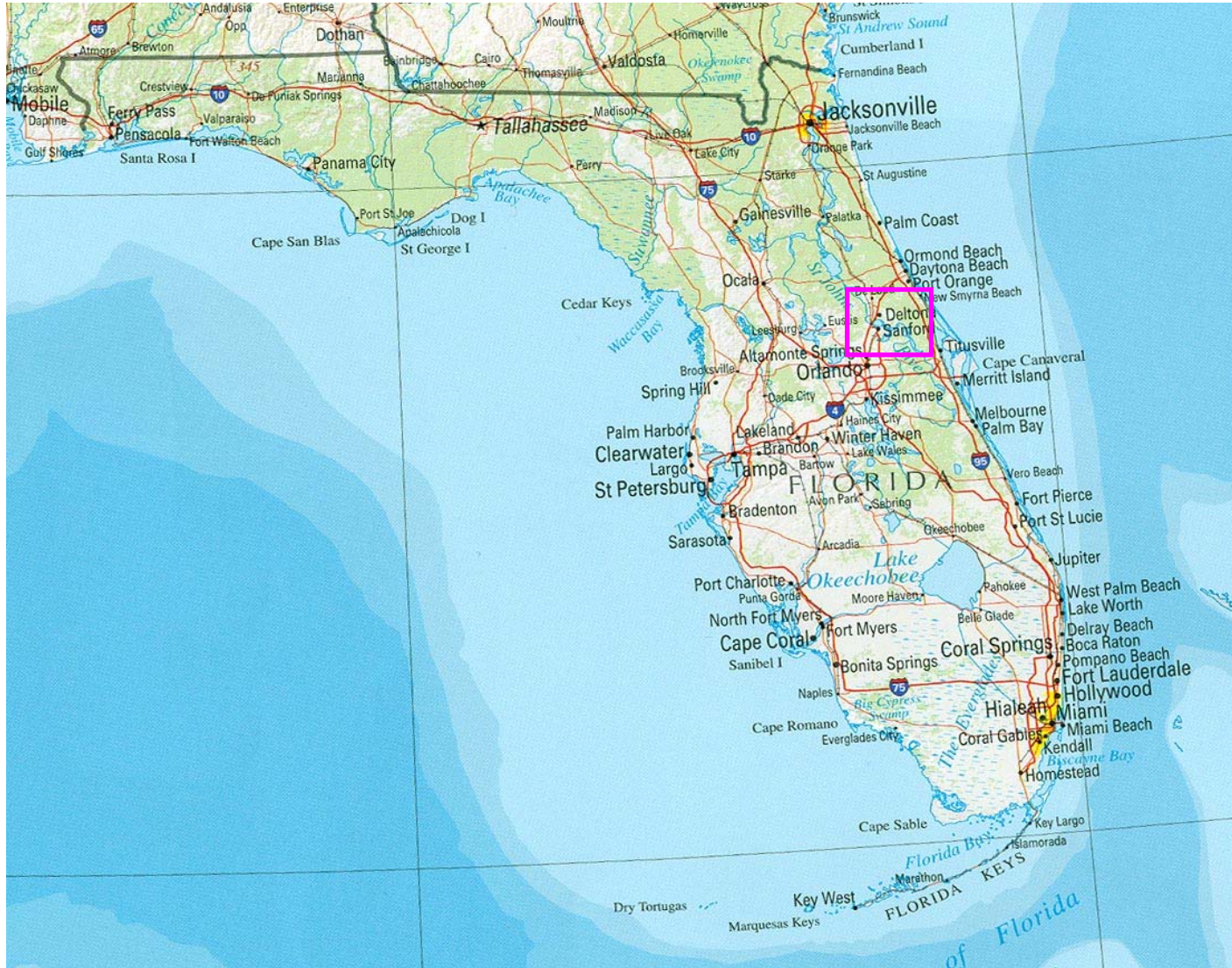




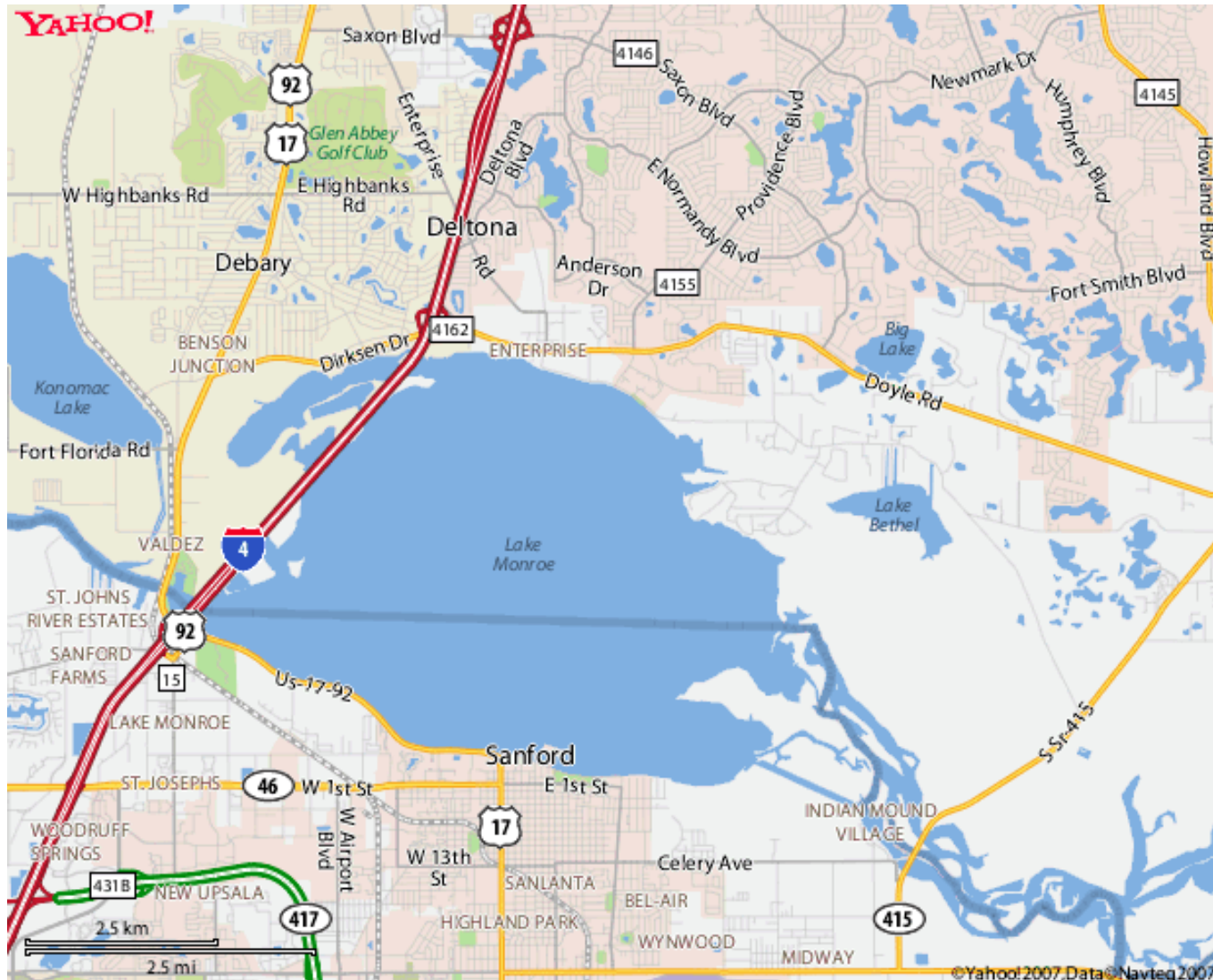
# Midge Surveillance and Control on a Central Florida Lake

By  
Annji Greenwood  
Environmental Specialist I  
Volusia County Mosquito Control

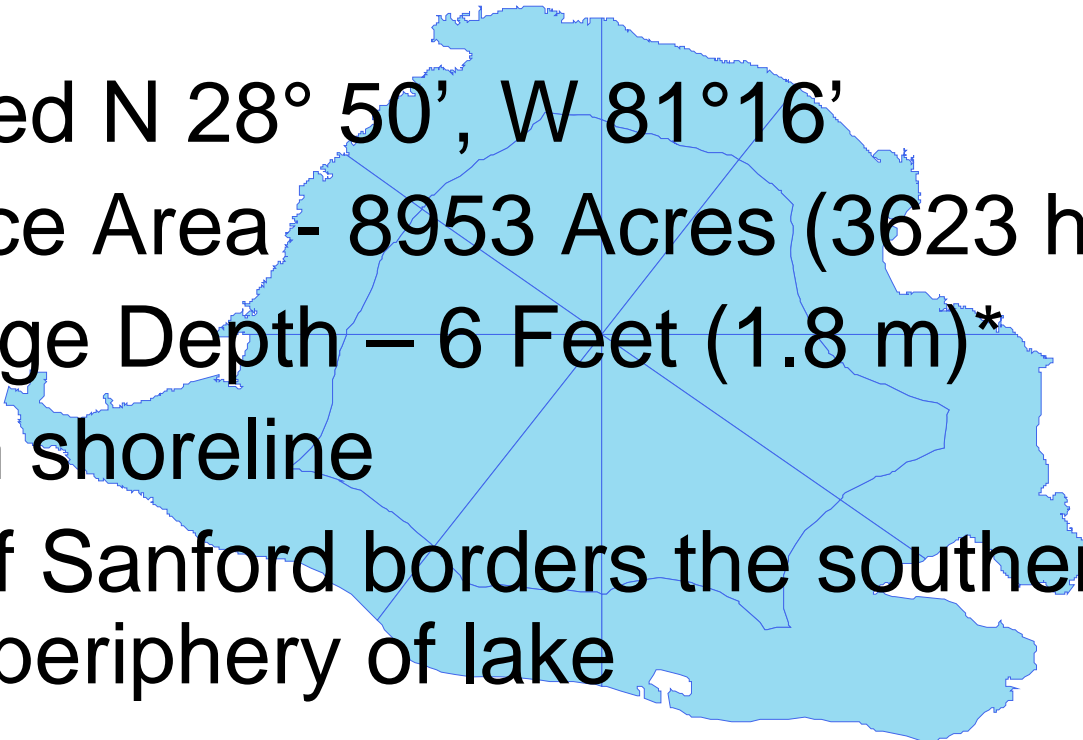
# Lake Monroe



# Lake Monroe



# Lake Monroe

- Located N 28° 50', W 81°16'
  - Surface Area - 8953 Acres (3623 ha)\*
  - Average Depth – 6 Feet (1.8 m)\*
  - 20 km shoreline
  - City of Sanford borders the southern 5- to 6-km periphery of lake
- 

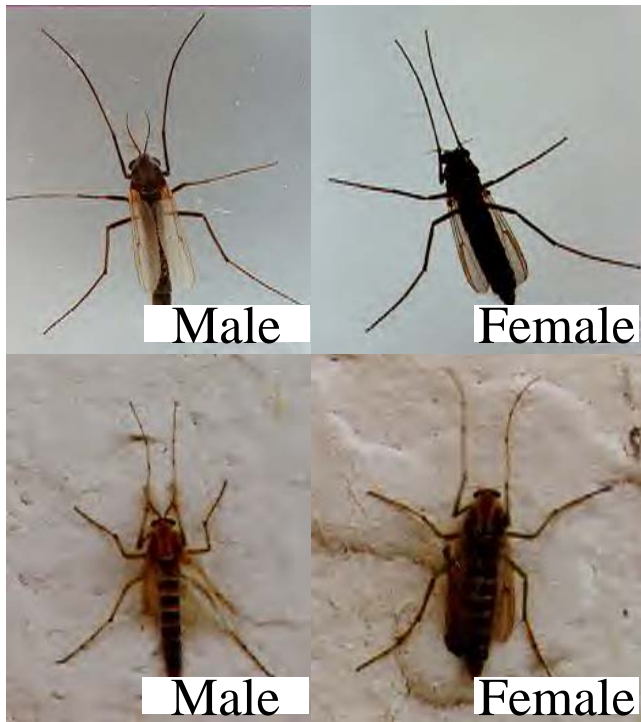
# Eutrophic System

- Sewage Treatment Input
- Stormwater Runoff



# Presence of Chironomids

- Low Species Diversity / High Abundance
- Primarily *Glyptotendipes paripes* and *Chironomus crassicaudatus*



# Chironomids as a Nuisance

- Resting Adults
- Carcasses
- Staining
- Odors



# Chironomids as a Nuisance

- Swarming
- Clogged Air Conditioners & Vents
- Spiders



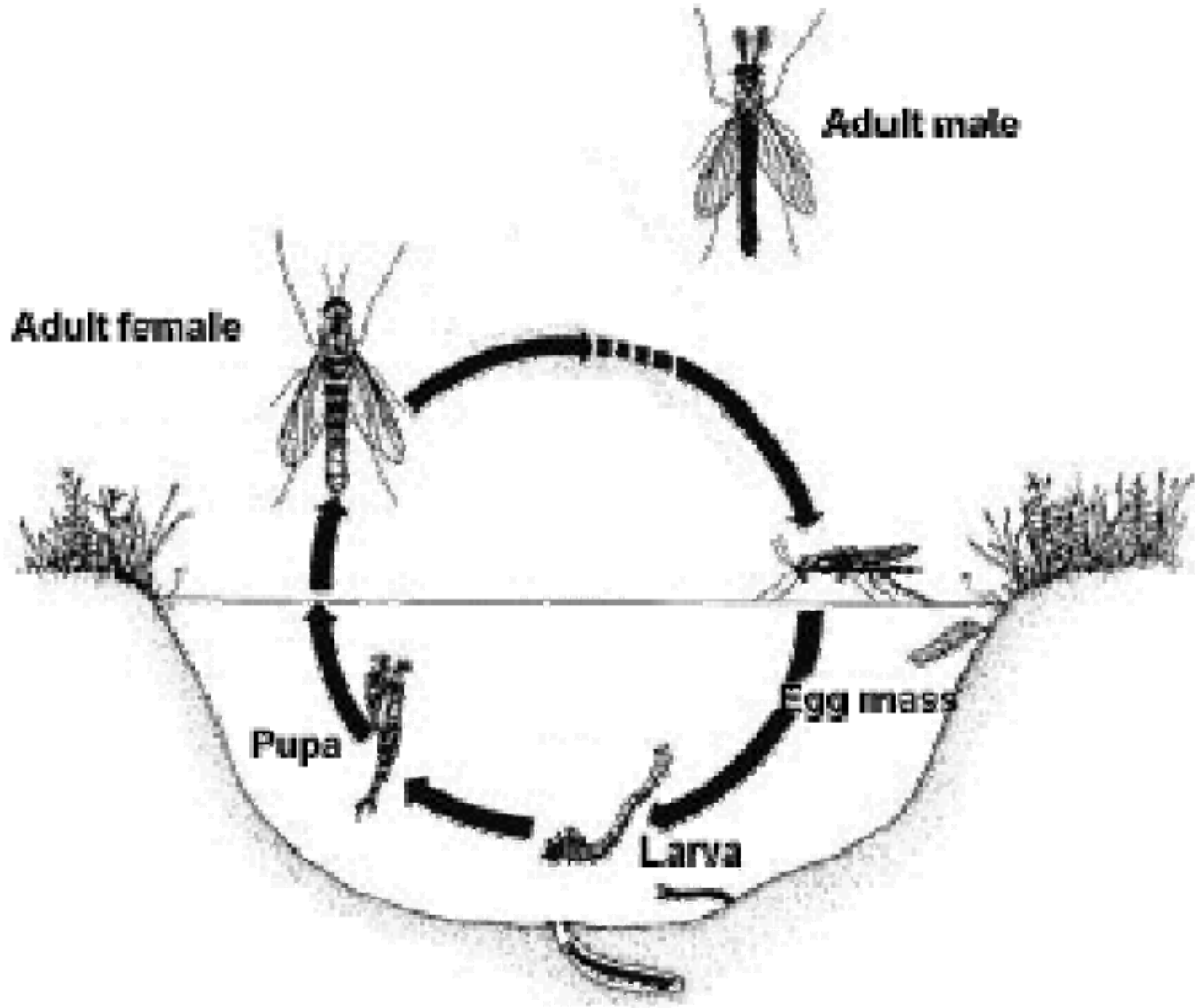


# Economic Loss

- A task force study showed that Sanford suffers an annual loss of 3 to 4 million dollars due to chironomid-related problems
- At least 10 other counties in Florida have similar midge problems

# Midge Biology

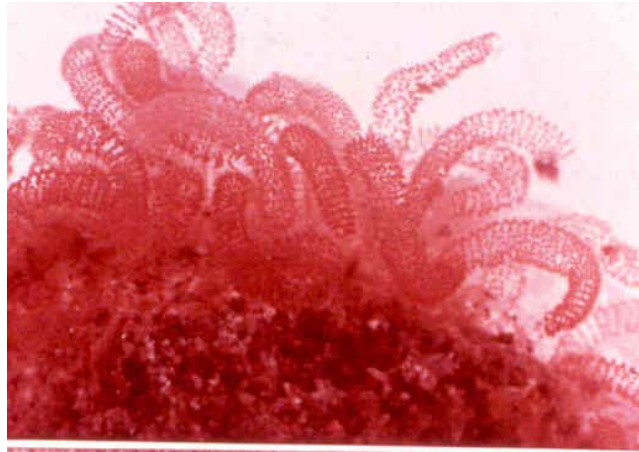
# Life Cycle



# Life Cycle

- During summer the entire life cycle can be completed in 2 to 3 weeks.
- Development can be suspended during winter months
- Speed of development is strongly influenced by temperature

# Egg Masses



# Eggs

- 2.5 - 6 days (dependent on temperature)
- Varies substantially between and within species

# Larvae



# Larvae

- Four instars
- First instar is mostly planktonic, swimming, phototactic, but at the mercy of currents
- Some contain a quantity of embryonal yolk in their guts suspected to sustain the larvae during the immediate post-hatching period
- Larvae reared in lab often spend several hours within the egg mass during which time they feed on the gelatin of the egg case.
- 1<sup>st</sup> instars are capable of feeding on detritus suspended in the water column.
- Occasionally cease swimming, and will not resume swimming if suitable substrate is found.



# Larvae

- Second, third and fourth instars are within the sediment.
- Ingest food in five categories: algae, detritus, macrophytes, woody debris, and invertebrates
- Diets may change as larvae mature or because of changes in food availability
- Often build tubes-decreases the risk of predation by vertebrates and invertebrates, they enlarge their tubes as they grow
- Red color results from haemoglobin, an iron containing compound that allows the larvae to respire under low dissolved oxygen conditions
- Larval stages last from 2-7 weeks

# Pupae



# Pupae

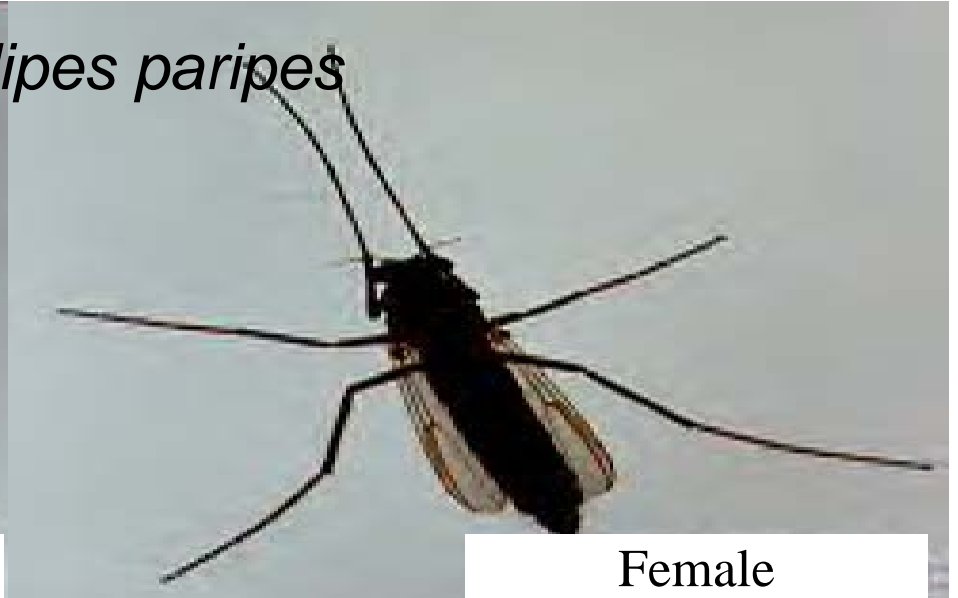
- Rarely last longer than 72 hours
- Possess structures that enhance the absorption of oxygen
- Actively swim to surface for adult emergence

# Adults

*Glyptotendipes paripes*



Male

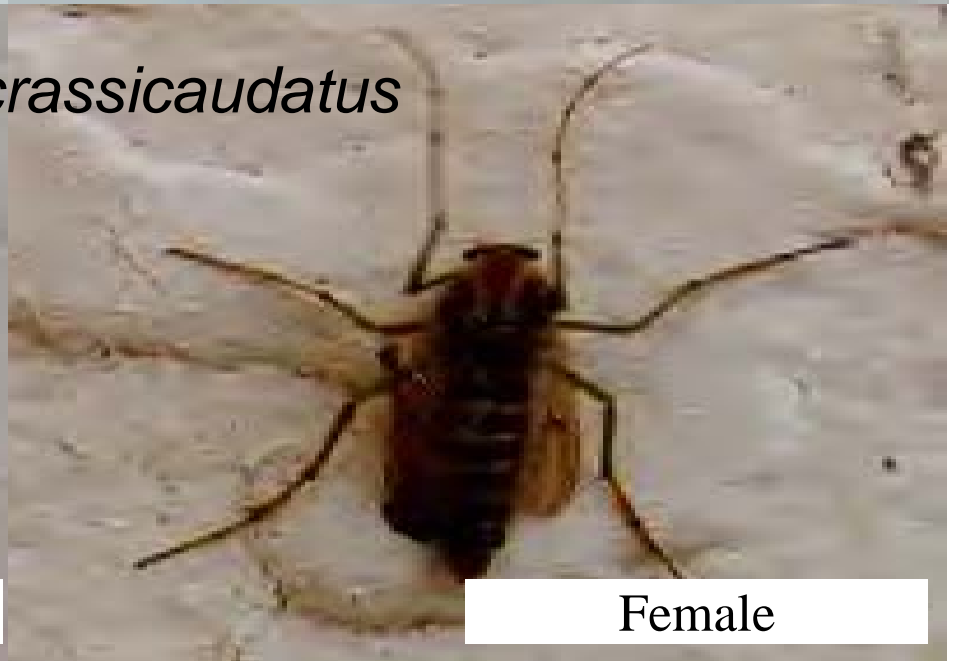


Female

*Chironomus crassicaudatus*



Male



Female

# Adult Midges

- Male midges produce aerial swarms, females rest on marginal vegetation and enter the swarm to select a mate and copulate (Ali, 1996)
- Swarms are predominantly monospecific
- Live 3-5 days
- Phototactic
- Do not eat

# Oviposition

- Triggered by changing light intensity
- Most eggs laid at dusk or during the night (likely reduces predation by visual predators)
- Lay eggs in large batches encased in mucilaginous cases
- Midges deposit eggs on firm substrata such as macrophytes, stones or leaf litter close to the water's edge or directly on the water's surface

# Methods for Chemical Control

# Truck Fogging

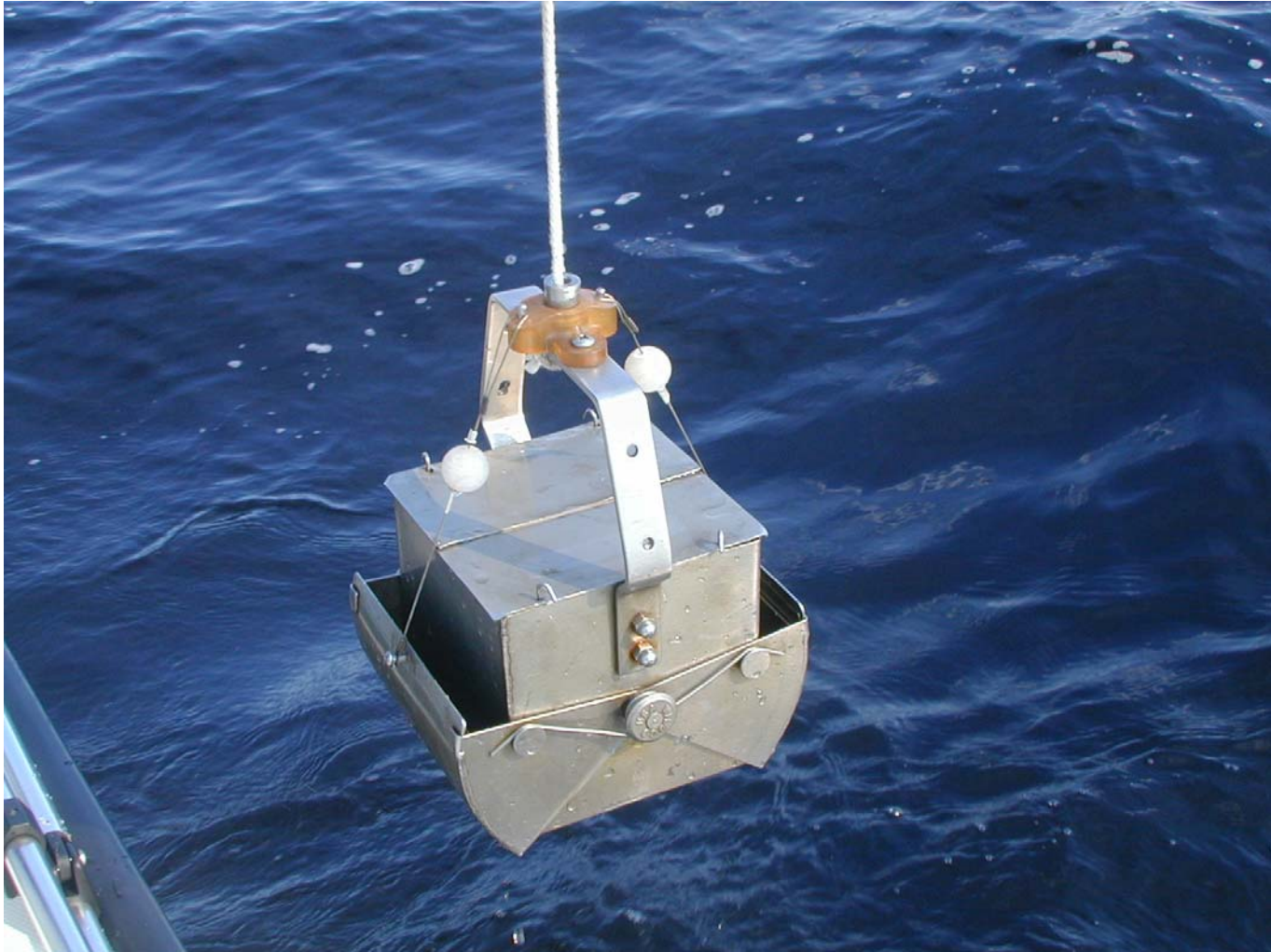




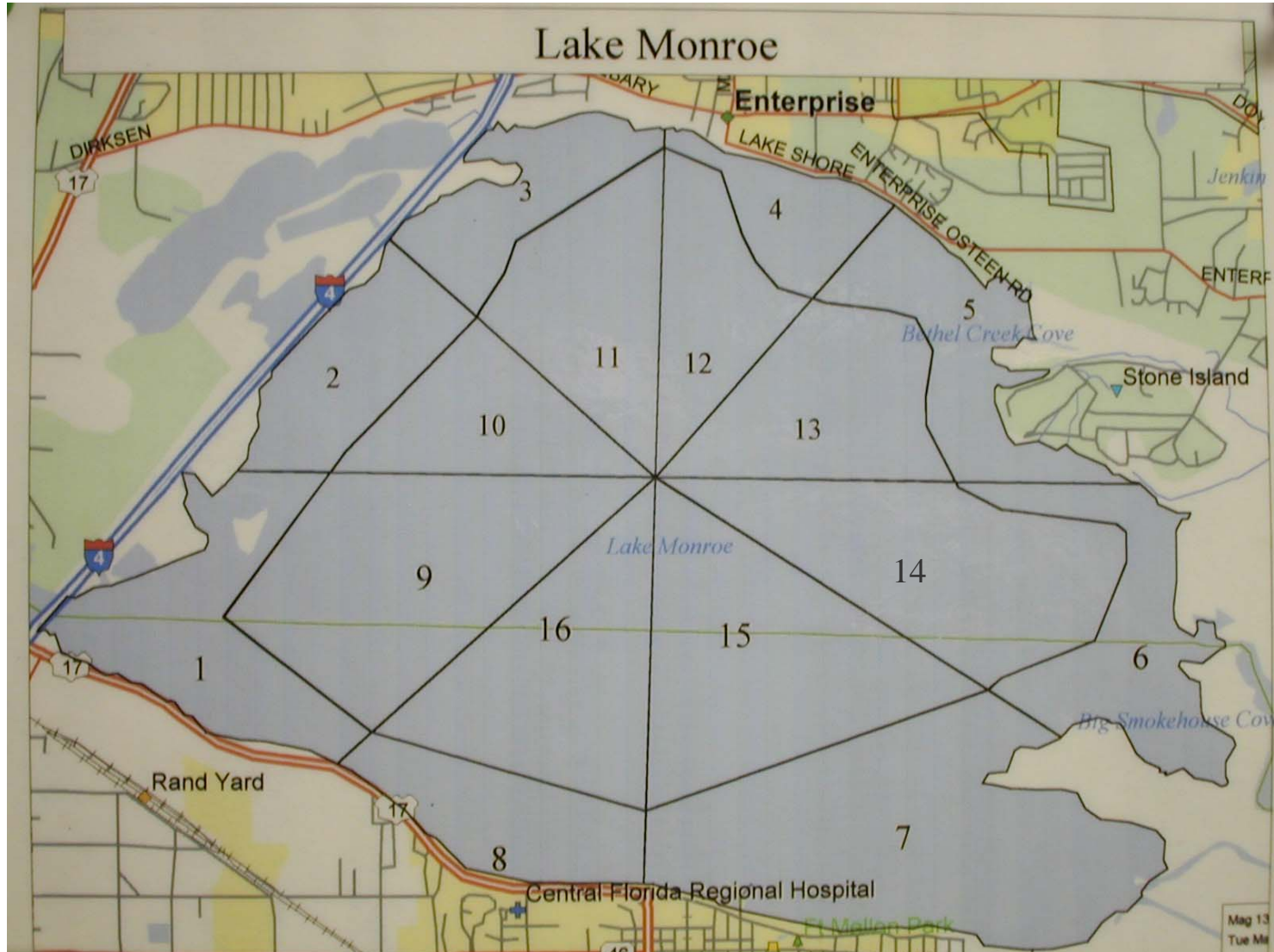
# Barrier Spraying



# Larval Sampling

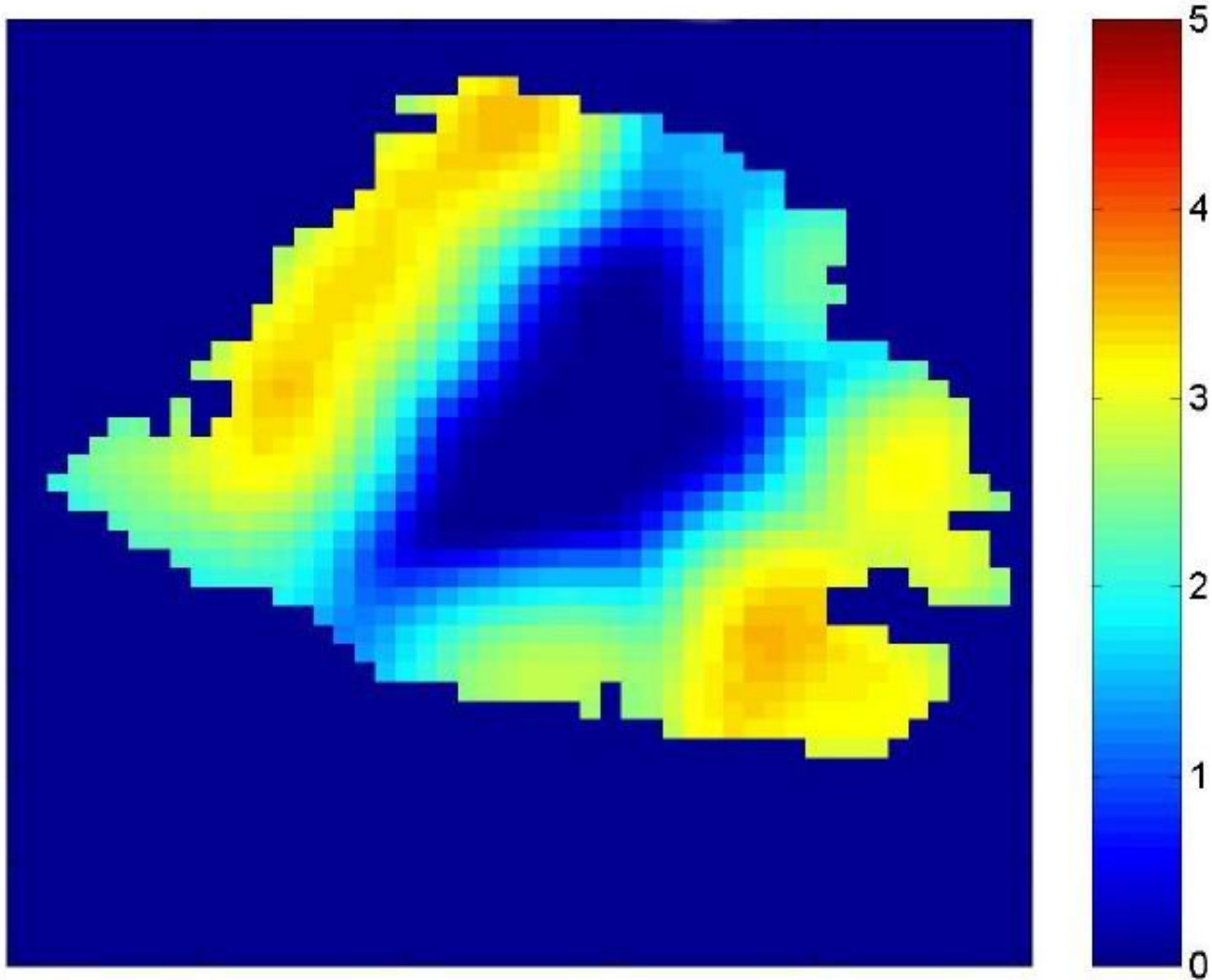


# Sampling Procedure: Lake Zones



# Spatially Explicit Computer Model for Larval Midge Distribution

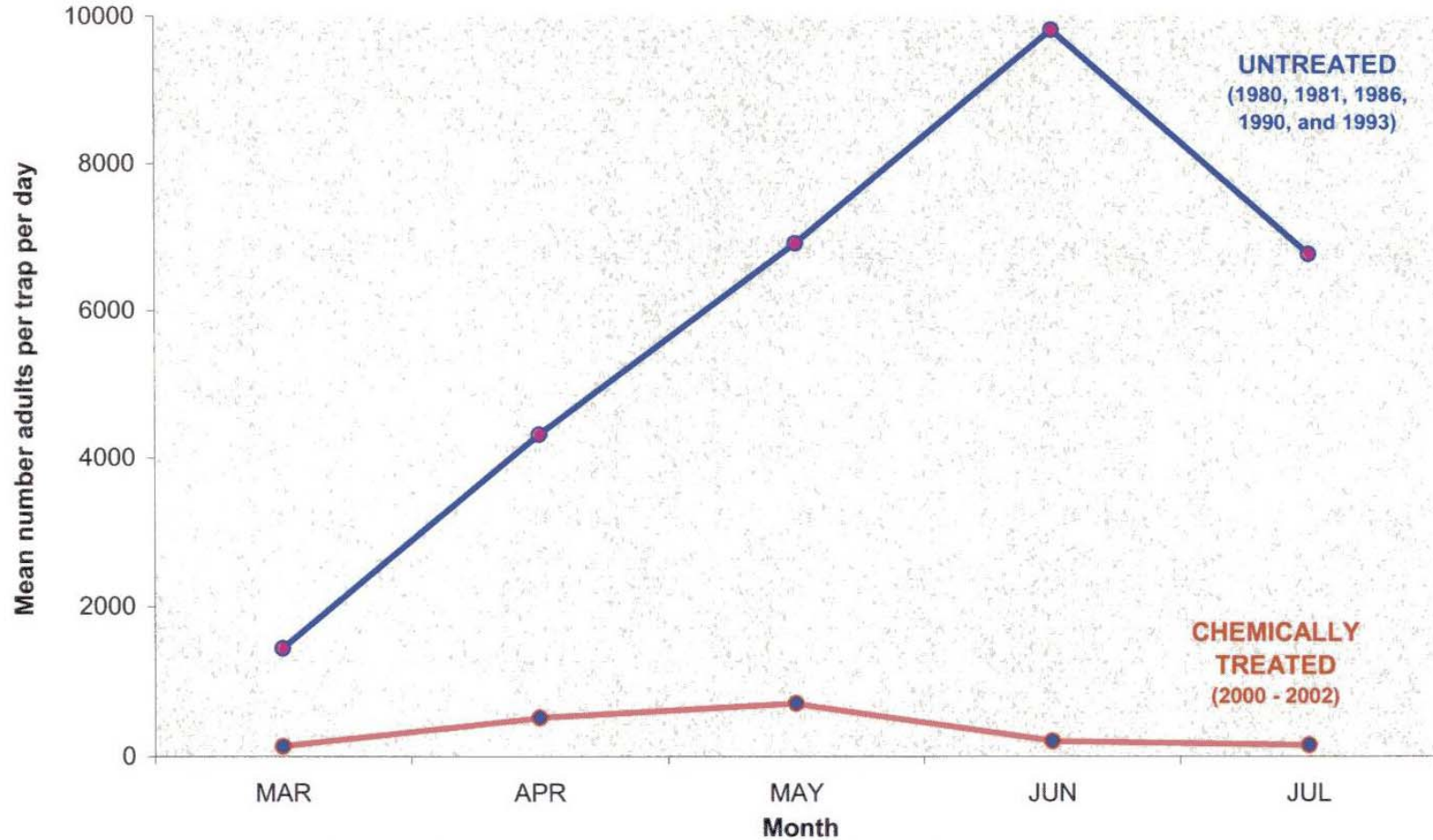
(Lobinske, *et al.*, 2002)



# Boat With Spreader Attachment



## Chemically Treated vs. Untreated Years of Midge Occurances at the Sanford Shoreline



\* A monthly comparison between years of relatively low water elevations.

# Constraints of Chemical Control

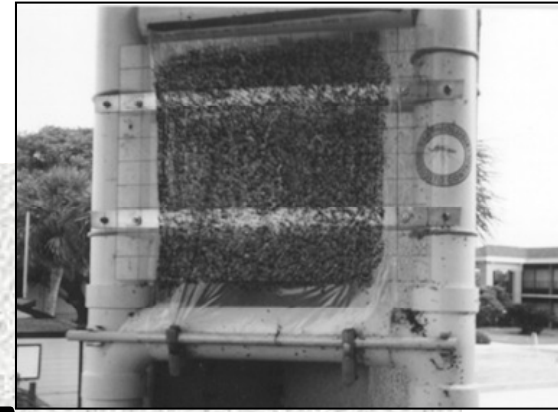
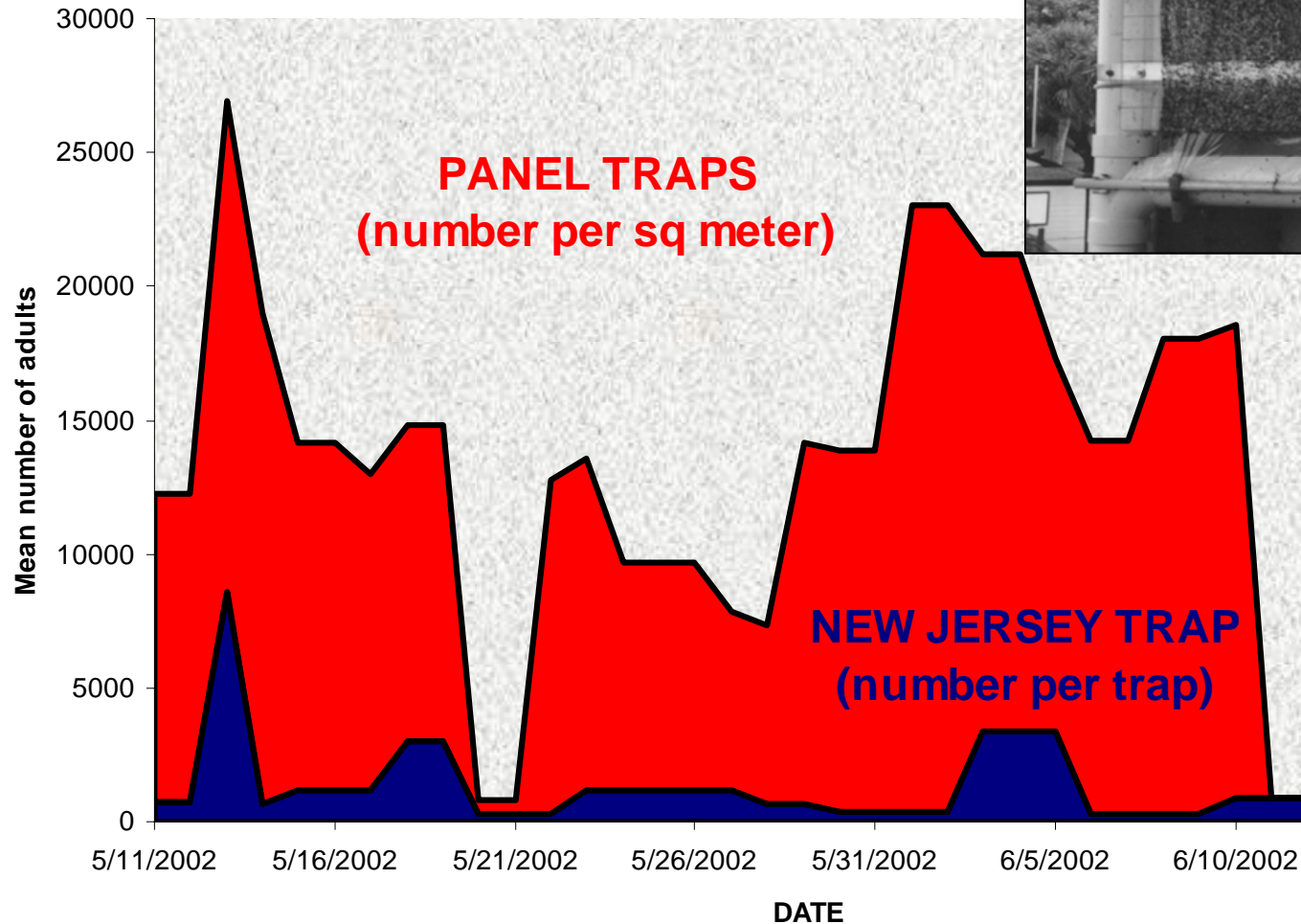
“In natural lakes covering a large area, chemical control is not economically feasible because of the large volume of water to be treated, as well as the undesirable impact on other organisms.”  
(Hirabayashi and Nakamoto, 2001)

# Physical Controls



# New Jersey Light traps versus Sticky Panels for Sampling Purposes

Data Comparison:  
Custom Panel Traps vs. New Jersey Traps



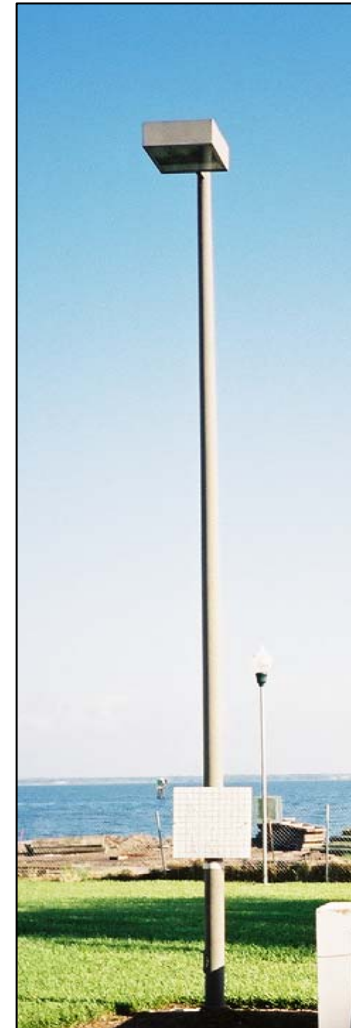
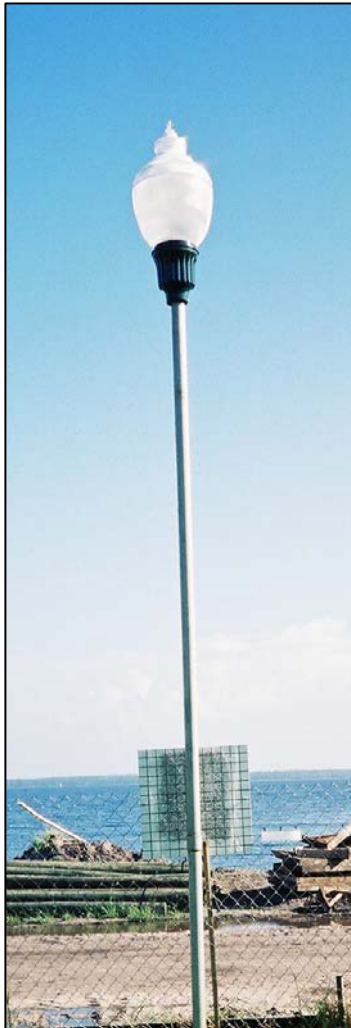
# The River Walk Project: 2003

- **\$11 million construction\***
- **1.2 miles of Sanford's shoreline\***
- **Over 150 decorative lights**

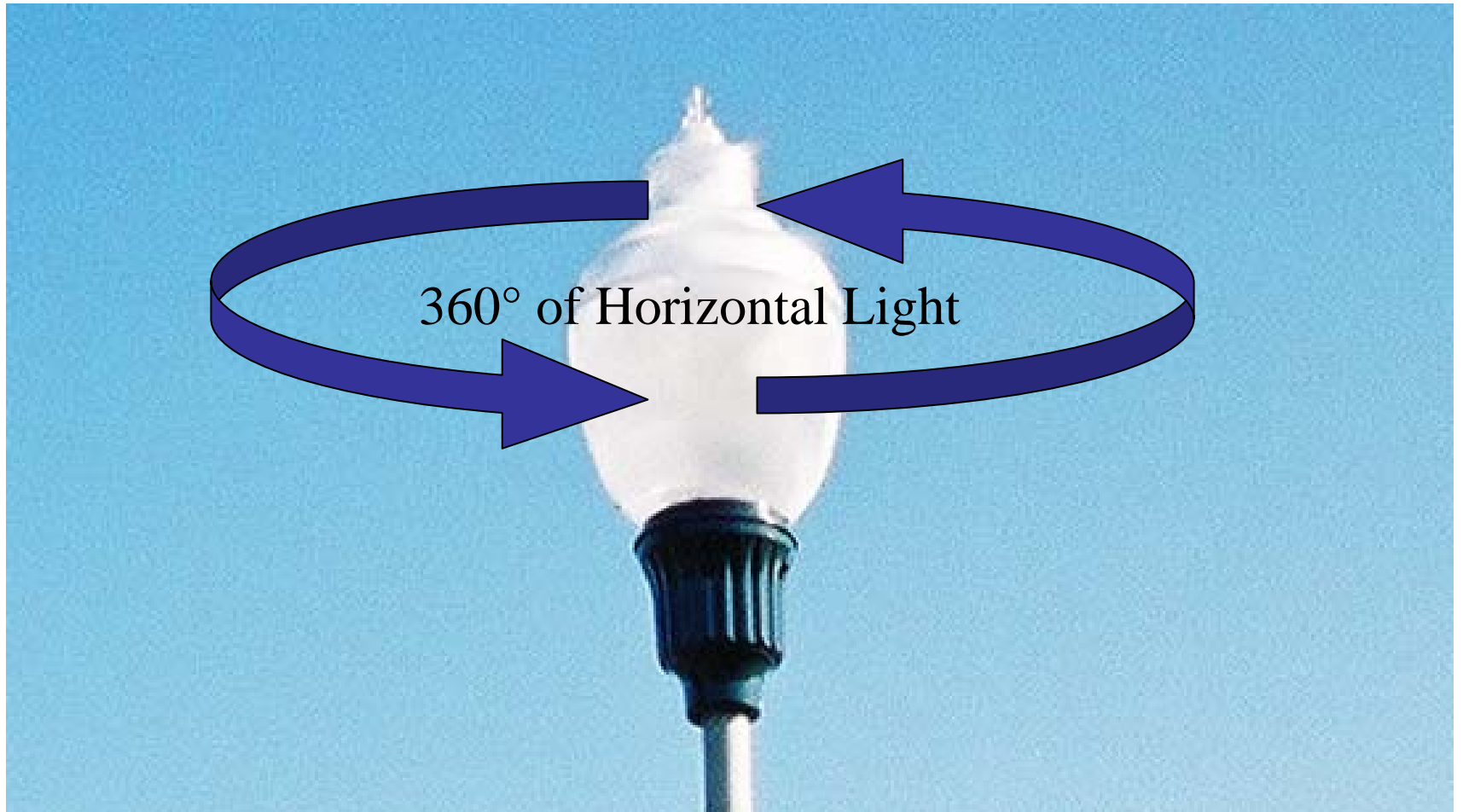
*\*The Sanford Herald*



# Selected Light Sources with Sticky Panels Attached

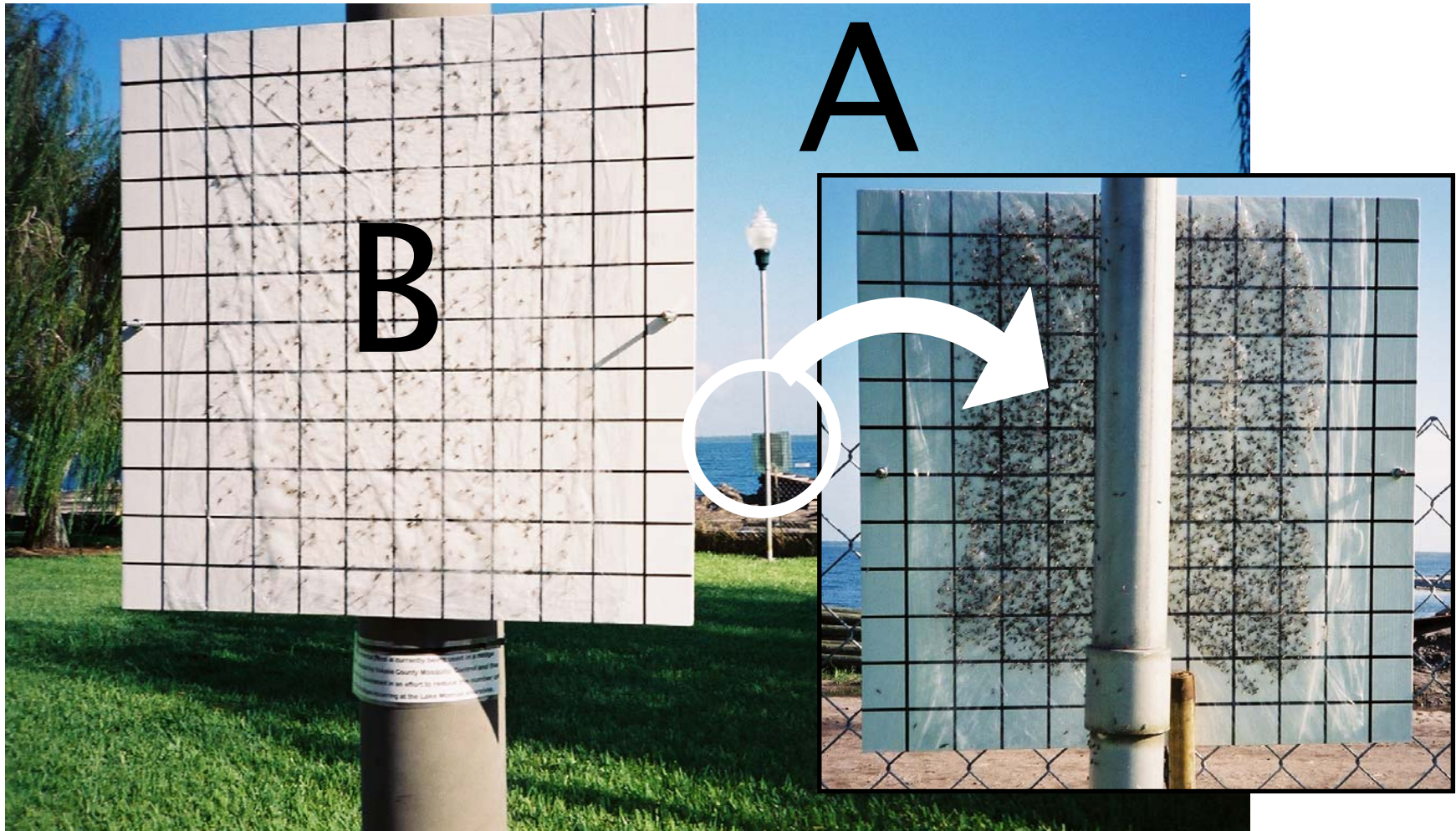


# River Walk Lights



# Influence of River Walk Lights

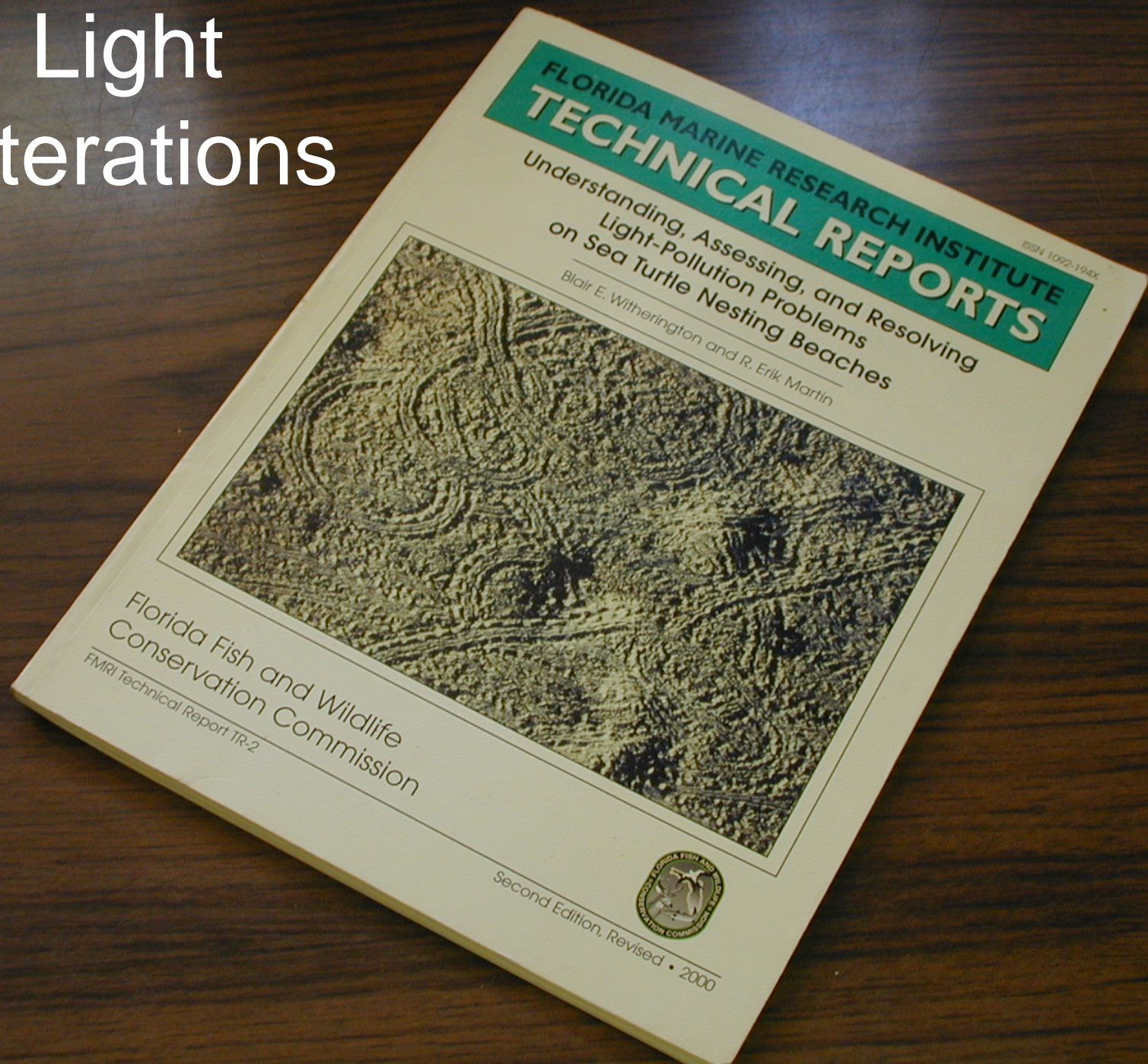
During one particular night, a River Walk light panel (A) intercepted several more adults than a competing streetlight panel (B) in the experimental area.



# Conclusions

- River Walk light design and orientation attracted **12 times more midges** than did preexisting streetlights
- River Walk lights seemed to attract the majority of adult activity away from surrounding streetlights and toward themselves

# Light Alterations

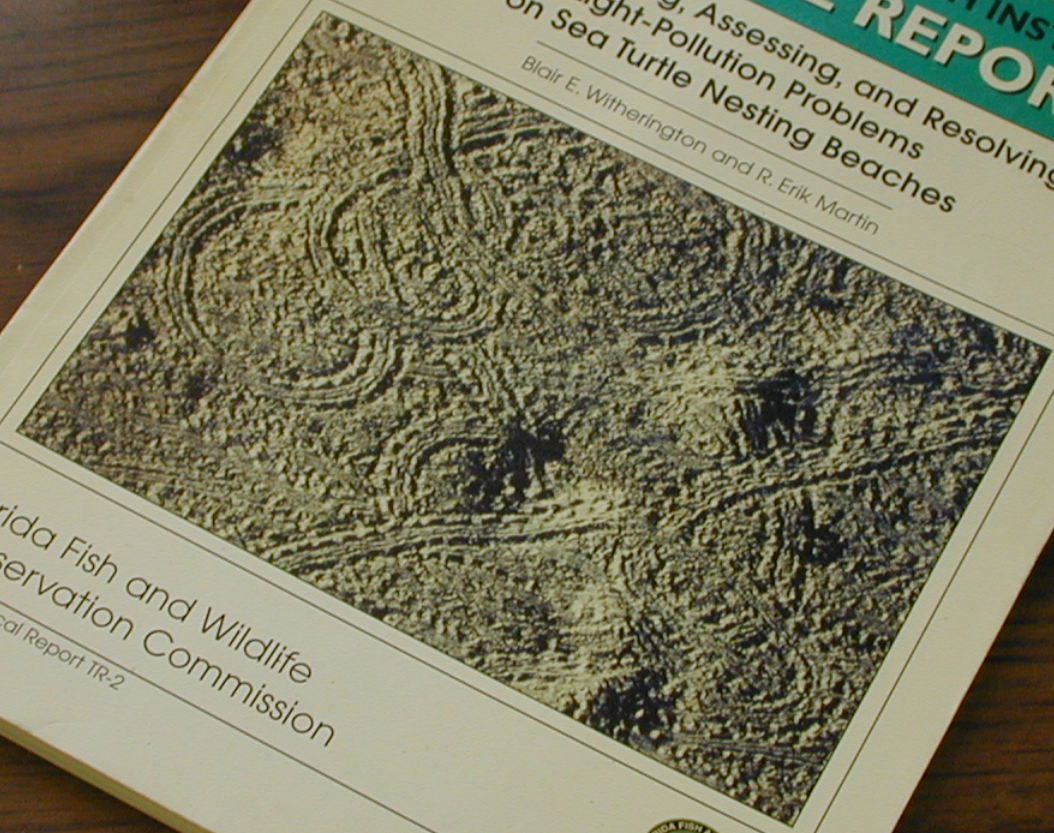


FLORIDA MARINE RESEARCH INSTITUTE  
**TECHNICAL REPORTS**

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Understanding, Assessing, and Resolving  
Light-Pollution Problems  
on Sea Turtle Nesting Beaches

Blair E. Witherington and R. Erik Martin



Florida Fish and Wildlife  
Conservation Commission

FMRI Technical Report TR-2



Second Edition, Revised • 2000

# The Light–Shield Study

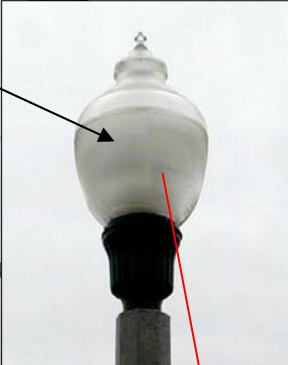
## Purpose:

- Test adult chironomid (*Glyptotendipes paripes*) response to directional light manipulations via shielding

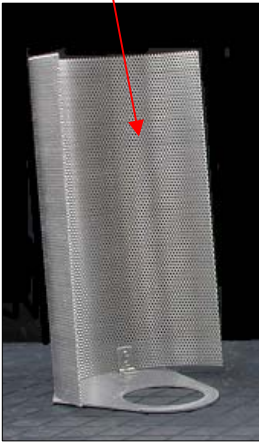




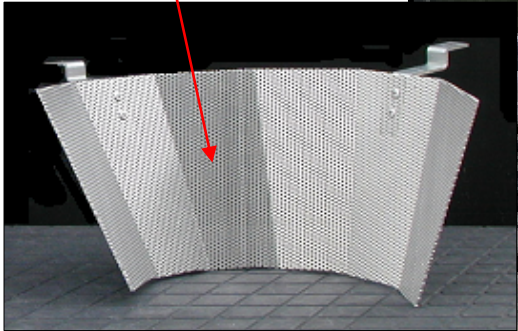
**Path light**



**Streetlight**



**Path light shield**



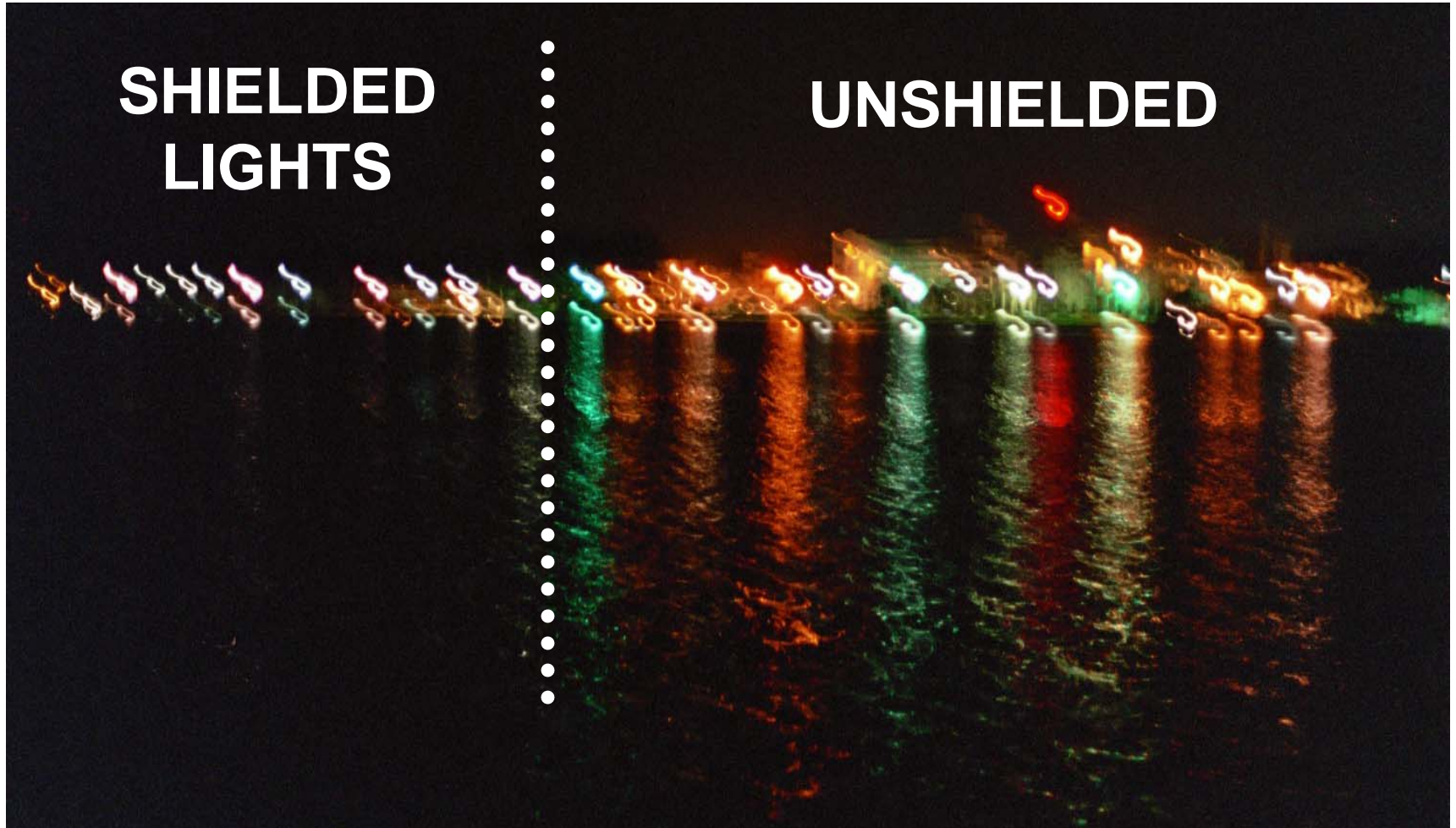
**Street-light shield**



**Sticky Sampling Panel**

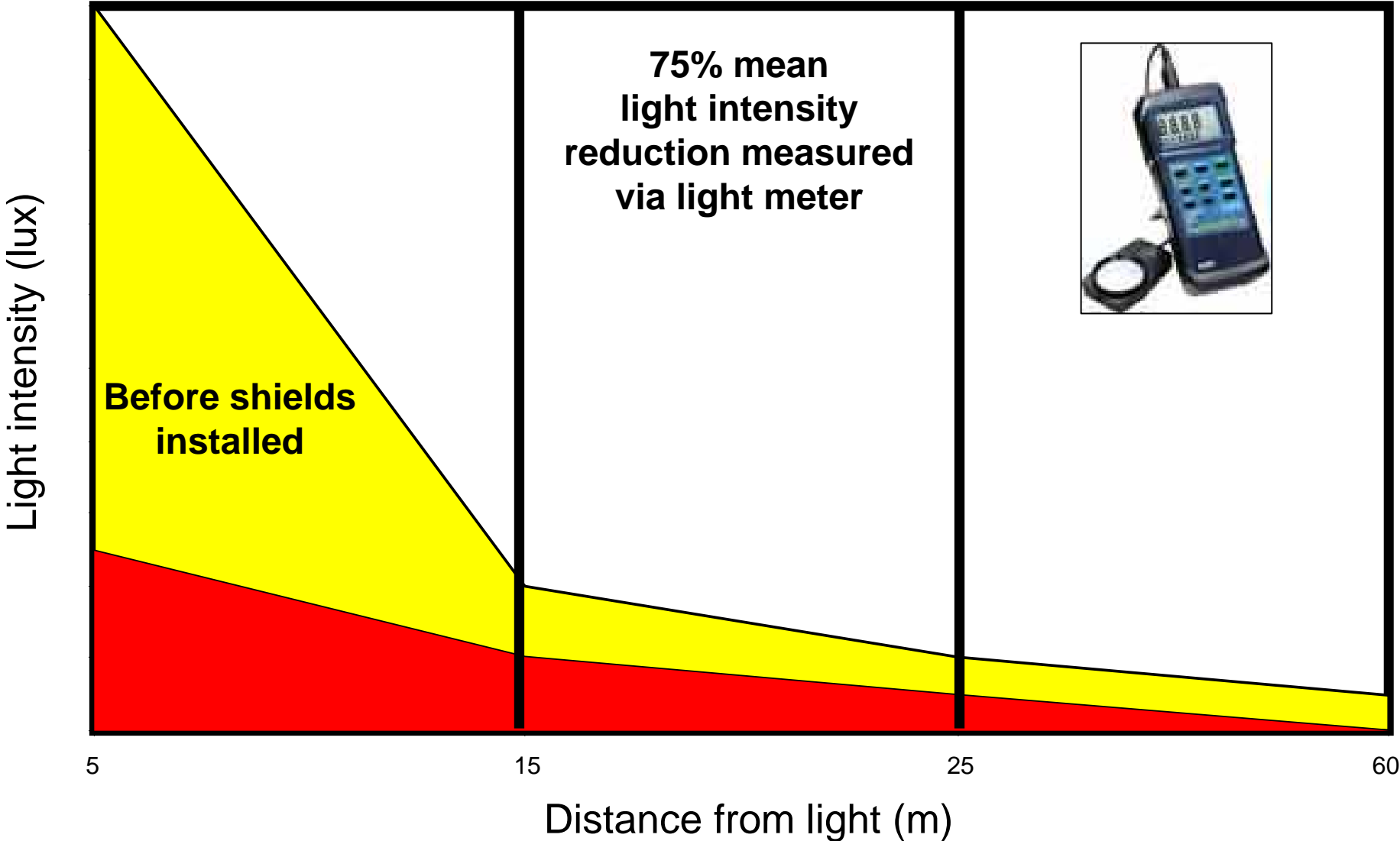


# Photo of shielded and unshielded areas of the River Walk after dark

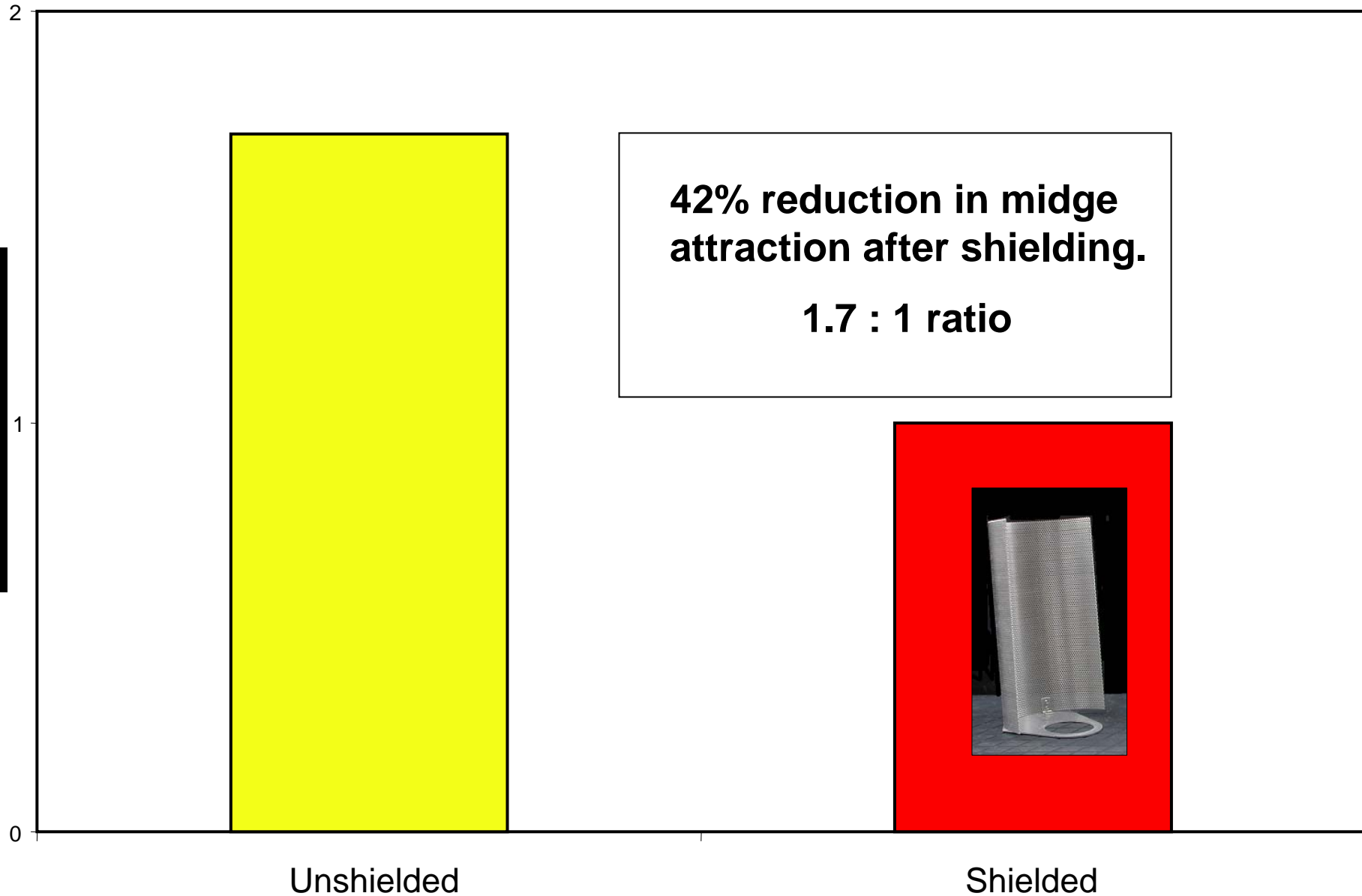


\*Note: The difference between these two areas was not visible to the human eye upon observation.

# Light intensity comparison before and after light shields installed.



# Mean midge attraction at unshielded versus shielded lights.



# Summary of Light Shield Study

- 42% Reduction in Midge Attraction
- 75% Reduction in Light Intensity
- Observed:
  - Effects of timing, physical barriers, and competing light

# Light Barge Studies

# University of Florida Research

Dr. Arshad Ali and Dr. Richard Lobinske (1998)

- Light Barges placed at least 0.5 to 2.0 km away from the shoreline to avoid any competing light sources
- Estimated that the barges intercepted an average of 4.78% *G. paripes* emerging from Lake Monroe under calm or low wind conditions

# Decoy Light Barges



UNIVERSITY OF FLORIDA  
RESEARCH CONDUCTED IN  
1998



TEMPORARY PONTOON SET-  
UP FOR SPECIAL EVENTS



# Volusia County Mosquito Control Light Barges



# Volusia County Light Barge Project Design

- Sticky Panels put out for 24 hr periods in three shoreline sections and on light barges (1 & 2)
- All panels placed at same height on lamp posts along the Riverwalk and facing same direction (due South) to minimize the impact of wind on midge numbers
- Light tests done to examine the effects of light barges on midge numbers at Riverwalk

# Panel and Barge Locations



# Sticky Panels-Section A



A1



A2



A3



A4



A5

# Sticky Panels-Section C



C1



C2



C3



C4



C5

# Sticky Panels-Section D



D1



D2



D3

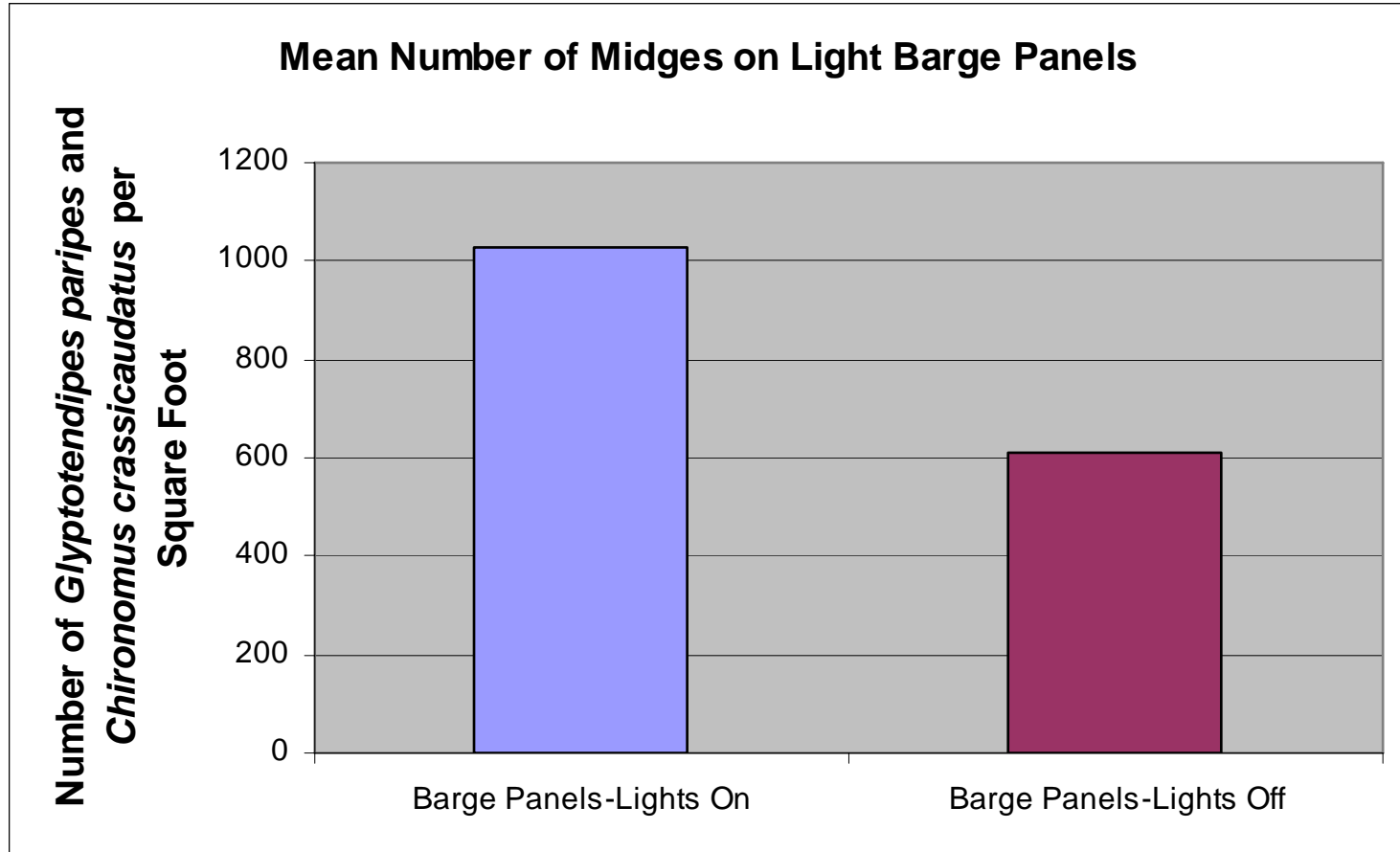


D4



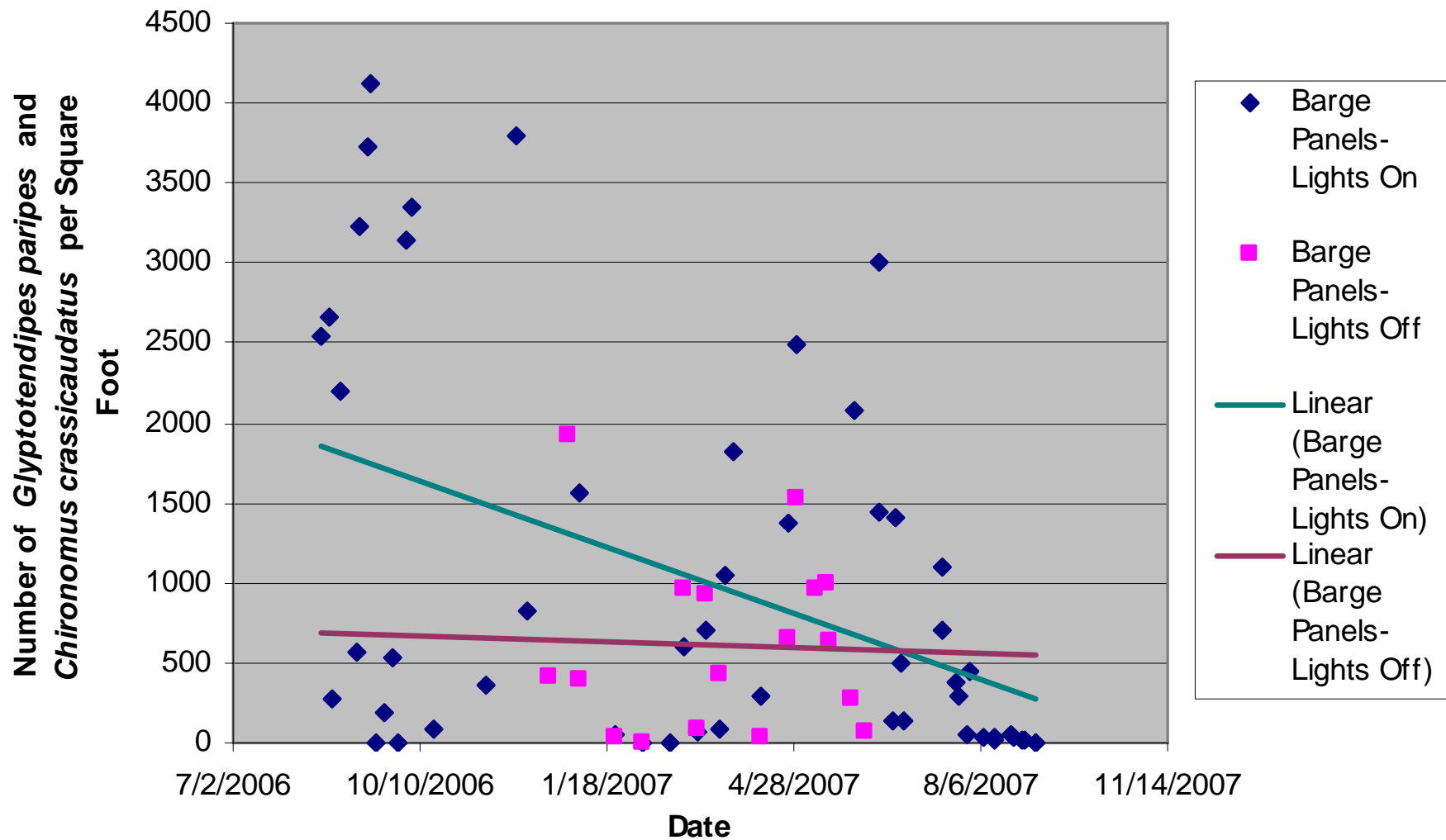
D5

# Results



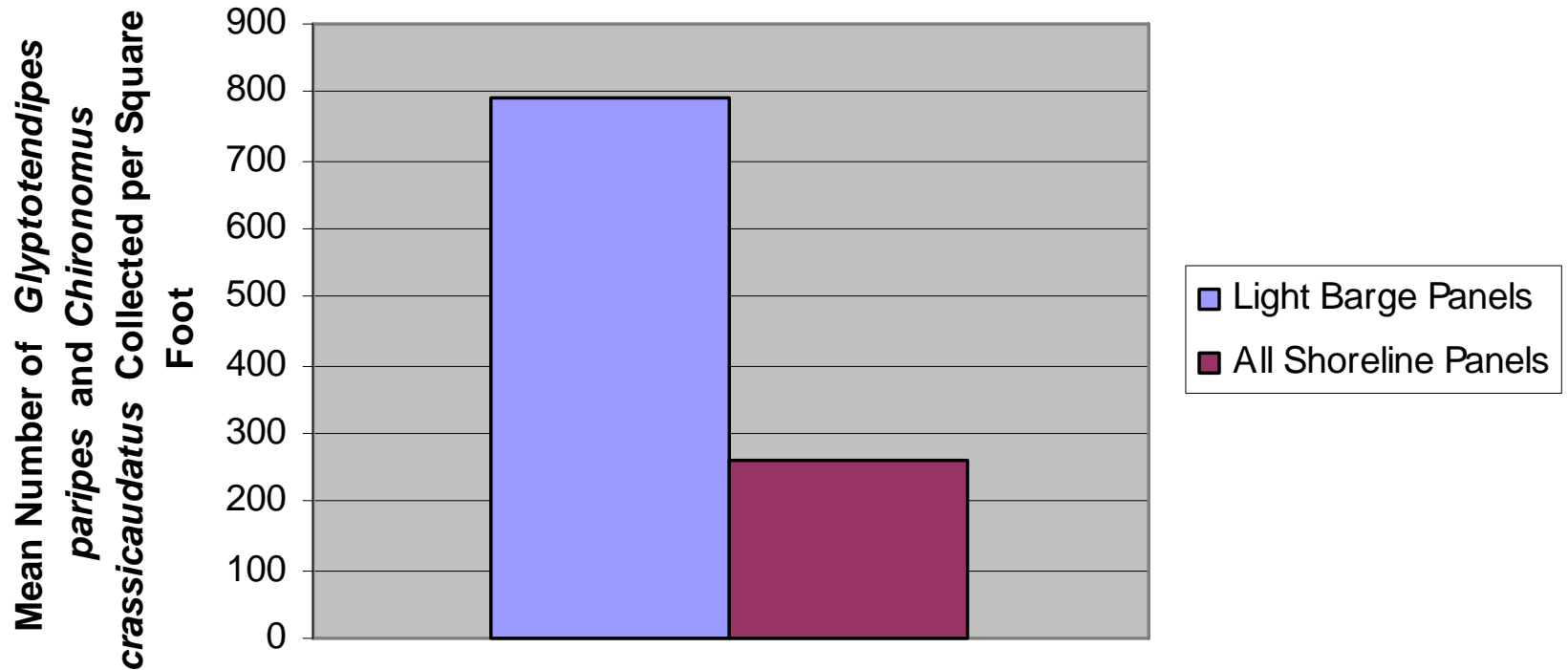
- Data collected between 8/18/07 and 9/5/07.
- Not only the surfaces, but the lights on the barges are drawing midges.
- Statistically, the light barges draw more midges with the lights on than off.

## Mean Number of Midges Collected on Light Barge Panels (8/18/07-9/5/07)



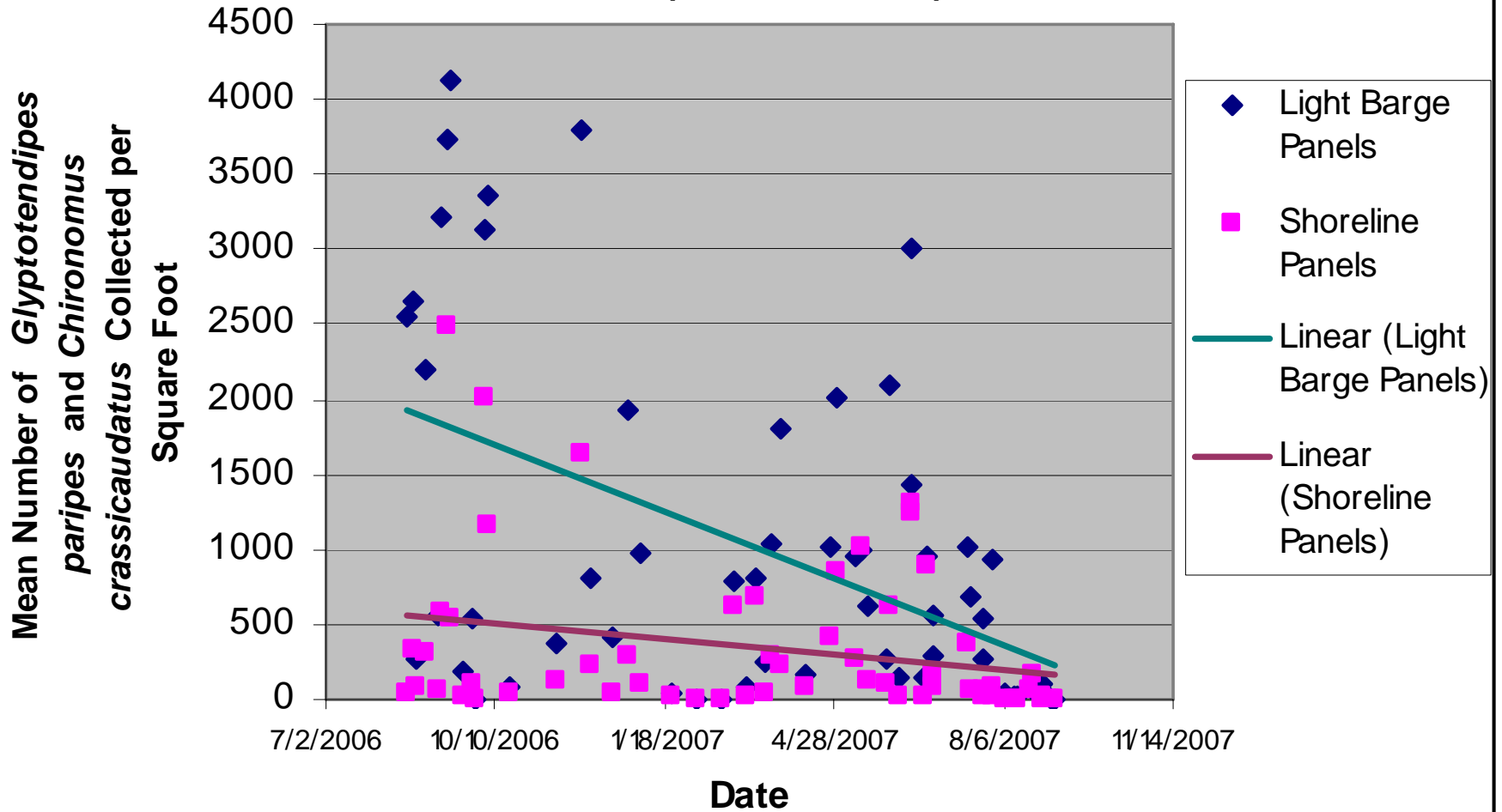


## Comparison Between Light Barge Panels and Shoreline Panels

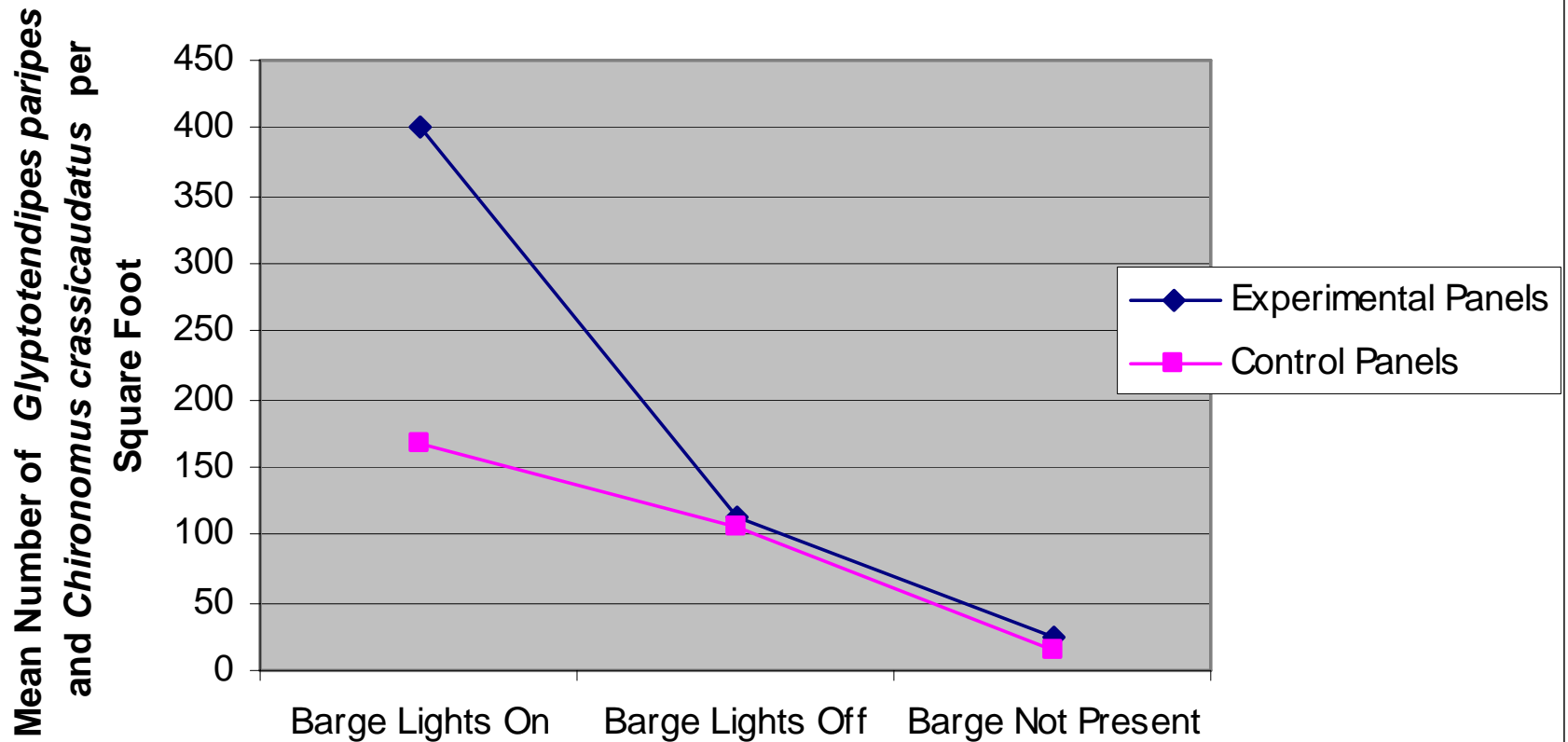


- Data collected between 8/18/07 and 9/5/07.
- Statistically, the light barge panels are drawing more midges than the shoreline panels.

## Comparison Between Light Barge Panels and Shoreline Panels (8/18/06-9/5/07)



## Number of Midges on Shoreline Experimental Panels versus Shoreline Control Panels (8/18/06-9/5/07)



- In both the control and the experimental panels the midge numbers were statistically higher with the barge lights on than with the barge not present.
- This may be the result of seasonal trends or the light barges may be drawing more midges to the shoreline than would occur in the presence of no light barge.

# Future Research

- Examine the effects of proximity of light barges to the shoreline to determine the ideal placement of the barges
- Examine the effects of more barges on overall midge annoyance along entire Riverwalk
- Examine the effects of vegetation on midge numbers

# Sound as a control?

- Hirabayashi and Nakamoto (2001) developed a new method to control adult chironomid midges, *Chironomus plumosus* (L.) and *Einfeldia dissidens* (Walker), using their acoustic responses to sound traps in the field.
- Could be used as another type of decoy to deter the midge from invading the city of Sanford.

# Acknowledgements

- Jonas Stewart, Volusia County Mosquito Control
- Bill Greening, Volusia County Mosquito Control
- Dr. Arshad Ali, University of Florida
- Dr. Richard Lobinske, Leon County Mosquito Control

# References

- Ali, Arshad. 1996. Long-term (1980-94) population trends of pestiferous Chironomidae (Diptera) along a lakefront in central Florida. *J. Am. Mosq. Control Assoc.* 12(1):106-111.
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- Lobinske, Richard; Ali, Arshad; and Frouz, Jan. 2002. Ecological Studies of Spatial and Temporal Distributions of Larval Chironomidae (Diptera) with Emphasis on *Glyptotendipes paripes* (Diptera: Chironomidae) in Three Central Florida Lakes