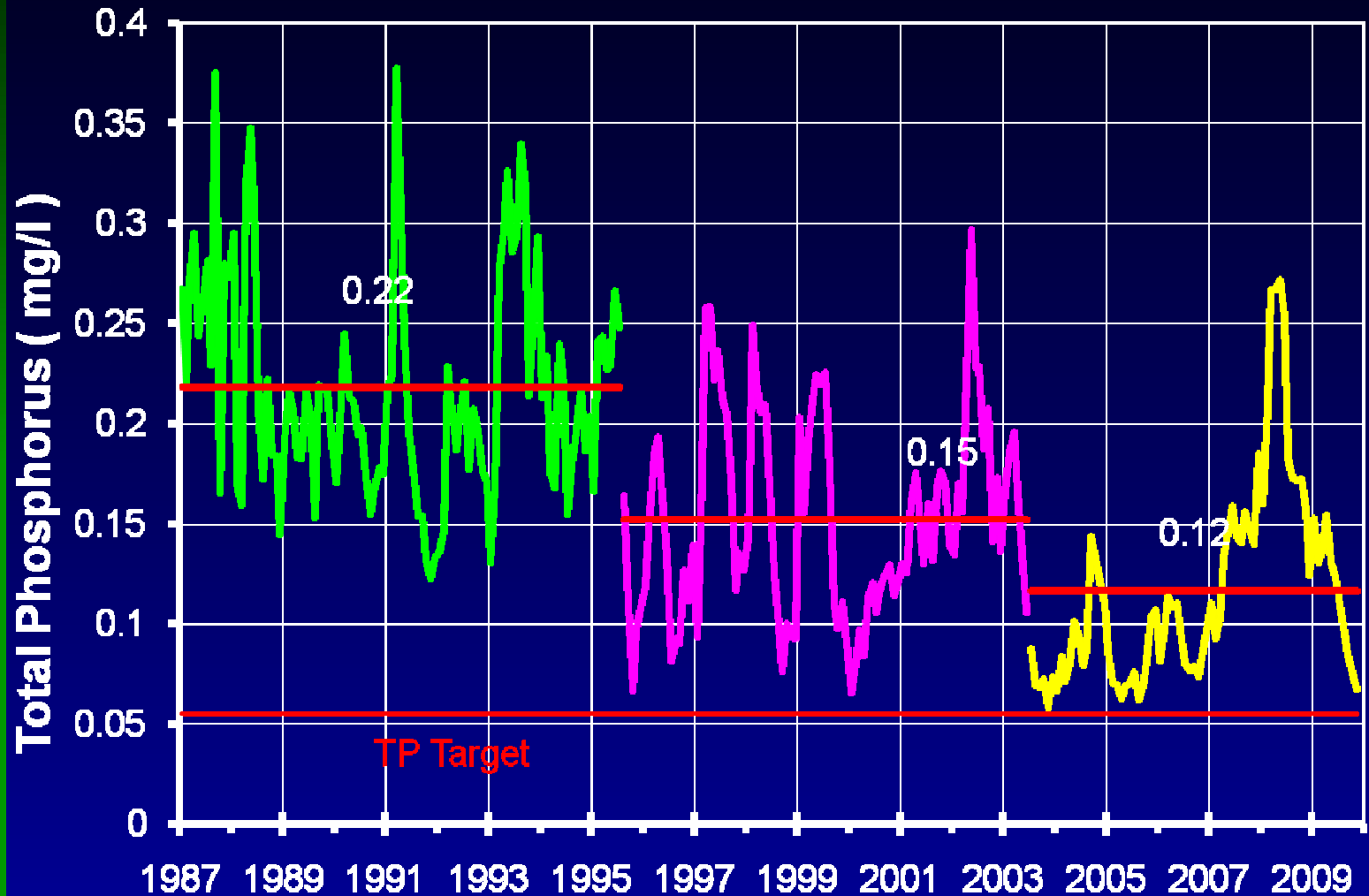
Lake Apopka Experimental Gill Net Samples Pre-Harvest Average Biomass/Sample



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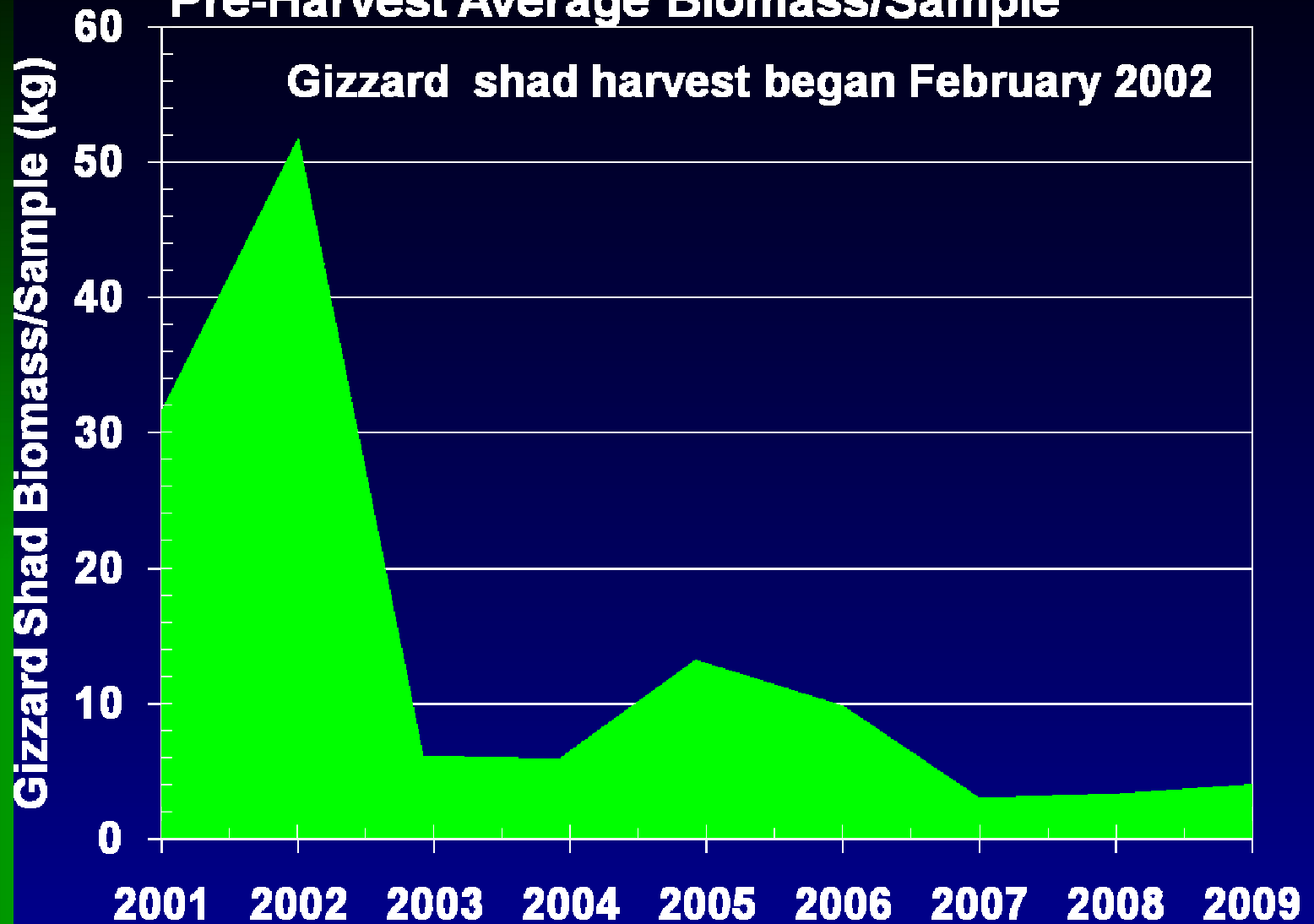
Lake Apopka

L. Apopka Mean Monthly Total Phosphorus. 1987 through November 2009



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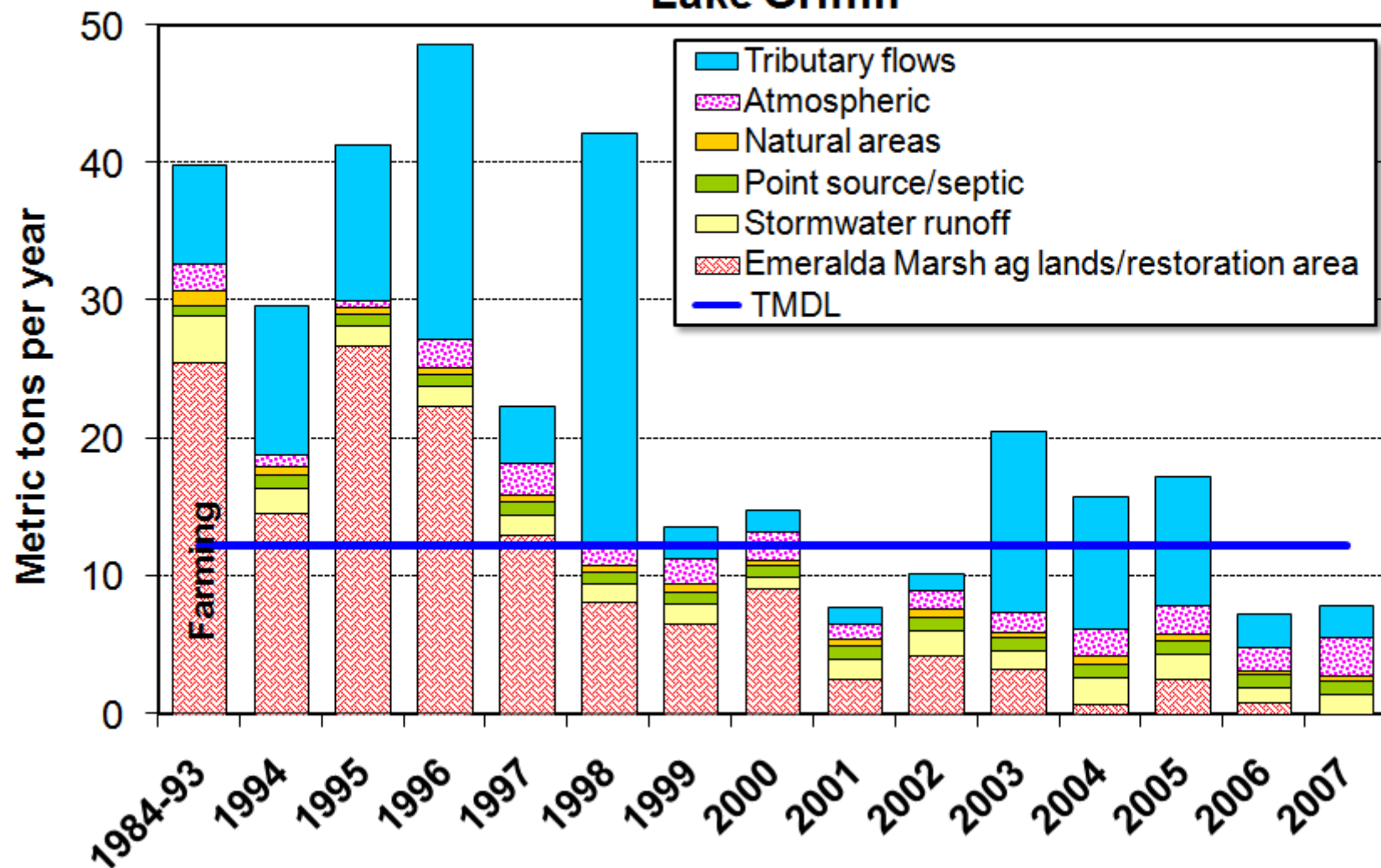
Lake Griffin Experimental Gill Net Samples Pre-Harvest Average Biomass/Sample



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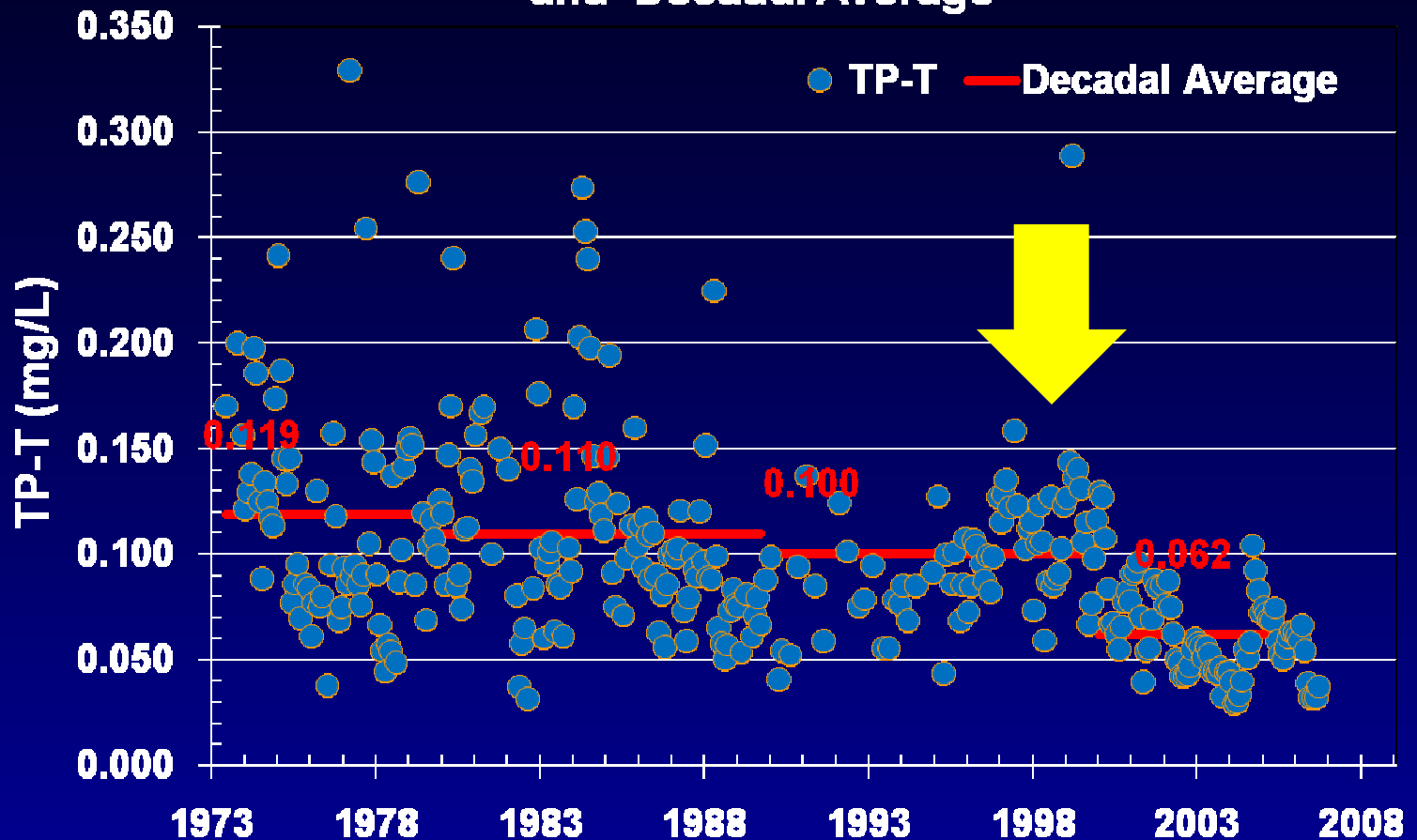
Lake Griffin

Estimated annual external total phosphorus loads to Lake Griffin



Lake Griffin Phosphorus

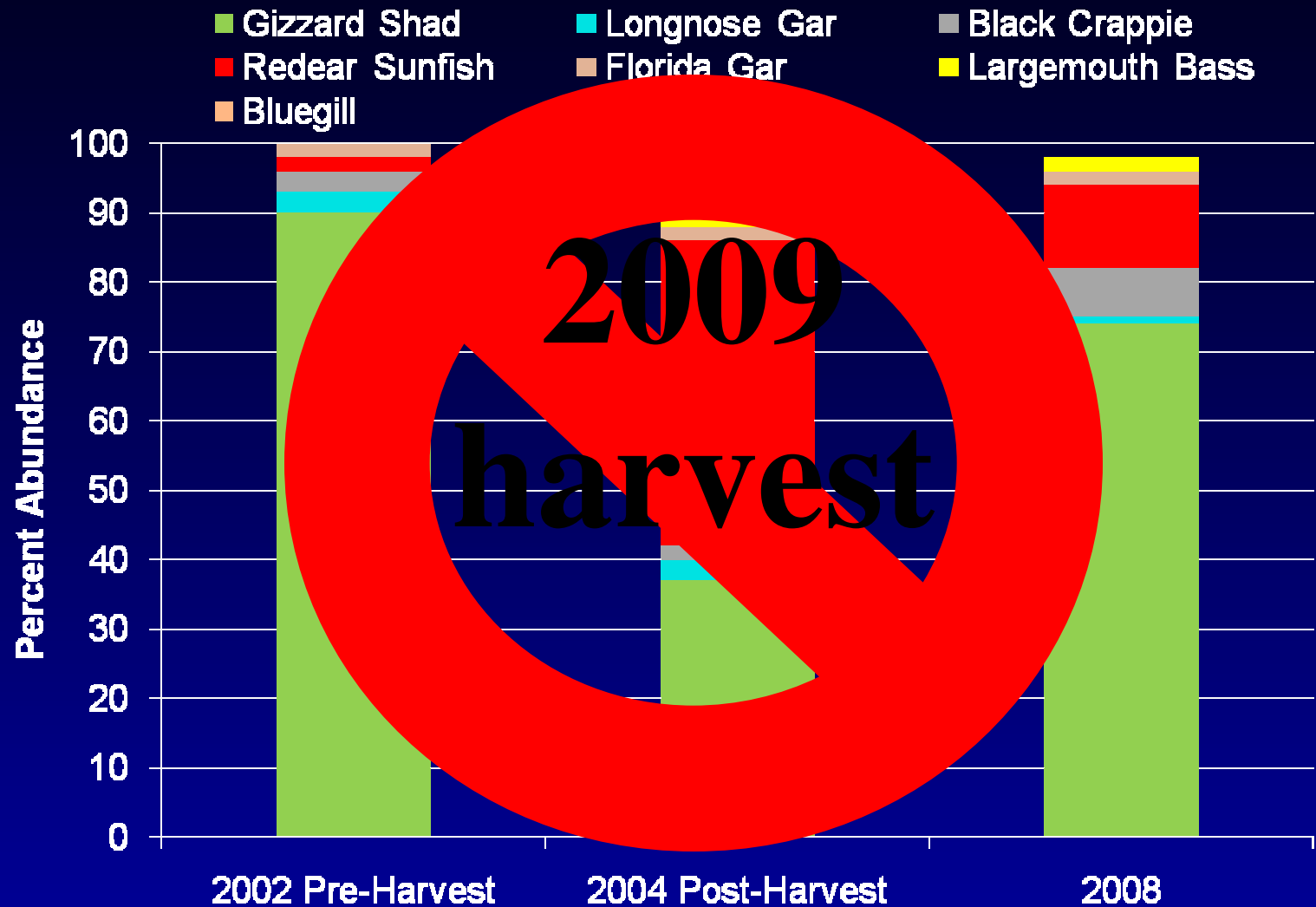
Lake Griffin Monthly Average Total Phosphorus
and Decadal Average



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Lake Griffin Fisheries Recovery

Lake Griffin Fish



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Harvest Lake Comparisons

Fall 2007

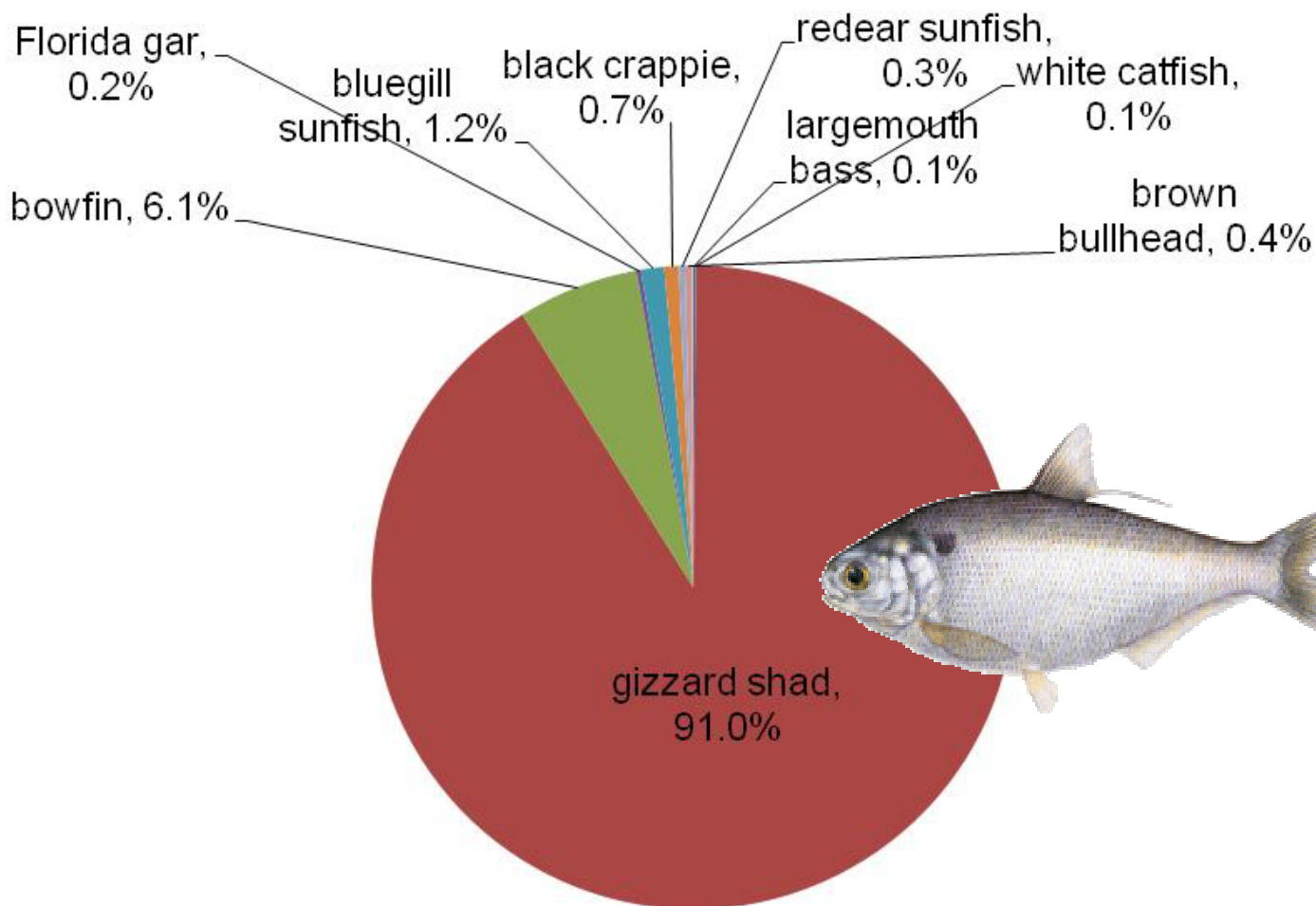


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Newnans Lake Fish Composition survey nets (by numbers) 2005-2009

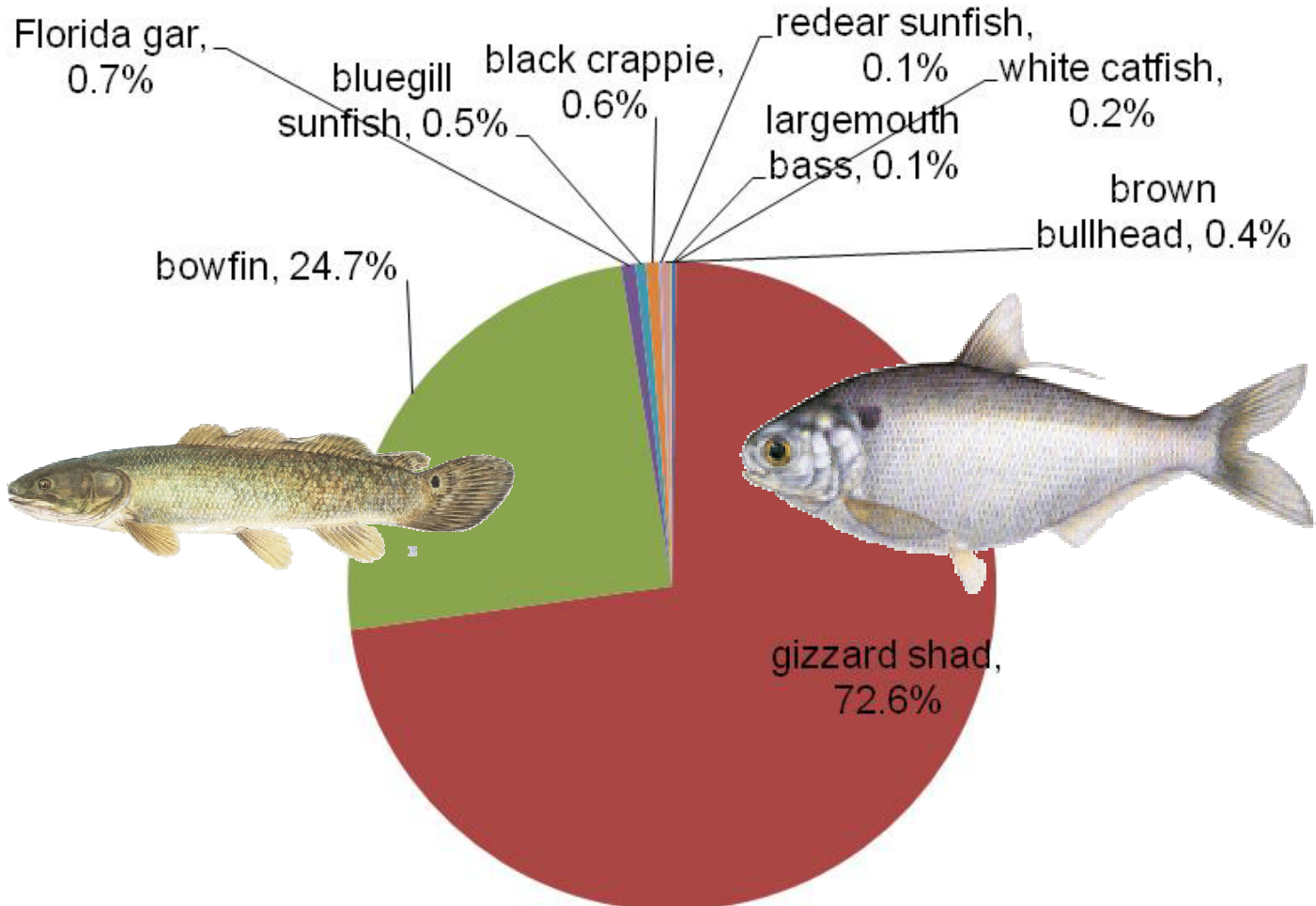
Newnans Lake Exp Gill Net By Numbers



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Newnans Lake Fish Composition survey nets (by weight) 2005-2009

Newnans Lake Exp Gill Net By Weight



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Newnans Lake

Rough Fish Harvest Experiment

- Goal: remove 500,000 pounds of shad per year for three years (2010 – 2012)
 - ~6 weeks of harvest
 - 8-9 boats using gill nets
- Operate within FWC's permit conditions
- Use small portion of Powers Park (both boat ramps will remain open)
- Monitor water quality and fishery effects within Newnans Lake



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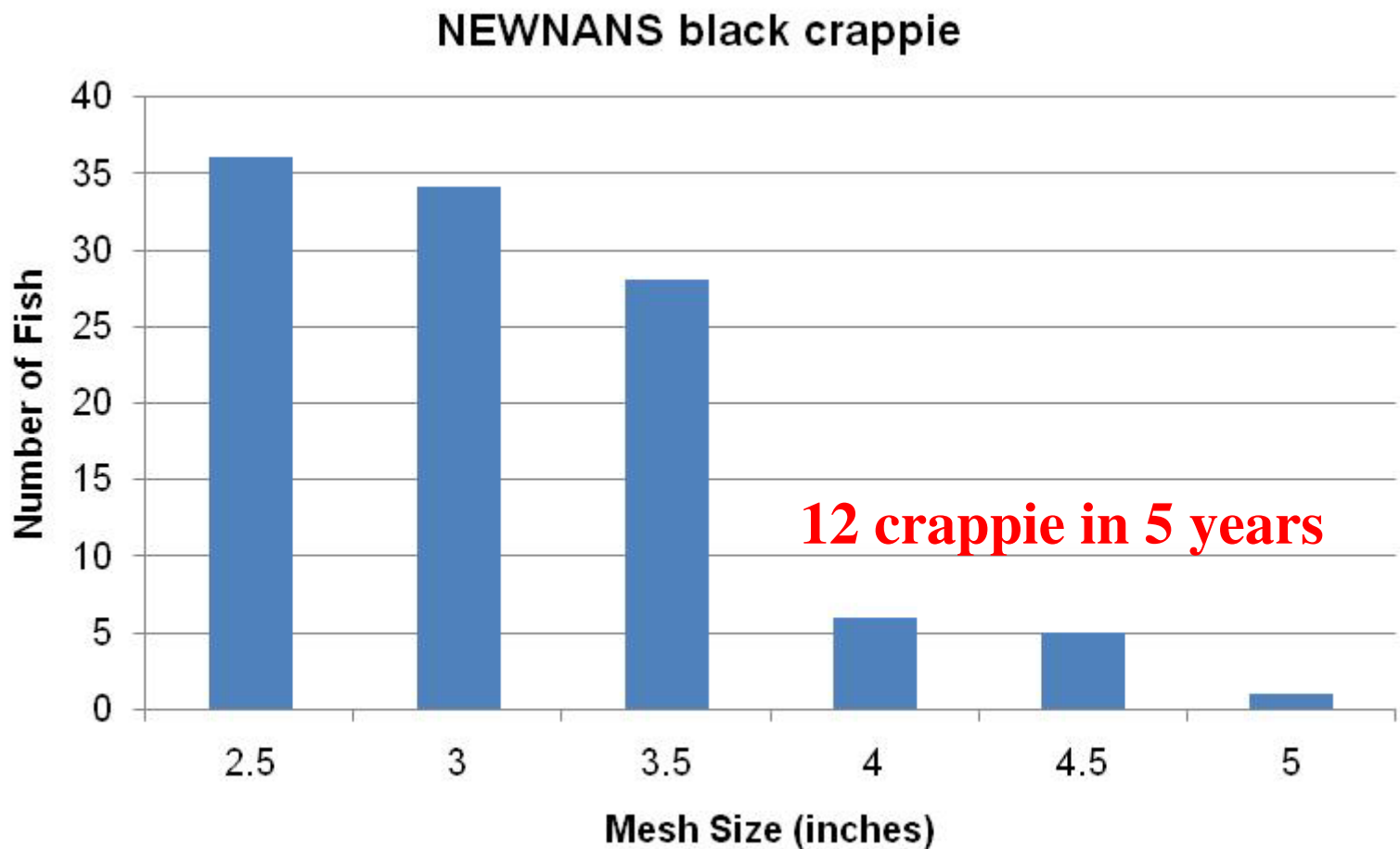
Minimizing By-Catch Is Essential

- Season – when crappie are in shallows and shad are in open water
- District holds fishers' permits and fines fishers who violate permit conditions (zero tolerance)
- District hires fishery biologist to oversee fishers & gather by-catch data every day of harvest
- FWC permit specifies a variety of conditions
 - Rough fish species harvested (gizzard shad, gar, bowfin, tilapia)
 - Net size (mesh ($\geq 4''$) and total length)
 - Net soak times (2 hours)



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Newnans Lake black crappie survey net totals (2005-2009)



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Other Issues

- Harvest will occur Monday – Friday, (Saturday possible, depending upon number of sport fishers)
- District is supporting FWC study of crappie population in Newnans
- Shad are sold by processor for crab and crayfish bait
- District has successfully conducting shad harvests since 1993. One of the most cost-effective phosphorus removal tools available.



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Newnans Harvest Plans for 2010 - 2012

- Harvest ~ 227,000 kg (500,000 lbs) of rough fish in 2010
 - Direct P removal ~ 1,600 kg P
 - Estimated P recycling reduction ~ 7,000 kg P



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Context of P Reduction

- Current Annual External P Load ~ 12,700 kg/yr (District PLRG ~ 6,130 kg/yr)
 - Direct Removal ~ 12.5%
 - Recycling Reduction ~ 55%
 - Combined ~ 68%
- Water Column P Inventory ~ 5,000 kg
 - Direct Removal ~ 32%
 - Recycling Reduction ~ 140%
 - Combined ~ 170%



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Context of P Reduction

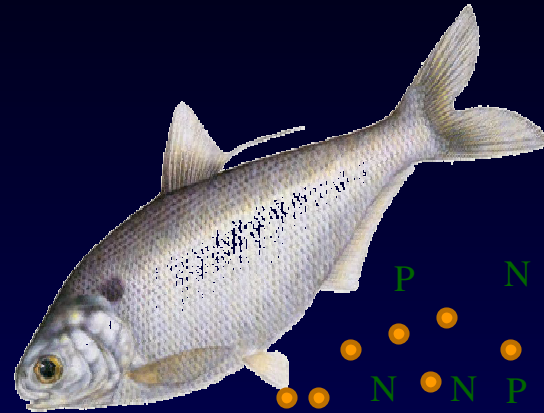
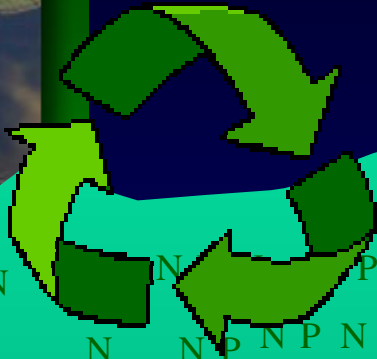
- Surficial Sediment P Inventory
top 20 cm ~ 326,000 kg (~ 22 yrs accumulation)
 - Direct Removal ~ 0.5%
 - Recycling Reduction ~ 2.1%
 - Combined ~ 2.6%
- To what sediment depth does shad feeding & bioturbation extend?
- Surficial Sediment P Inventory
top 10 cm ~ 163,000 kg
(~ 11 yrs accumulation)
 - Direct Removal ~ 1%
 - Recycling Reduction ~ 4.2%
 - Combined ~ 5.2%



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“Internal Loading” & “Internal Recycling”
“Sediment Nutrient Loading” & “Sediment Nutrient Recycling”

Recycling



Surficial, Younger Sediments

Net Deposition

Deeper, Older Sediments

Net Loading



Shad Removal

- Removes nutrients from
 - water column
 - young, surficial sediments
- The benefits of shad removal should be linked to the mass of shad removed
 - Altered by temperature & body size effects
 - Shortens time between when nutrients enter lake from watershed and when they are permanently buried
 - Should hasten water quality responses to external nutrient load reductions (future)



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Est. Shad Removal Costs

- Newnans Lake – Year One
 - \$275,000 = 500,000 lbs shad @ \$0.55/lb
 - \$29,000 on-site processing (mob, demob, etc.)
 - \$21,175 fishery monitoring (District & FWC)
- \$325,175
 - \$92.71/lb P direct removal
 - \$13.24/lb P including 7X recycling



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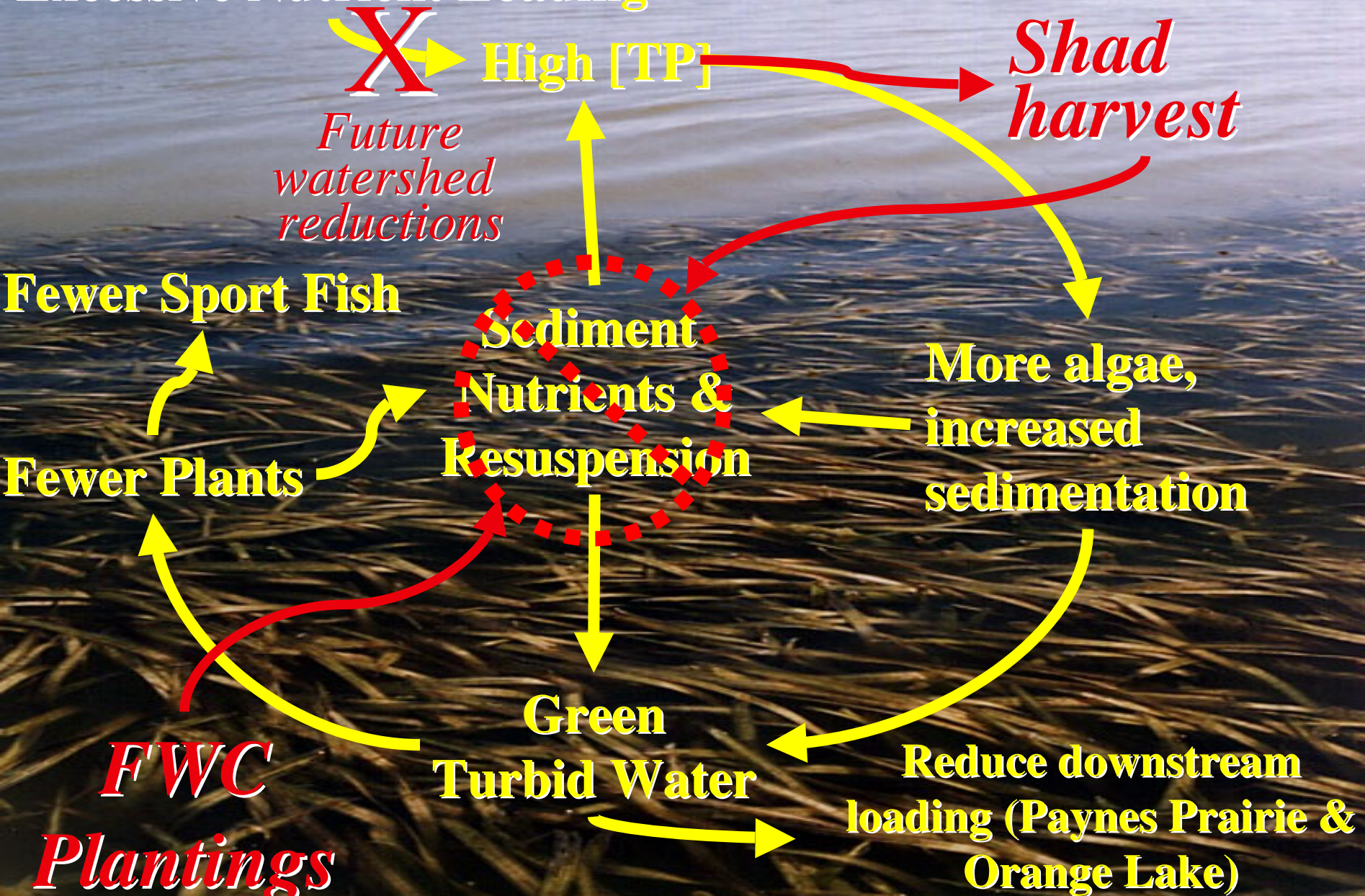






Newnans Lake Restoration Efforts

Excessive Nutrient Loading



Questions?



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