Refugia in a Novel Ecosystem: Everglades Snail Kite in Florida

Wiley Kitchens

Chris Cattau

Zach Welch

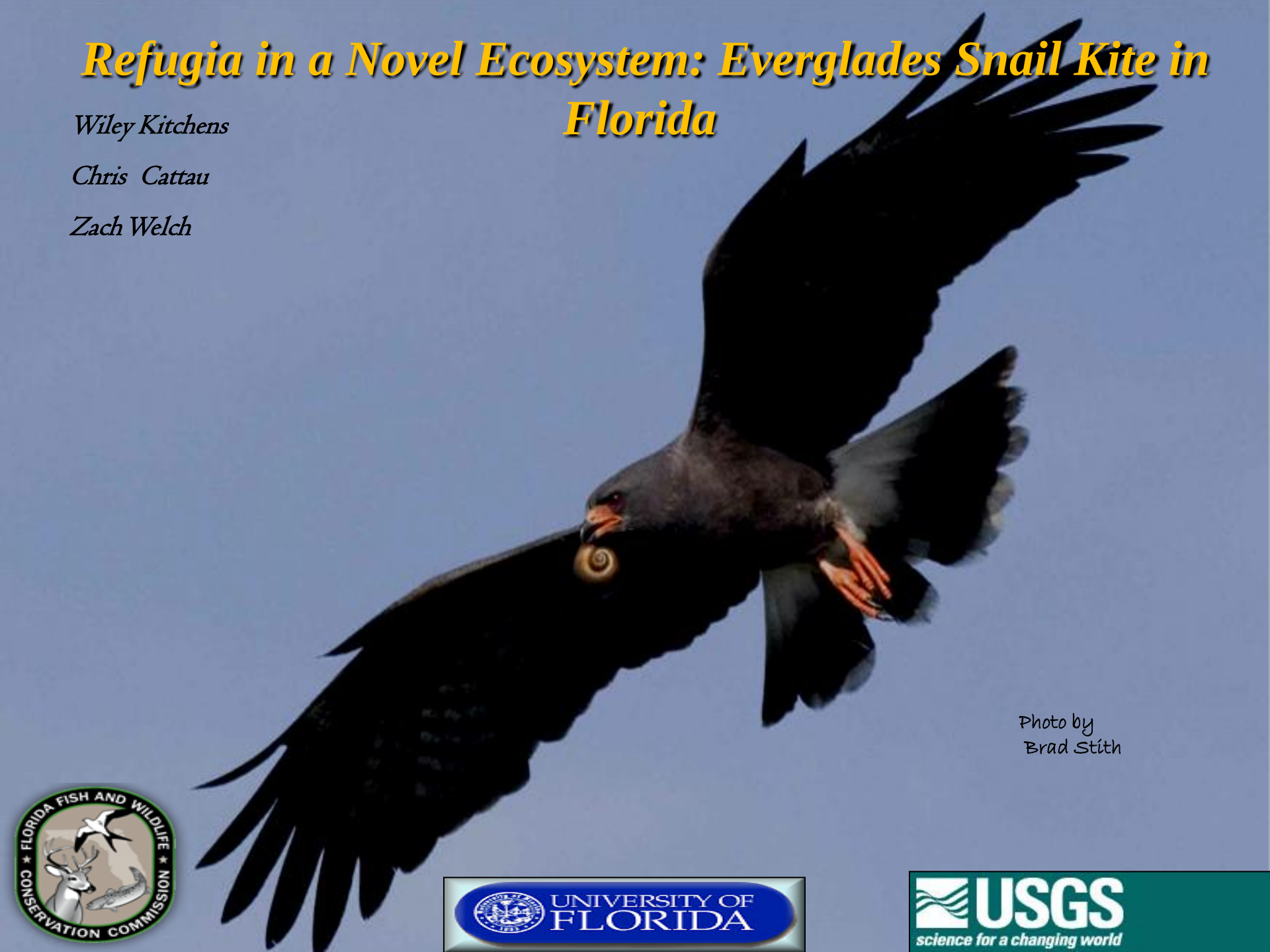


Photo by
Brad Stith

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

UNIVERSITY OF FLORIDA

USGS
science for a changing world

Snail kite in Florida Sentinel/Indicator ?

Food specialist

Endangered species

Closed population

Wetland dependent

Confined to C. and S. FL

STUDY DESIGN

1992-Present

Airboat surveys during breeding season

Nest Monitoring –Reproduction

- #'s
- Locations
- Success
- Young fledged

Mark-Resight Protocol – Demographic Vital Rates

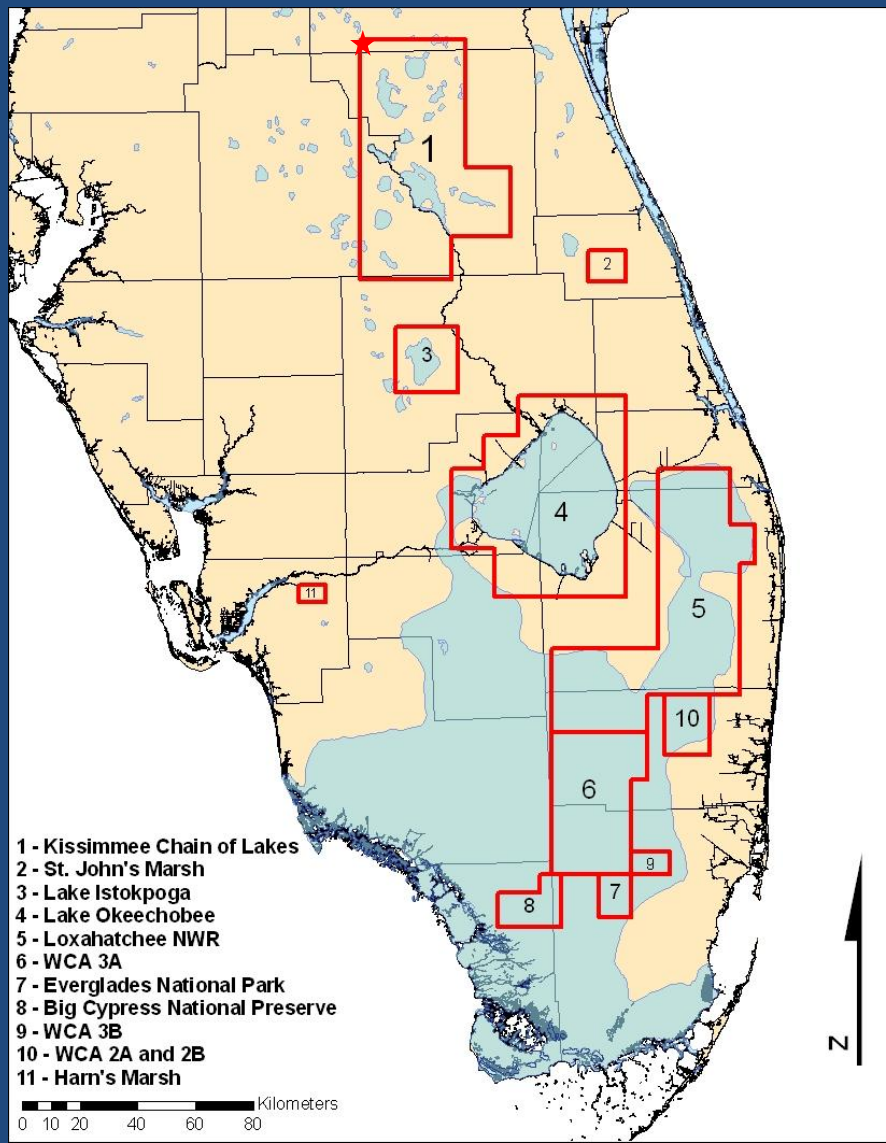
- Survival
- Movement
- Population estimates
- Breeding probabilities
- Population Age structure

Statistical Modeling Protocols

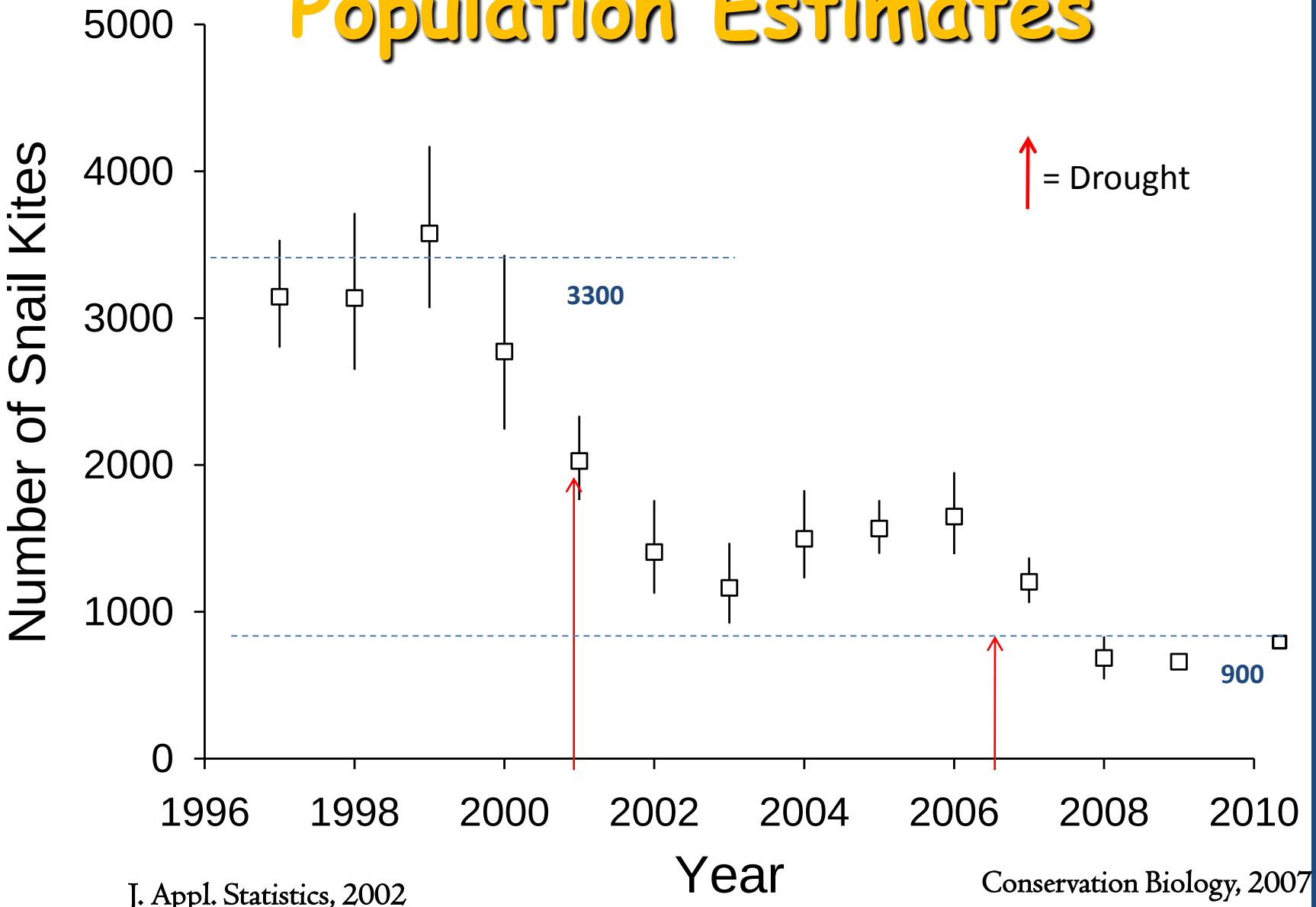
- Cormack-Jolly-Seber,
- Multi-state models,
- Robust Design,
- Logistic Regressions

Matrix Models

- Population Projection Models
- Population Viability Models



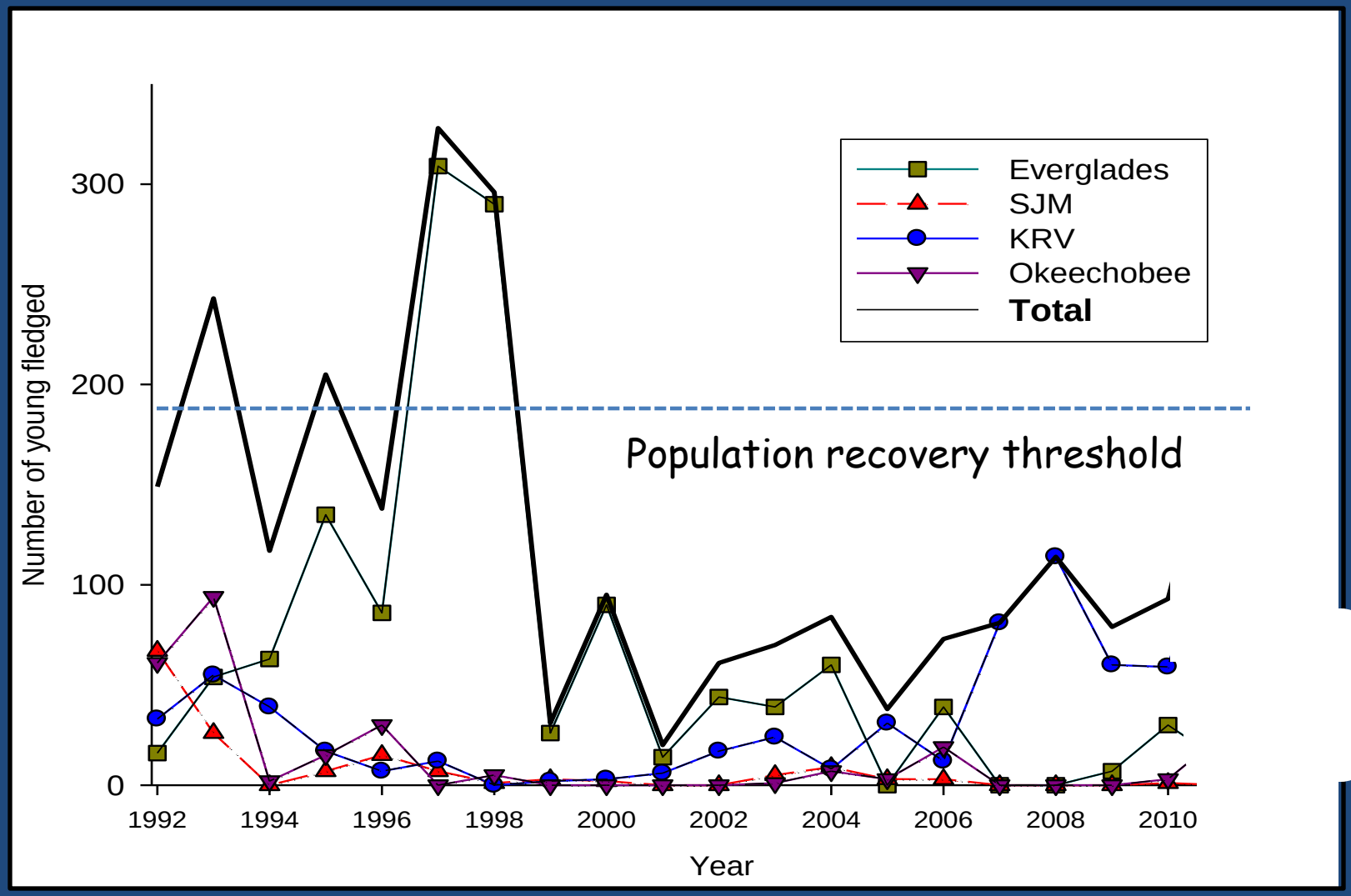
Population Estimates



J. Appl. Statistics, 2002

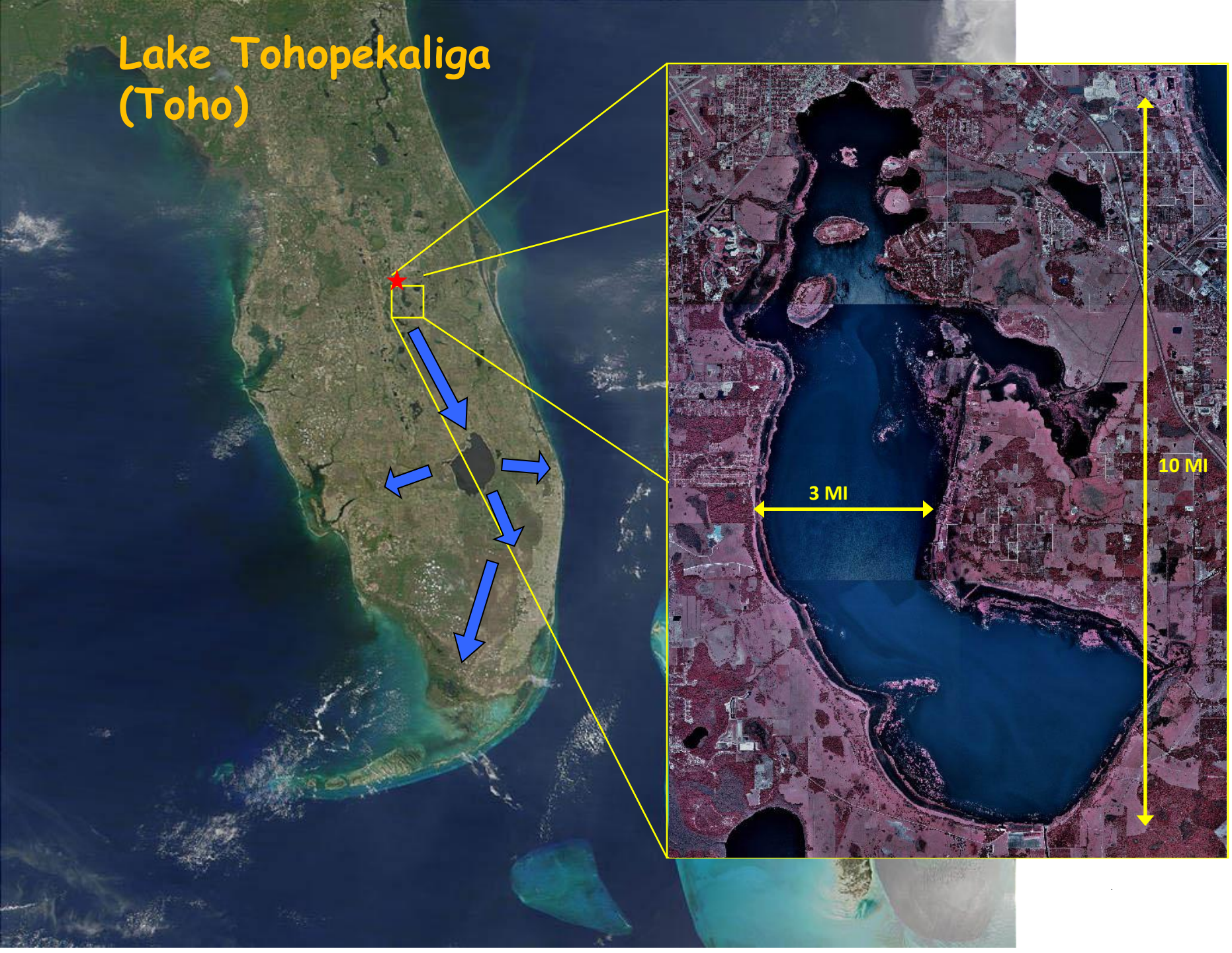
Conservation Biology, 2007

Total Young Produced Annually

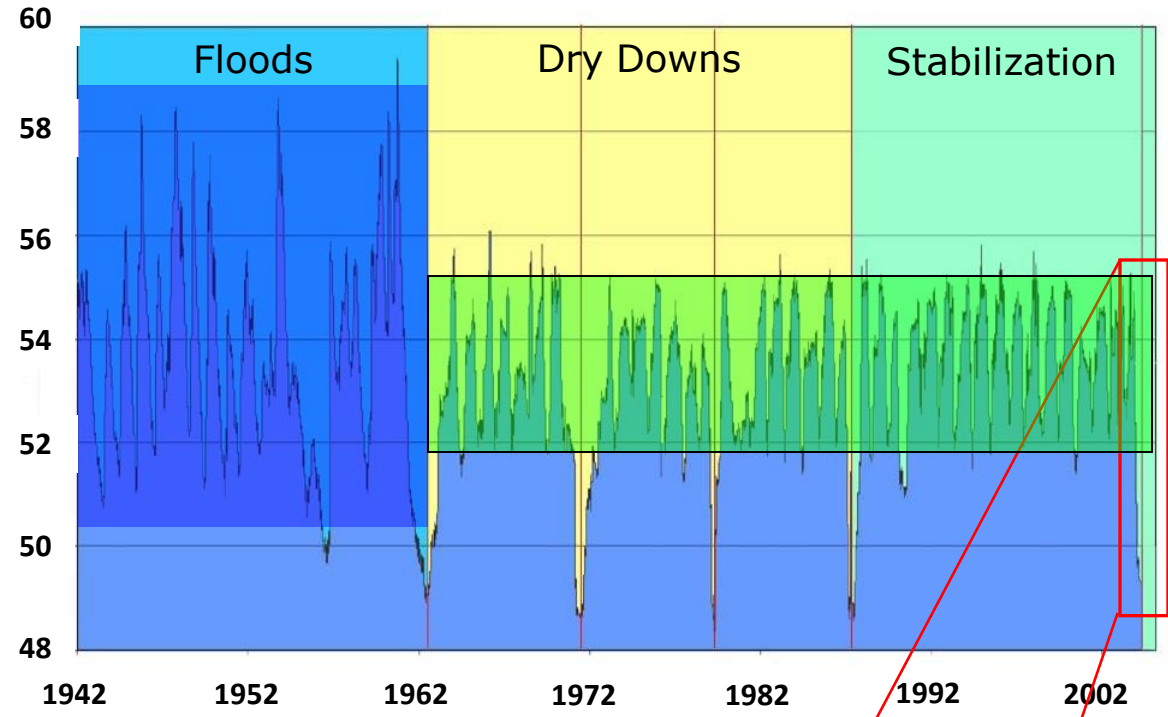


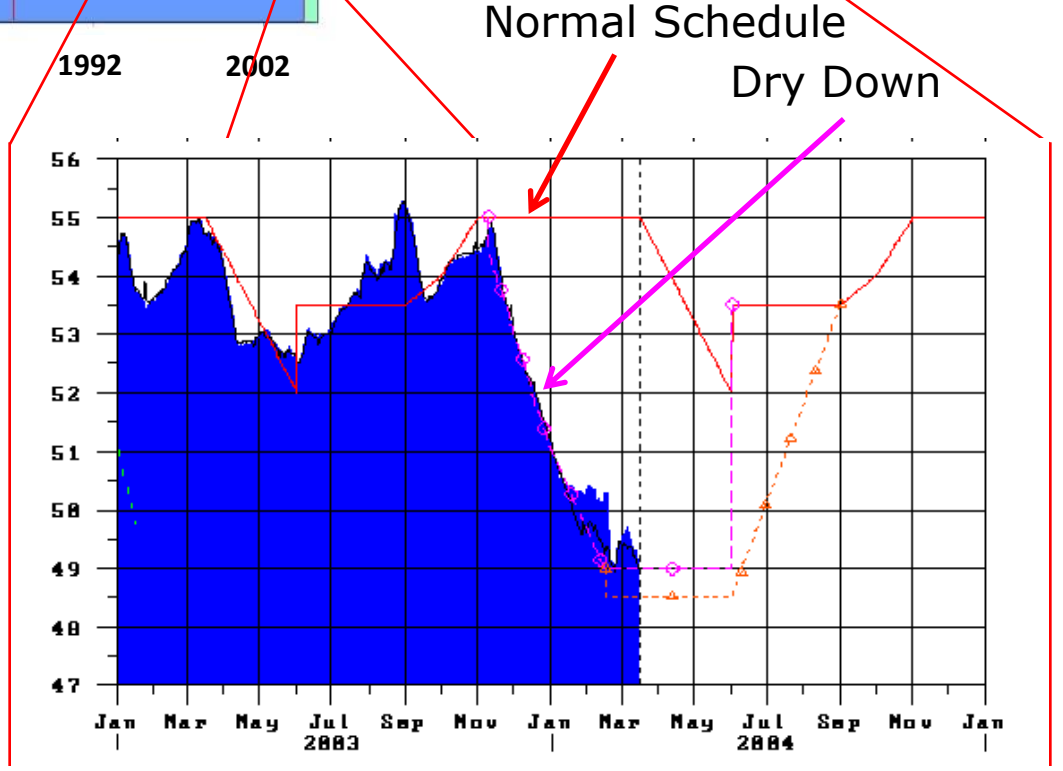
So What About Novelty?

- This is Florida
- First focus on L. Toho
- Extension to range
- Dim light at the end of the tunnel ?


Lake Tohopekaliga
(Toho)
3 MI
10 MI

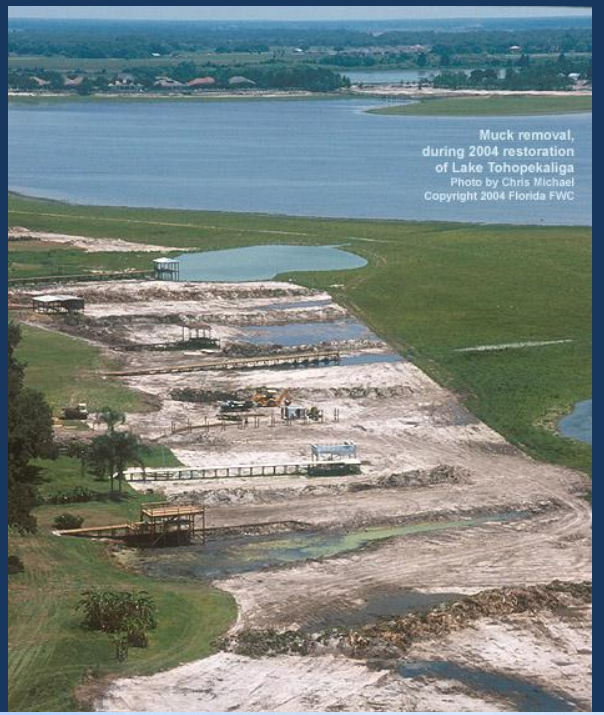
Water Management





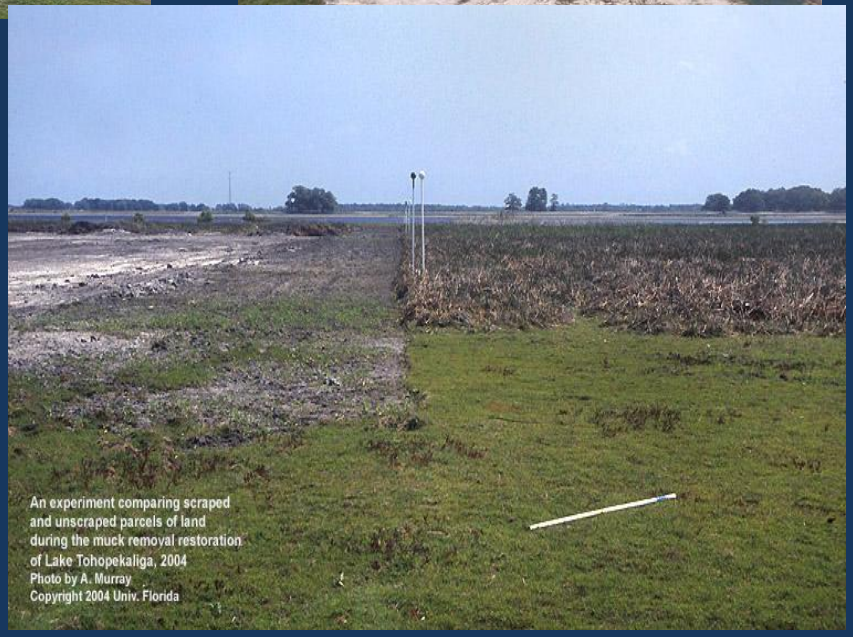
Extreme Drawdown	Muck Removal
1962 (Natural drought)	None
1971	None
1979	None
1987	225,000 cu yds
2004	9,000,000 cu yds

2004 Extreme dry down and scraping

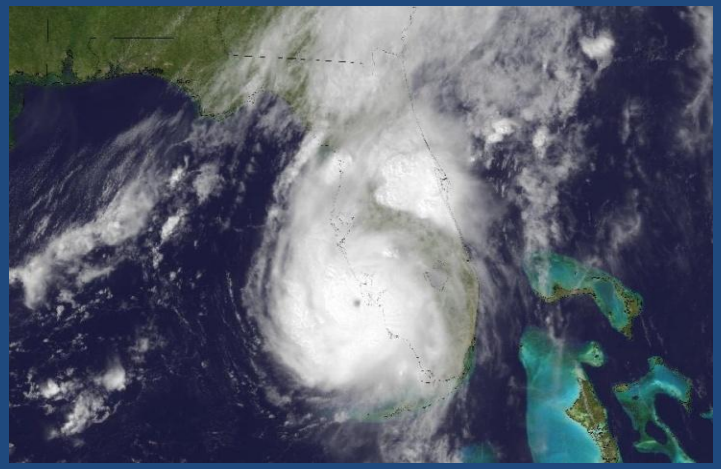


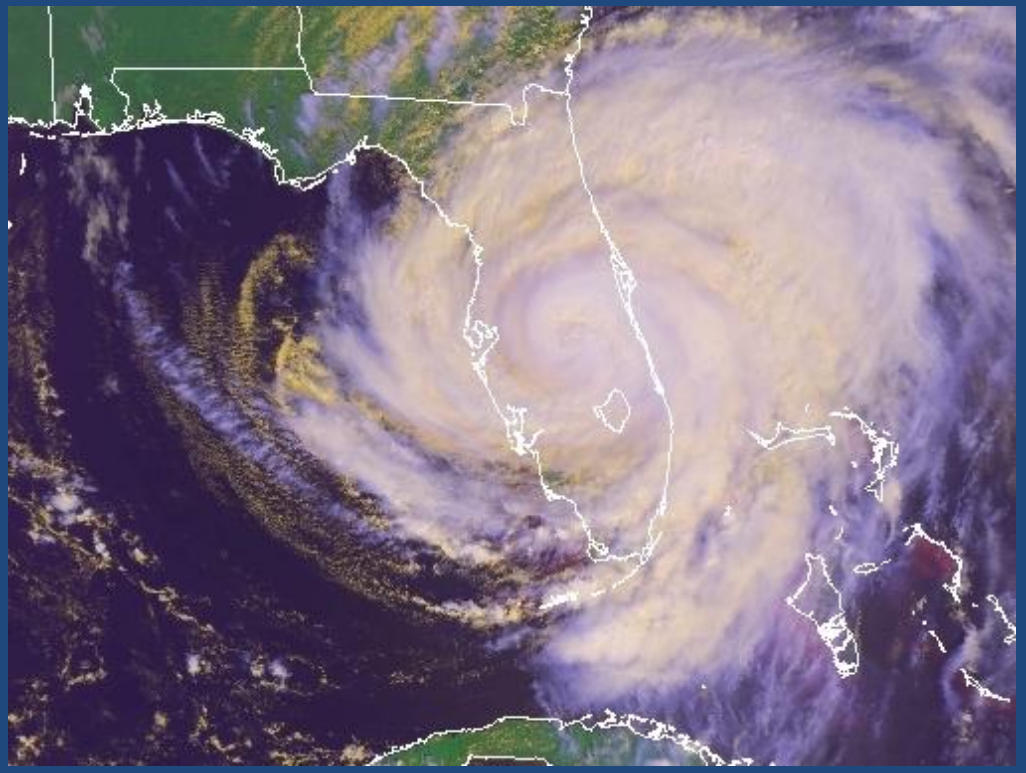
- Exposed 40% of lake bottom
- 3,700 acres scraped

- 7, 971,770 yds^3 of muck were removed for a total cost of $6,448,926.78
- 29 in-lake disposal islands



Other Complications

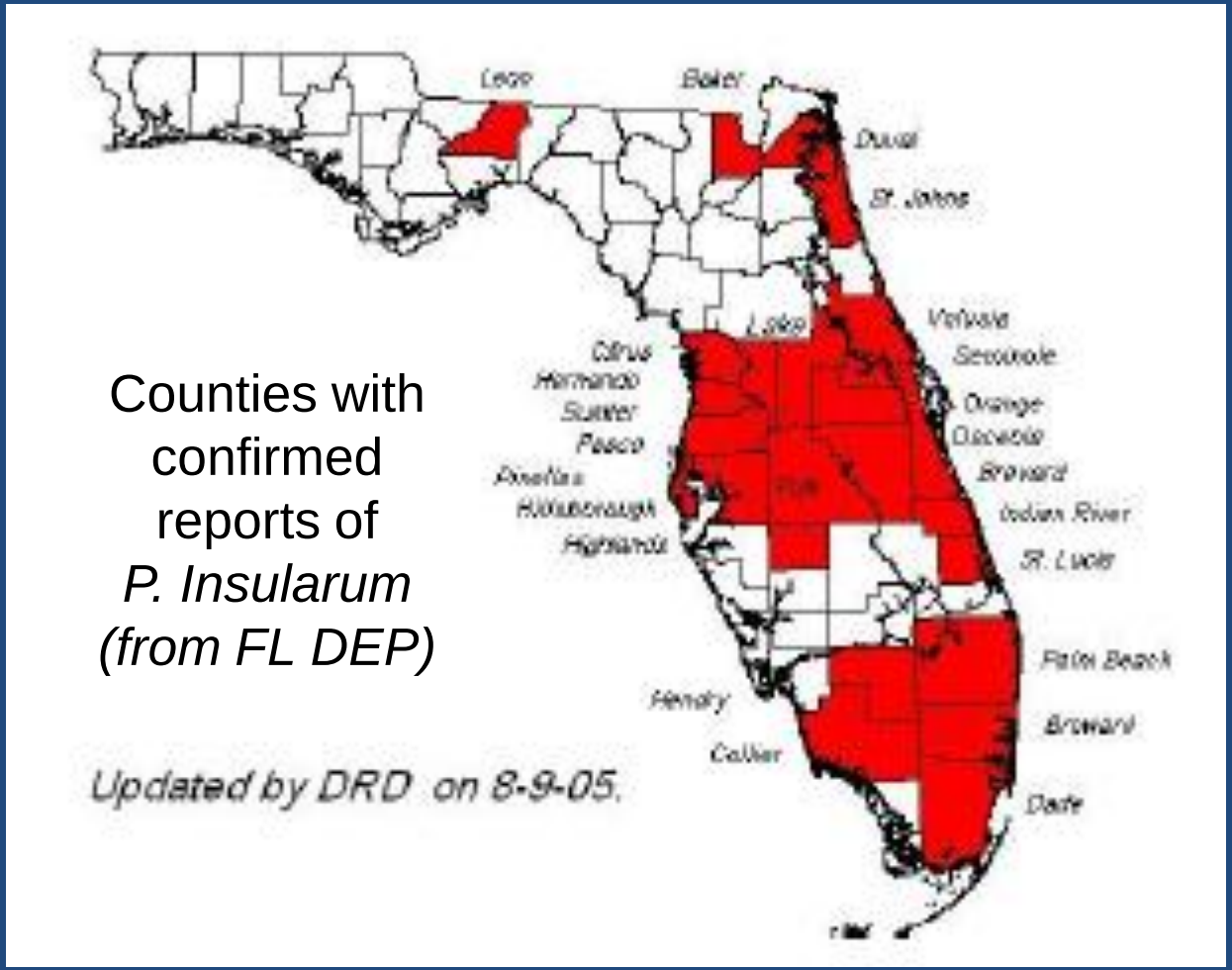




Rapid Re-flooding

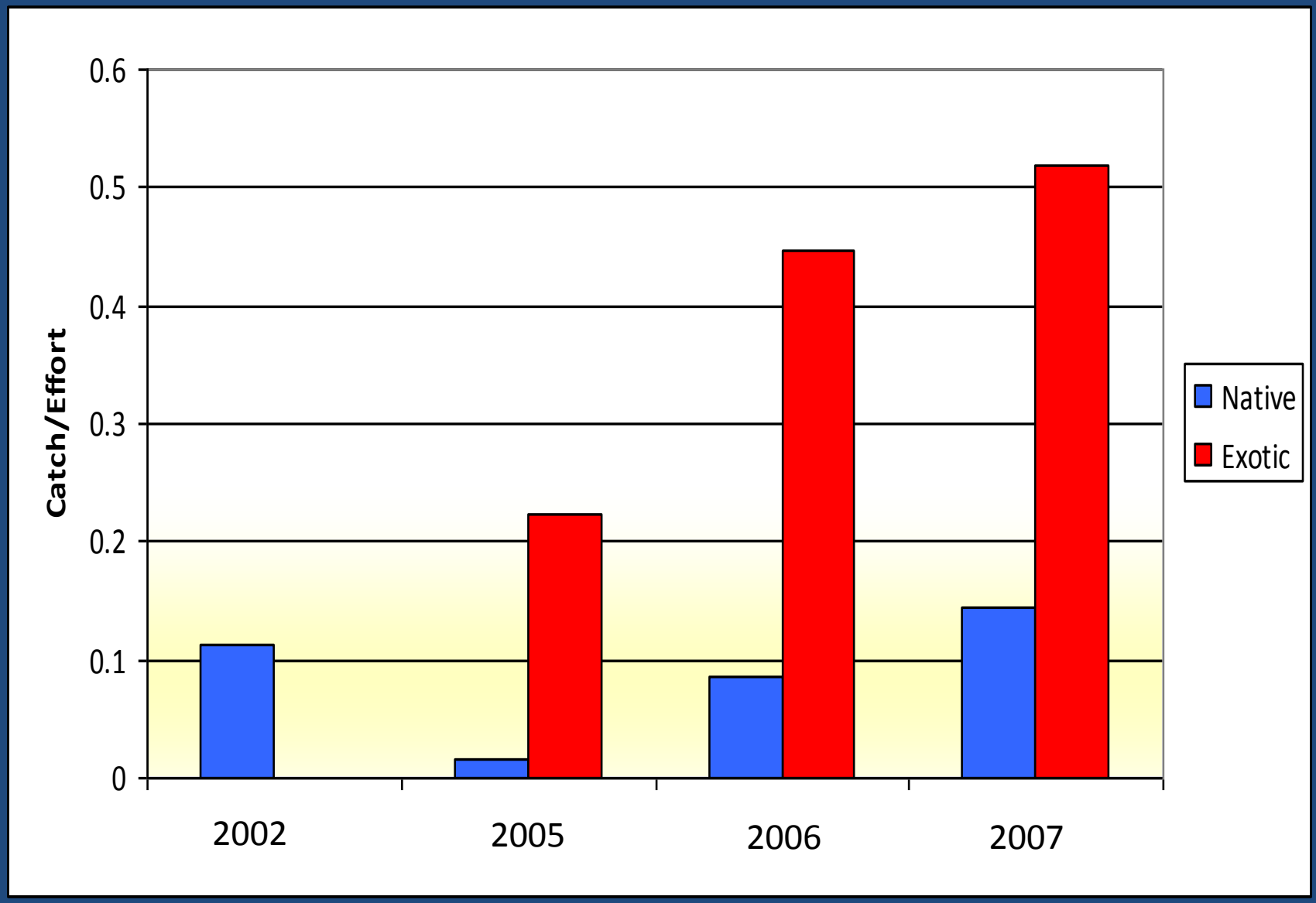
A new threat or not? – The invasive, exotic Island apple snail (*Pomacea insularum*)

- Native to Argentina, Brazil, and Bolivia
- 2002: Confirmed in U.S.
- 2004-2006: Populations spread rampantly throughout Florida

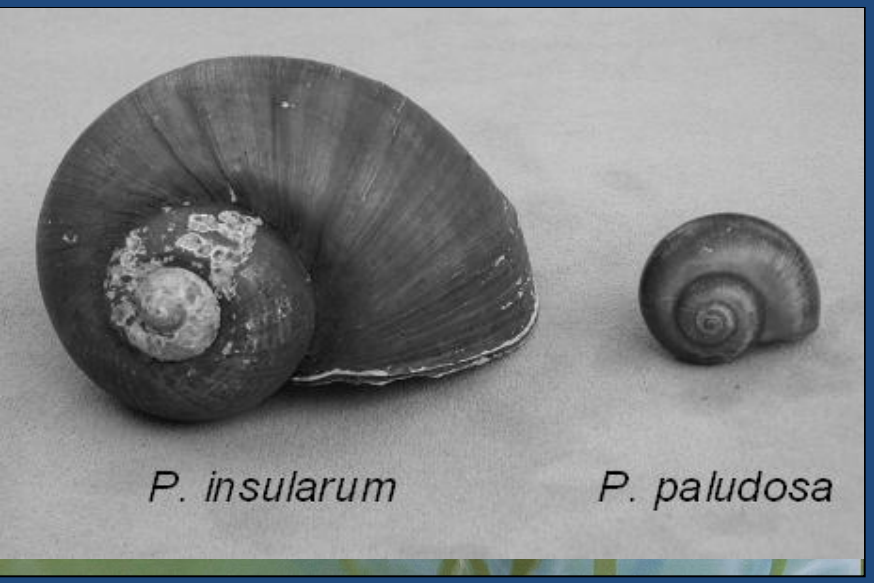


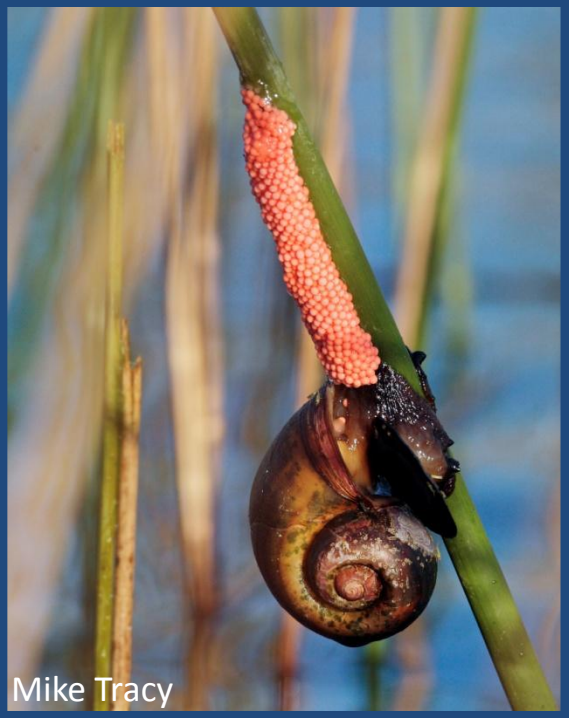
Counties with confirmed reports of *P. Insularum (from FL DEP)*

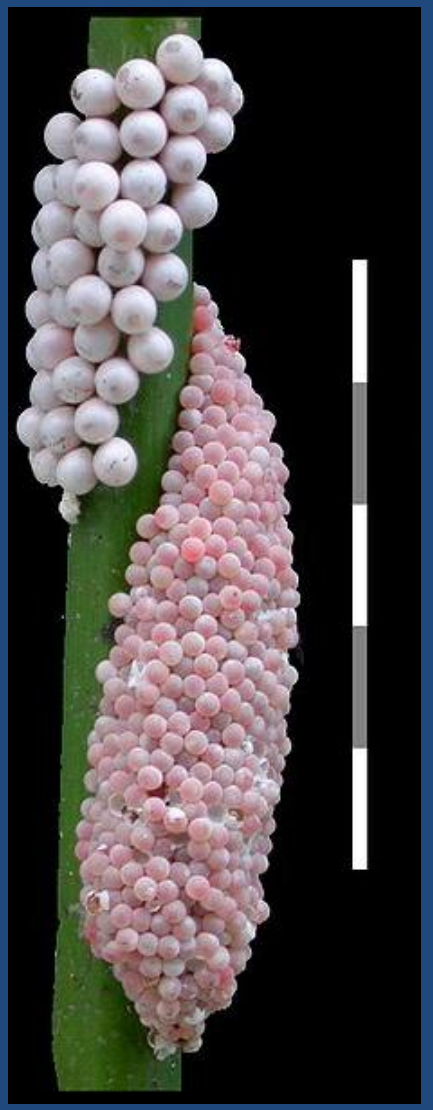
Exotic Invasion of Lake Toho



Exotic Snails

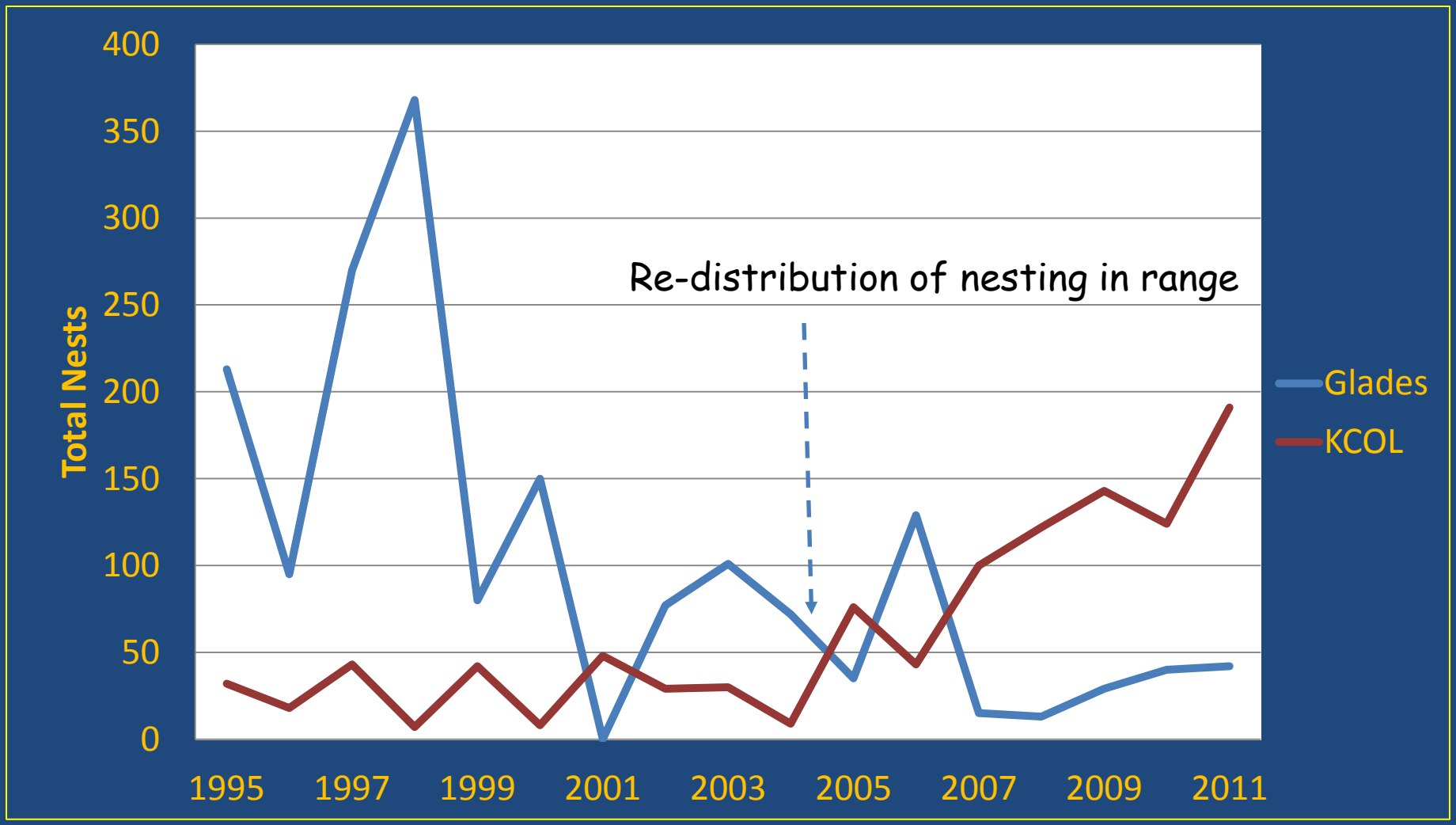






- 30x more eggs in clusters
- Twice as large, 2-3 times longer-lived
- More clusters per year
- More drought (chemical?) tolerant
- Eat plants instead of periphyton

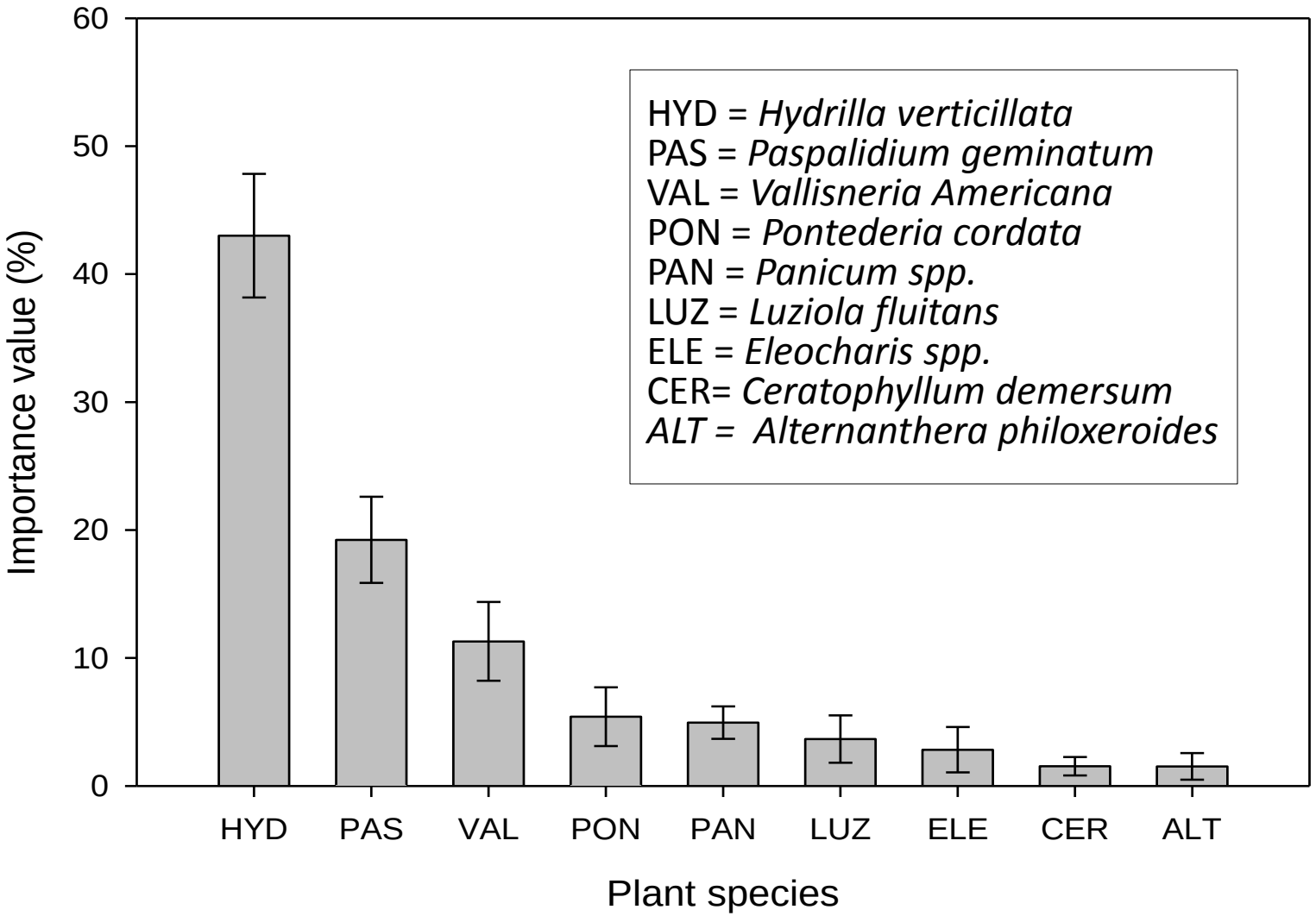
Snail Kite Nests: 1995 - 2011



Hydrilla: A Further Complication

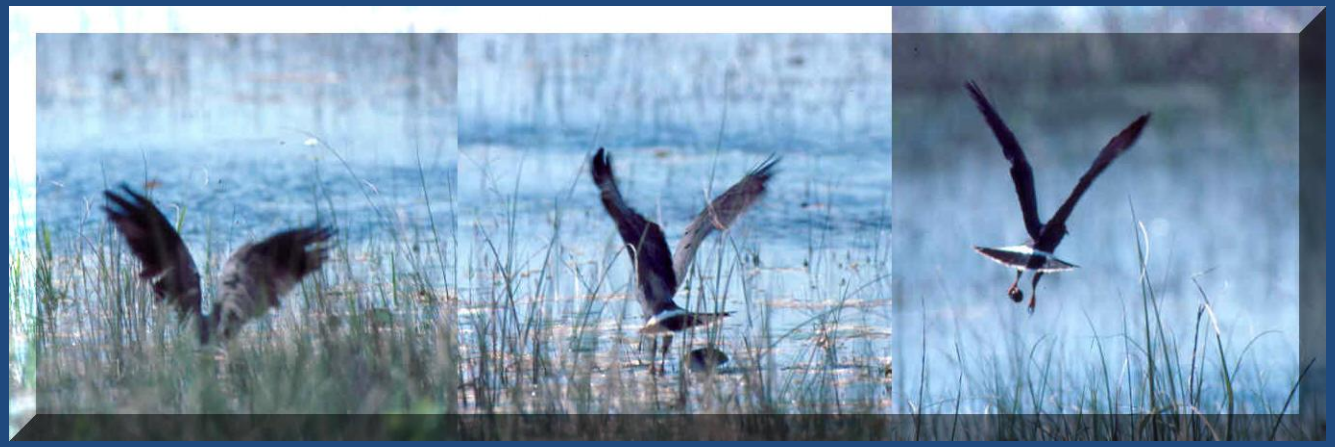
- *Hydrilla verticillata*
  - Invasive submerged plant
  - Introduced to Florida in the 1940's-50's
  - Rapidly forms thick mats
  -

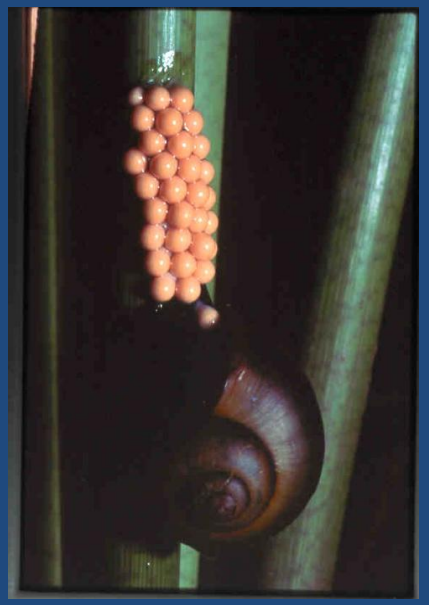
Percent Importance Value (± SE) of dominant plant species at capture points on Lake Toho, 2006-2008



Foraging

- Forage over emergent vegetation
- Capture snails at or near the water surface

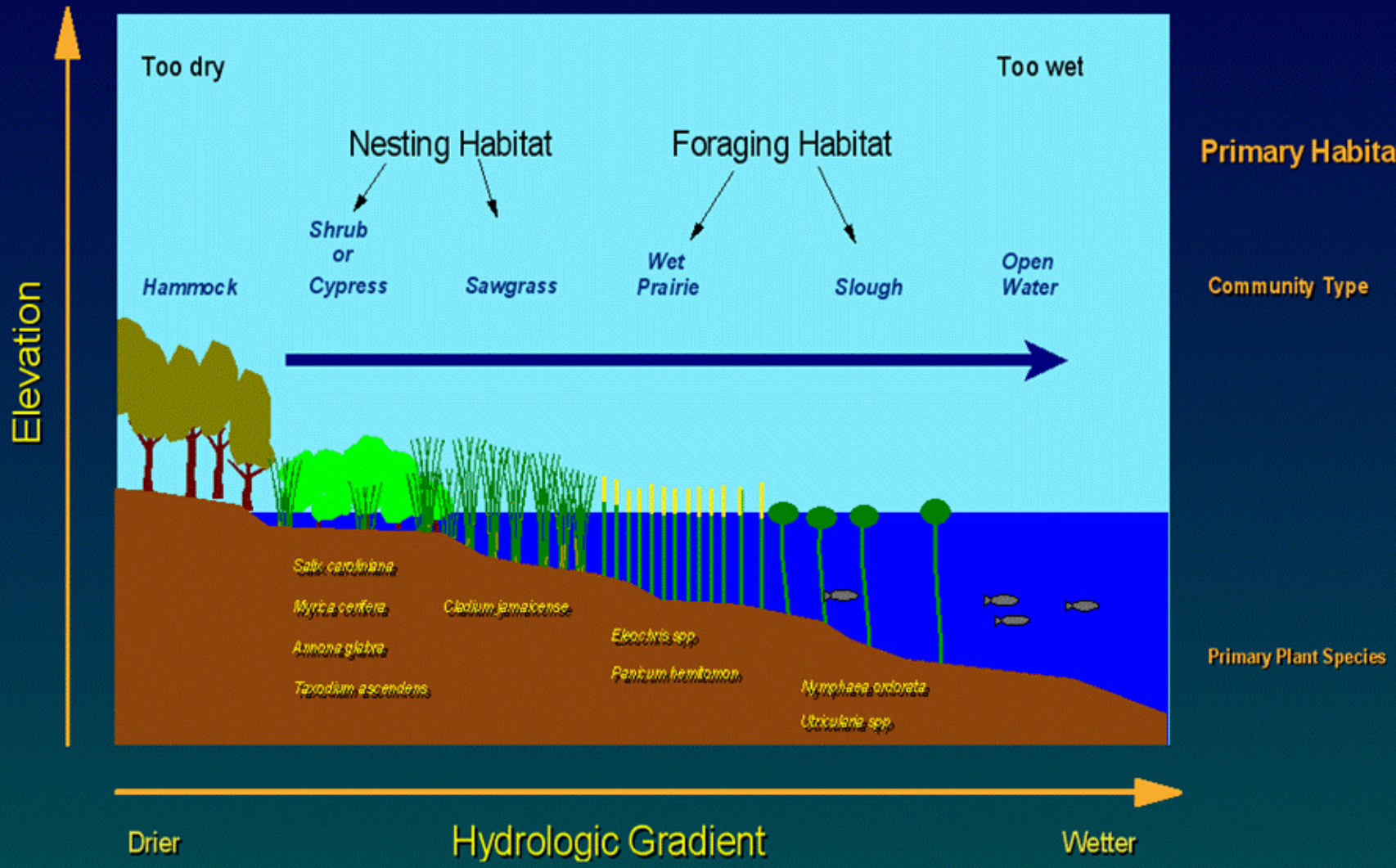


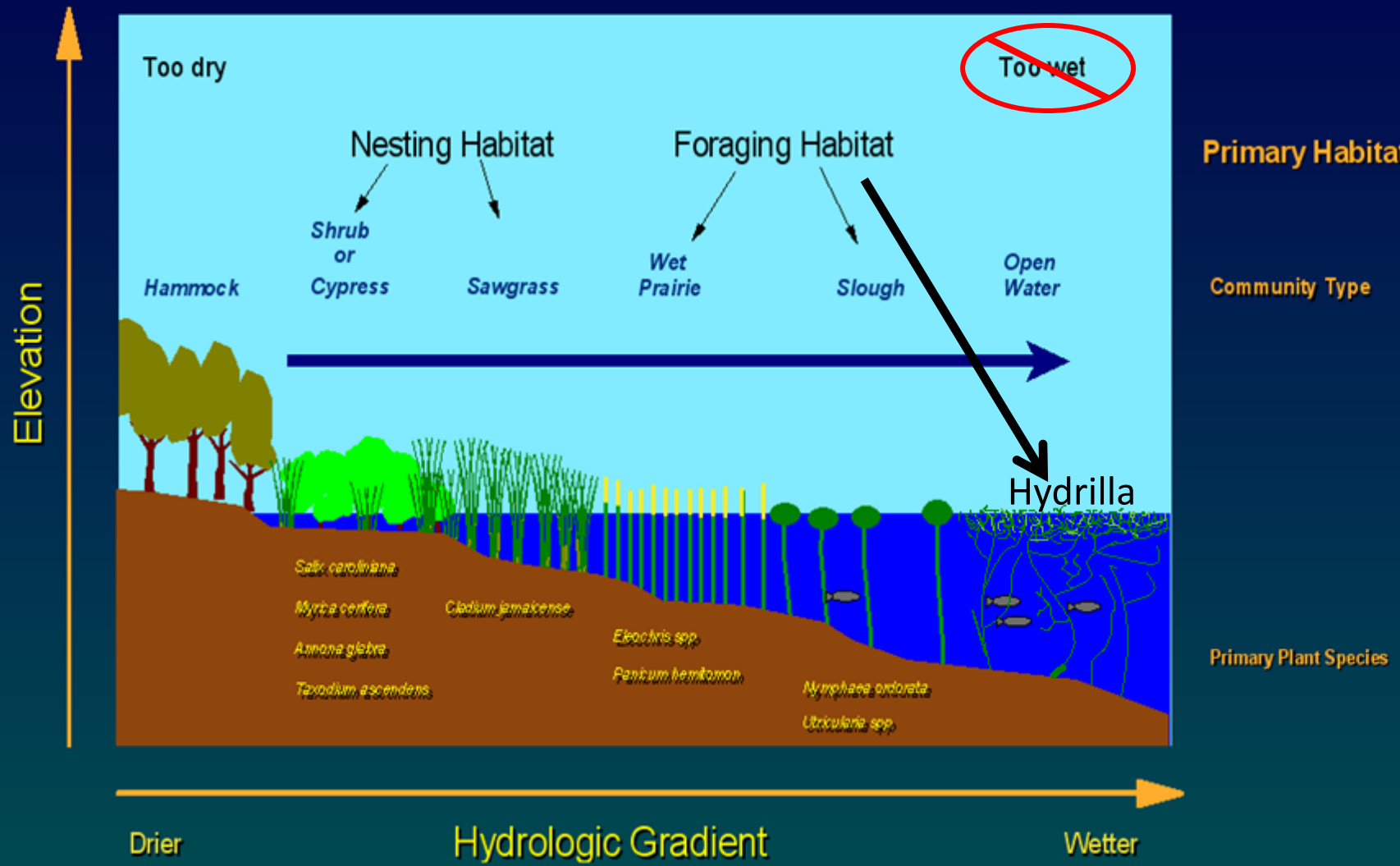


Novel Paradigm: Exotic Snails and Hydrilla

Photos by Frederick Wasti

- Snails lofted in tops of hydrilla
- More snails at surface for kites (deep water)
- Higher temps in hydrilla mats, more active snails earlier in the spring
- Increased spatial extent of foraging habitat


Too dry
Too wet
Nesting Habitat
Foraging Habitat
Primary Habitat Use
Shrub or Cypress
Hammock
Sawgrass
Wet Prairie
Slough
Open Water
Community Type
Elevation
Salix caroliniana
Myrica cerifera
Annona glabra
Taxodium ascendens
Cladium jamaicense
Eleocharis spp.
Panicum hemitomon
Nymphaea odorata
Utricularia spp.
Primary Plant Species
Drier
Hydrologic Gradient
Wetter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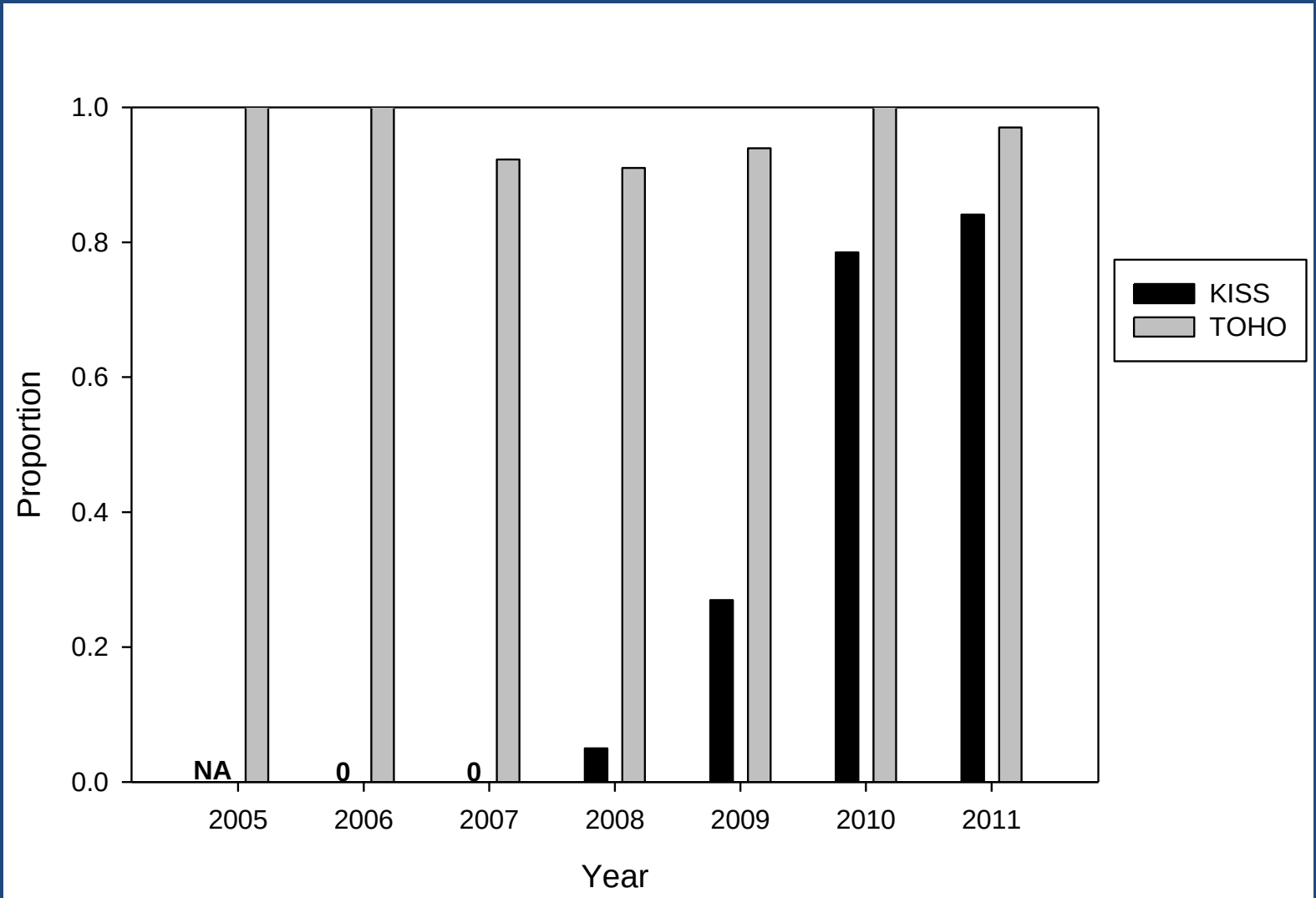
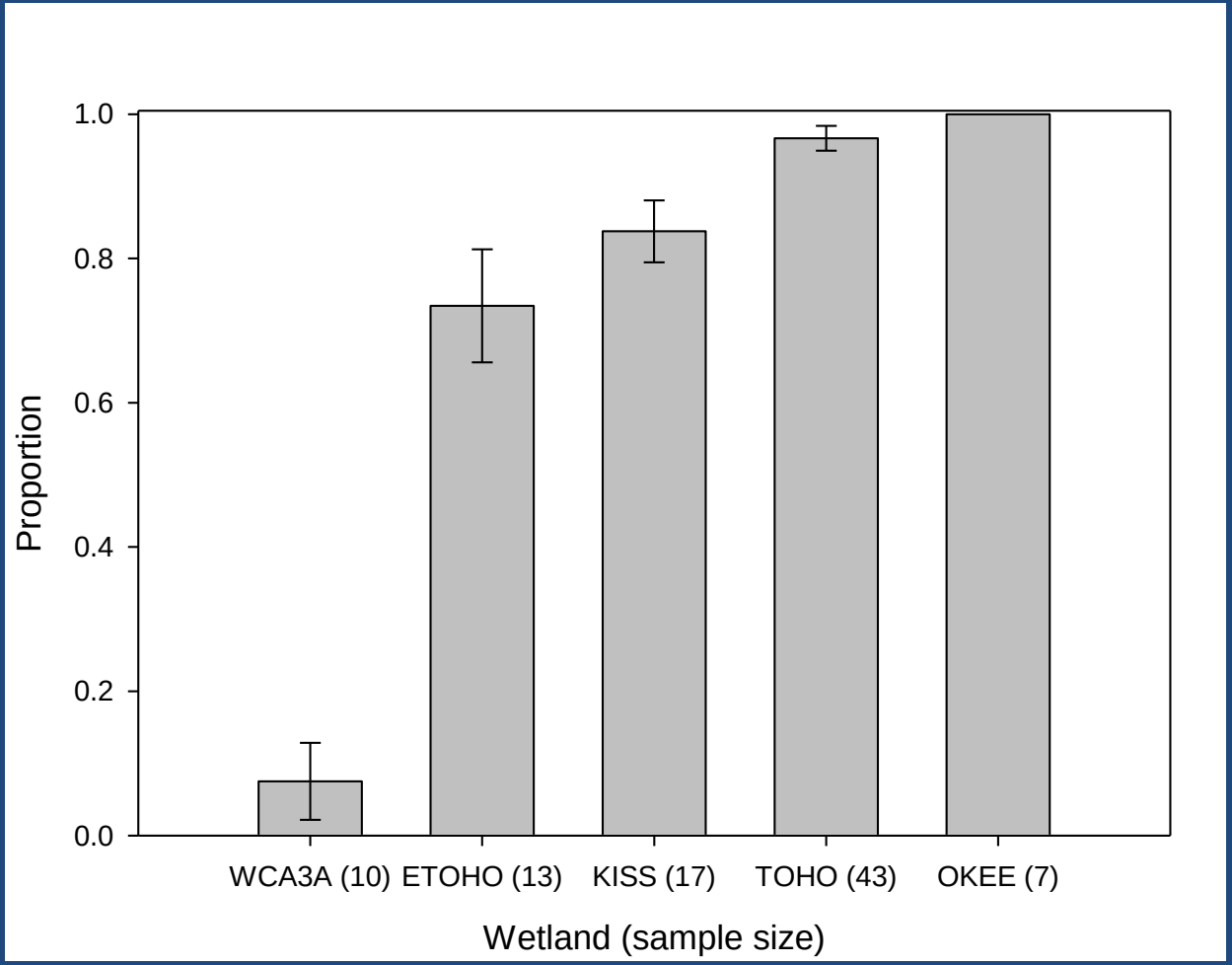
Relative frequency of exotic snails consumed by Snail Kites in Lakes Toho and Kissimmee, 2005-2011

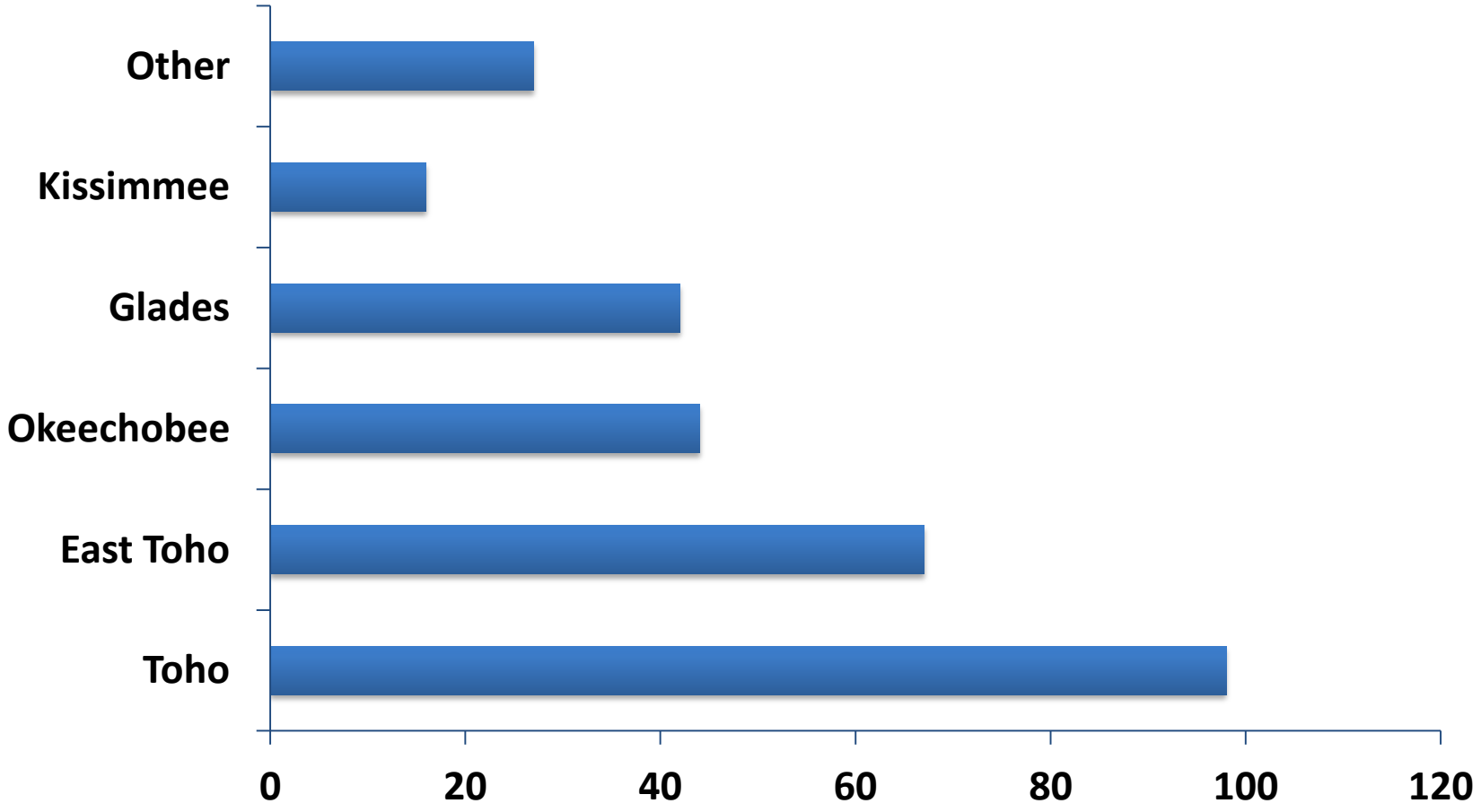


Birds are Tracking Exotic Expansion Over Range

Proportion (± SE) of snails collected at kite nests that were exotic, 2011



Nesting Totals by Area 2011



Dim Light at the End of Tunnel?

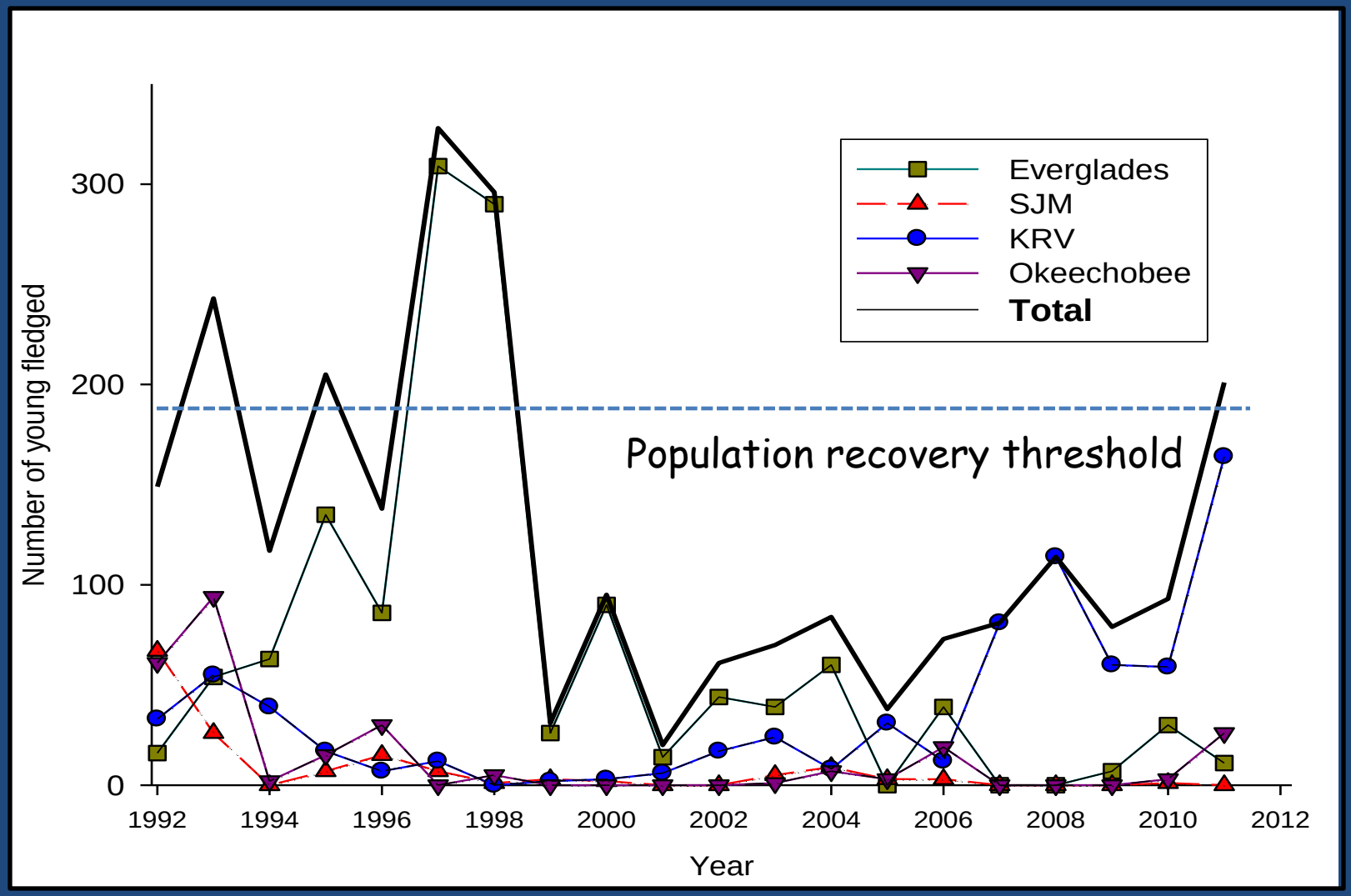


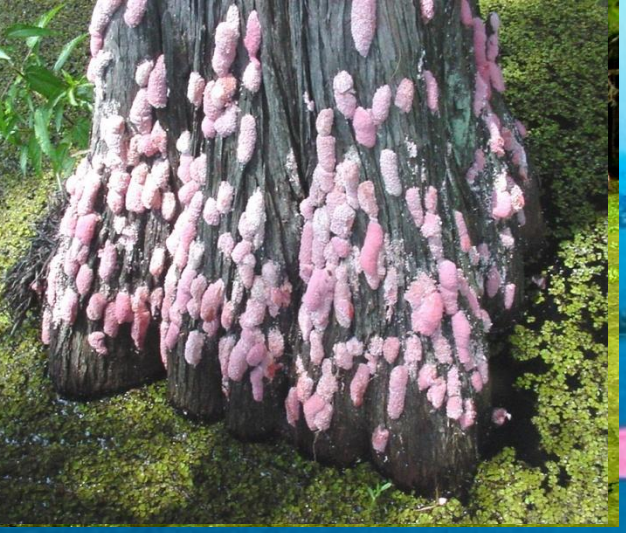
Photo by Chuck Hanlon

Worth a 1000 words?

- Potential Adaptation in Recent Years to Exotic Snails
  - New behaviors such as eating snail on ground
  - Smaller snails are being caught
  - Common response of native species to an invasive prey source

Perhaps Visual Attraction or …?

"Christo Effect"?



Median size of exotic snails consumed by Snail Kites on Lake Toho, 2005-2011