Influence of Physiography, Landscape, and Drought on Species Richness and Presence of Imperiled Unionids in the Lower Flint River Basin, Georgia

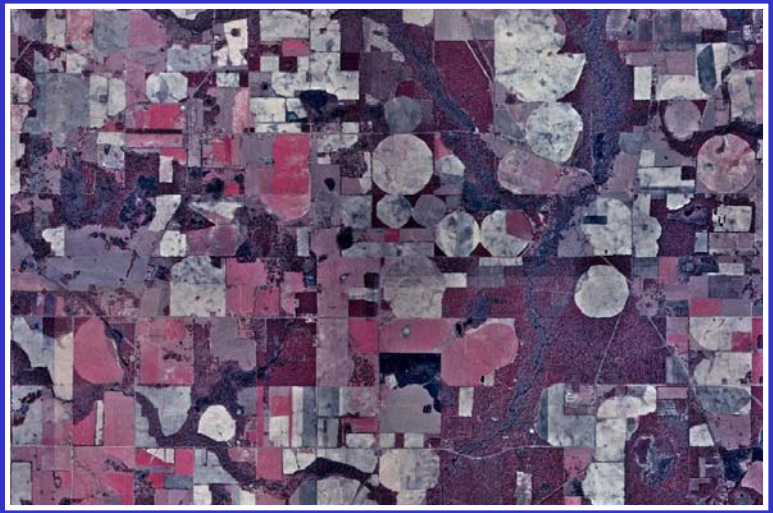
Jason Wisniewski
Georgia DNR
Nongame Conservation
Wildlife Resources Division

Colin Shea
Warnell School of Forestry
and Natural Resources
University of Georgia

James Peterson
USGS - Georgia Cooperative
Fish and Wildlife Research
Unit University of Georgia

Water Use and Flow Modification

- Important factors affecting aquatic biota in the US
- Projections for increased population growth and water supply development (e.g. reservoirs, irrigation)
- Growing need for assessing the effects of flow modification on aquatic biota



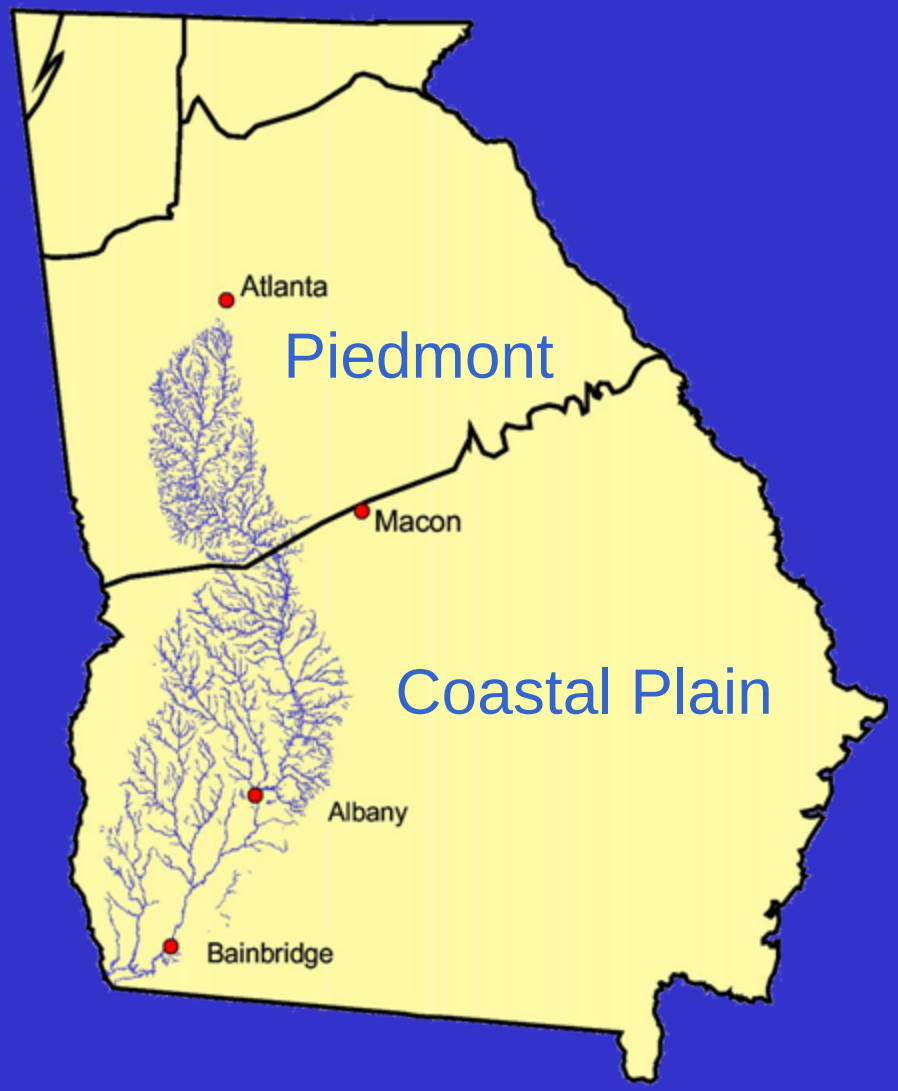
North American Freshwater Mussels (unionids)

- Diverse: ~ 300 known species
- Most species occur in Southeast US
- Many endemic species
- Substantial population declines in recent decades
- Imperiled: ~ 70% endangered, threatened, or sensitive

Factors

- Flow modification
- Habitat degradation & fragmentation
- Periodic drought

Flint River Basin, Georgia



- Headwaters near Atlanta
- 3 major impoundments
- Joins Chattahoochee to form the Apalachicola River below Lake Seminole
- Drains ~ 21,917 km^2

Lower Flint River Basin

5 Subwatersheds in LFRB

1. Middle Flint River
2. Lower Flint River
3. Kinchafoonee-Muckalee
4. Ichawaynochaway Creek
5. Spring Creek

>1 million acres irrigated in GA

>500,000 acres in Dougherty Plain

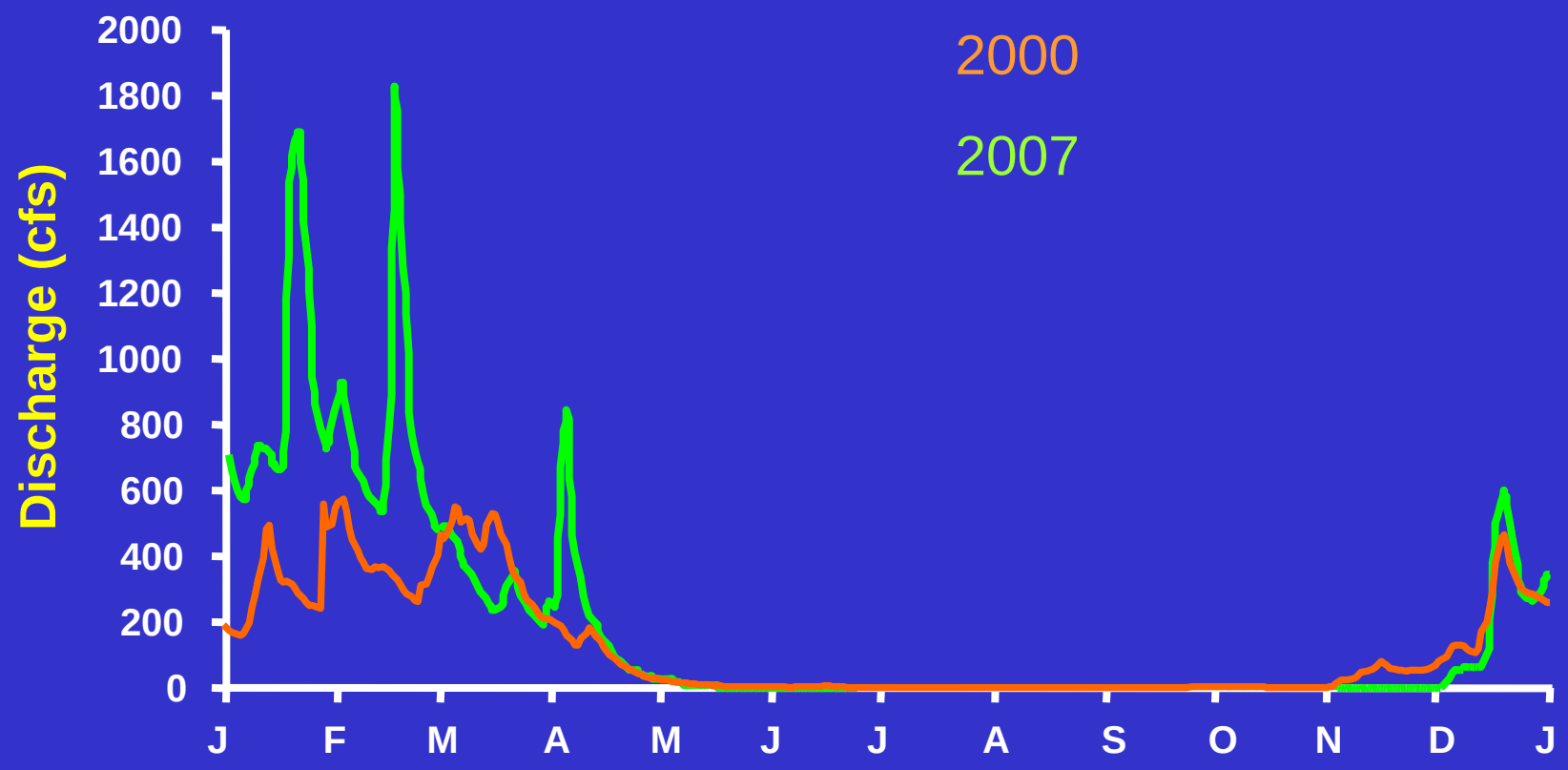
Flint River Basin Unionid Diversity

- 27 of 31 historically known species are extant
- 5 Federally protected species
- 5 State protected species
- 8 endemic species

Gulf Moccasinshell

Shinyrayed Pocketbook

Severe Drought !!!



Spring Creek

Objective

Estimate the relationship between physiography, drought, and land-use on mussel species richness and species presence.

Mussel Sampling

- Surveys completed by numerous individuals from several organizations
- Qualitative/semi-quantitative sampling methods
- 107 total sites sampled from 1997-2004
- 16 sites surveyed 2 or more times

Stream and Landscape Characteristics

Site-specific variables

- Stream size
- Isolation by impoundment
- Sampled pre or post drought

Subwatershed specific variables (%)

- Urban landcover
- Forested landcover
- Wetland landcover
- Dougherty Plain

Statistical Analysis & Modeling

Species Richness

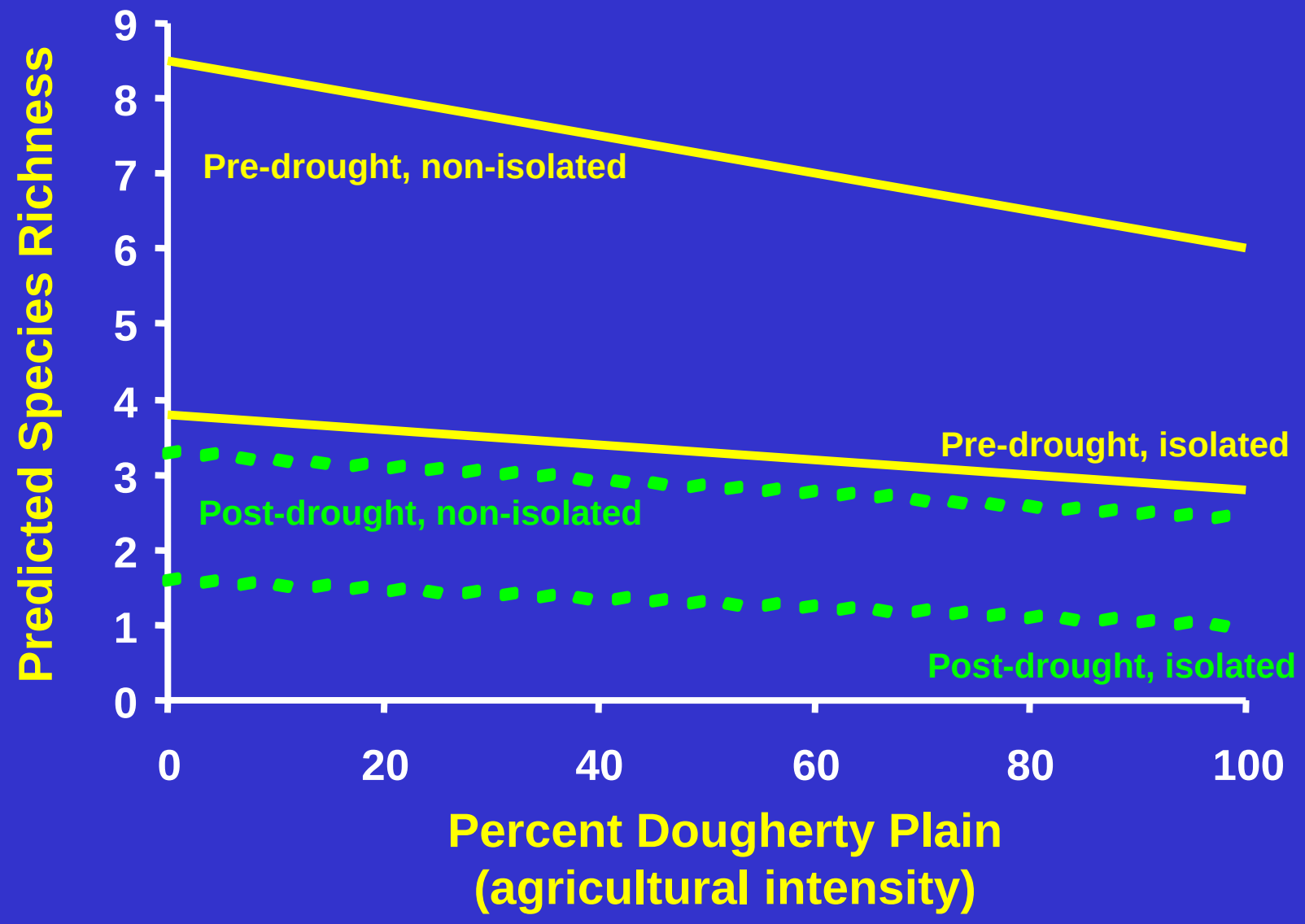
- Adjusted for incomplete detection
- Modeled as a function of physiography, drought, land-use.

Species Presence

- Jointly modeled species presence and detection (MacKenzie et al. 2002) using hierarchical multi-species occupancy models (sites nested within watersheds).

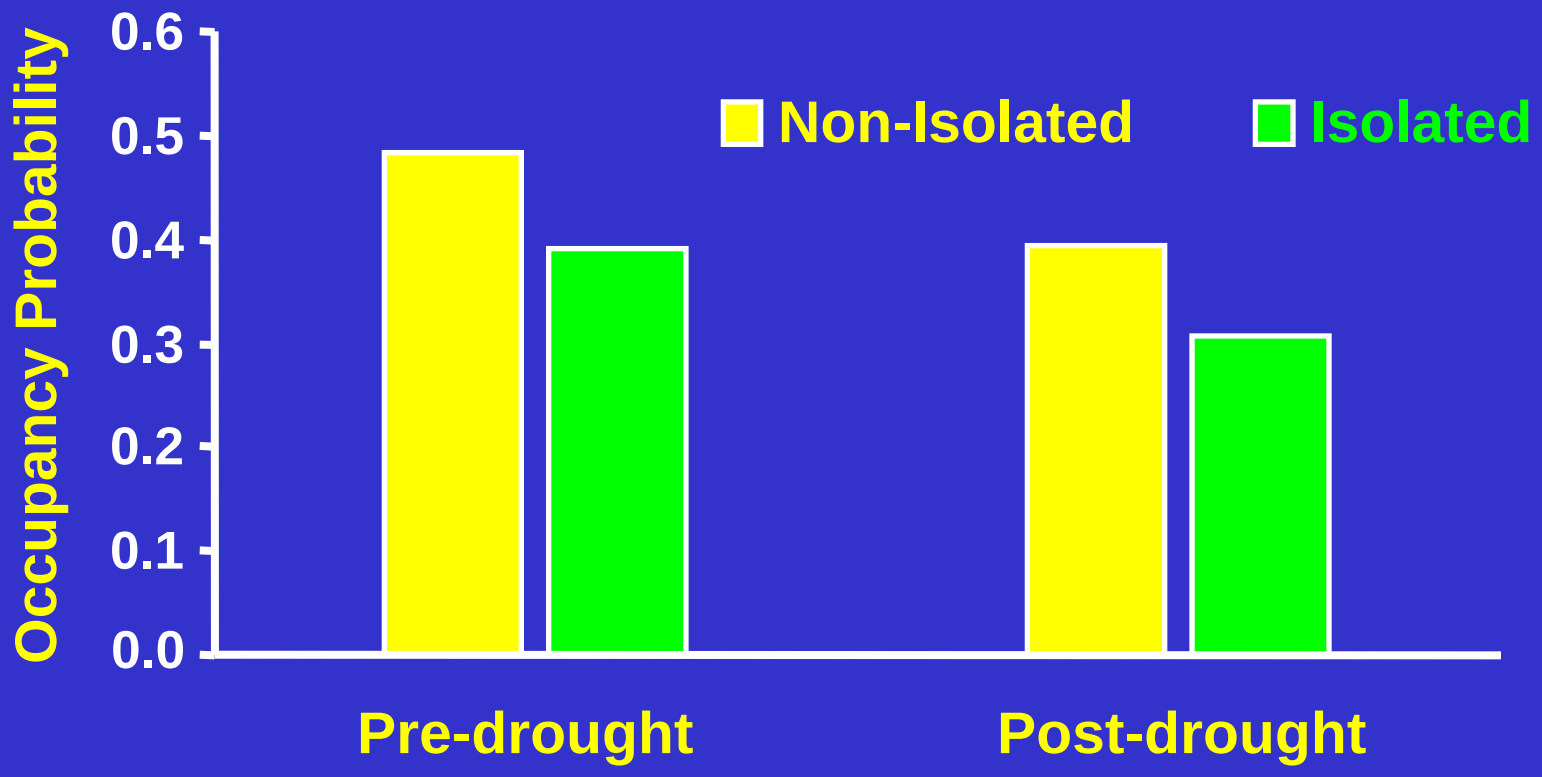
1) Shinyrayed Pocketbook *Hamiota subangulata*
2) Oval Pigtoe *Pleurobema pyriforme*
3) Inflated Spike *Elliptio purpurella*

Results: Species Richness



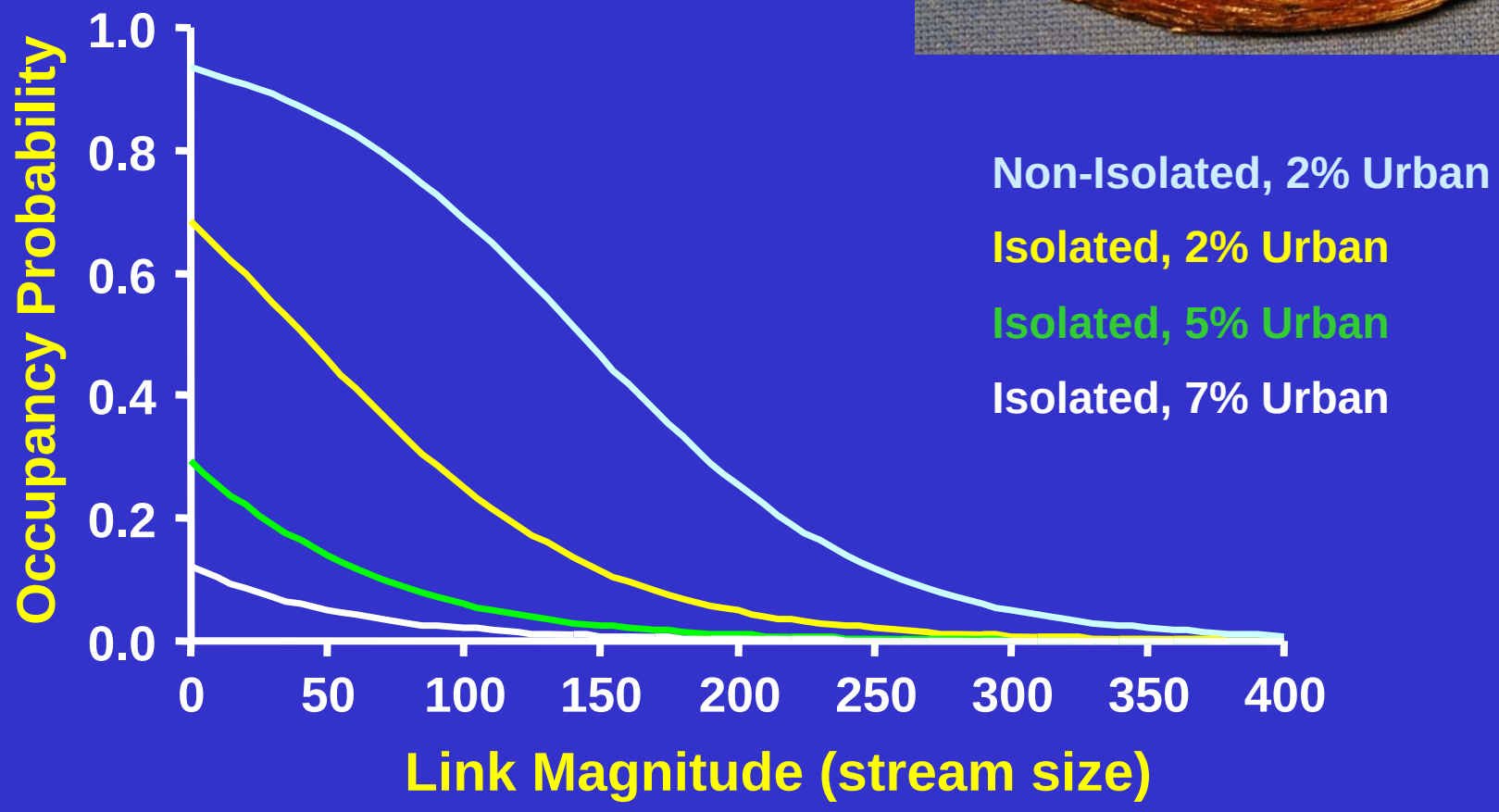
Results: Species Presence

Shinyrayed Pocketbook *H. subangulata*



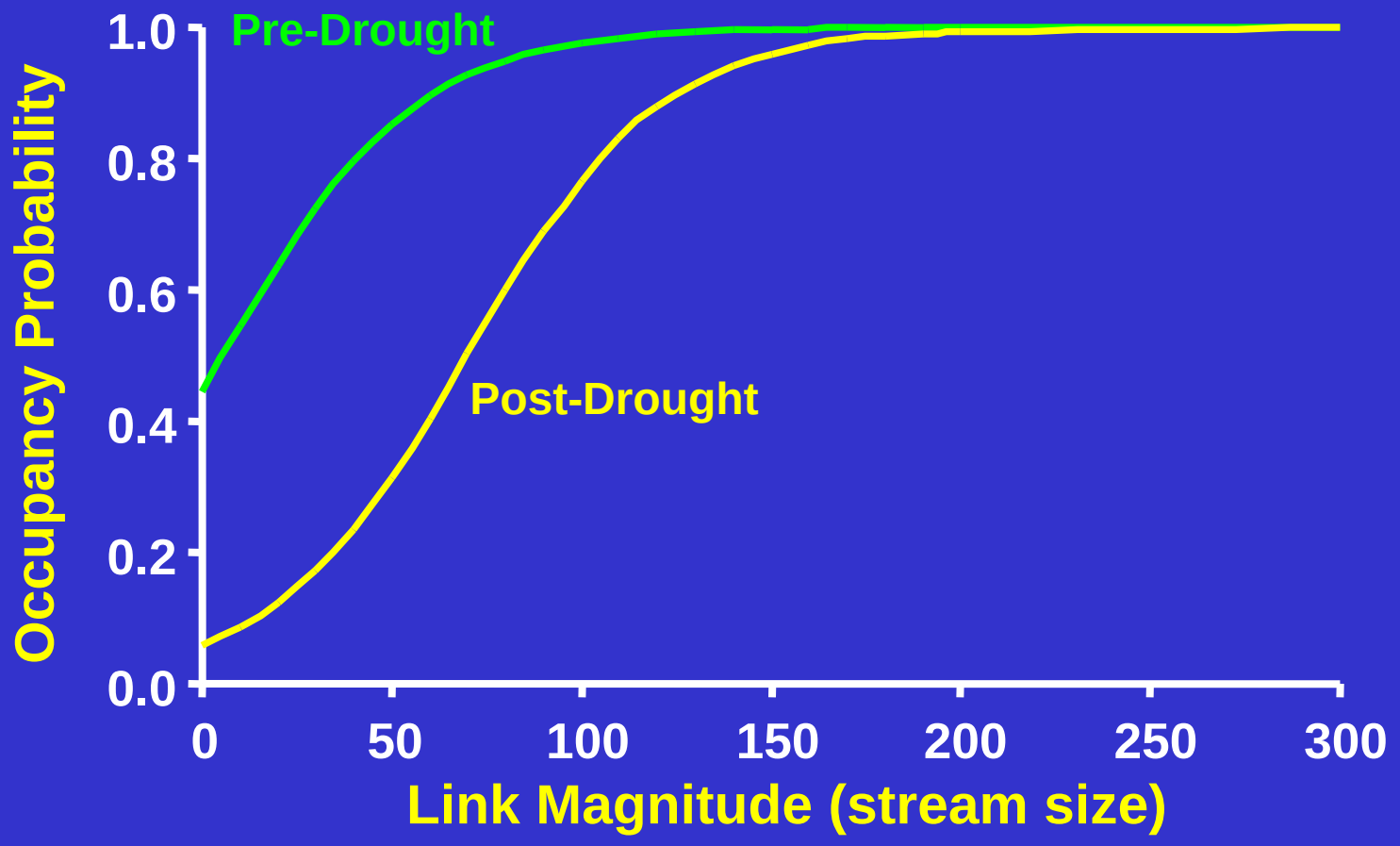
Results: Species Presence

Oval Pigtoe *Pleurobema pyriforme*



Results: Species Presence

Inflated Spike *Elliptio purpurella*



Conclusions

Drought

- On average, 5.2 more species prior to the drought
- *H. subangulata* and *E. purpurella* less likely to occur after drought

Isolation

- Sites occurring in non-isolated reaches had 4.7 more species than those in isolated reaches.
- Endangered unionids less likely to occur in isolated streams.

Land Use

- *P. pyriforme* presence negatively related to urbanization
- Species richness negatively related to % Dougherty Plain

Ongoing Research

We modeled a static system…

- **Next step is to develop models for estimating meta-demographic rates (e.g., colonization, extinction)**
- **Use meta-demographic rates via simulation to develop optimal management and conservation strategies for recovery of listed mussel species.**
- **Optimize monitoring protocols for feedback into decision tools under an adaptive management framework.**

Acknowledgements

Sandy Abbott

Brett Albanese

Holly Blalock-Herod

Gerry Dinkins

Steve Golladay

Rob McDowell

Carson Stringfellow

Deb Weiler

Questions?