



*Implementing  
State Wetlands  
Monitoring  
Programs*



## BAWWG Module:

*An Administrative Framework  
for the  
Implementation of a Wetland  
Bioassessment  
Program*



# Florida's Approach

By Russ and Ellen



## Tag-Team Presentation:

### 1. IBI Tool Development (Russ)

Biological assemblages

Regionalization

Classification

Metrics

Training/QA

### 2. Implementation w/ Wetlands Program (Ellen)



# *Development of a Statewide Bioassessment Program*

- ❖ Assessment tool (IBI) development
- ❖ Training/ quality assurance
- ❖ Implementation
  - Fulfill Program needs:
    - ✓ Mitigation /restoration success
    - ✓ Routine monitoring



## *Successful Programs Must Be:*

- Based on sound science
- Legally defensible
- Cost effective
- Appropriately communicated to stakeholders
- Established with adequate staff training, QA, and data management systems



# *Procedure to Develop Wetland Biological Assessment Tools*

- Classify wetland site types
- Define regional expectations
- Sample biota across human disturbance gradient
- Select relevant biological attributes that provide a reliable signal about human effects
- Extract and interpret patterns in the data
  - ✓ Finalize IBI

# Potential Target Communities for Aquatic Bioassessment...



Figure 1

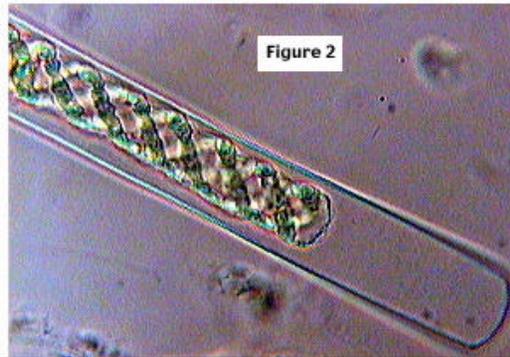
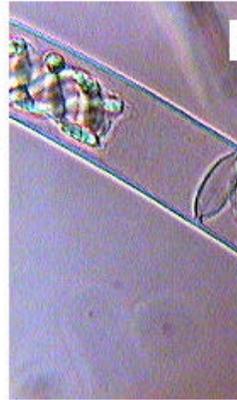


Figure 2



Algal Photo  
(Photos taken)

Diatoms page 1

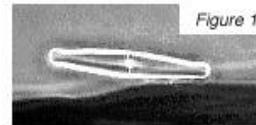


Figure 1

Central area circular  
Valve 2-3 $\mu$  wide; 10-26 $\mu$  long

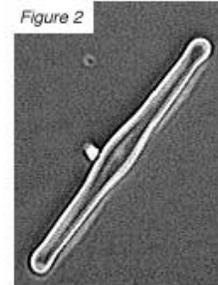


Figure 2

Central area irregular  
Capitate ends  
Valve up to 40 $\mu$  long  
Striae not visible in this photo



Figure 3

~15-20 $\mu$  long  
Middle striae farther apart than end striae

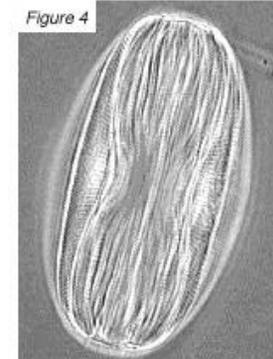


Figure 4

~35-45 $\mu$  long  
~20 $\mu$  wide

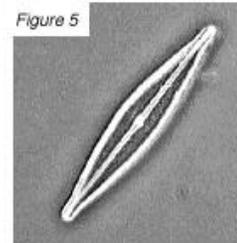


Figure 5

25-35 $\mu$  long  
~5 $\mu$  wide  
More capitate ends

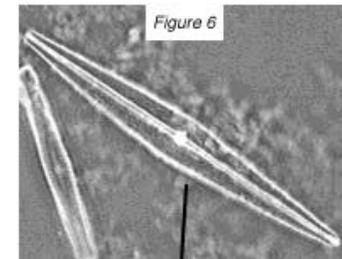


Figure 6

~40 $\mu$  long  
~5 $\mu$  wide

# Macroinvertebrates

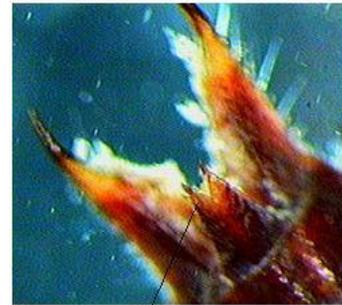
various species of *Argia*



no setae

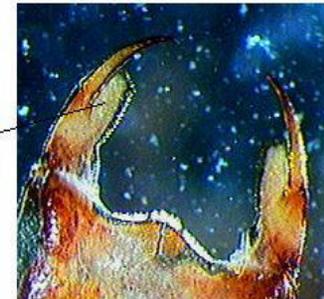


*Boyeria vinosa*



bifid epiroct

truncated palpal lobe









# *Florida Wetland Bioassessment Contract*

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**University of Florida  
Center for Wetlands**

**Mark Brown  
Susan Carstenn  
Chuck Lane**



# *Wetland Classification*

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- Shrub-scrub
- River swamp
- Depression swamp
- Lake swamp
- Strand/Seepage swamp
- Flatland swamp
- River marsh
- **Depression marsh**
- Lake marsh
- Seepage marsh
- Wet prairie



# *Wetland Classification Sources*

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- National Wetlands Inventory
- Florida Natural Areas Inventory
- FLUCCS
- U.S. Fish and Wildlife Service
- Soil Conservation Service

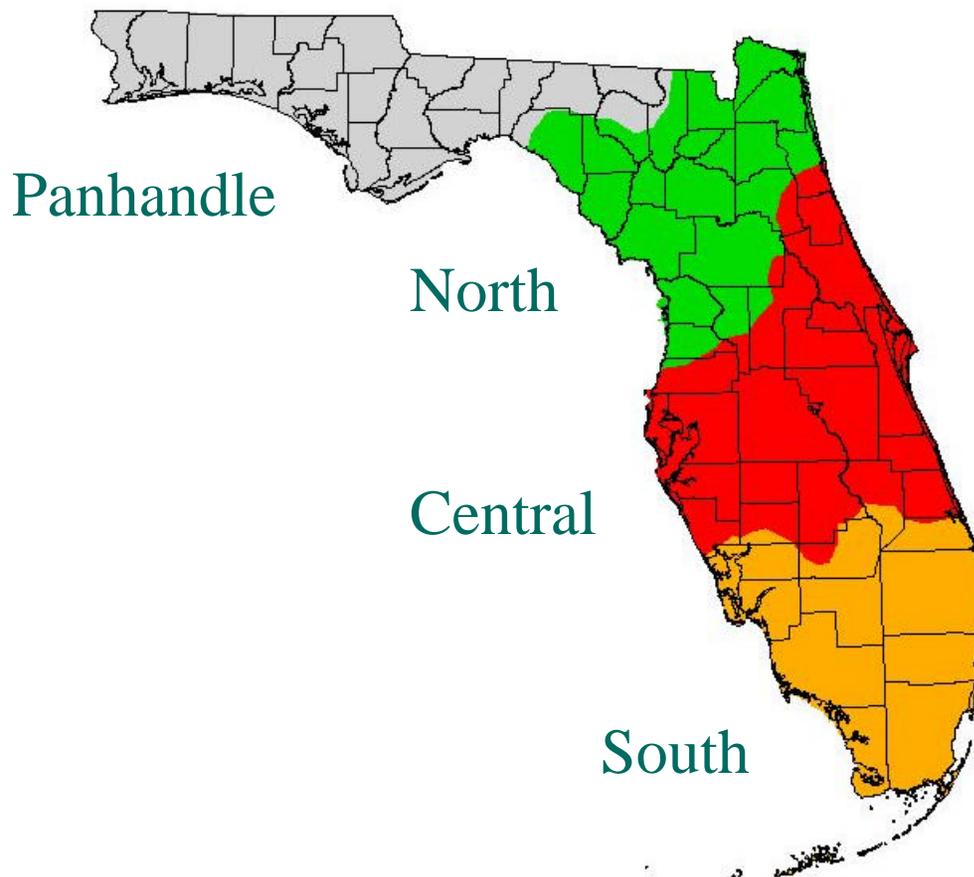


# *Wetland Regionalization*

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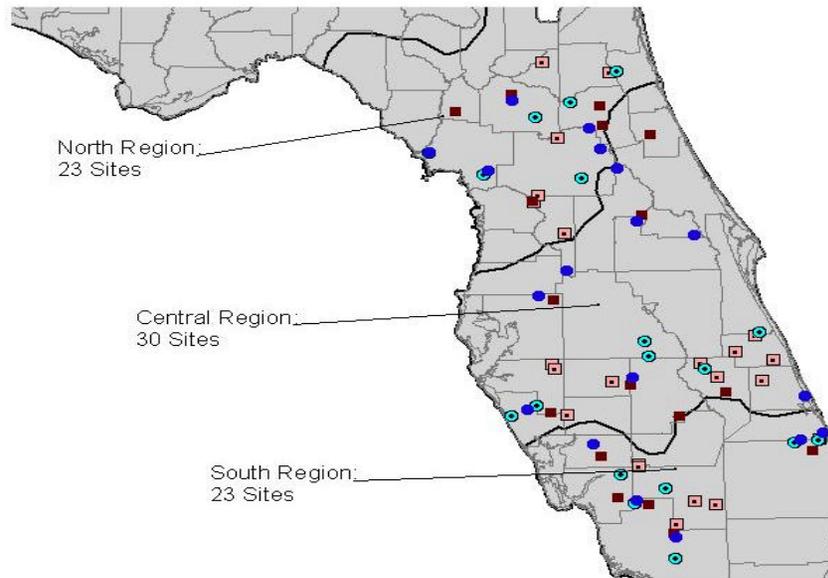
- Modeled water movement
- Physical and climatic inputs
  - Growing season rainfall (Jan-April)
  - Evapotranspiration
  - Days below freezing
  - Slope
  - Percolation rates
  - Runoff rates

# *Wetland Regions*



# Study Wetlands

Figure 1: 1999 & 2000 Marsh Sites



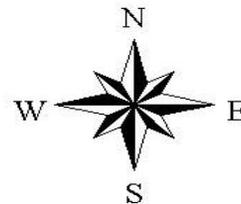
North Region:  
23 Sites

Central Region:  
30 Sites

South Region:  
23 Sites

70 0 70 140 Kilometers

- 1999 Reference Sites
- 1999 Agricultural Sites
- 2000 Reference Sites
- 2000 Agricultural Sites
- Usgs\_counties
- Regions.shp



**Total of 76 study  
wetlands selected in  
3 regions**



# *Landscape Development Intensity (LDI) Index*

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- Quantifies disturbance gradients
- Independent measure of disturbance using aerial photographs and ground observations



# *Primary Factors Considered in Developing the LDI*

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- Sediment and nutrient loading
- Hydrologic alterations
- Physical impacts



# *Landscape Development Intensity Coefficients*

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1- 2	Upland Forest or Wetland
2.5-3	Pine Plantation
3-4	Rangeland
4-5	Woodland Pasture
6	Field and Citrus Crops
7-8	Improved Pastureland
9	Intense Row Crops
10	Feed lots and Dairy Operations



# *Landscape Development Intensity Index*




$$\mathbf{LDI = S (LDC * \%LU)}$$

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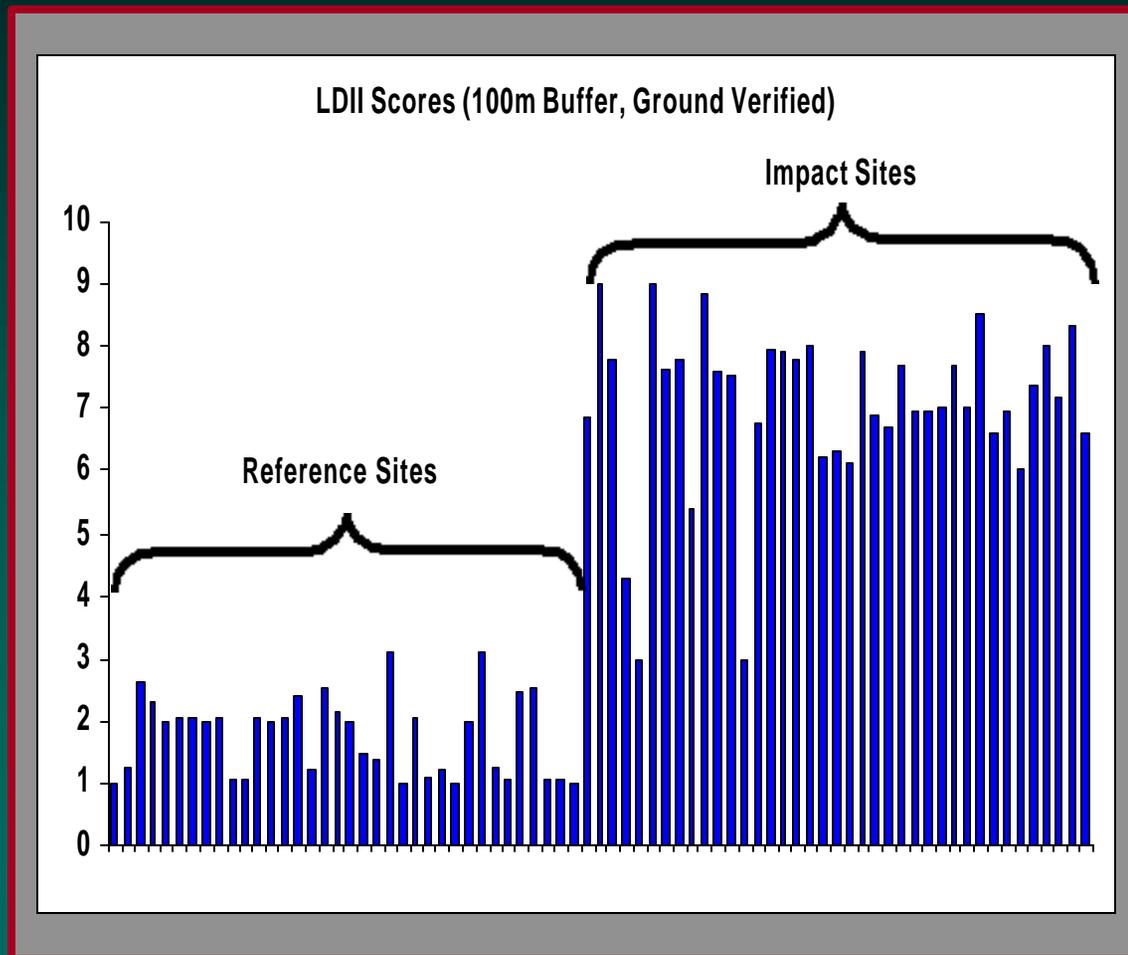
**Where,**

**LDI** = Landscape Development Intensity  
Index

**LDC** = Disturbance Coefficient Associated  
with the Particular Land Use

**%LU** = Percent Area of the Wetland  
Drainage Basin Occupied by the  
Land Use Category

# Comparison of LDI scores for Reference and Impacted sites



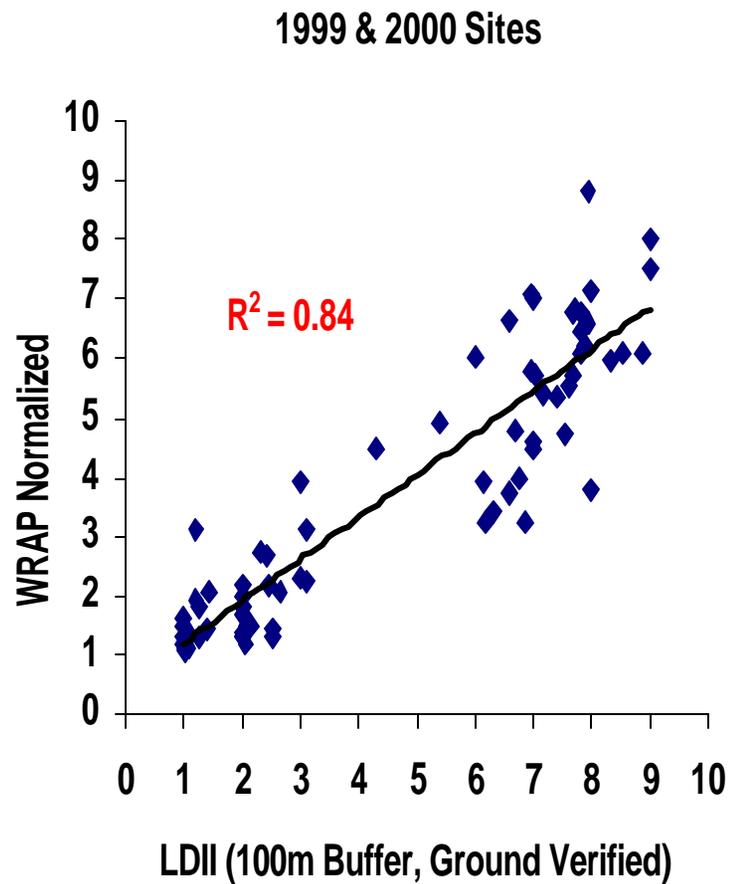


# *Wetland Rapid Assessment Procedure* (WRAP; Miller & Gunsalus 1997)

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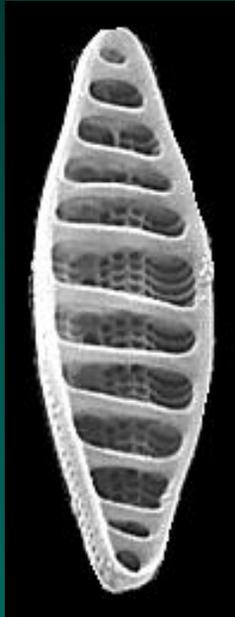
- SFWMD Regulatory tool to evaluate wetland sites
- Measured Variables (0.0 – 3.0)
  - Wildlife Utilization
  - Wetland Overstory / Shrub Canopy
  - Ground Cover
  - Adjacent Uplands / Wetland Buffer
  - Hydrologic Indicators
  - Water Quality Inputs / Treatment

# Correlation of LDI with WRAP

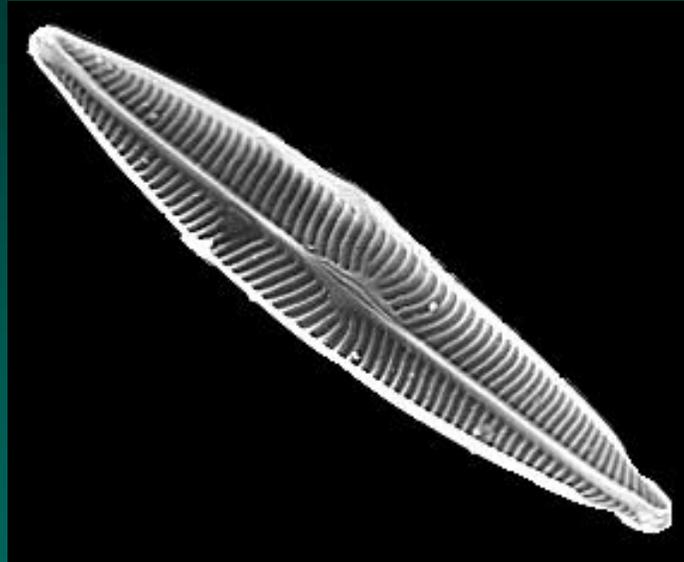




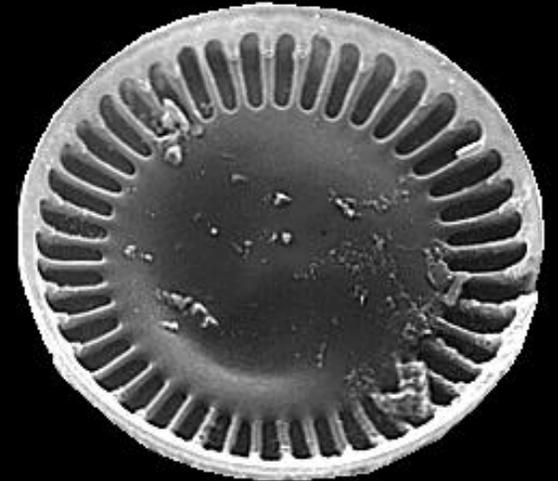
# *Algae*



*Nitzschia sp.*



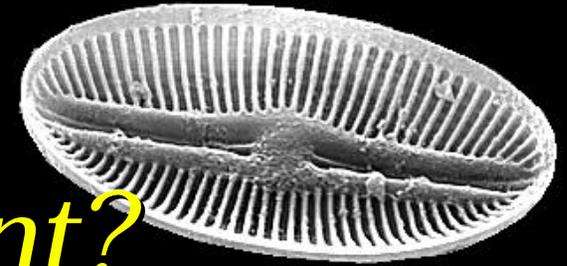
*Navicula sp.*



*Cyclotella sp.*



# *Why Use Algae in Ecological Assessment?*



## **Intrinsic Values**

- Biodiversity
- Base of Food Web
- Nutrient Cycling
- Substrate Stabilization
- Habitat for other Organisms

## **Source of Problems**

- Oxygen Depletion
- Habitat Alteration
- Drinking Water
  - Taste & Odor
- Recreational Aesthetics
  - Turbidity & Smelly
- Toxicity

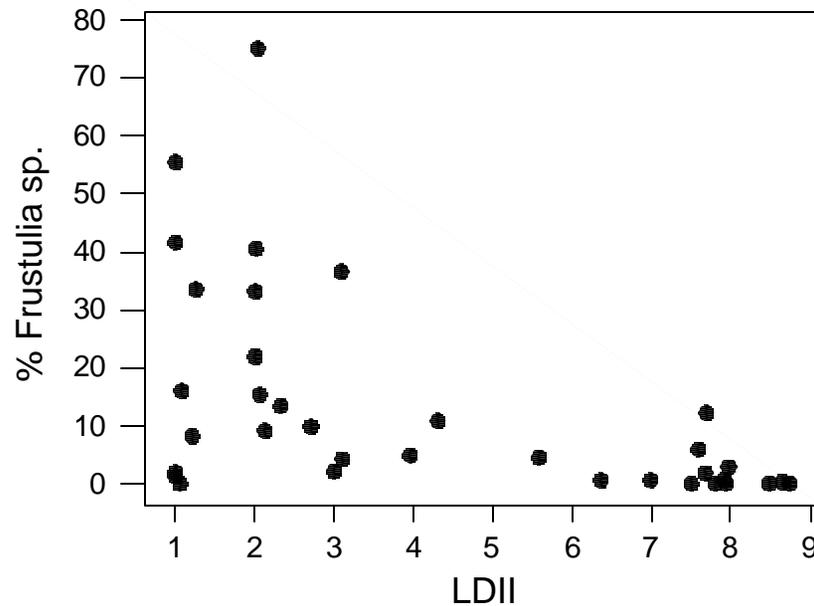
# *Algae Methods*

Benthic Algae (epipelon)  
Epiphyton (attached)  
Metaphyton (floating)  
Phytoplankton (column)



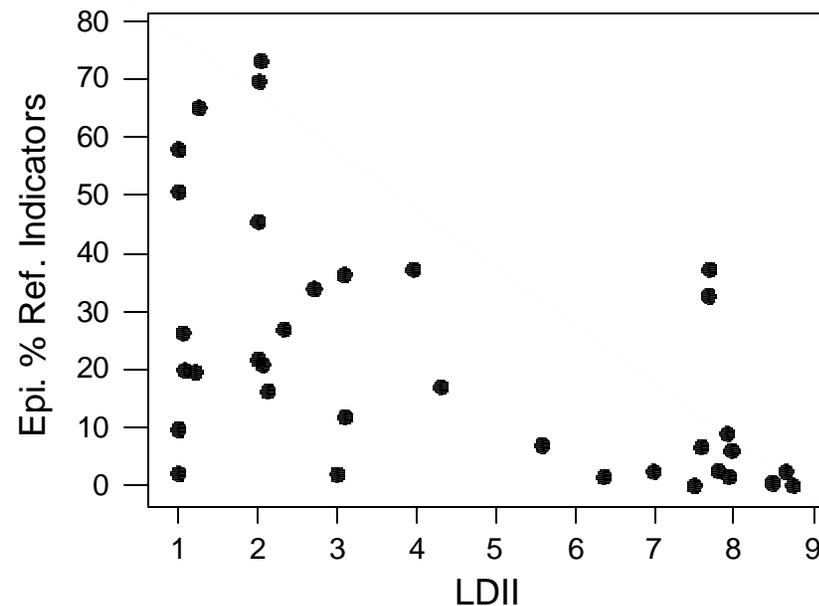
# Epiphyton: Reference Indicator Genera

- *Anomoeneis* sp.
- *Frustulia* sp.
- *Pinnularia* sp.



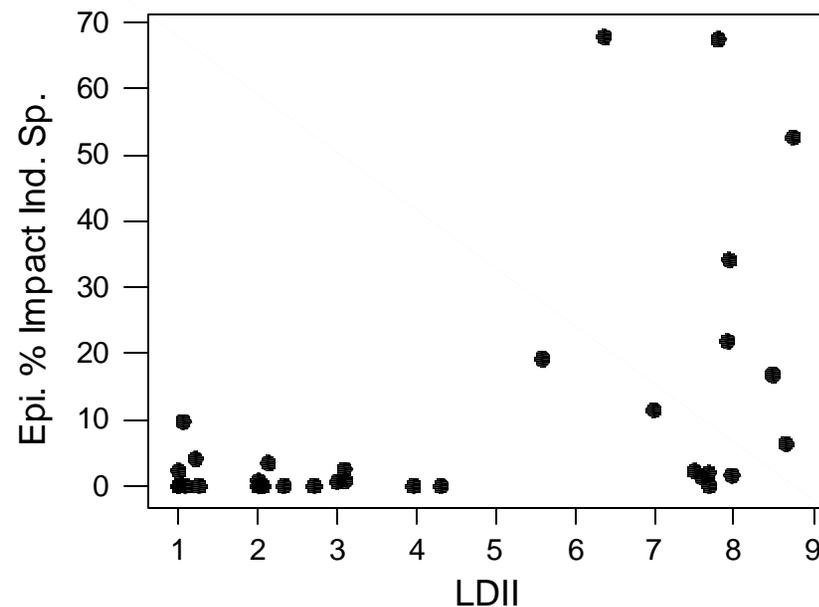
# Epiphyton Species Reference Indicators

- *Anomoeneis serians*, *A. serians acuta*, *A. serians brachysira*, *A. vitrea*, *Chroococcus turgidus*, *Desmogonium rabenhorstianum elongatum*, *Eunotia naegelii*, *Frustulia rhomboides capitata*, *F. rhomboides saxonica*, *Mastogloia smithii*, *Navicula subtilissima*, *Oscillatoria limnetica*, *Pinnularia braunii*



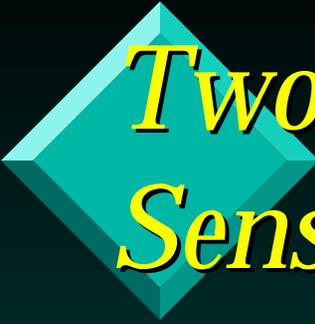
# Epiphyton Species Impact Indicators

- *Achnanthes hungrica*
- *Caloneis bacillum*
- *Gomphonema parvulum*
- *Navicula confervacea*, *N. cryptotenella*, *N. minima*, *N. pupula rectangularis*, *N. seminulum*
- *Nitzschia amphibia*, *N. frustulum*, *N. palea*
- *Sellaphora rectangularis*



# *Macrophytes*





# *Two Methods for Plant Sensitivity Metric Development*

- Empirical Analysis
  - Compare taxa occurrences in reference vs. test sites
- Expert Judgment
  - Have experienced botanists independently score each taxon



# *Schematic of Empirical Analysis*

All Sites (n=75)

All Species

Reference Sites

Impacted Sites

All Species

All Species

Ubiquitous

Species

Species unique  
to Reference Sites

Sensitive  
Species

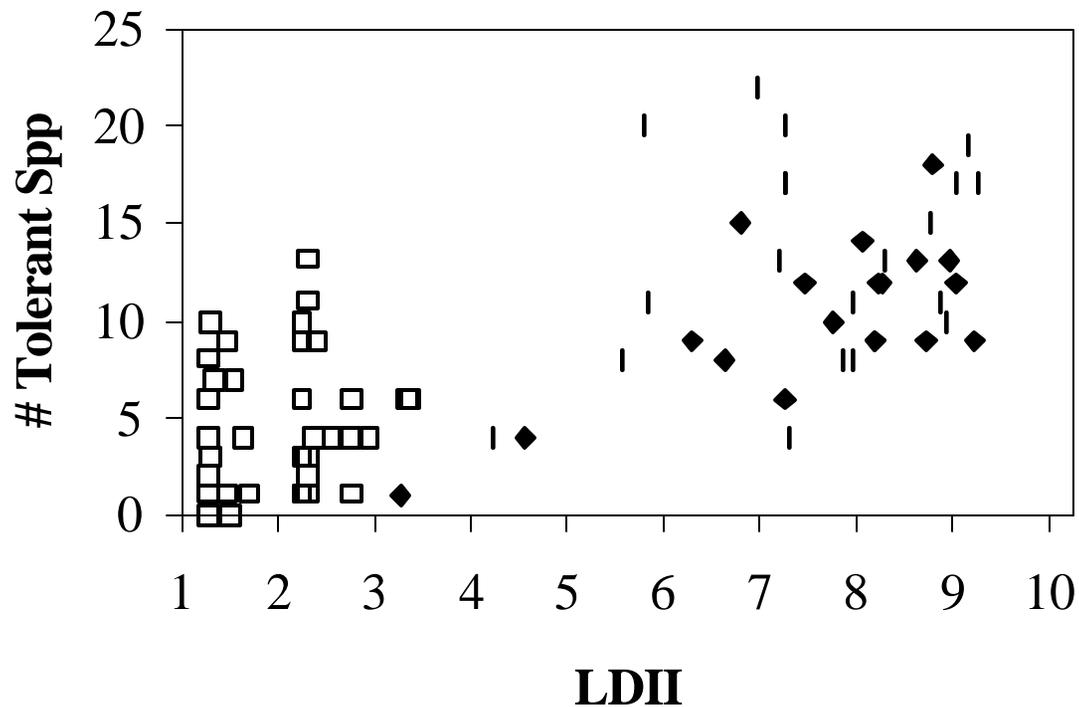
Truly  
Ubiquitous  
Species

Tolerant  
Species

Species unique  
to Impacted  
Sites



# *Empirically Derived Tolerant Species Correlated with LDI*

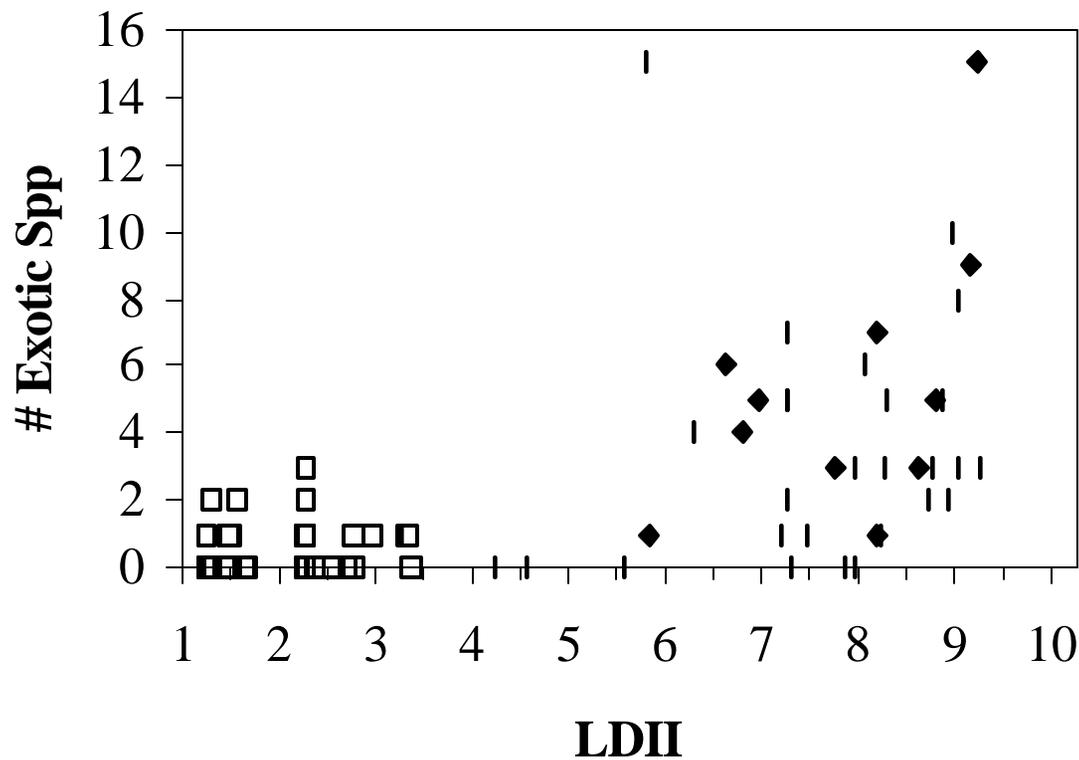


# *Species Characteristics Metrics*

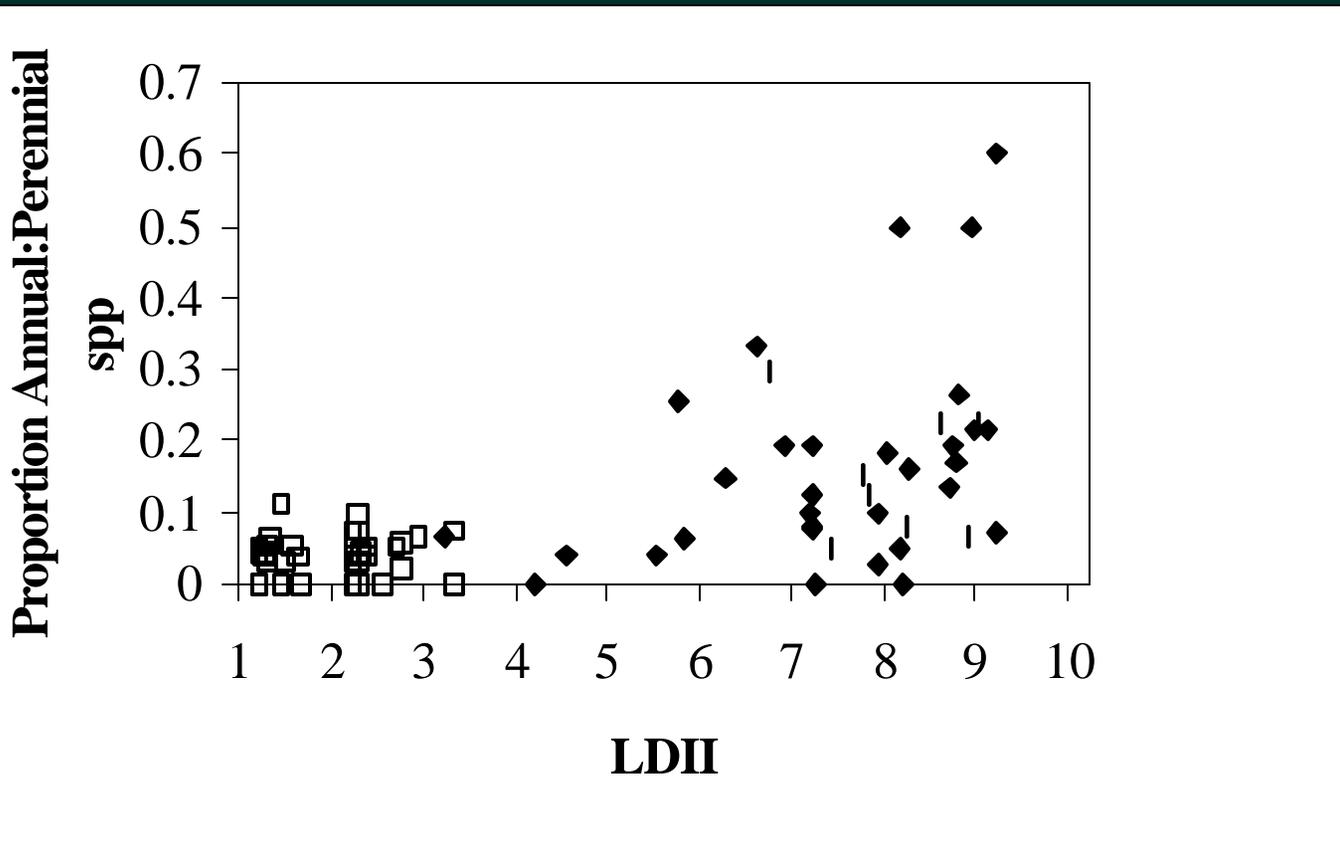
- Life-form characteristics:
  - Annual or Perennial
  - Grass-like species
  - Indigenous or Exotic



# *State-wide # of Exotic species Correlated with LDI*



# *Proportion of Annual to Perennial Species Correlated with LDI*





# *Floristic Quality Assessment*

Developed and Applied by:

Wilhelm 1989

Swink and Wilhelm 1994

Wilhelm and Masters 1995

Fennessey et al. 1996

Herman et al. 1997



# *Floristic Quality Index Development*

Team of Florida Expert  
Botanists

- Keith Bradley
- Nina Raymond
- David Hall
- Tony Arcuri
- Bruce Tatje
- Wendy Zomlefer
- Kathy Burks
- Jim Poppleton



# *Floristic Quality Index Development*

- Send list of all taxa sampled to experts
- Provide Coefficient of Conservation scoring criteria
- Compile and calculate “Coefficient of Conservation” (C of C)
- Calculate the “Floristic Quality Index”



# *Coefficient of Conservatism Scoring Criteria*

*(modified from Fennessy et al. 1996)*

- |          |  |
|----------|--|
| 0        | Alien and invasive native taxa   |
| 1.0 - 3  | Tolerant taxa  |
| 3.1 - 6  | Ubiquitous taxa  |
| 6.1 - 9  | Intolerant (sensitive) taxa  |
| 9.1 - 10 | Taxa that exhibit high degrees of fidelity to a narrow set of ecological conditions. |



# *Floristic Quality Index*

“Simple Mean” Coefficient of Conservation

$$\text{Avg C of } C_j = (\sum C \text{ of } C_{ij}) / N_j$$

where  $j$  is the site,  $i$  is each species at site  $j$  and  $N$  is the number of species



# *Examples of C of C Taxa = 0 – 1 Alien or Very Tolerant*

***Alternanthera  
philoxeroides***

*Amaranthus blitum*

*Cyperus prolifer*

***Eichhornia crassipes***

*Hydrilla verticillata*

*Ipomoea aquatica*

*Melaleuca quinquenervia*

*Mimosa pigra*

*Scleria vaginata*

***Paspalum urvillei***

***Panicum repens***

*Lygodium microphyllum*

***Ludwigia peruviana***

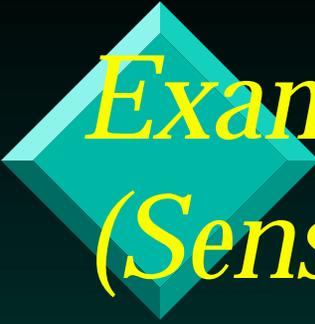
***Eupatorium capillifolium***

*Vitis aestivalis*

*Vitis rotundifolia*

*Cyperus croceus*

**Red = Confirmed by UF empirical analysis**



# Examples of C of C Taxa = 6.1 – 9 (Sensitive)

*Aristida stricta*

***Cladium jamaicense***

*Crinum americanum*

*Drosera capillaris*

***Eriocaulon decangulare***

*Gordonia lasianthus*

*Ilex cassine*

*Justicia angusta*

*Lobelia paludosa*

*Lyonia ferruginea*

*Magnolia virginiana*

*Nyssa biflora*

*Osmunda regalis*

***Oxypolis filiformis***

*Paspalum monostachyum*

*Persea borbonia*

*Persea palustris*

*Polygala rugelii*

***Rhynchospora tracyi***

***Scleria baldwinii***

*Stillingia aquatica*

*Utricularia cornuta*

*Woodwardia areolata*

**Red = Confirmed by UF empirical analysis**



*Potential C of C = 9.1 – 10*

*High fidelity (unique to reference)*

*Gratiola ramosa*

*Iva microcephala*

*Rhychospora filifolia*

*Lachnocaulon minus*

*Stillingia aquatica*

*Lycopodium appressum*

*Brasenia schreberi*

*Persea palustris*

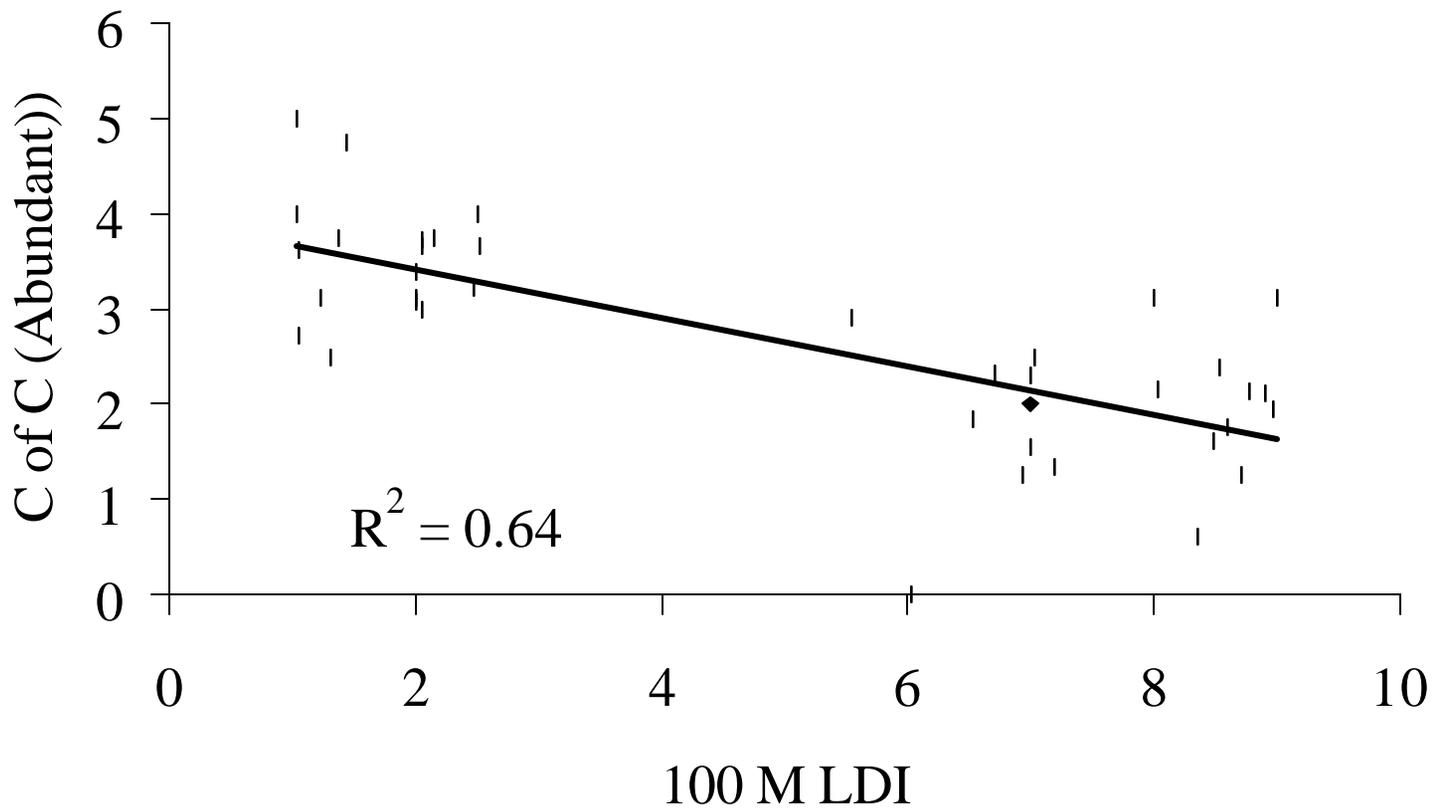
*Drosera revifolia*

*Drosera capillaris*

*Gordonia lasianthus*

The botanists did not identify any C of C 9.1-10 taxa. These were identified through UF empirical analysis.

# Coefficient of Conservation vs. LDI

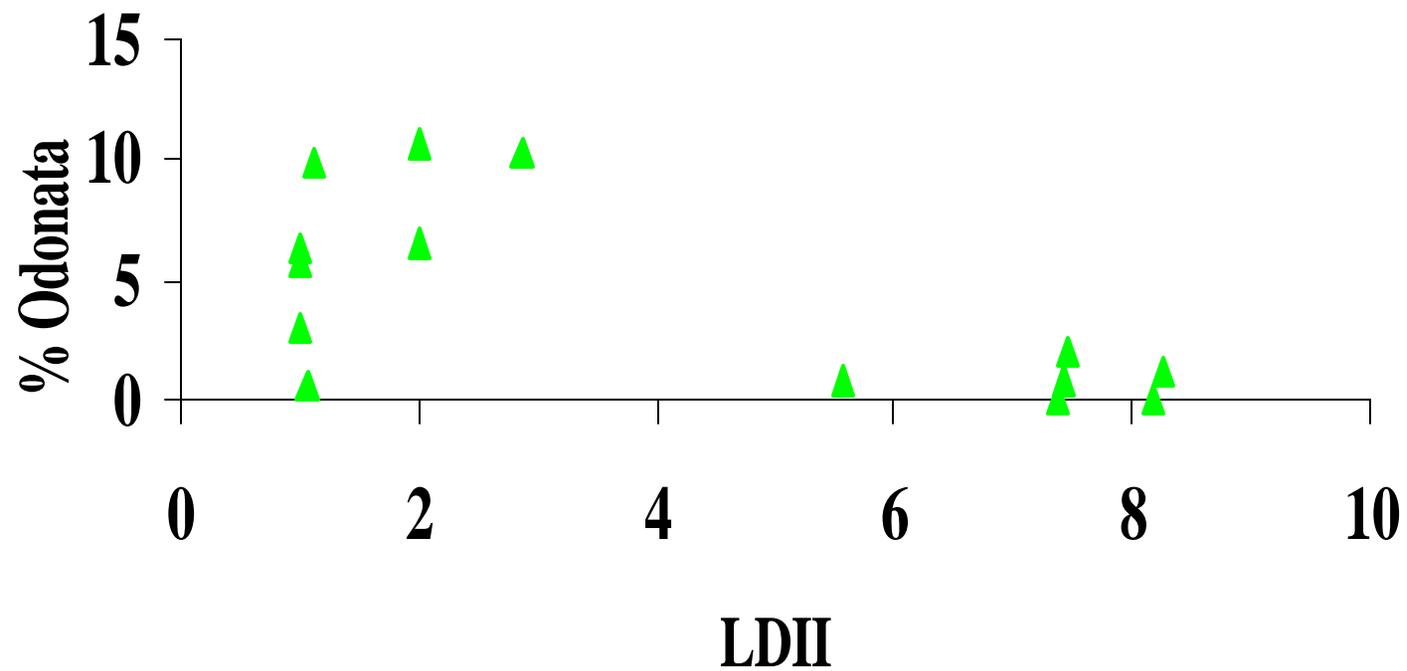


# *Macroinvertebrates*



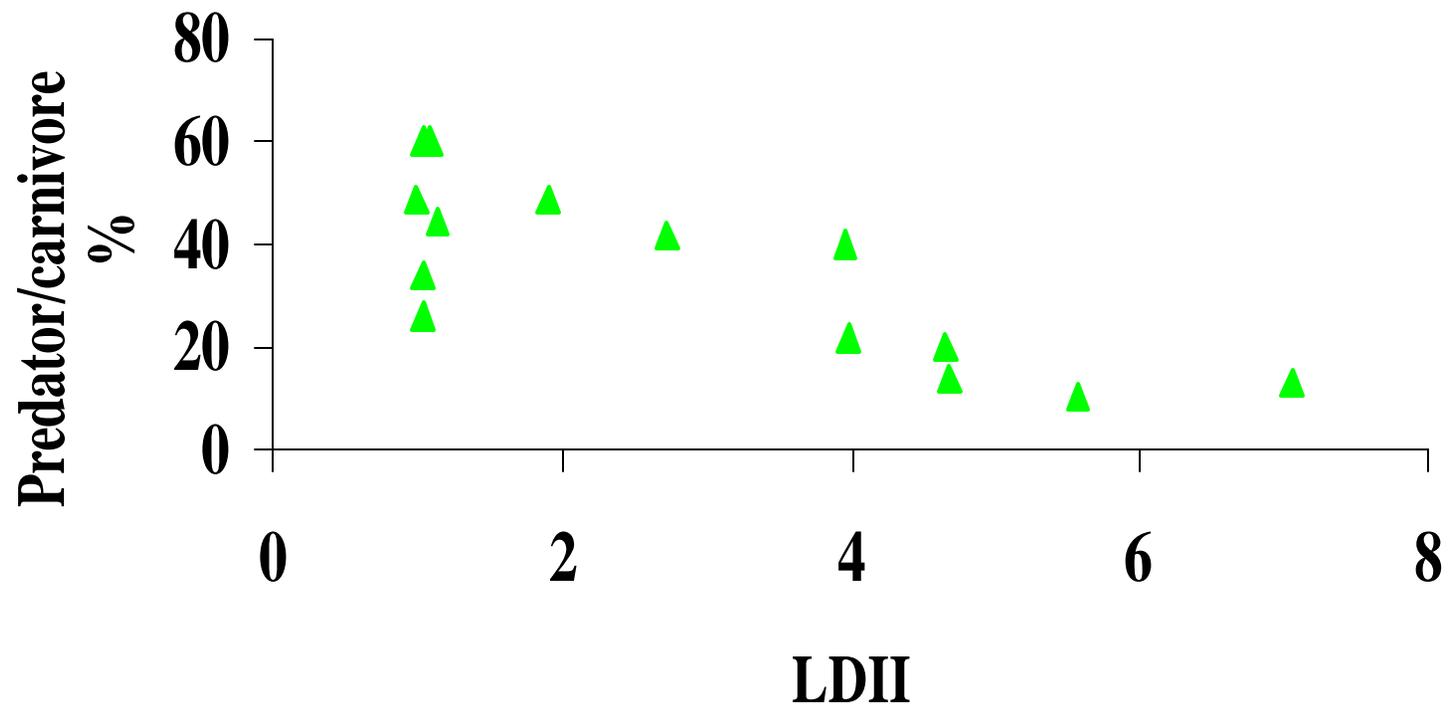
# *% Odonata*

## COMPOSITION MEASURES

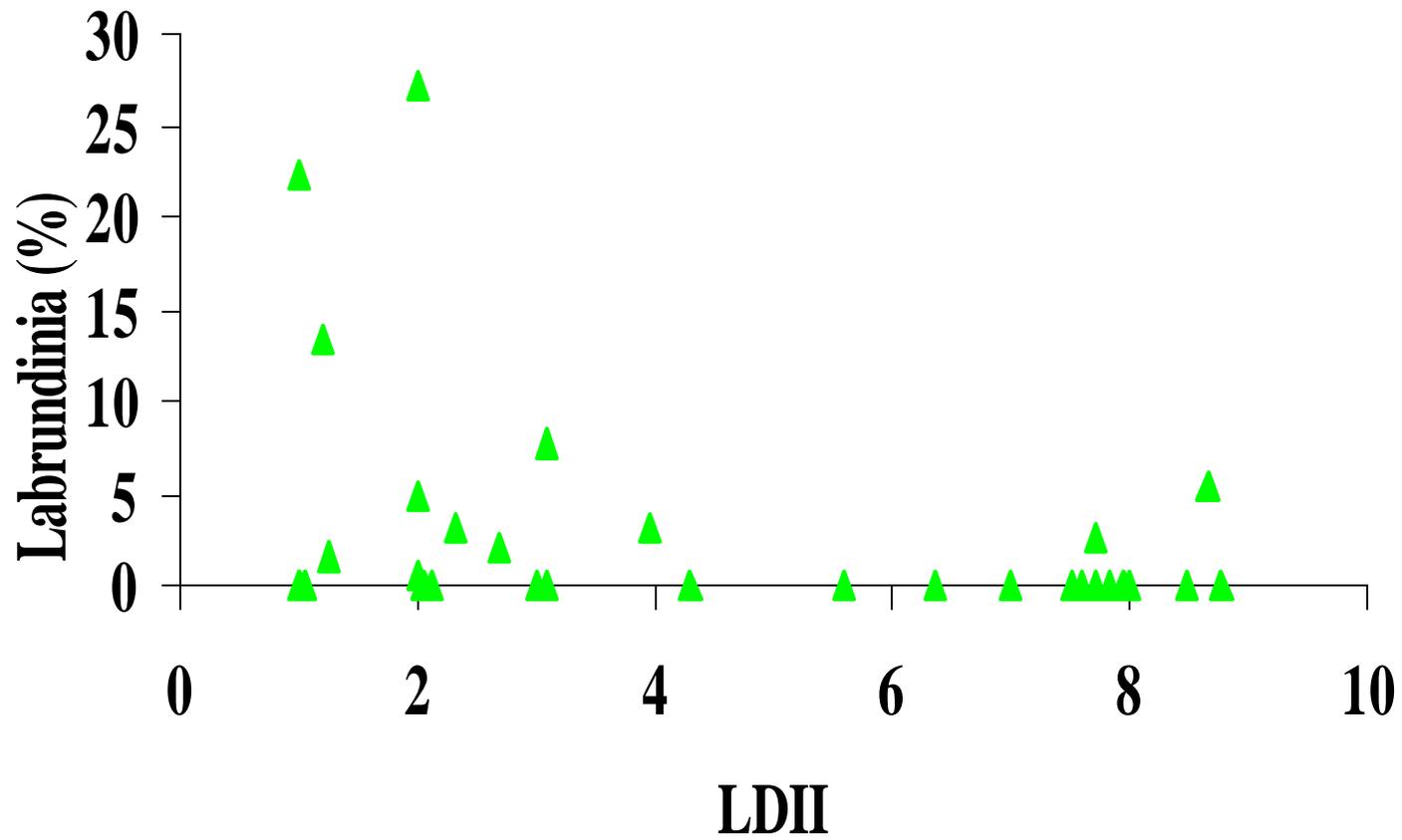


# *% Predators*

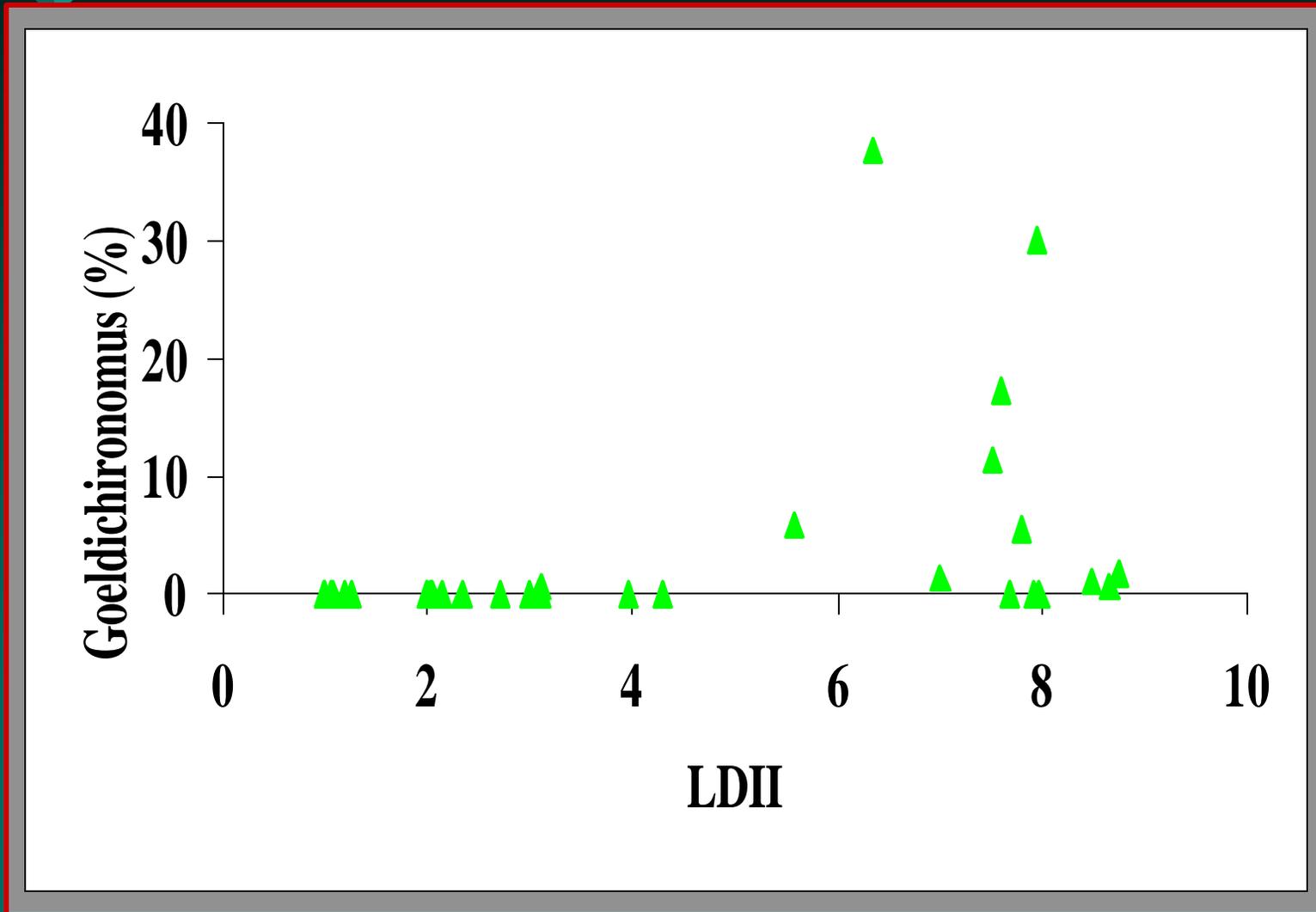
## TROPHIC MEASURES



# *% Labrundinia*



# *% Goeldichironomus*





# *Potential Invertebrate Metrics*

- Composition measures
  - % Diptera
  - % Odonata
- Trophic measures
  - % Predator/carnivore
  - %Collector-filterers
  - %Epibenthic collector-gatherers
  - %Plant piercers
- Phylogenetic measures
  - % Labrundinia
  - % Goeldichironomus



# *Implementation*

- Evaluate rapid assessment methods for permitting program (in proposed Rule)
- Success of mitigation projects over time, related to rapid methods
- Demonstrate sound science behind rapid methods



## *Development of the State-wide Uniform Wetland Mitigation Assessment Method (F-RAM)*

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- What is Intended?

*Consistent, statewide method of wetland  
and mitigation project assessment*

- Who is Involved?

*DEP, WMDs, COE, local govts*



# *F-RAM*

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- Objective #1 - Develop the Protocols
- Objective #2 - Apply to Mitigation Program



## *Objective # 1 - The Protocols*

F-RAM Schedule:

- Develop methods by Sept. 2001
- Rule Development in 2002

[Rule adoption no later than  
Jan. 31, 2002]



## *F-RAM Rule*

- When/How will be used ?
- IBI “Calibration” Project



## *Calibrate F-RAM with Wetland IBI*

- Perform IBI + LDI + F-RAM at same sites
- Look at correlations
- Similar to Ohio “ORAM” approach



## *F-RAM/IBI Project Considerations*

1. Objectives
2. Planning
  - design
  - SOPs/QA
  - Funding/Budgeting
3. Field Deployment
4. Information Technology
  - Data mgt. Plan
  - GIS plan
  - System administration
5. Reporting
6. Legal Requirements

See Implementation  
Module

\*\*Must consider entire  
list before starting



## Rule Info and Contact:

- [MyFlorida.com/environment/learn/waterprograms/wetlands/mitigate/uwmam.html](http://MyFlorida.com/environment/learn/waterprograms/wetlands/mitigate/uwmam.html)
- Contact: **Connie Bersok**  
Bureau of Submerged Lands  
and  
Environmental Resources  
(850)921-9858  
[connie.bersok@dep.state.fl.us](mailto:connie.bersok@dep.state.fl.us)