Human Health Risks Associated with Channeled Apple Snails in the GSARP Region

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How Do Channeled Apple Snails Measure Up as an Invasive Species?

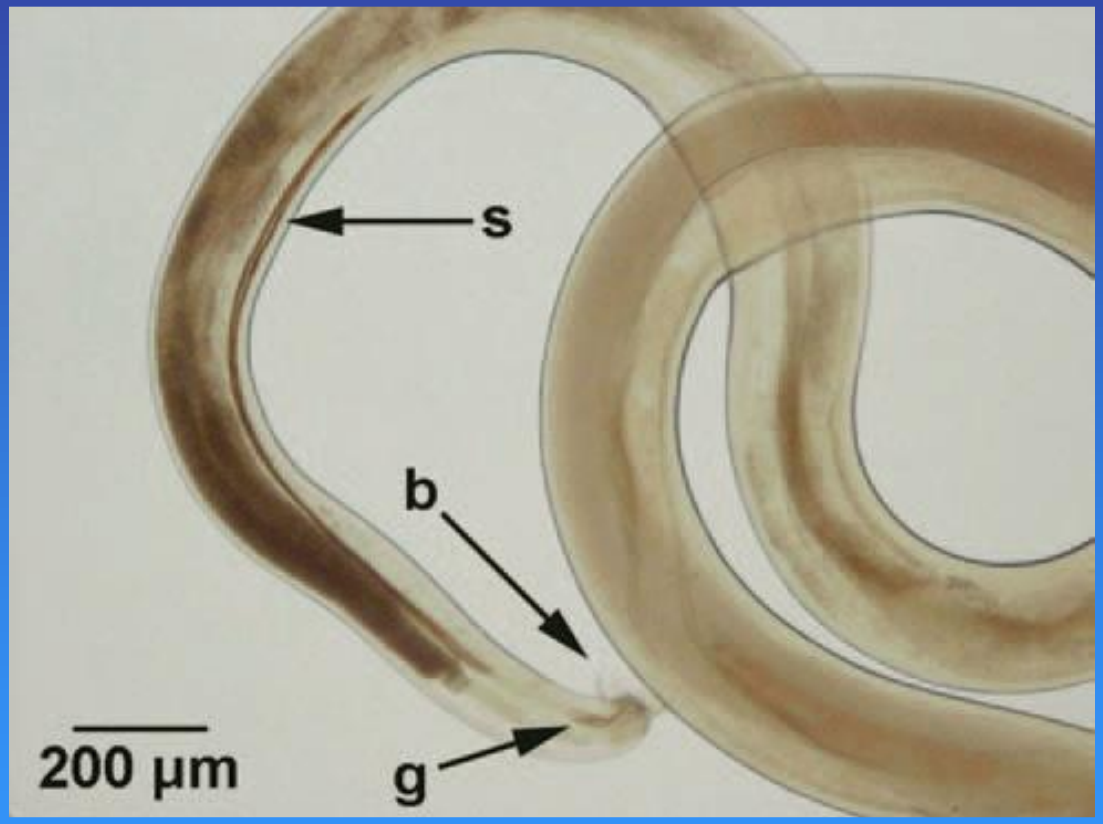
In the Executive Summary of the National Invasive Species Management Plan (NISMP) the term invasive species is defined as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health."

Economic damage – Causes taro crop losses in Hawaii.

Environmental – Causes loss of native aquatic vegetation

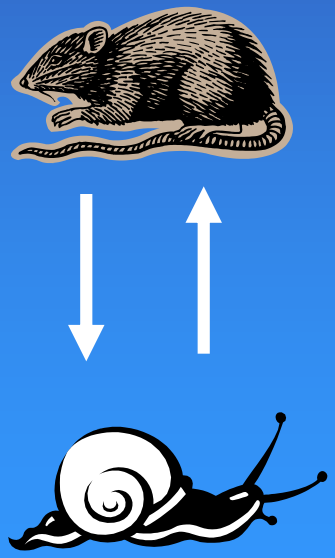
Human Health –Host for the human pathogen, the rat lung worm (*Angiostronglyus cantonensis*).

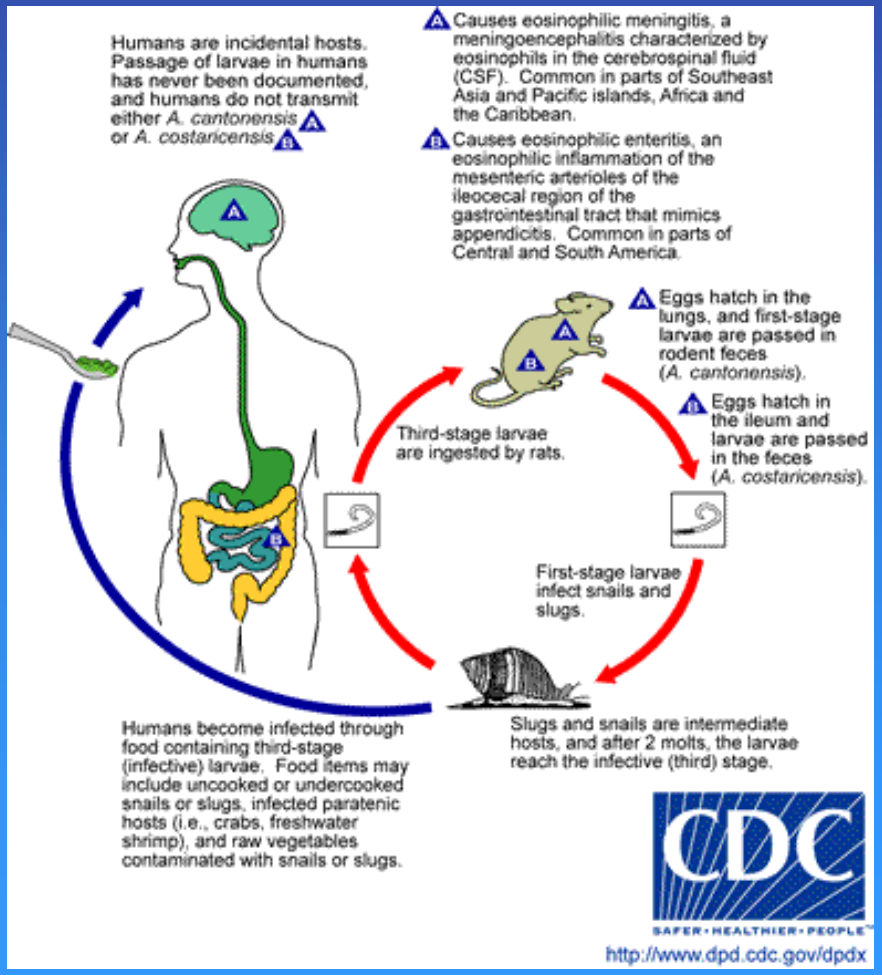
Angiostrongylus cantonesis



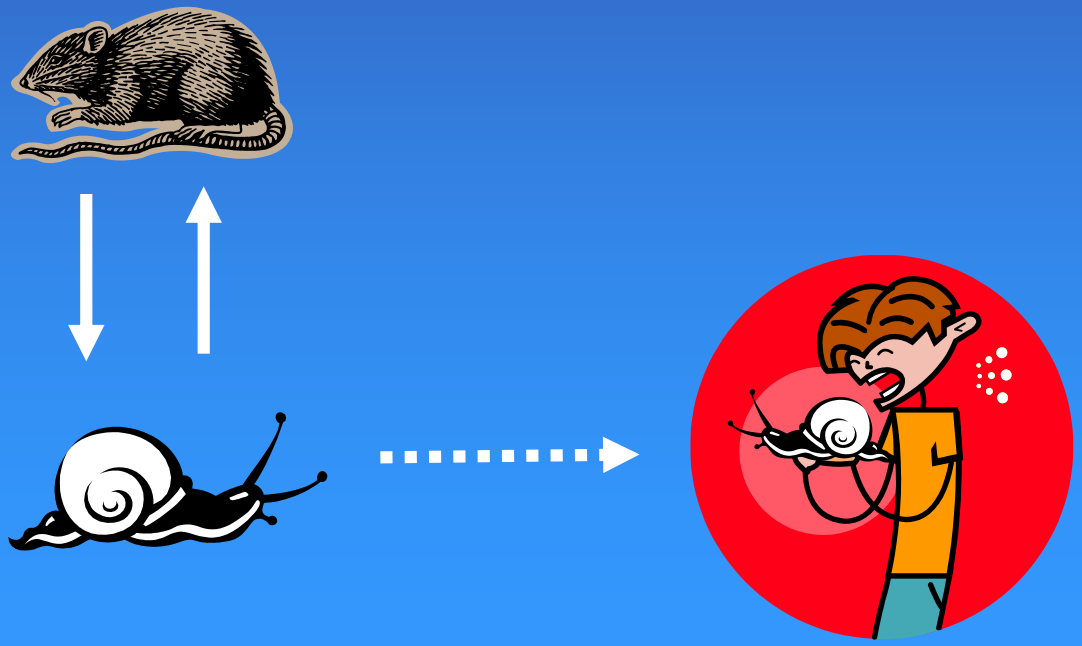
(Duffy et al, 2004)

The Life Cycle of *A. cantonesis* Requires Infection of a Rat Host in Addition to a Snail Host



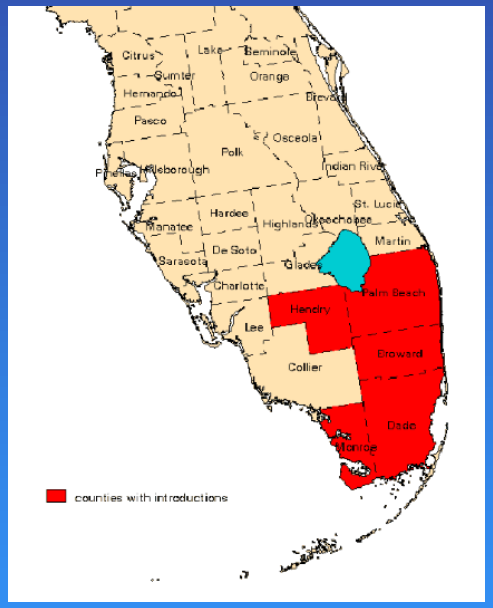


Humans Can Become Infected with *A. cantonesis* by Eating Raw Snails



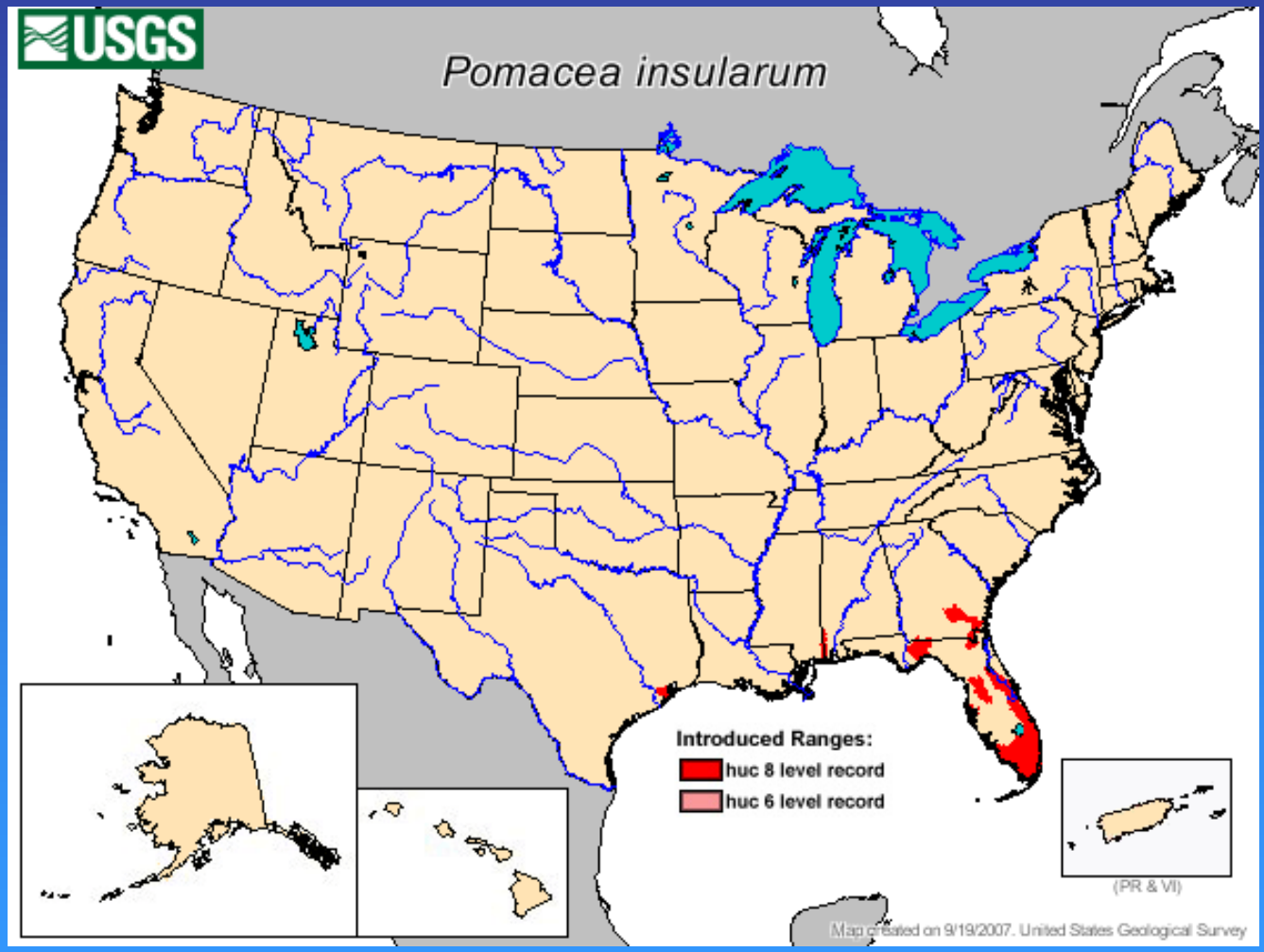
The Predominate Channeled Apple Snail in the GSARP Region is *Pomacea insularum*

Marisa cornuarietis is an Apple Snail Common to South Florida

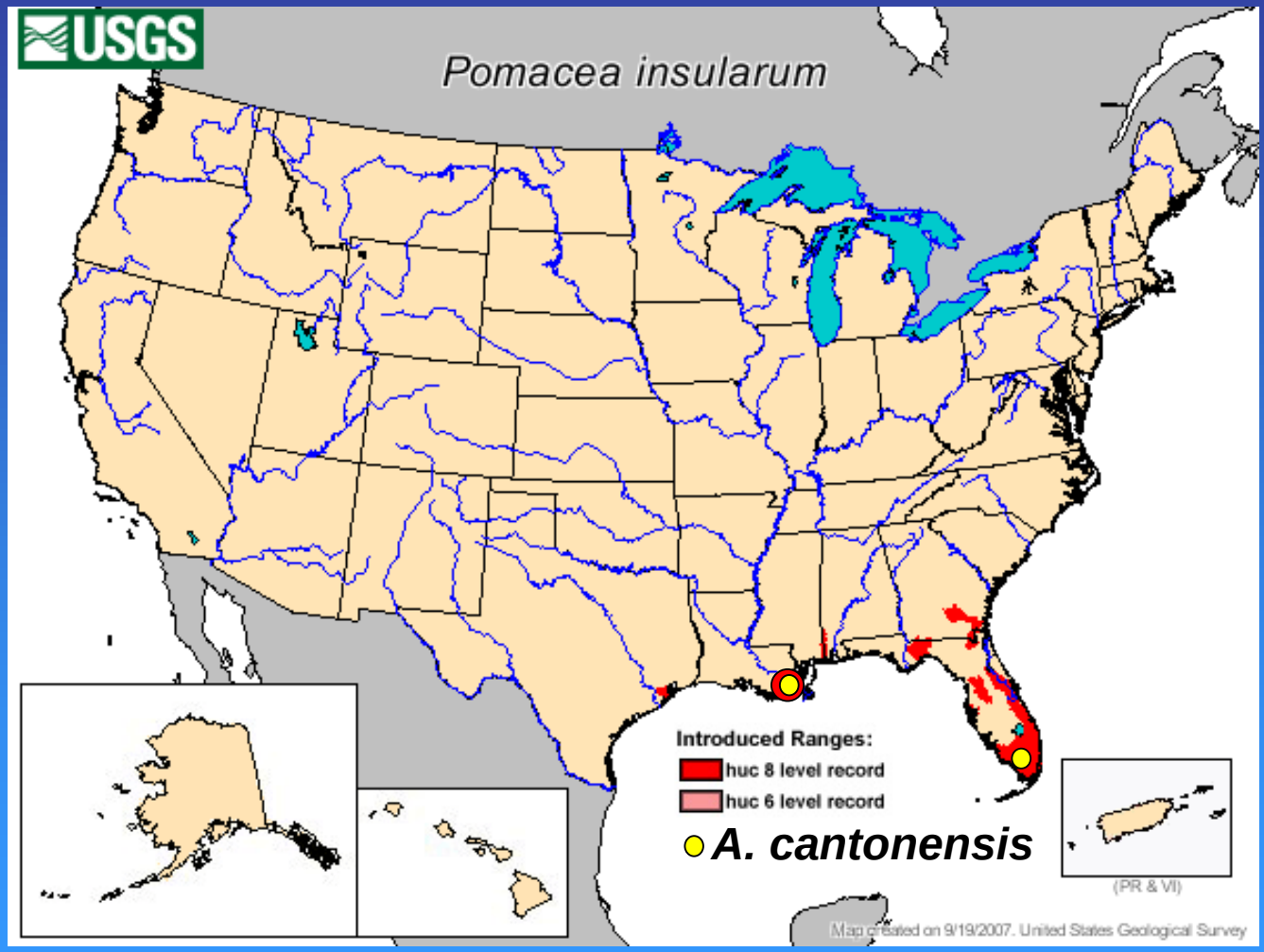


Other species of nonindegenous apple snails in the GSARP region include *Pomacea canaliculata, Pomacea haustrum, Pomacea bridgesii*

Pomacea insularum



Pomacea insularum



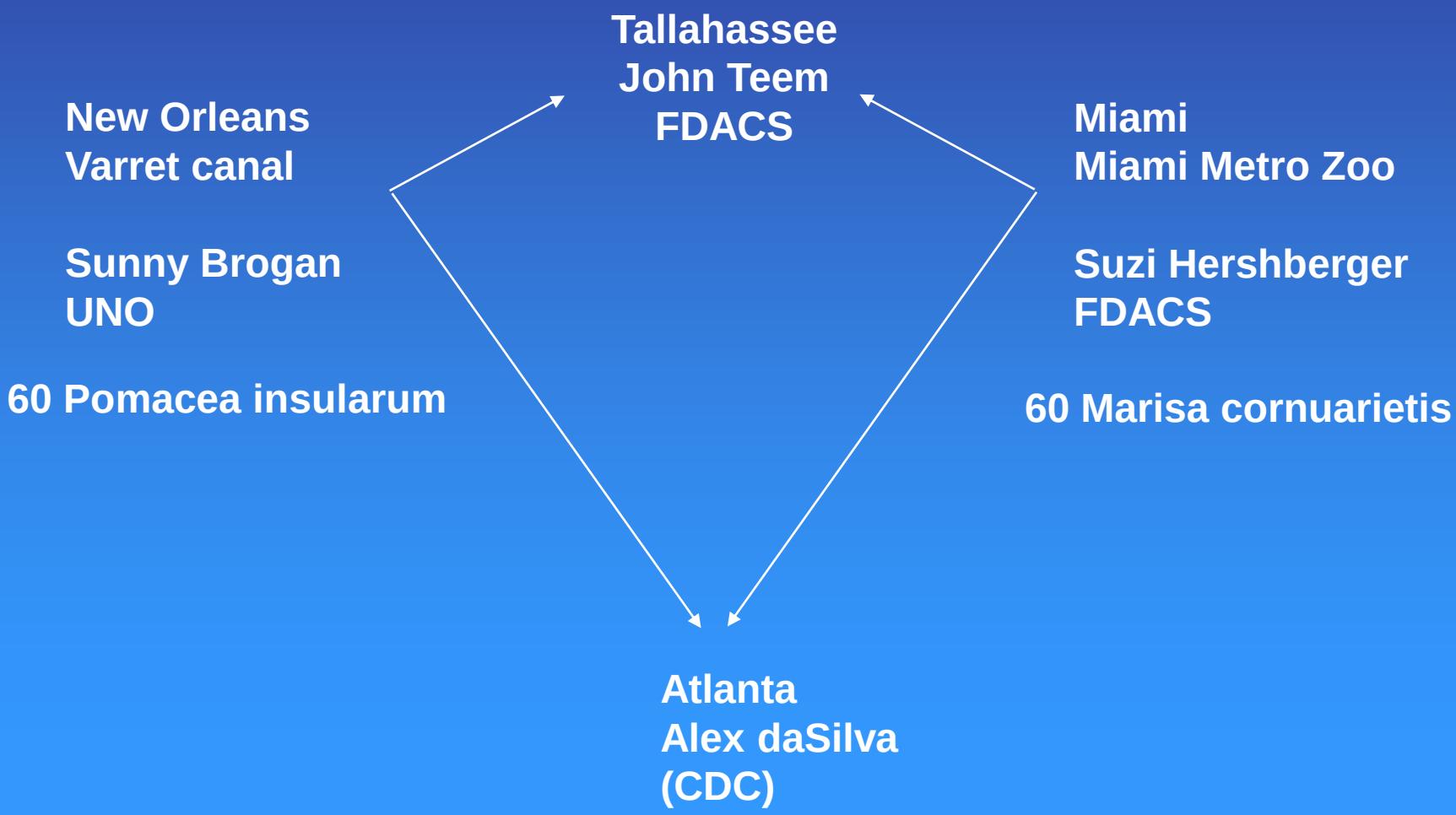
Assessing the Health Risks Associated with Channeled Apple Snails in the GSARP Region

Collect apple snails from New Orleans and Miami, send samples to the CDC in Atlanta to assay for the presence of the rat lung worm using DNA-based detection assays (PCR)

Develop an in-house capacity to detect the rat lung worm using PCR. Test channeled apple snails from a third location (Tallahassee).

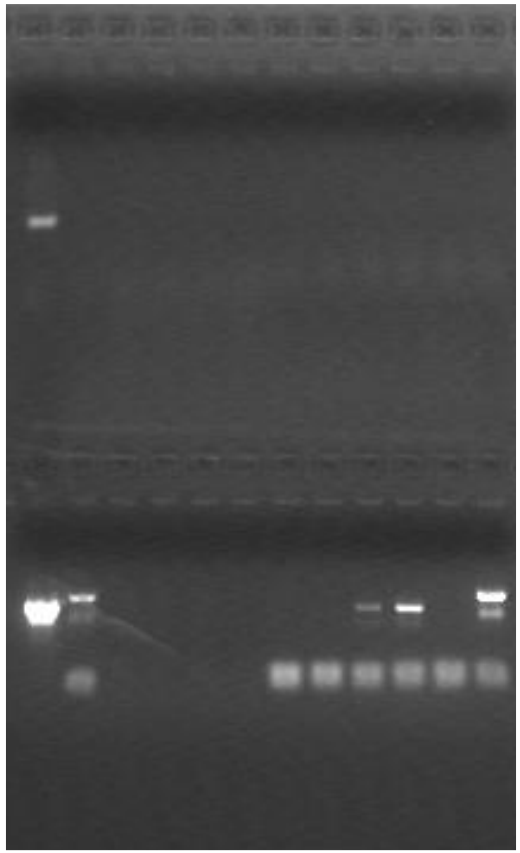
Develop a mathematical model to predict the spread of channeled apple snails.

Duplicate Samples from New Orleans and Miami Sent for DNA Analysis by PCR



No Parasite Detected in First Samples Tested from Miami, New Orleans, or Tallahassee.

AngioF1
AngioR1

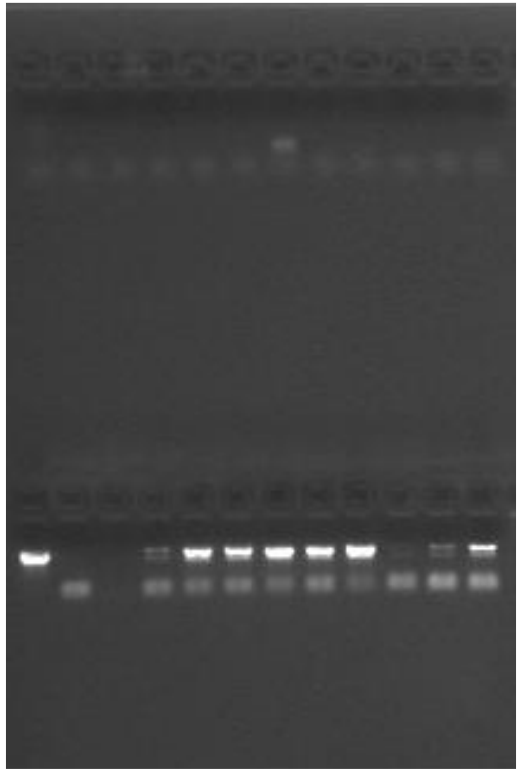


NEM3F
NEM2R

1. Angio DNA control
2. Snail DNA #1 Miami
3. Snail DNA #2 Miami
4. Snail DNA #3 Miami
5. Snail DNA #4 Miami
6. Snail DNA #5 Miami
7. Snail DNA #6 New Orleans
8. Snail DNA #7 New Orleans
9. Snail DNA #8 New Orleans
10. Snail DNA #9 New Orleans
11. Snail DNA #10 New Orleans
12. Snail DNA #11 Tallahassee

Parasite Detected in One Sample From from Miami

AngioF1
AngioR1



NEM3F
NEM2R

1. Angio DNA control
2. Snail DNA #16 Miami
3. Snail DNA #17 Miami
4. Snail DNA #18 Miami
5. Snail DNA #19 Miami
6. Snail DNA #20 Miami
7. Snail DNA #21 Miami
8. Snail DNA #22 Miami
9. Snail DNA #23 Miami
10. Snail DNA #24 Miami
11. Snail DNA #25 Miami
12. Snail DNA Tallahassee

DNA sequencing will be required to confirm *A. strongylus*

Mathematical Model Objectives

Create partial differential equations that model the diffusion of a species over time through a spatial domain.

Create a grid of polygons representing the spatial domain, in which each polygon represents a geographic area with specific properties related to the diffusion of the species.

Model the diffusion of the species through the grid, calibrating the diffusion rate with experimental data.

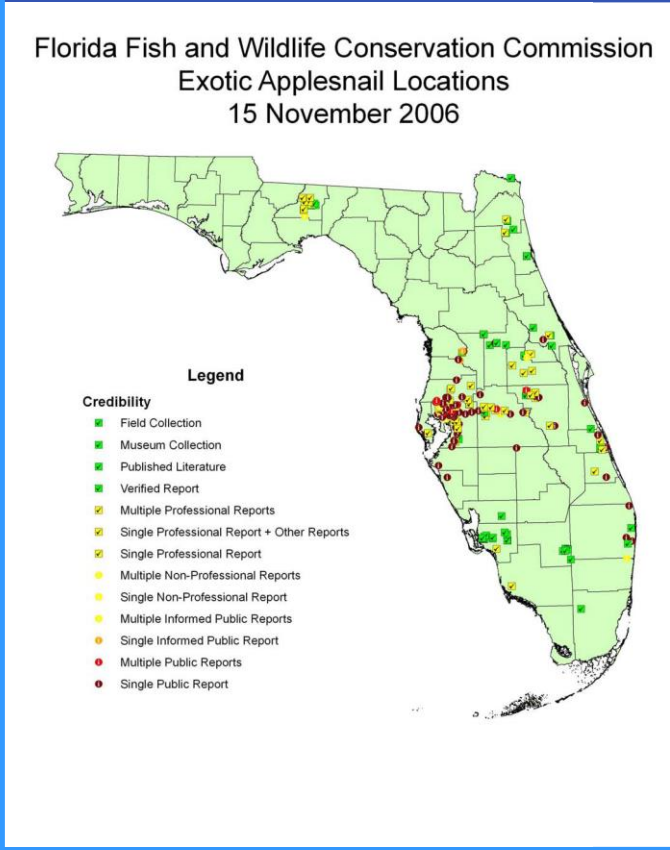
Generate new grids using existing GIS data maps.

Model the effects of biocontrol efforts on spread.

Invasion Modeled Within a Spatial Domain

Create partial differential equations (PDEs) that model the diffusion of a species over time through a spatial domain.

Ideally, the spatial domain will be represented in the format of geographic map which will show the spread of the species from points of introduction over time.



Invasion Modeled Within a Spatial Domain

Create partial differential equations (PDEs) that model the diffusion of a species over time through a spatial domain.

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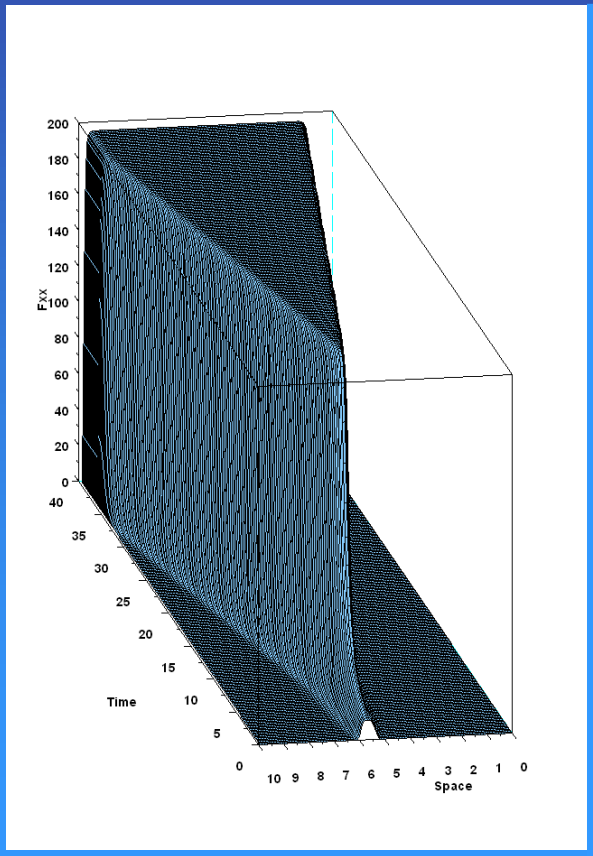
Invasion Modeled Within a Linear Spatial Domain



Currently, the spatial domain is represented by a line (analagous to a riverine system).

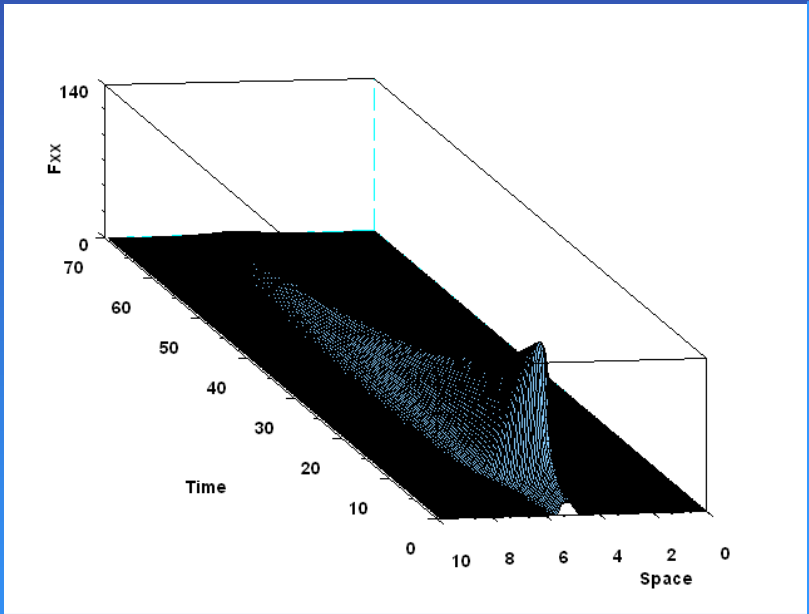
Invasion over time is represented by a 3-D graph showing the increase in the population over time and through space.

X axis-space
Y axis- time
Z axis- population

Graphic representation of a successful invasion using PDE model

Biocontrol Modeled Within a Spatial Domain

Create partial differential equations that model the diffusion of a species over time through a spatial domain.



Graphic representation of an aborted invasion following biocontrol (Trojan YY eradication used as a biocontrol example)

Conclusions

Snails were collected at sites in Miami and New Orleans and sent to the CDC in Atlanta. DNA analysis is currently in progress.

A subset of samples in each location were tested by PCR for the rat lung worm at FDACS. One snail from the Miami Zoo was found to be positive for parasite.

Partial differential equations describing the spread of apple snails through a 2-D system have been produced. The mathematical model is currently being developed further as software application that utilizes GIS mapping data.