

HARBOR BRANCH

FLORIDA ATLANTIC UNIVERSITY

The Potential of Aquaculture to Support the Recovery of the Florida Apple Snail

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Florida Apple Snail (*Pomacea paludosa*)

- **Largest indigenous freshwater snail in North America**
- **Well adapted to dry conditions, but have a limited capacity to survive prolonged periods of drought**
- **Negatively impacted by excessively deep water**
- **Critical component of the food web**
 - **invertebrates, turtles, alligators, birds**

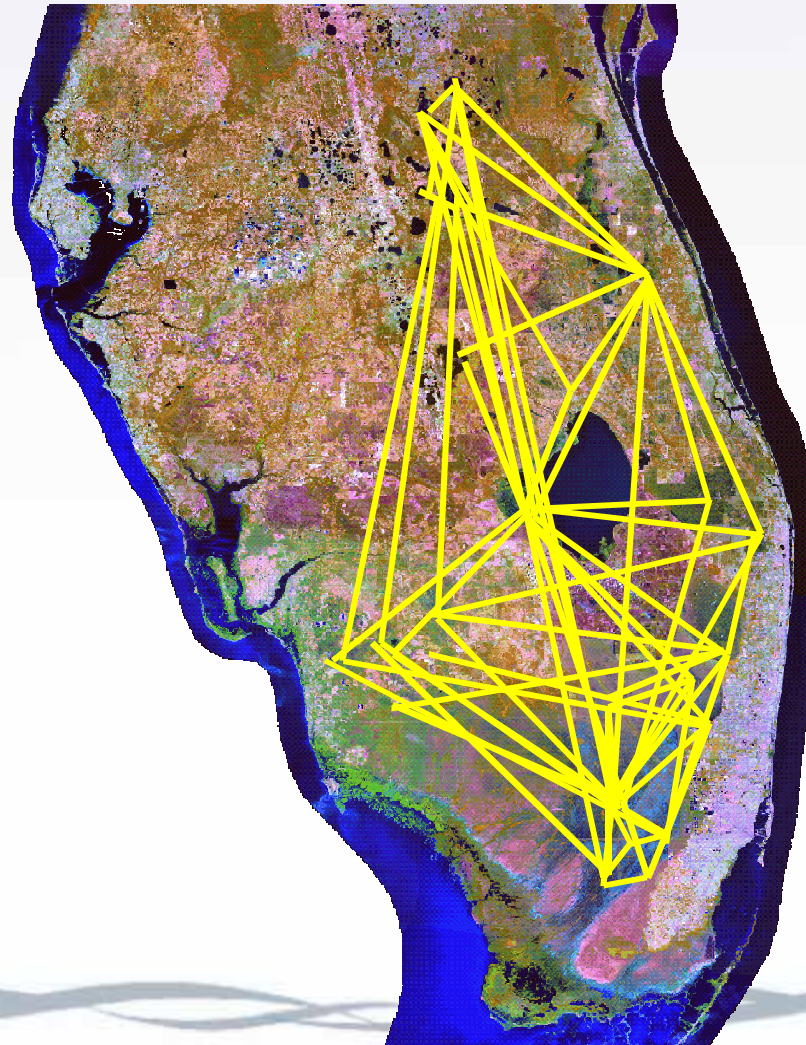


Snail Kite (*Rostrhamus sociabilis*)

- **Endemic to Central-South Florida; Central and South America**
- **Federally endangered species**
- **Primary food source is the Florida apple snail**
- **Nomadic lifestyle**



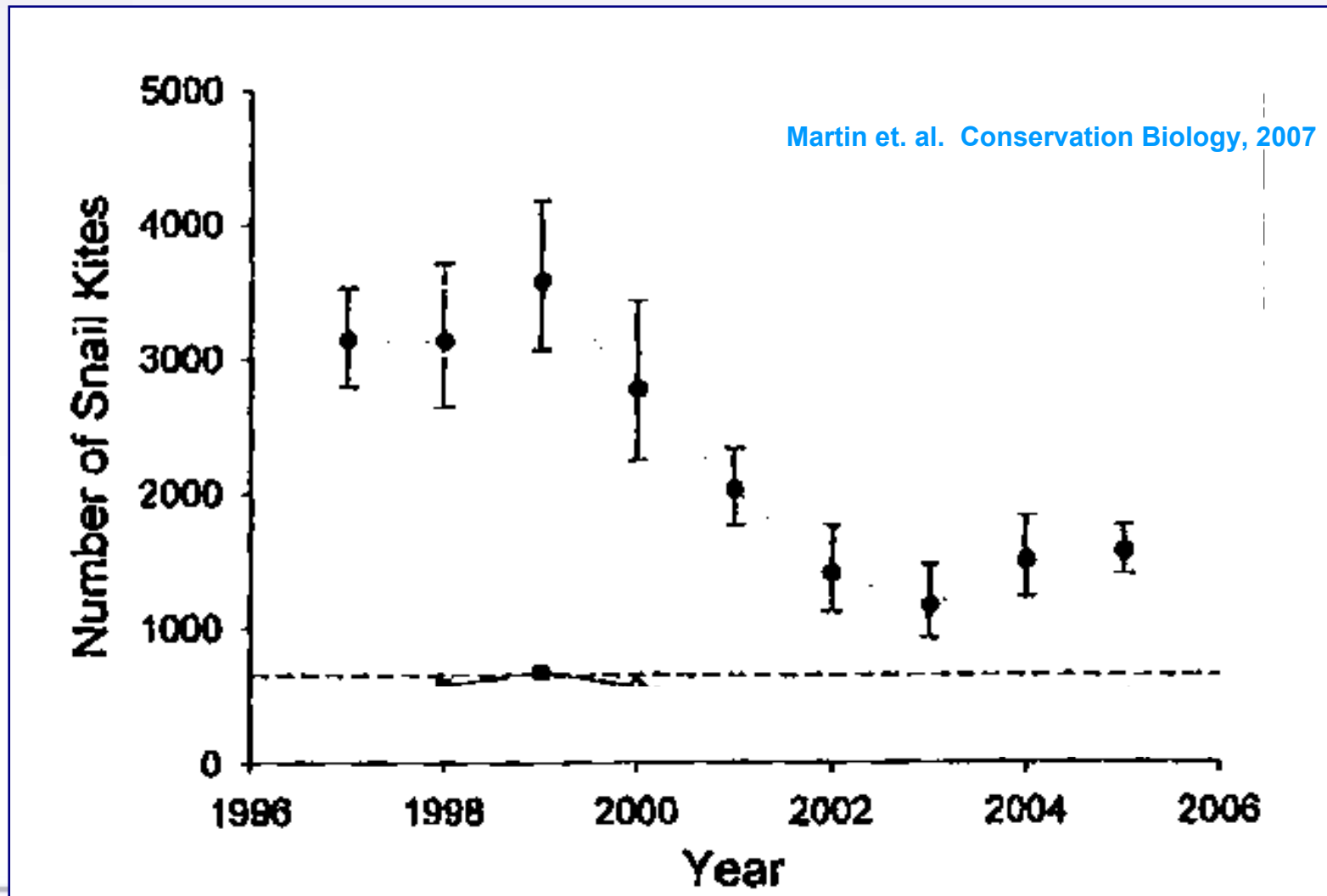
Snail Kite Habitat Network



Pre 1995

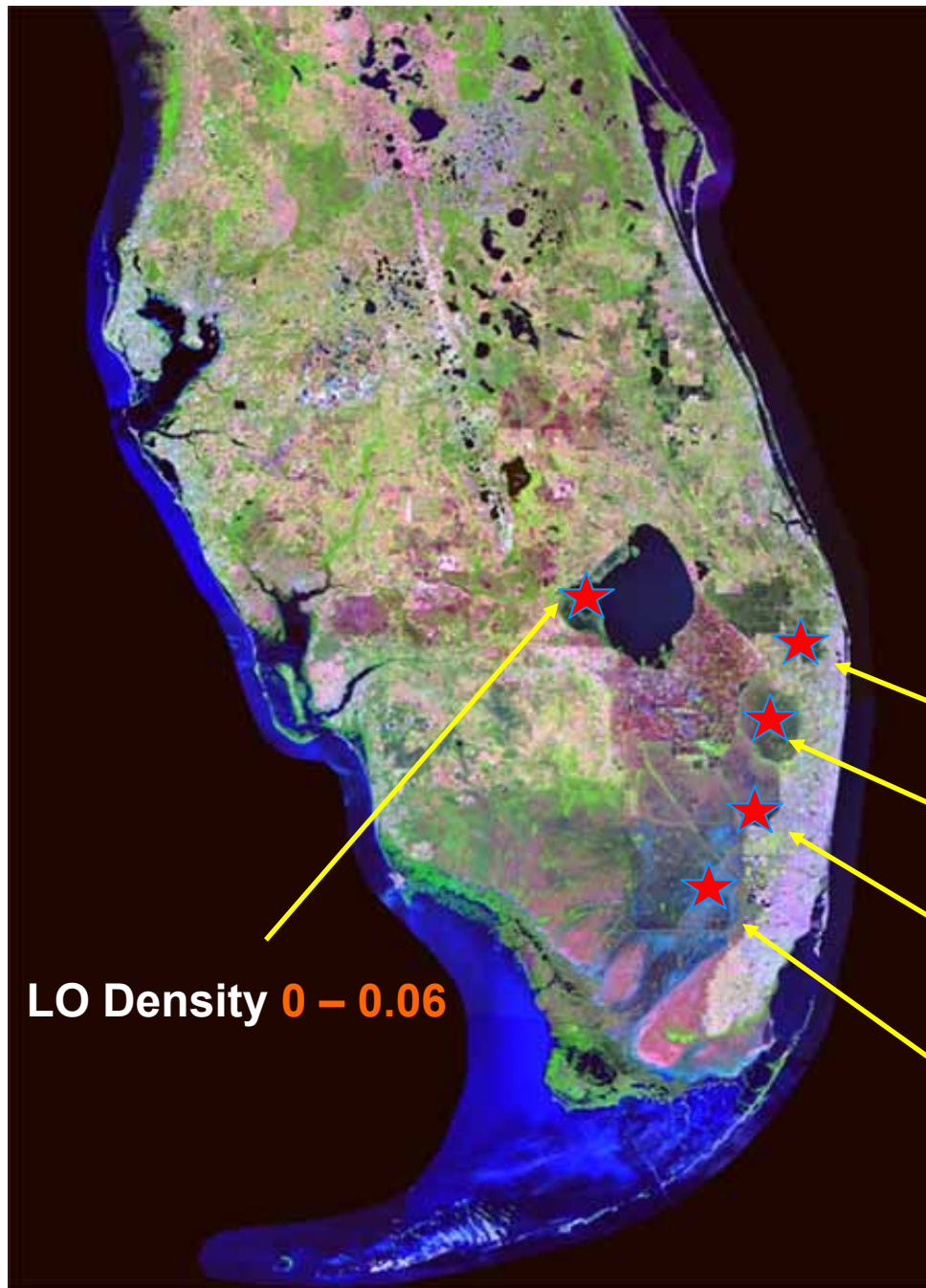
**Kite Movements-
3 YR Summary**
Kitchens et al. 2007

Snail Kite Population



Snail densities throughout South Florida

- **Minimum threshold density to support snail kite foraging is 0.14 snails/m^2**
- **Intense sampling conducted from 2003-2006**



Grassy Waters Density $0.022 - 0.10$

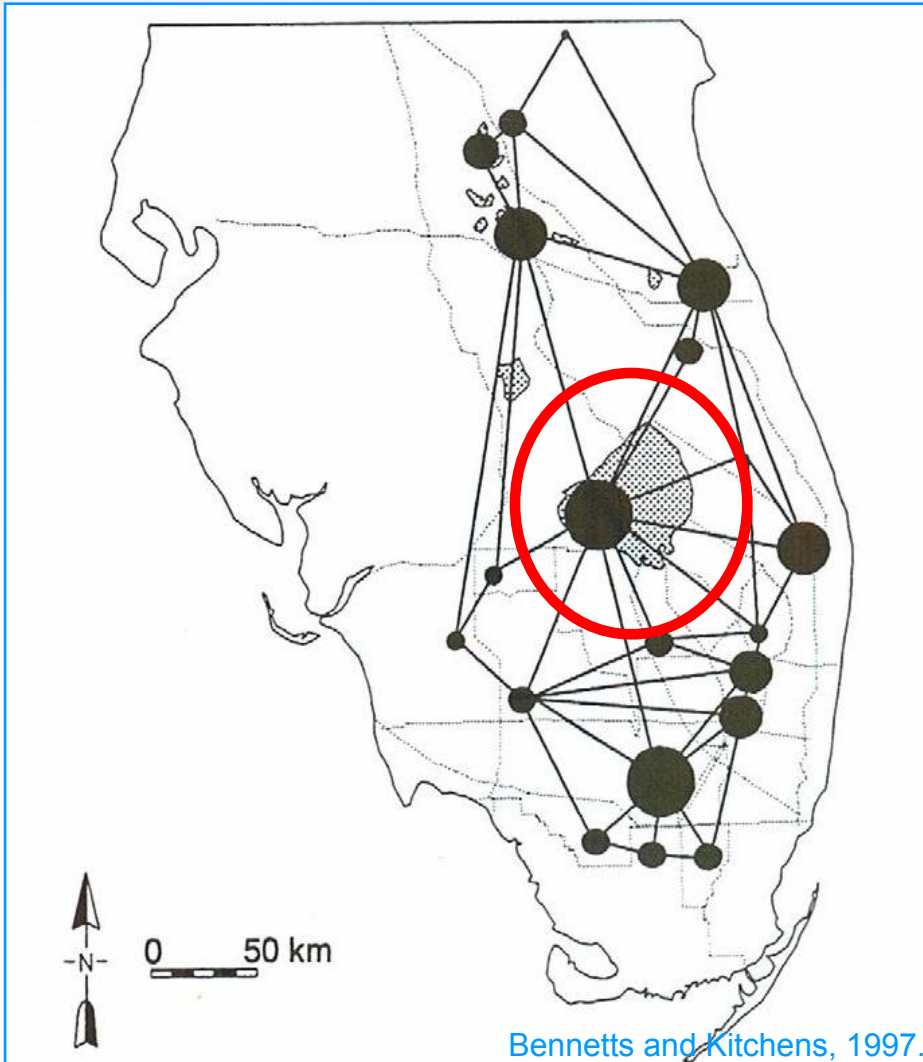
WCA1 Density <0.14

WCA-2B Density $0.023 - 0.064$

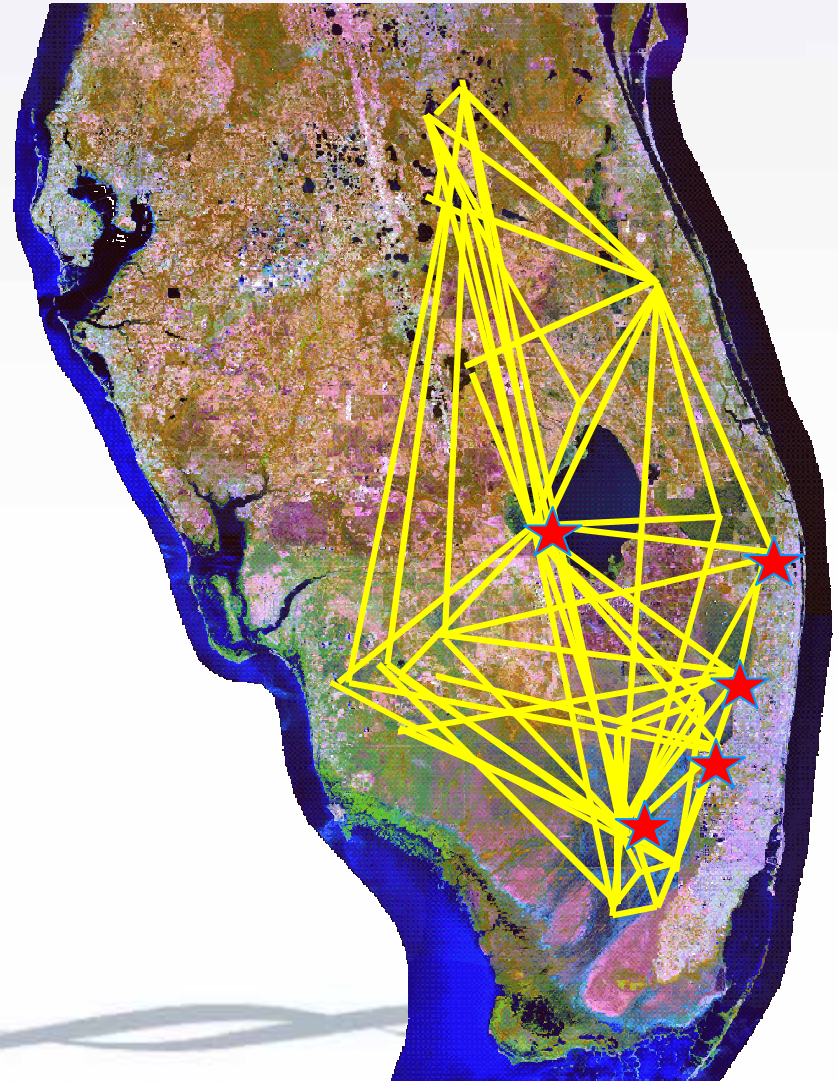
WCA-3B Density $0.015 - 0.076$

LO Density $0 - 0.06$

Snail Kite Habitat Network



Bennetts and Kitchens, 1997.



Lake Okeechobee Apple Snail Population



Timeline:

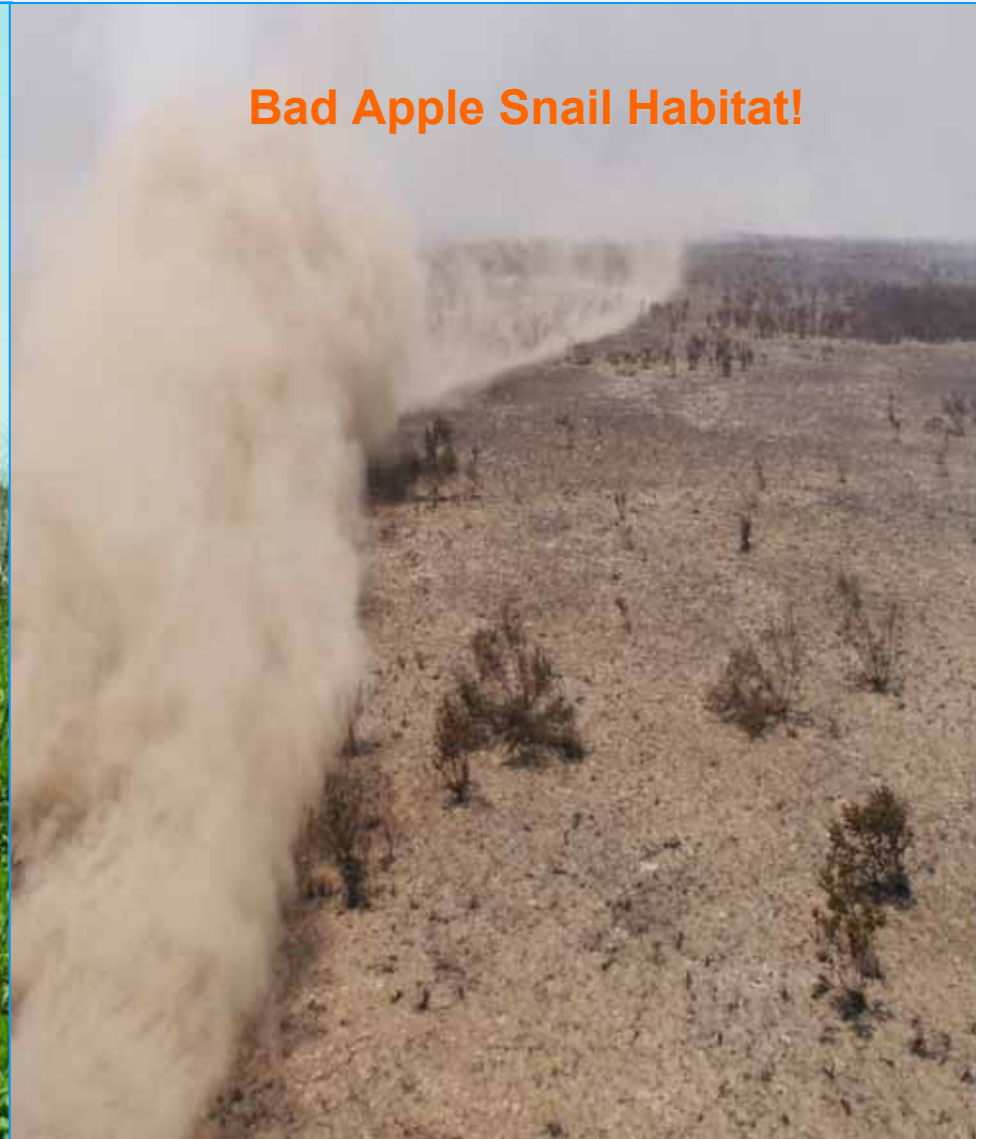
- 1996-2000 – Kites did not use the lake; corresponds with high Lake stage
- 2001 – severe drought that left the littoral zone dry for 1.5 years
- 2005 – very few snails found despite extensive sampling
- 2006 – severe drought; littoral zone continues to be dry

Lake Okeechobee Drought 2001

Bad Apple Snail Habitat!



Lake Okeechobee Drought 2006



Bad Apple Snail Habitat!

Potential Management Strategy???



Photo by Chuck Hanlon



Apple Snail Aquaculture Project

Objective: Use existing aquaculture technology to determine the feasibility of large scale apple snail production

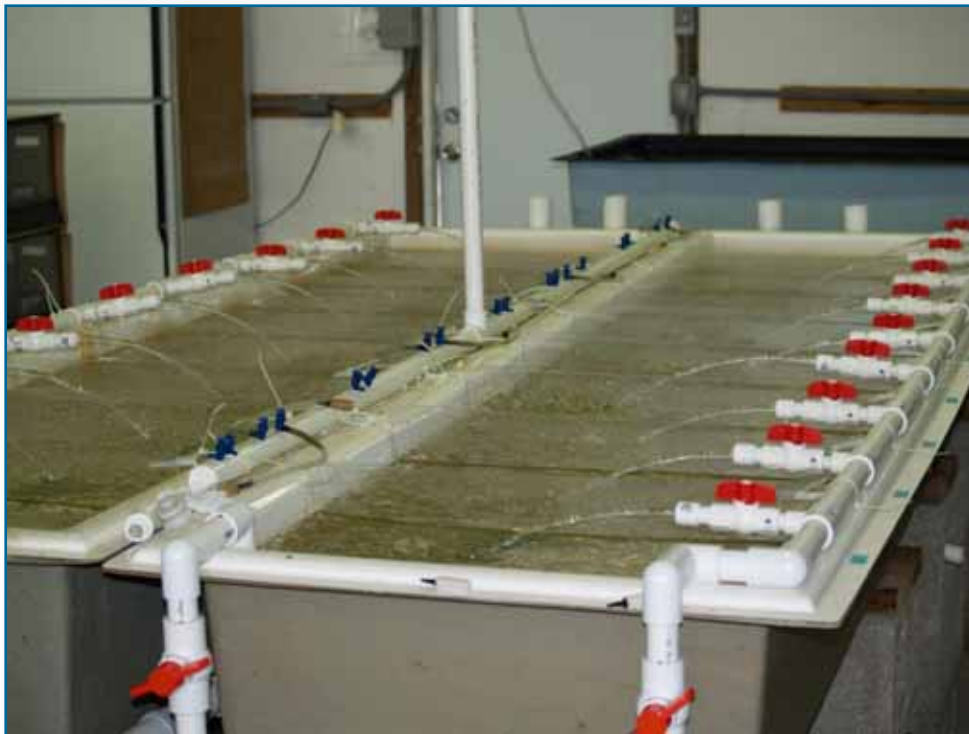
Project Goals:

- 1. To successfully raise snails to adult size**
- 2. Promote reproduction in captivity**
- 3. Determine appropriate release strategy**



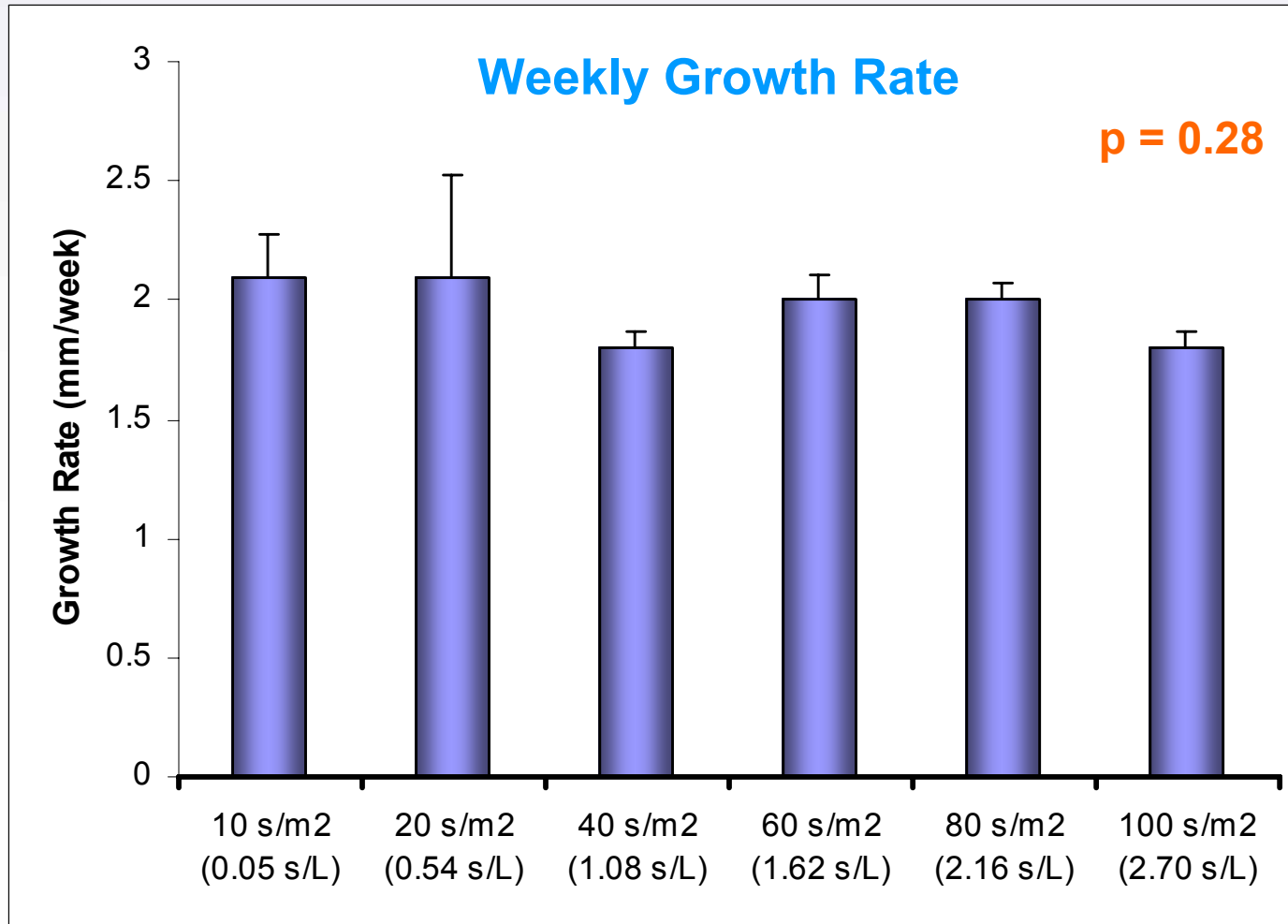
Goal 1: Apple snail growth

Density Experiment Objective: To determine the effect of stocking density on apple snail growth rate



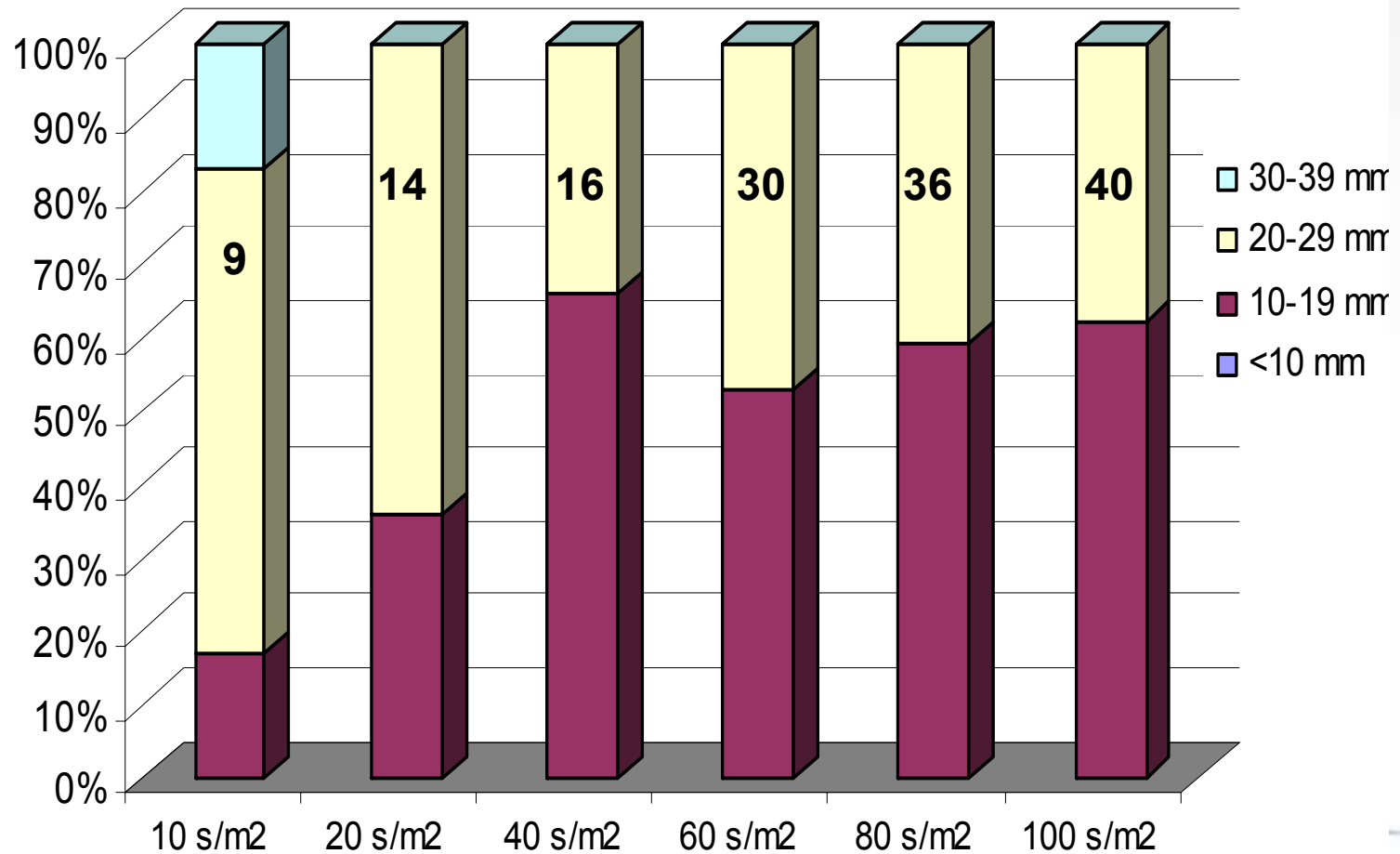
- 3m x 0.6m troughs
- 9 sections 0.22 m²
- 6 density treatments; 3 replicates
 - 10 snails/m²
 - 20 snails/m² – (control)
 - 40 snails/m²
 - 60 snails/m²
 - 80 snails/m²
 - 100 snails/m²

Results of Density Experiment

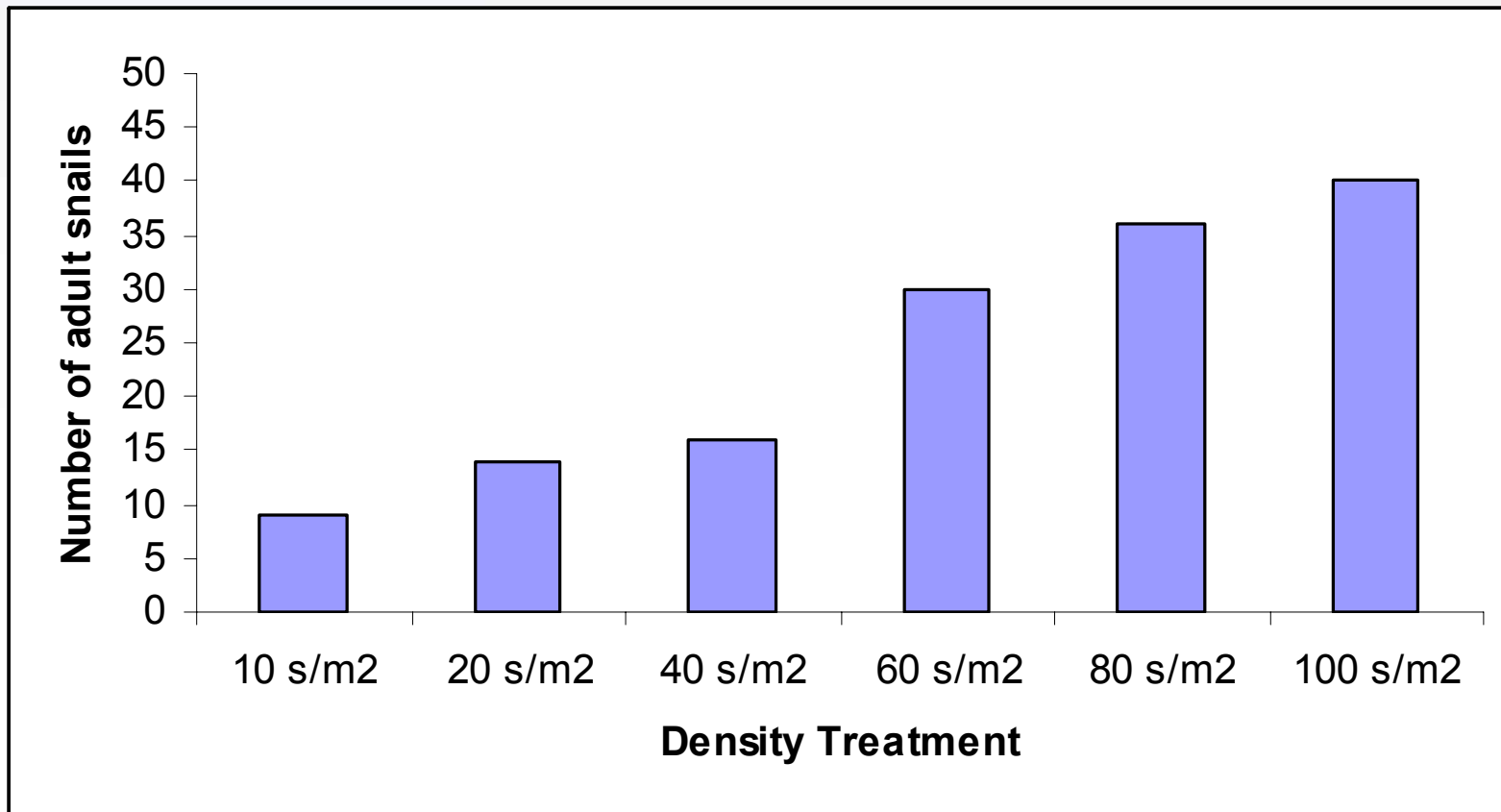


Results of Density Experiment

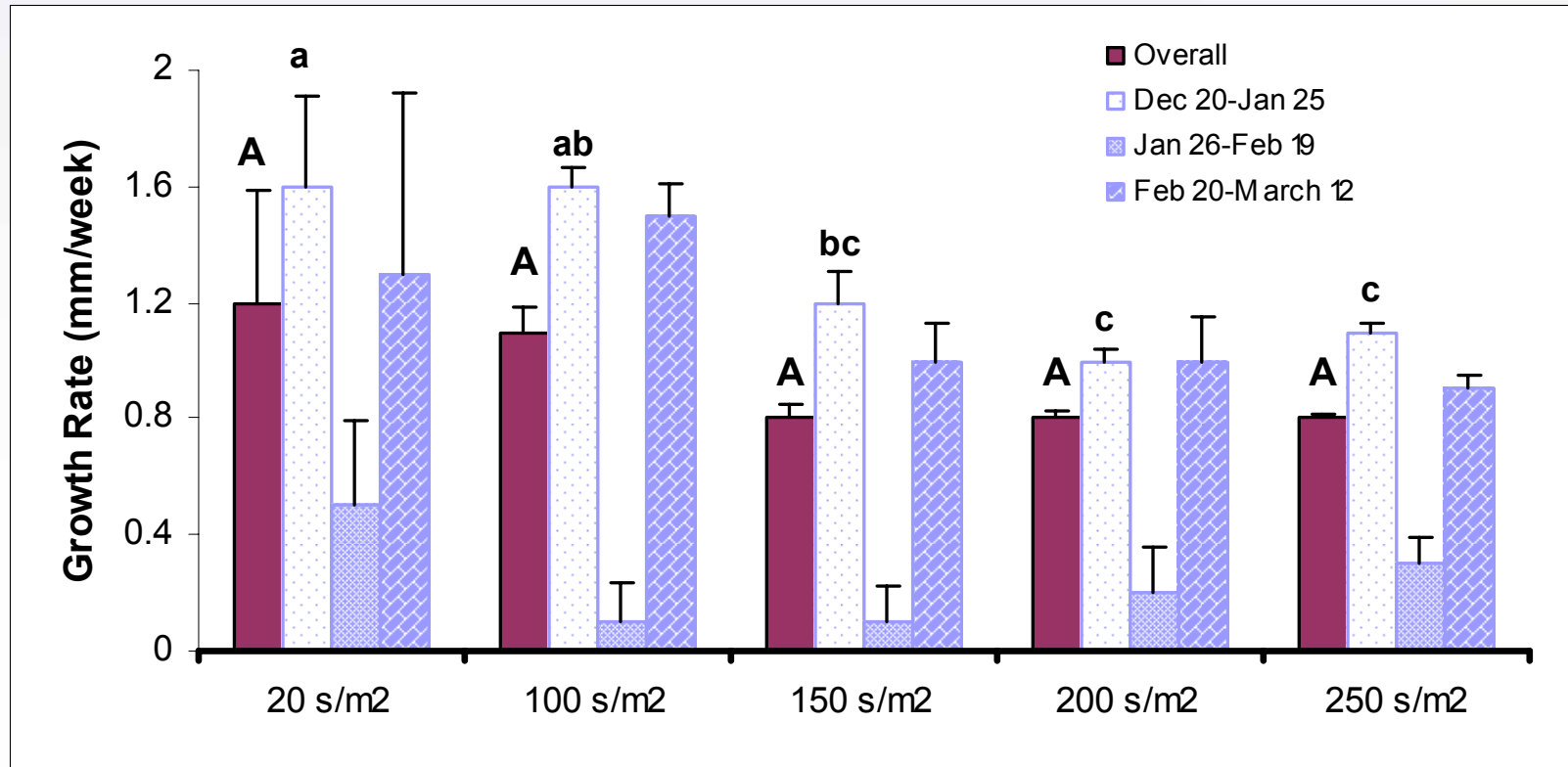
Size Frequency Distribution



The number of snails that reached adult size (≥ 24 mm) after two month in each density treatment.



Upper Stocking Density Limits



Experiments will continue.

Goal 2: Apple Snail Reproduction

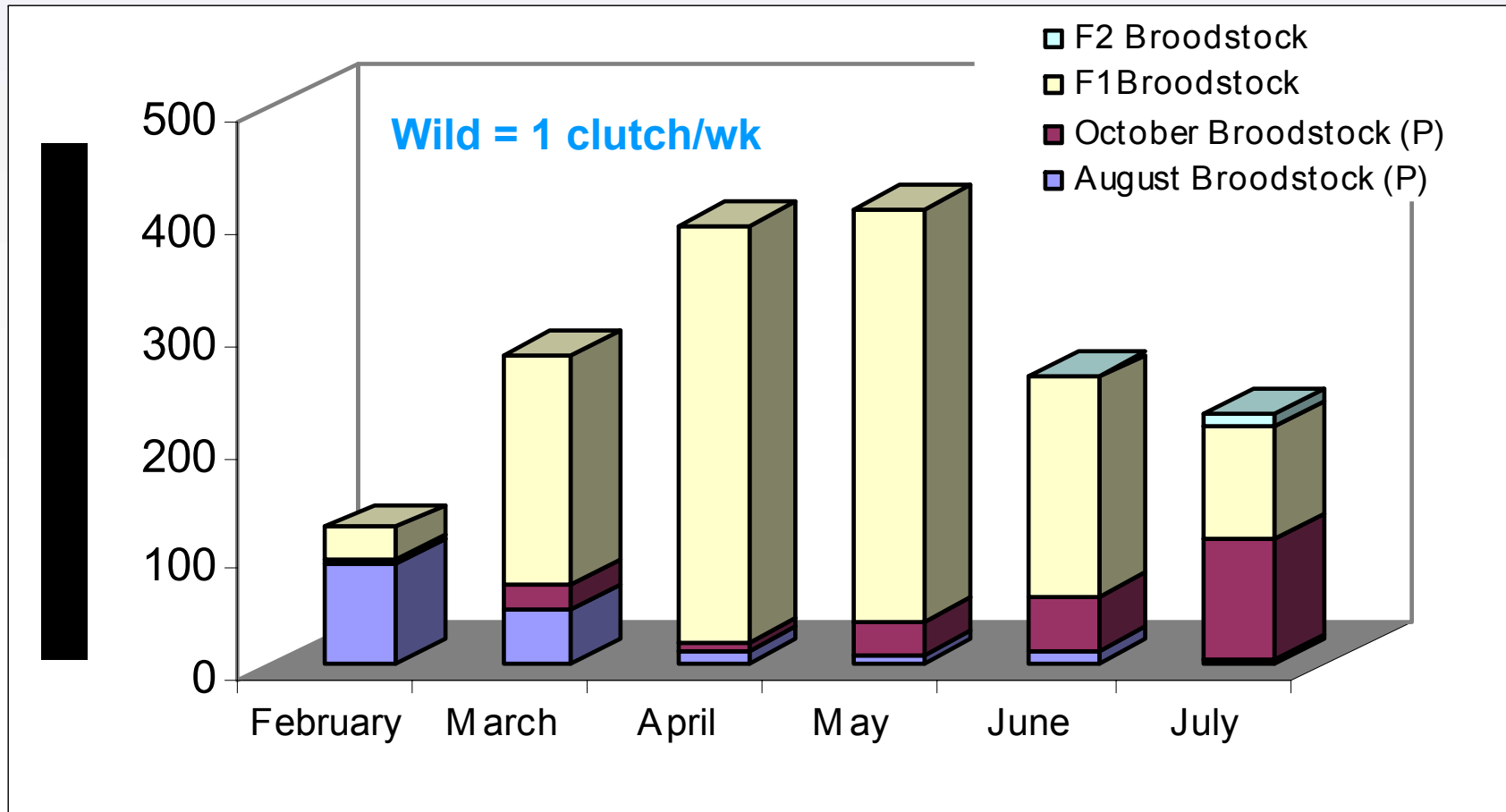
P generation	Total Clutches	Total Eggs per Clutch	Clutches Hatched	Hatch Rate (%)	Total Snails
August	33	29.1 ± 12.9	33	56.6 ± 38.5	560
October	228	26.4 ± 9.3	108	28.7 ± 36.1	2000

- **P generation began spawning Oct. 20**
- **P generation produced 1035 F₁ generation snails**
- **F₁ generation has produced 2600 F₂ generation snails**



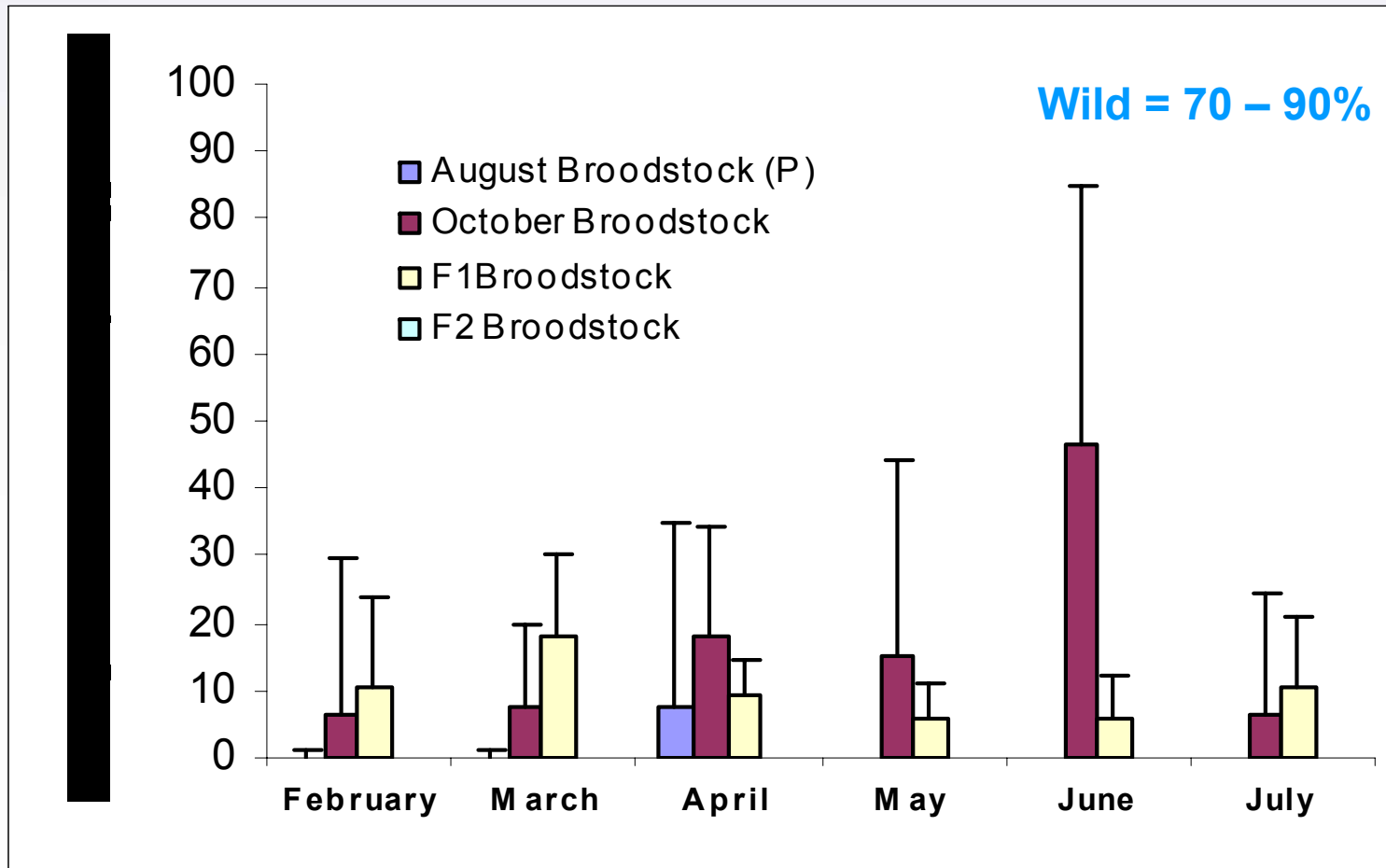
Challenges:

Captive Egg Production vs. Wild Egg Production



Challenges:

Captive Hatch Rate vs. Wild Hatch Rate



Future Experiments

1. Diet – natural and artificial
2. Density dependent reproduction and sex ratio
3. Physiological requirements – cool period, etc



Goal 3: Release Strategy – Field Trials

Project Goals:

- **Determine survivorship**
 - **acclimation studies**
 - **predation studies**
- **Determine size at time of release**
 - **Comparison between hatching and 10-15mm**
- **Determine whether captive released snails contribute to reproduction**



Conclusions

- **Snail Kite population decline has reached a point where emergency management is required**
- **Early experiments indicate that using aquaculture to restock parts of Lake Okeechobee is feasible**
- **A better understanding of the physiological requirements of apple snails will improve culture techniques and reproductive output in captivity**



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Questions?



Photo by Chuck Hanlon

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