# *An Update:*

## Status of Asian Swamp Eels in Georgia

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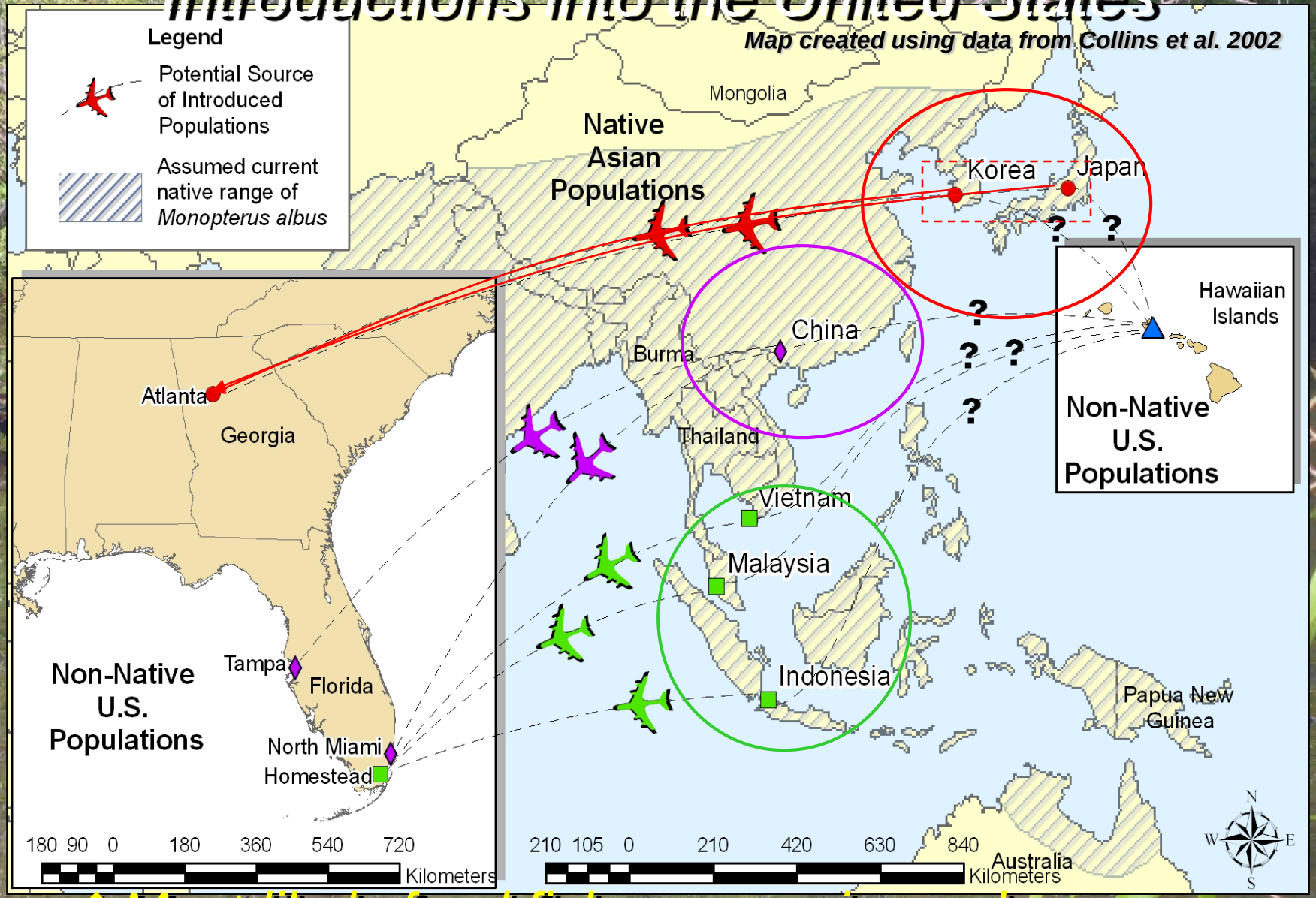
# Asian swamp eels

## Summary

- Mid-level predator
  - Primarily feeding on invertebrates in ponds
- New food item for wading birds and others
  - Observed herons feeding on eels
- Breeding in 3 ponds and possibly marsh
  - Young-of-year eels captured in all areas

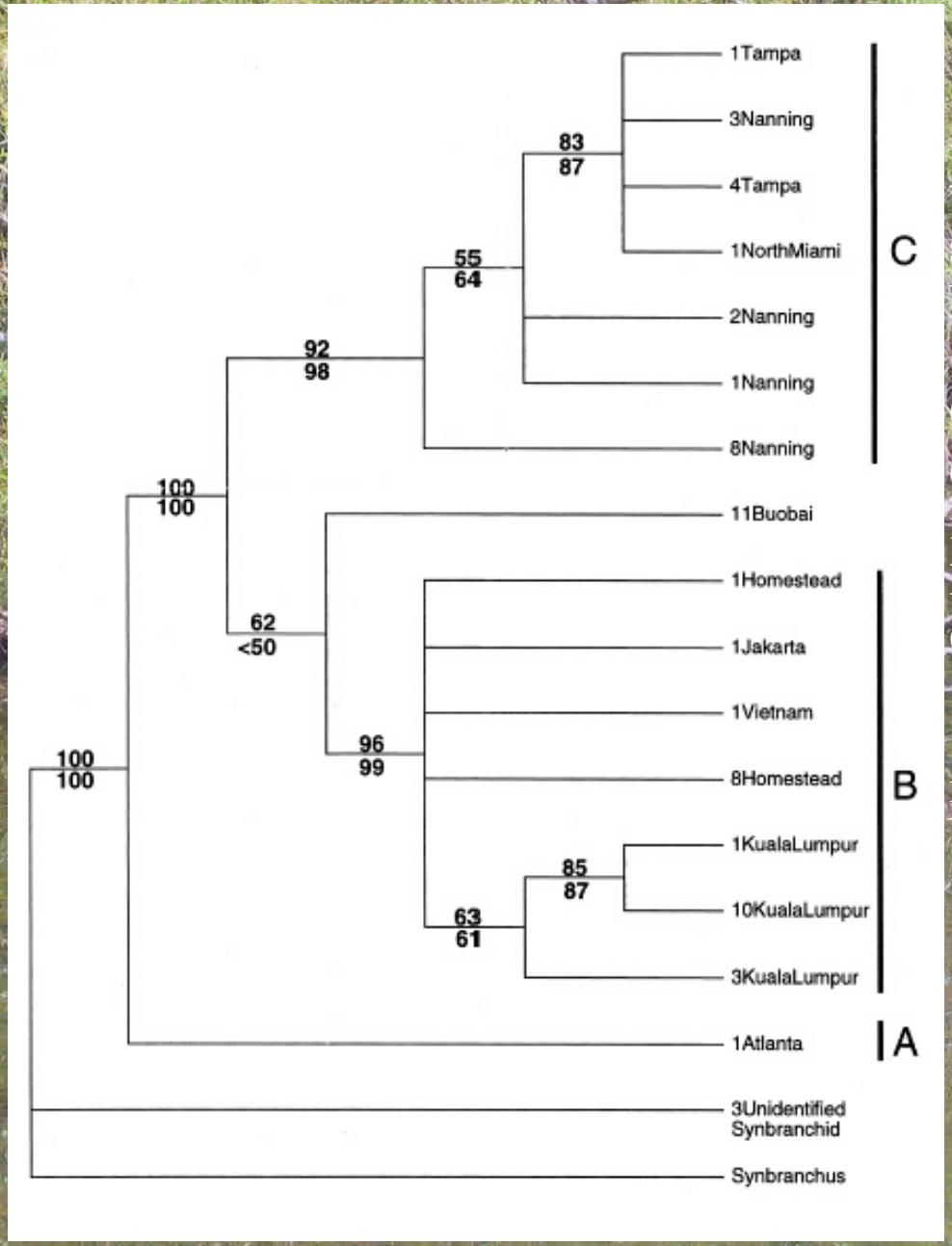
# Asian swamp eels in Georgia

## Introductions into the United States




❖ *Most likely food fish or aquarium releases*

Asian swamp eels being processed




Strict consensus of 24 most parsimonius trees based on haplotypes from 16S gene sequenced from all unique swamp eel haplotype-locality combinations.

Clade A (Atlanta) has > 10% genetic distance from other clades. Sequence for Atlanta individuals is identical to Nara prefecture in Japan indicating Japan or Korea as most likely source.

Tampa / Miami

China

Homestead

SE Asia

Atlanta

(Japan)

From Collins et al. 2001, Conservation Biology Vol 16, No 4. Pp 1024-1035.

# *Asian swamp eels in Georgia*

## *Chattahoochee Nature Center*

- **Discovered 1994**
- **Introduced *c.* 1990**
- **Breeding population in 3 ponds**
- **Direct access to marsh**

# *Asian swamp eels in Georgia*

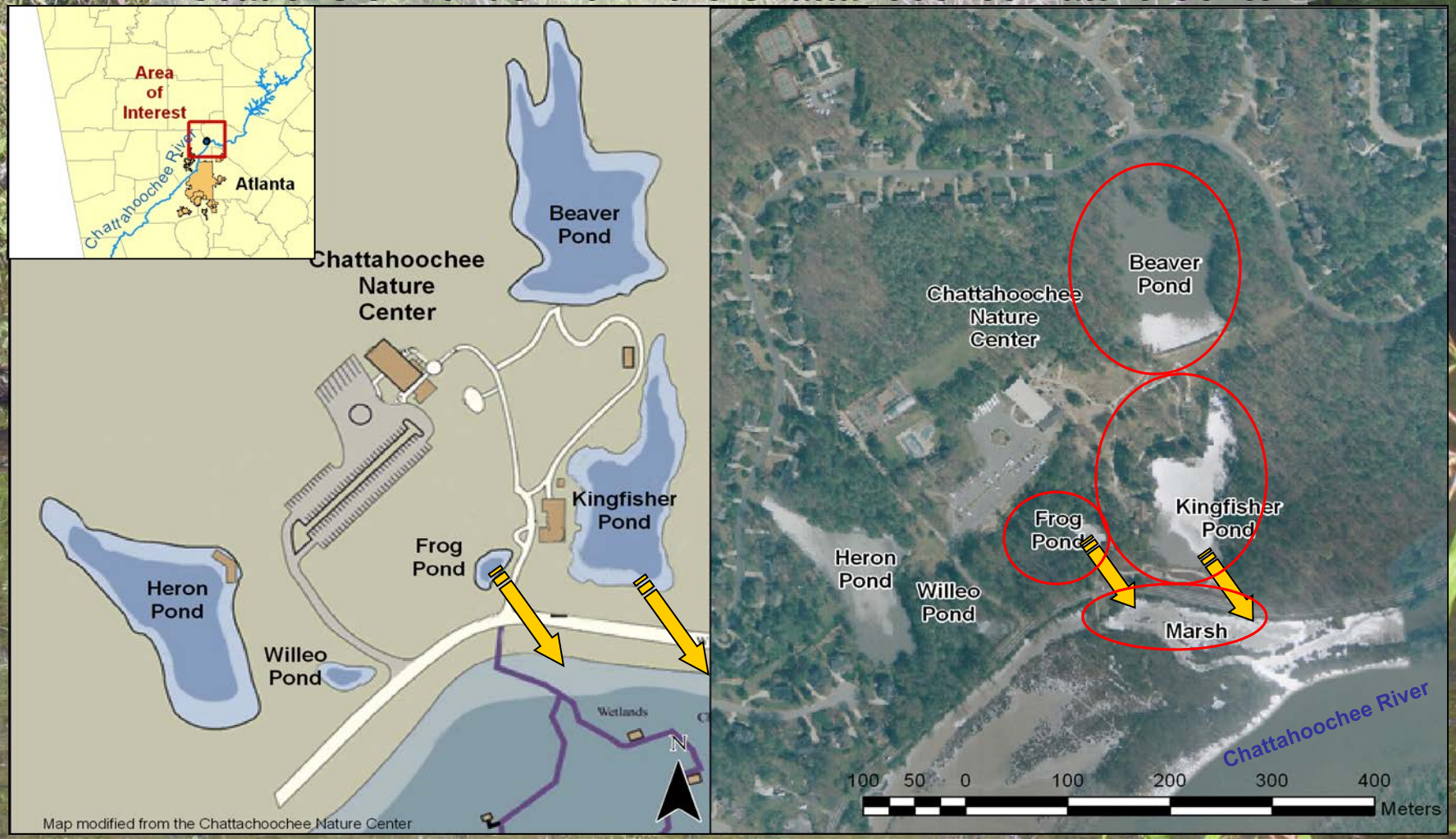
## *Chattahoochee Nature Center*

- **UGA studies began in 1998**
- **Current study objectives:**
  - **Assess population status**
  - **Assess potential impacts to native fauna**
  - **Evaluate control / eradication options**


*Photo credit: B. Y. Tang*

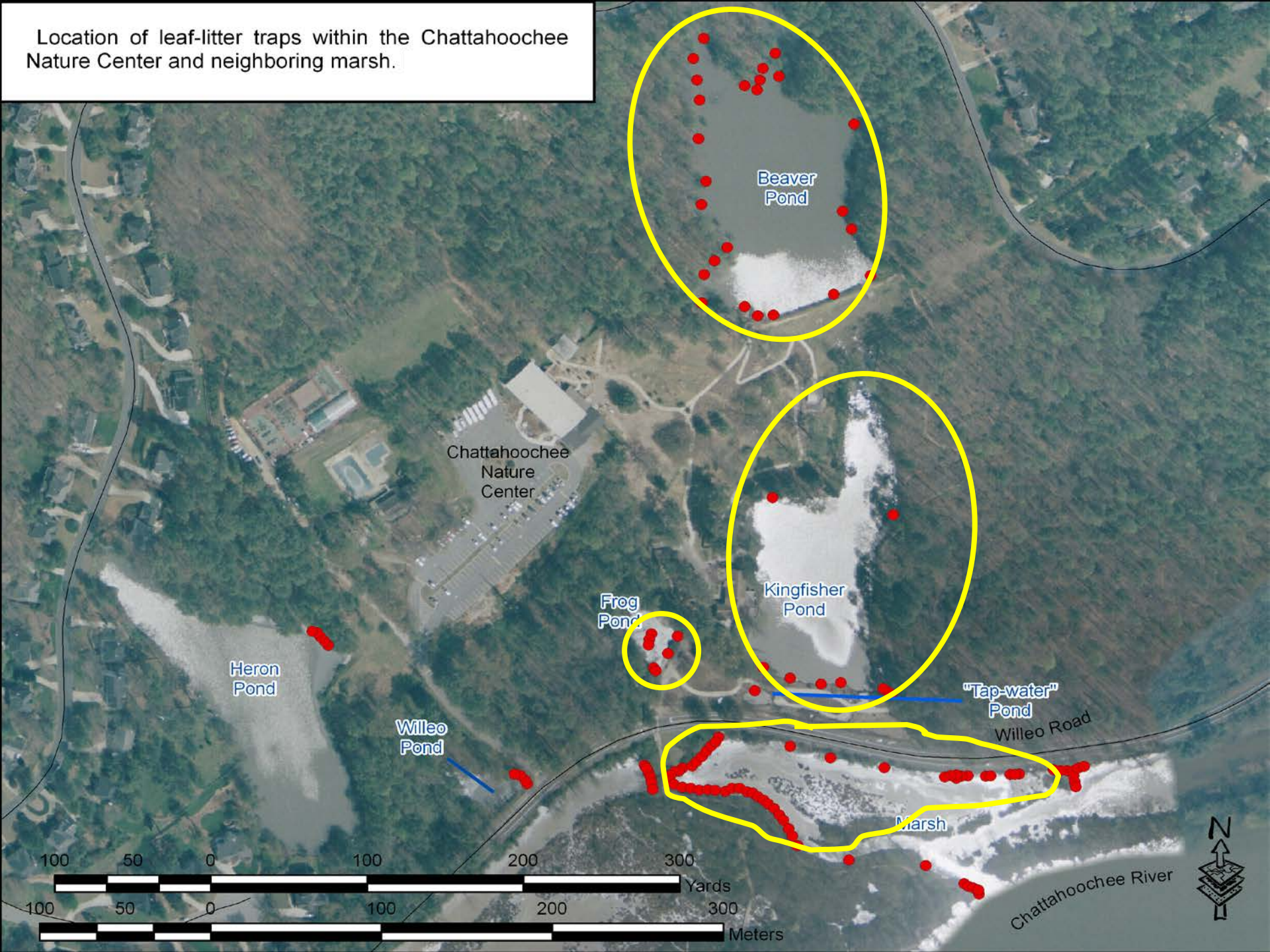
# Chattahoochee Nature Center

## Locations of Ponds within the Chattahoochee Nature Center



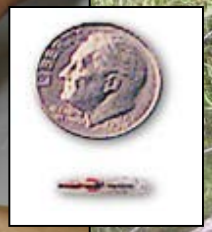
# Asian swamp eels

## Chattahoochee Nature Center


Location of leaf-litter traps within the Chattahoochee Nature Center and neighboring marsh.
Beaver Pond
Chattahoochee Nature Center
Kingfisher Pond
Frog Pond
Heron Pond
Willeo Pond
"Tap-water" Pond
Willeo Road
Marsh
Chattahoochee River
100 50 0 100 200 300
Yards
100 50 0 100 200 300
Meters
N

# *Marking Techniques*

**Passive Integrated Transponder (PIT)**



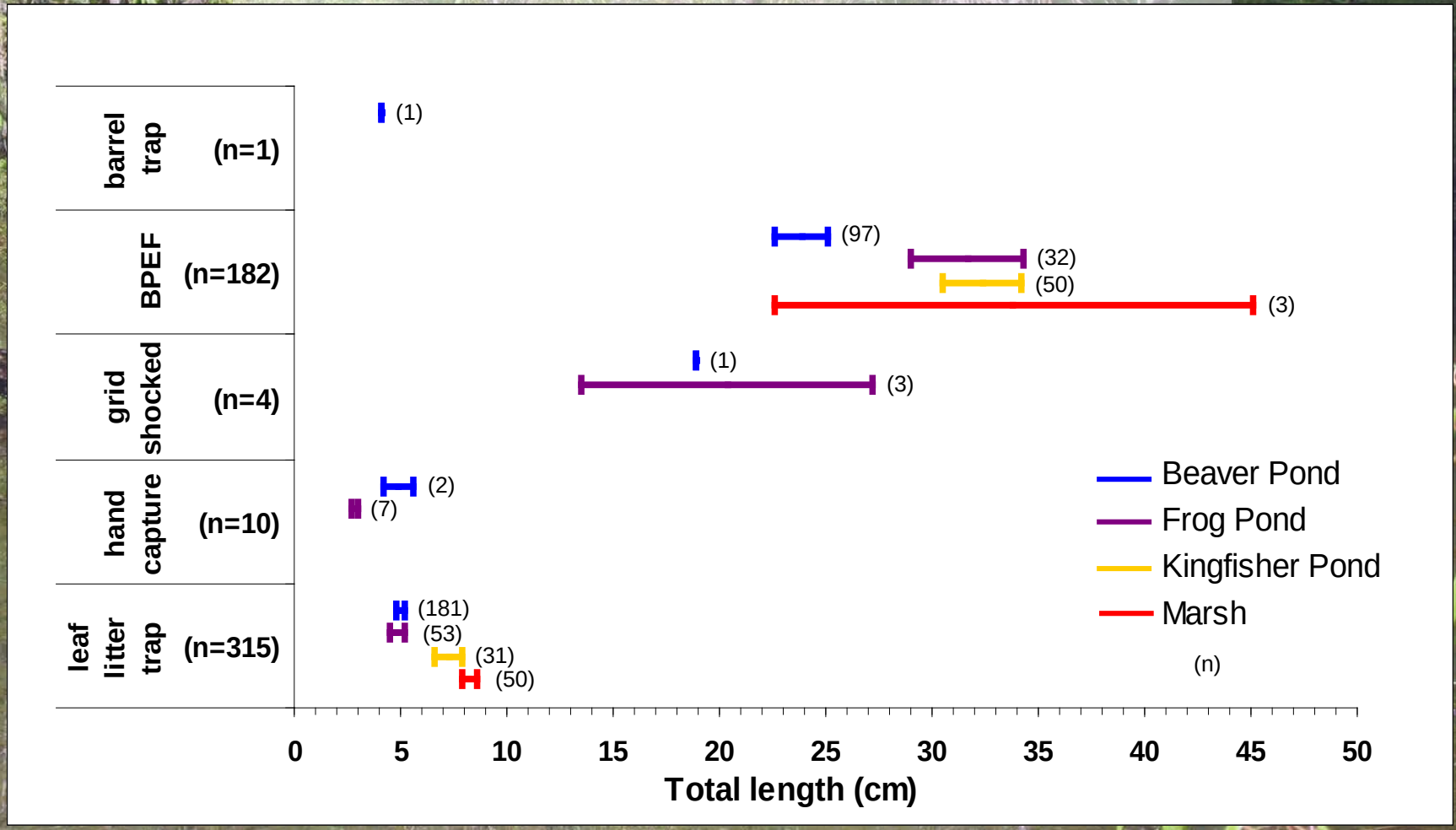
**Eels >35cm total length**

**Visible Implant Elastomer (VIE)**

**Eels 11-35cm total length**

# Size Classes, Capture Methods, Locations

## Capture Methods and Size Classes by Location



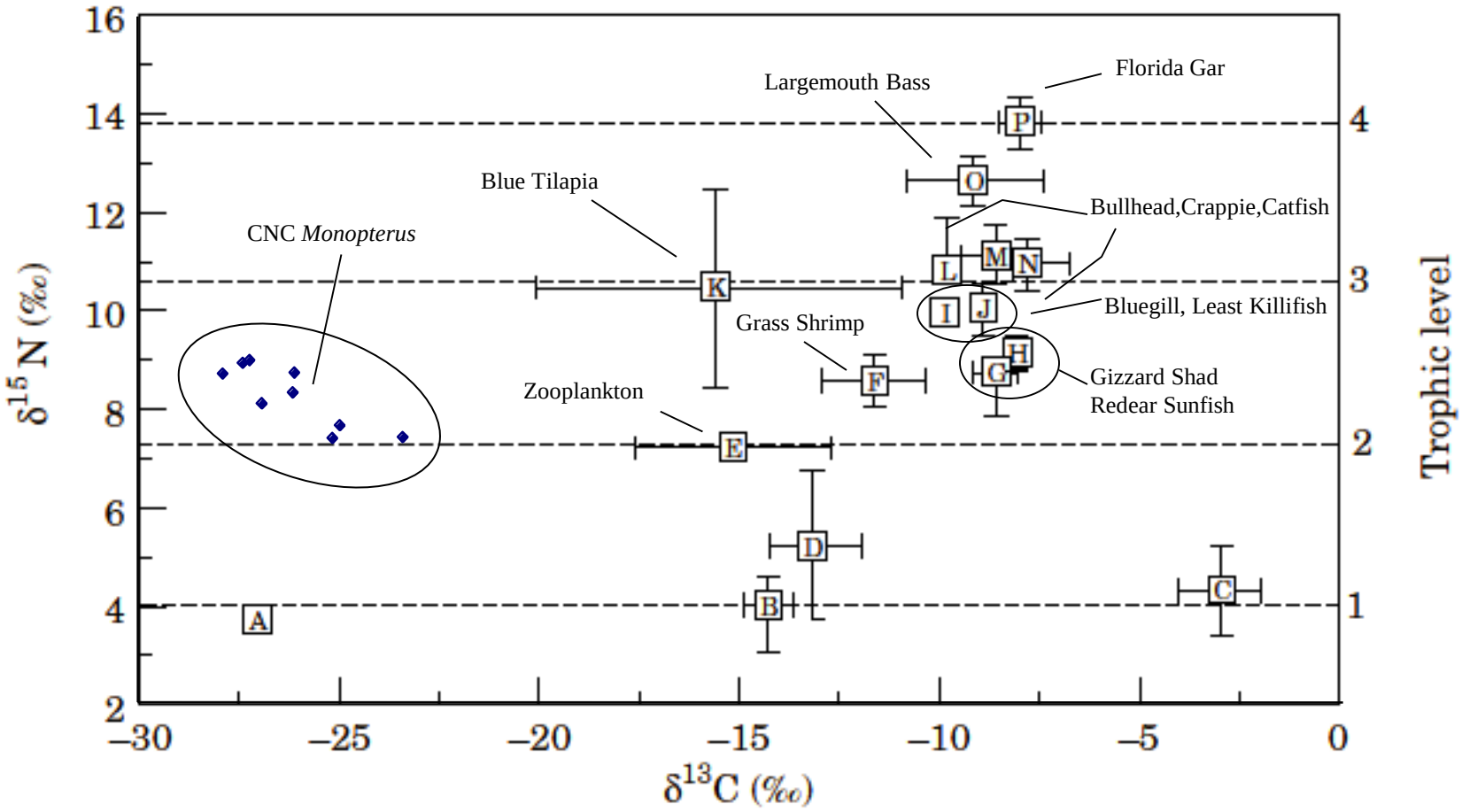



FIG. 1. Dual isotope plot of biota from Lake Apopka. Error bars represent one standard deviation unless smaller than symbol. A, Cattail; B, diatoms; C, *Microcystis*; D, small cyanobacteria (bulk plankton); E, zooplankton; F, grass shrimp; G, gizzard shad; H, redear sunfish; I, least killifish; J, bluegill sunfish; K, blue tilapia; L, brown bullhead; M, black crappie; N, white catfish; O, largemouth bass; P, Florida gar. Trophic levels were assigned based on a calculated 3·3‰ increase in $\delta^{15}$N from one trophic level to another.

Gu, B., C. L. Schelske And M. V. Hoyer. 1996. Stable isotopes of carbon and nitrogen as indicators of diet and trophic structure of the fish community in a shallow hypereutrophic lake. Journal of Fish Biology (1996) 49, 1233–1243

# Stable Isotope Structure of Beaver Pond

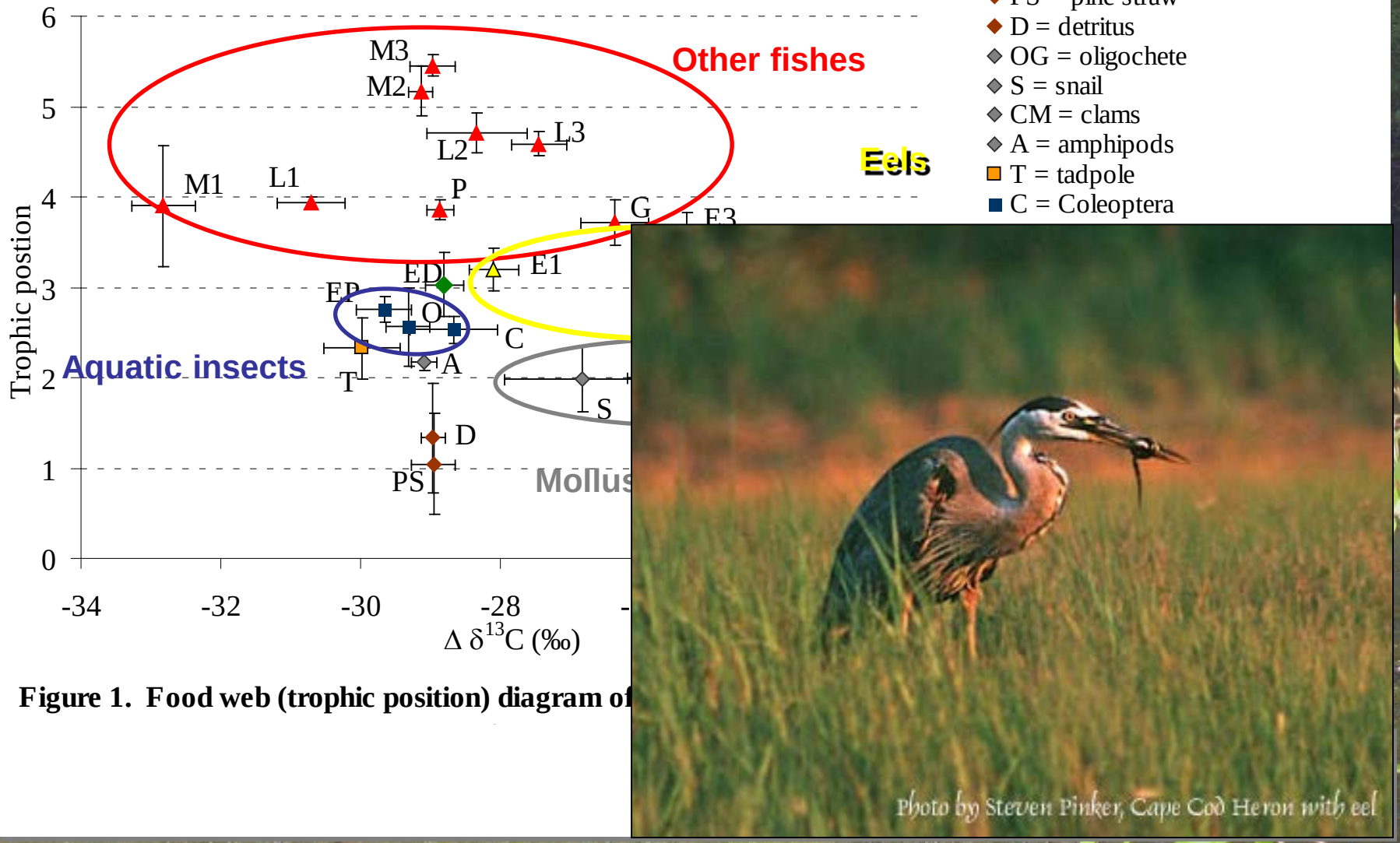
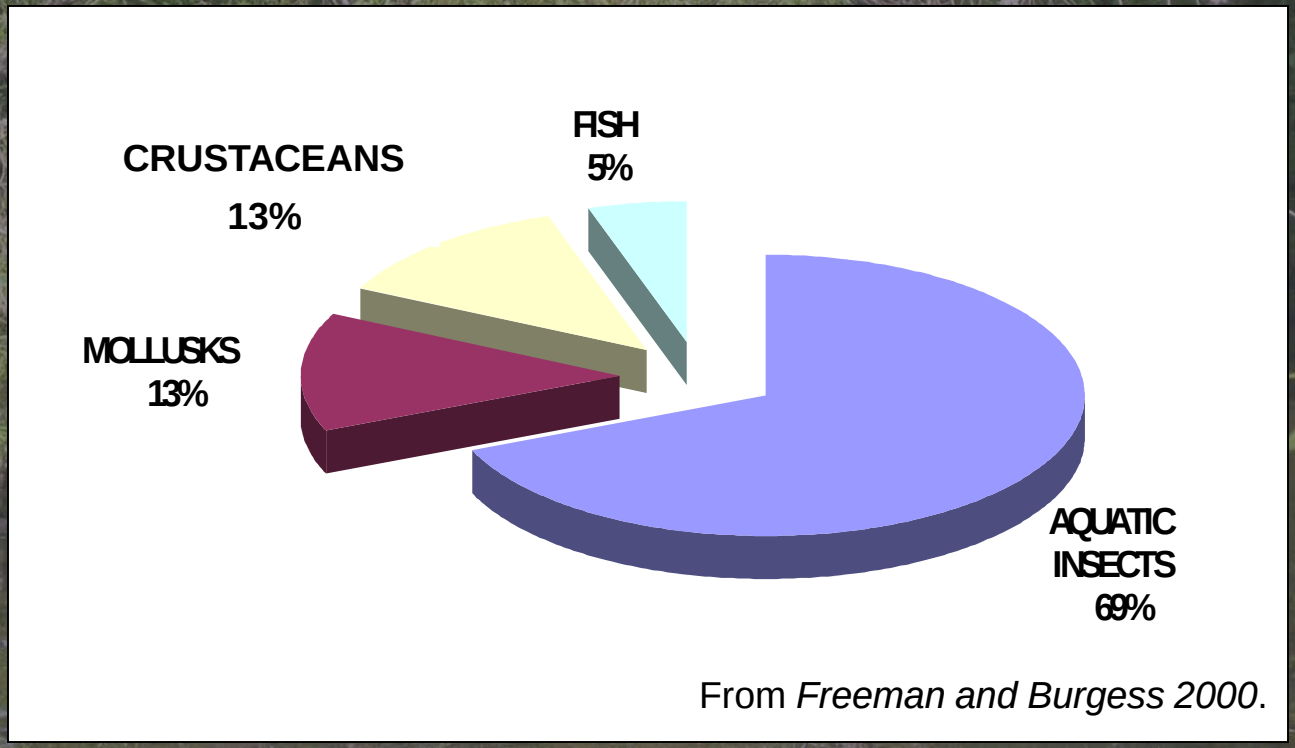



**Figure 1. Food web (trophic position) diagram of**

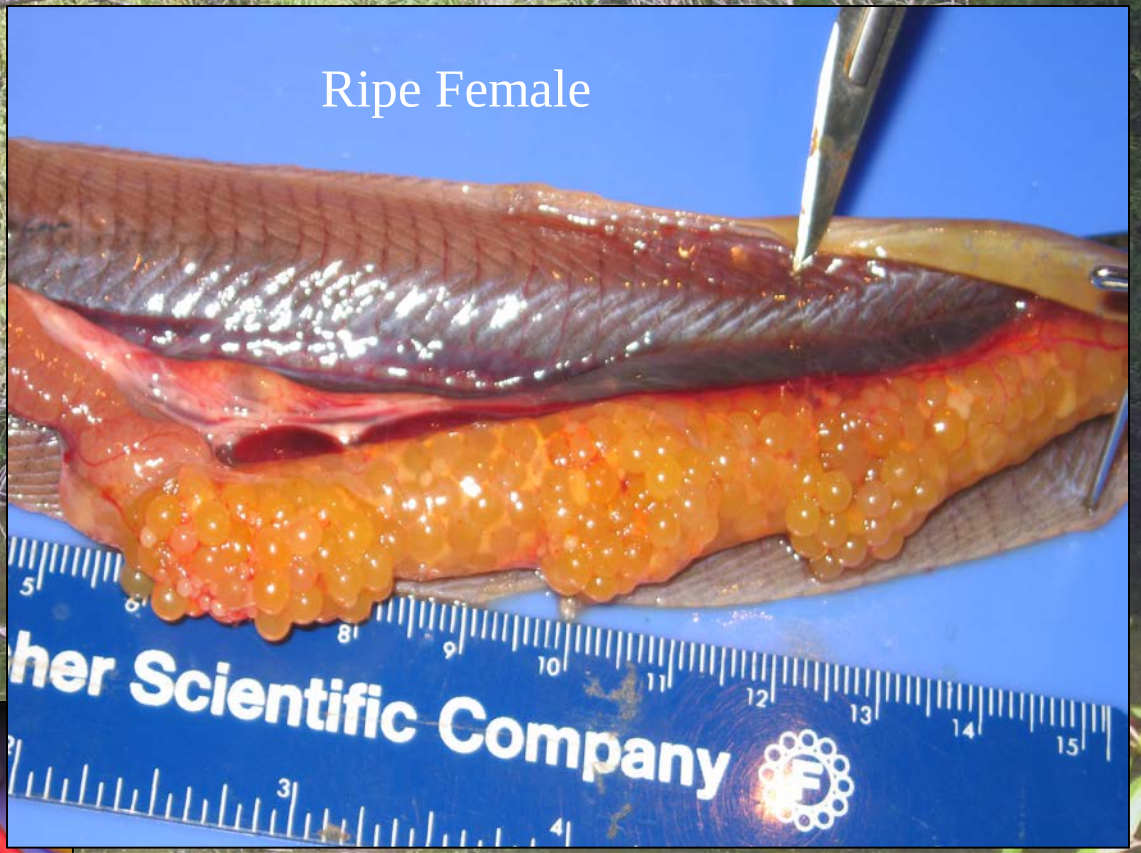
# *Previous gut analysis study*




From *Freeman and Burgess 2000*.

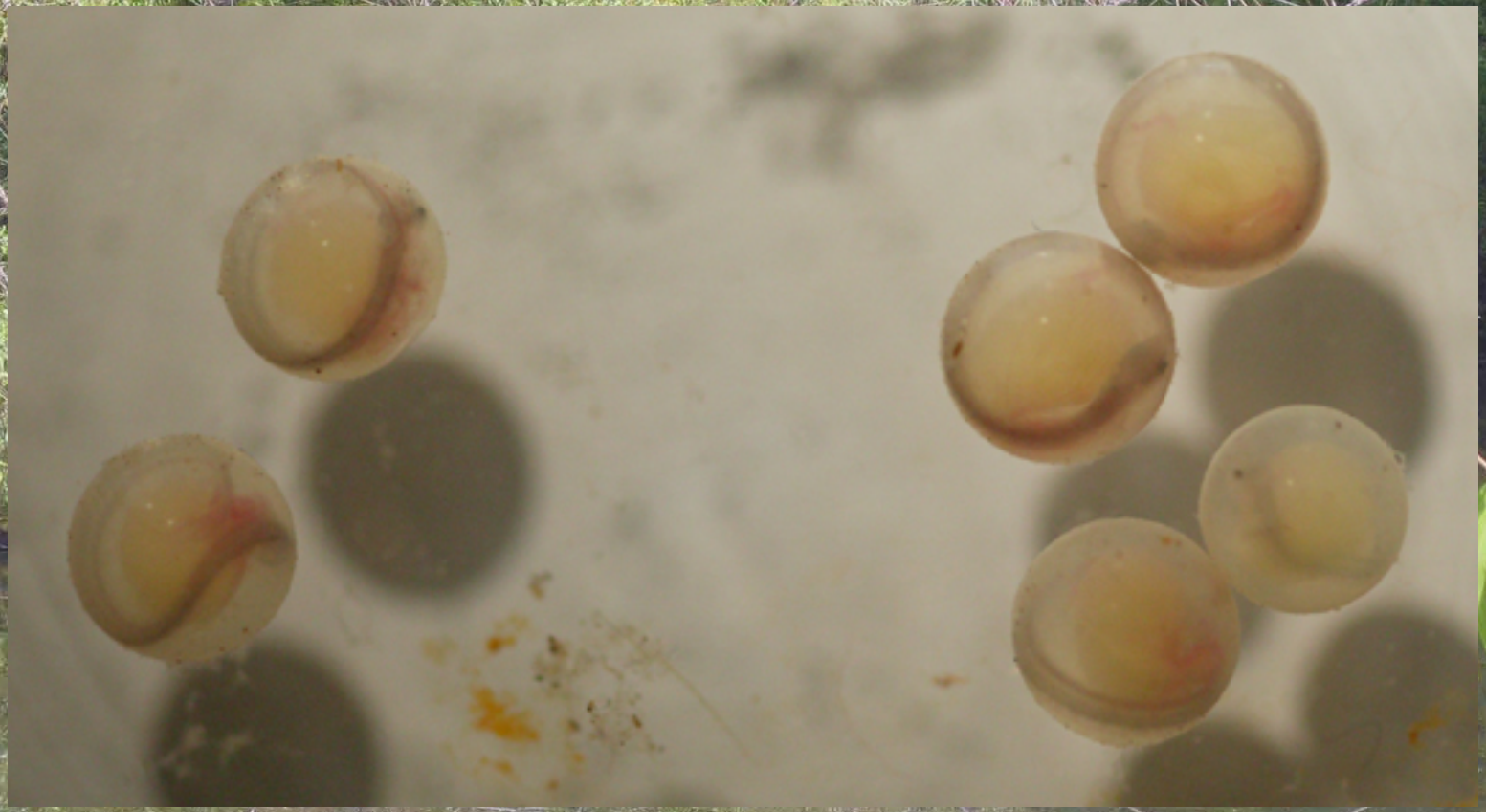
- Omnivorous carnivore
  - Corresponds to stable isotope study of eels captured in Beaver Pond

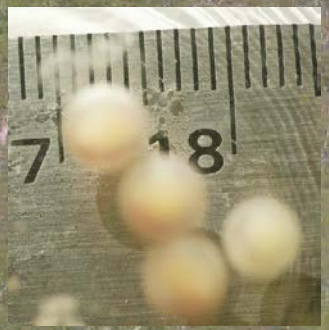
Ripe Female




Eggs in Bubble Nest

Approximately 48-hours PRE- hatch larval *Monopterus* sp.





Approximately 5mm in diameter

Approximately 12-hours post hatch larval *Monopterus* sp.
Grids in background are 2mm square.

# *Asian swamp eels in Georgia*

## *Control Options*

Swamp eels are highly adaptable to a diverse number of environments.

burrowing, air breathing, travel on land

- Piscicides
  (rotenone, antimycin)
- Trapping (removal)
- Dredging / Draining
- Electric barriers
- Modified outflows

# *Asian swamp eels in Georgia*

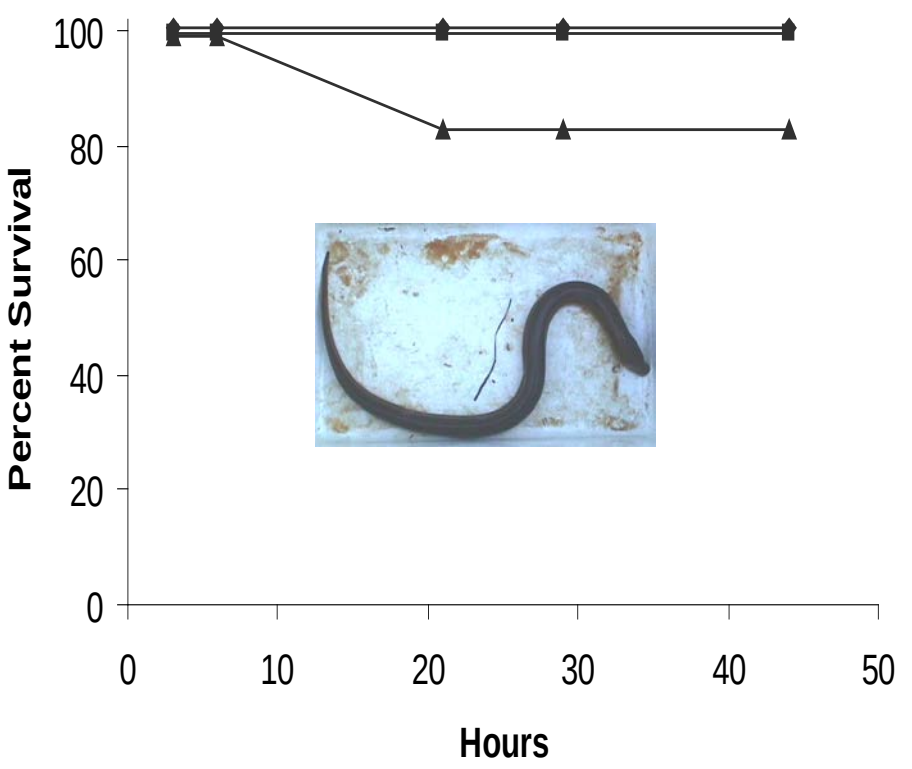
## *Lab Studies*

- **Effects of Antimycin-A**
  - **Tested young eels (3.53 ± 0.98 cm SVL)**
  - **Positive controls: golden shiner (*Notemigonus crysoleucas*)**
  - **0, 2, 5, 10, 15, 100 ppb (nL/L) Fintrol®**
  - **44 h observation**
- **Aquabiotics, Inc. recommends:**
  - **5 ppb for control of scaled fishes**
  - **15 ppb for hardier fishes**

# Asian swamp eels in Georgia

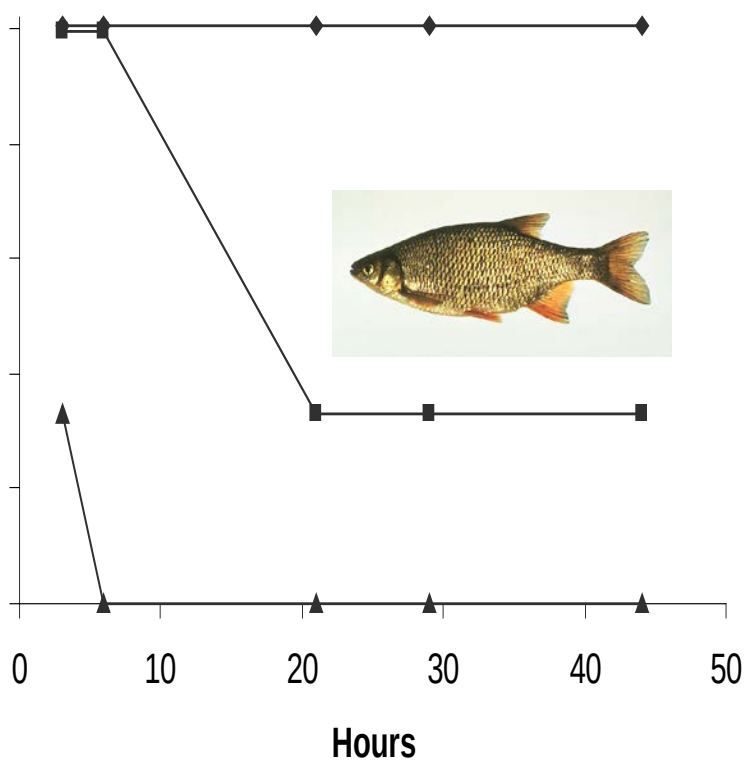
## Lab Studies

- ***Initial study (0, 2, 5, 15 ppb ): 100% eel survival***
- ***Second study (0, 10, 100 ppb):***




n = 6 eels / trt






n = 3 fish / trt



*picture by J.F. Scarola*

# *Asian swamp eels in Georgia*

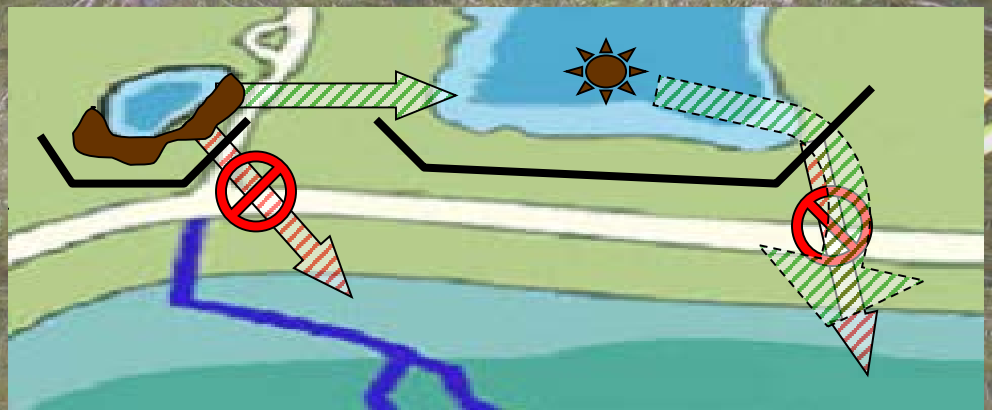
## *Lab Studies*

- **Conclusions**
  - **Young eels unaffected by Antimycin**
  - **Effective on positive controls**
  - **Chemical control may not be option**

# *Asian swamp eels in Georgia*

## *Containment Options*

- **Eliminate access to marsh**
  - **Reconfigure Kingfisher outflow**
    - **Close current outflow**
    - **Install deep-water screened standpipe**
  - **Redirect Frog Pond Outflow**
    - **Elevate pond berm**
    - **Direct outflow into Kingfisher**
  - **Erect silt fences**



# *Asian swamp eels in Georgia*

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# *Asian swamp eels in Georgia*

## *Control Options*

- **Reduce total numbers**
  - **Spring-time electrofishing**
    - Removes spawning adults
  - **Summer leaf-litter traps**
    - Removes spawned juveniles

# *Asian swamp eels in Georgia*

## *Conclusions*

- **Eels resistant to standard chemical control**
- **Eels susceptible to trapping**
  - Adults: Electrofishing
  - Juveniles: Leaf-litter traps
- **Ponds can be reconfigured**
  - Eliminates access to marsh
  - Greatly reduces immigration potential

# If all else fails…

# Asian swamp eels in Georgia

## Acknowledgements


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