



Resilience to Salinity Changes of the Non Native Freshwater Snail *Melanooides tuberculatus*

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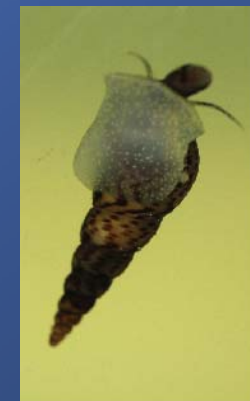
What is *Melanooides tuberculatus* (Red-Rimmed Melania)?

- A non-native gastropod (Family Thiariidae)
- Native to southeast Asia and Africa
- In 2003 found in large numbers in BNP
- 2004 informal study began in BNP to determine distribution
- 2007 formal one year study to map distribution



How did *Melanooides* get here?

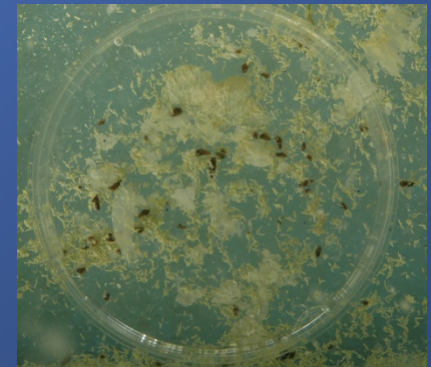
- Specifics of how it got here not known
- Believed to be the aquarium trade
- By 1977 had reached areas adjacent to Biscayne Bay
- In 2003 found in large numbers in Biscayne National park near Black Point



Known distribution in US



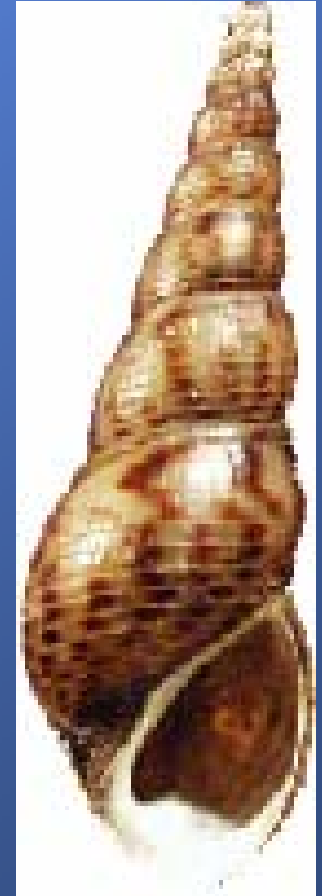
Known distribution of *M. tuberculatus* as of April, 2006; the non-native snail is likely to have expanded its range from the areas shown.



Why should you be concerned about *Melanooides*?

- Potential carrier of trematode parasites harmful to humans and other animals
- Displacement of native species

Significant factors in south Florida environment

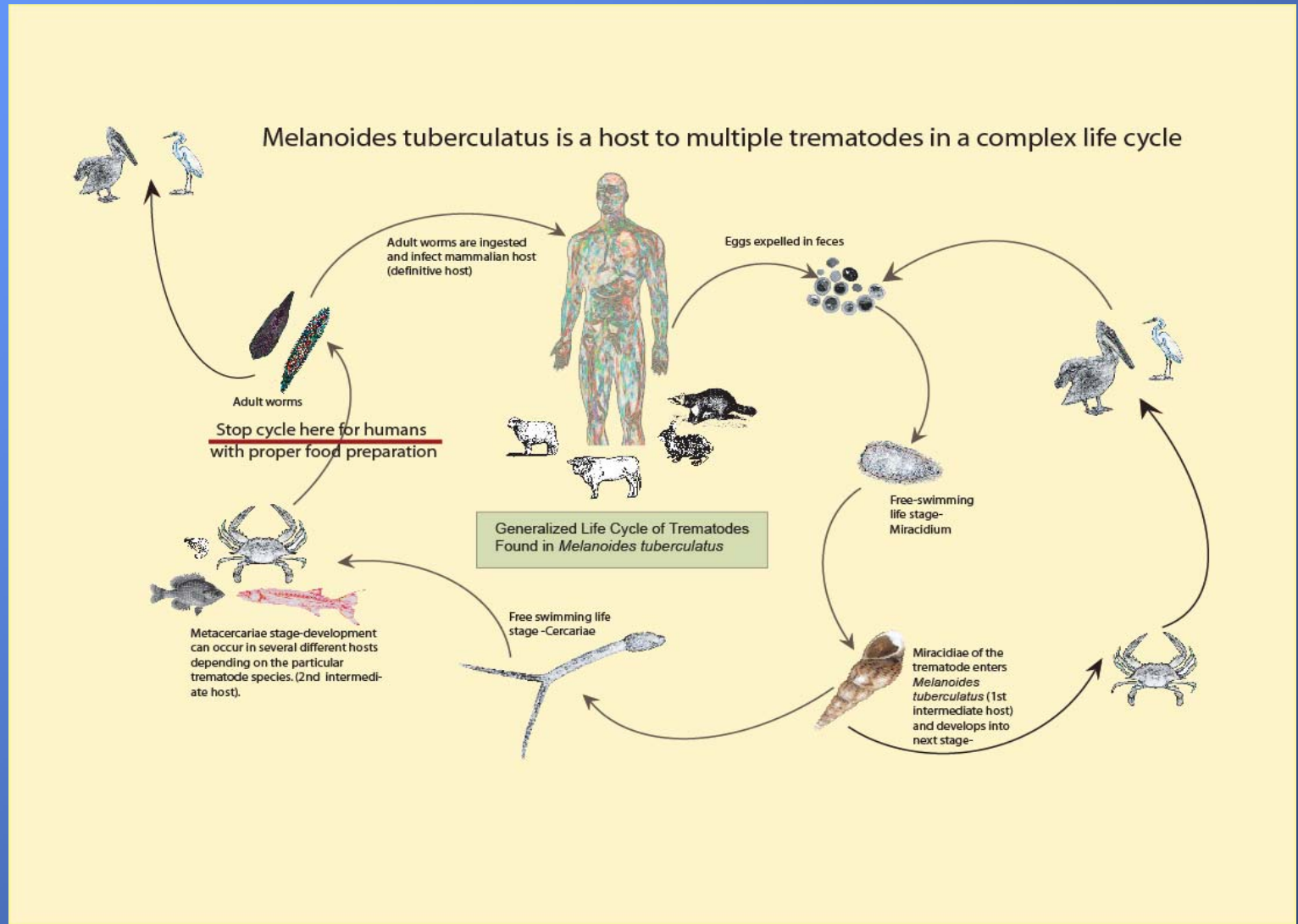


■ Host to parasites that can be harmful to human health

In Asia *Melanoides* plays key role in life cycle of several species of trematode parasites:

- *Clonorchis sinensis* - liver flukes
- *Opisthorchis* spp..- liver flukes
- *Haplorchis* spp..- liver and muscle flukes
- *Paragonimus westermani* - lung fluke.

■ Host to parasites that can be harmful to human health



■ Host to parasites that can be harmful to human health

Disturbing facts:

- Methods of food preparation
- Infection by the lung fluke documented in the U.S and Miami
- Parasite infections can last for years



■ Host to parasites that can be harmful to animal health

Flukes also affect waterfowl, fish and other animals
Centrocestus formosanus

- burrows into gills of fish (new data)
- causes losses of over \$3 million annually to ornamental fish producers
- *Haplorchis* spp. - infects the muscle tissue of fish
- *Philophthalmus megalurus* - affects the eyes of birds, including water fowl



■ Displacement of native species

Disturbing facts about *Melanooides*:

- Reported occurring in densities of 10,000/m² in St. Johns River, FL (Thompson, 2004)
- 23,000/m² near Coral Gables, FL (Roessler and others, 1977).
- Reproduce asexually
- High reproductive rates
- Brood their young internally



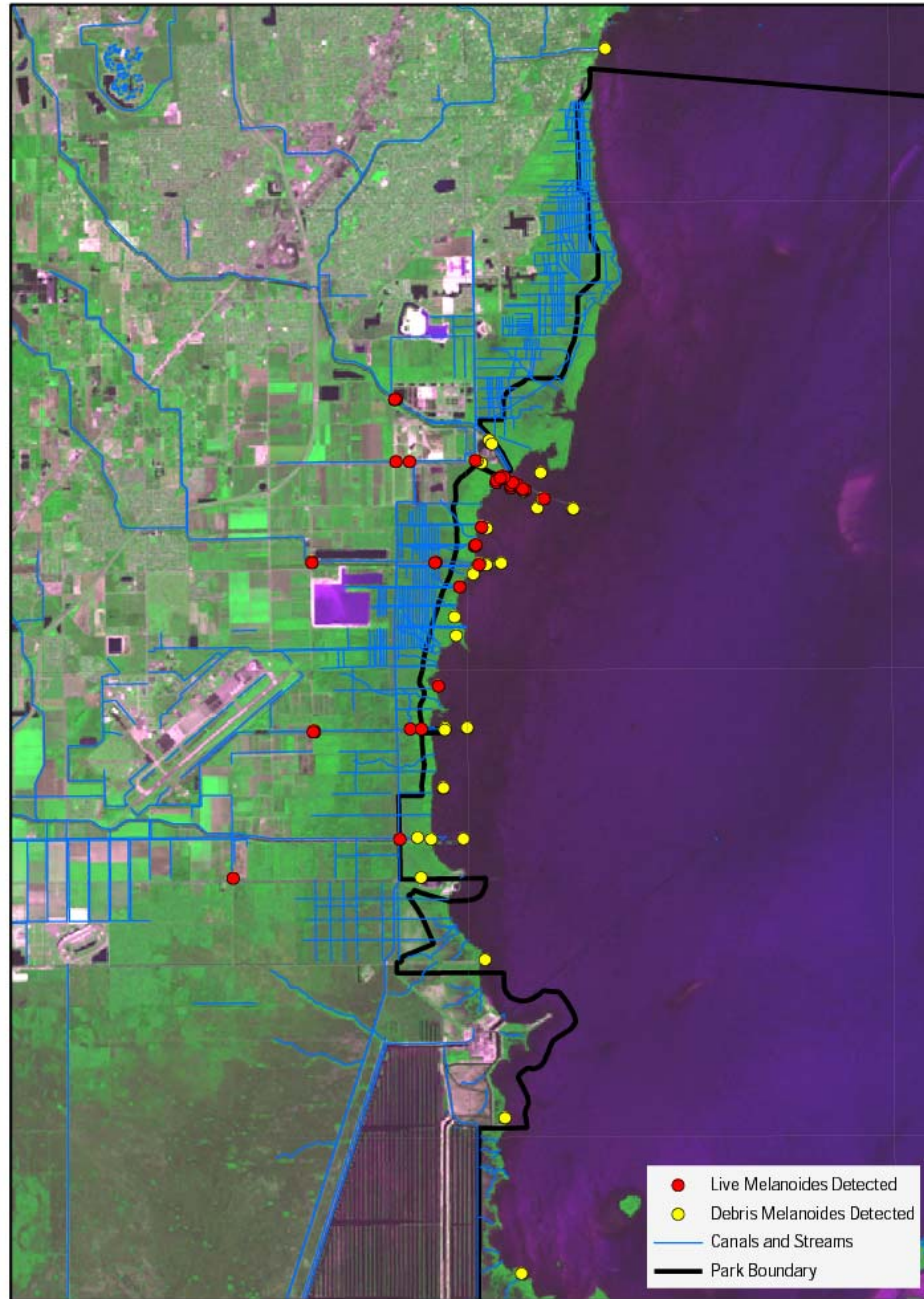
■ Special Concerns in South Florida

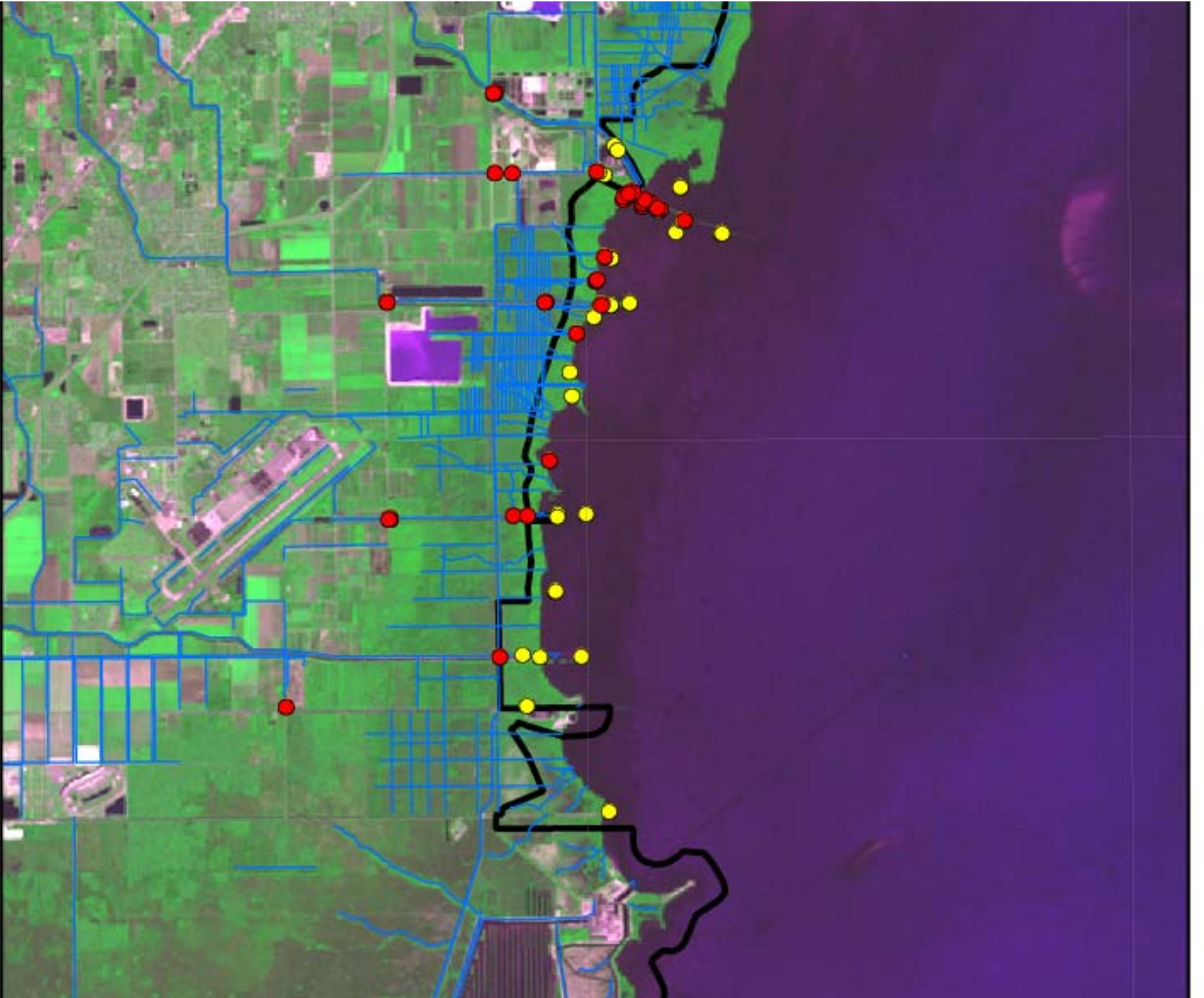
- Climate of south Florida
- Conditions favor the parasitic life cycle
 - Snail, fish, and crustacean hosts are present in large numbers
 - Recreational activities increase risk
 - Untreated human waste exposure
 - Porous limestone and septic tanks account for approximately 21% of waste disposal



What is the distribution of *Melanooides* within BNP?



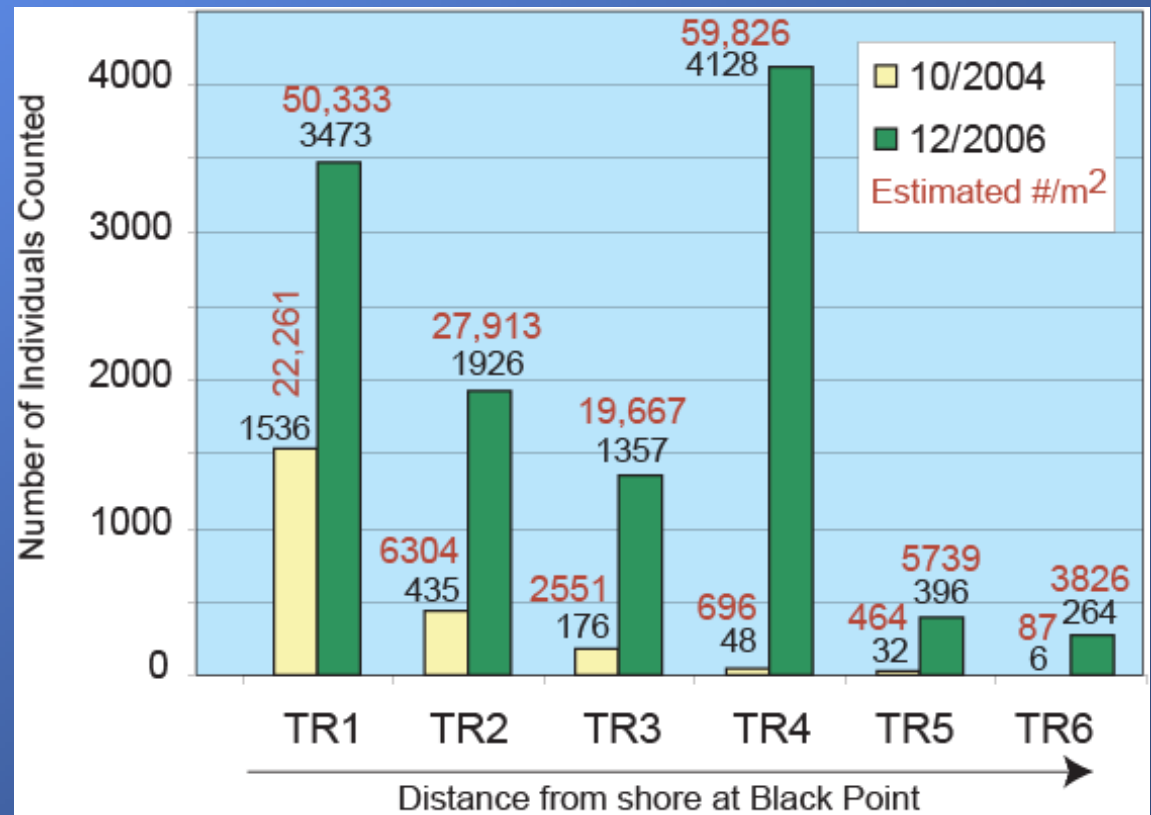




What is the distribution of *Melanoides* within BNP?



Highest concentrations of live and dead shells around Black Point



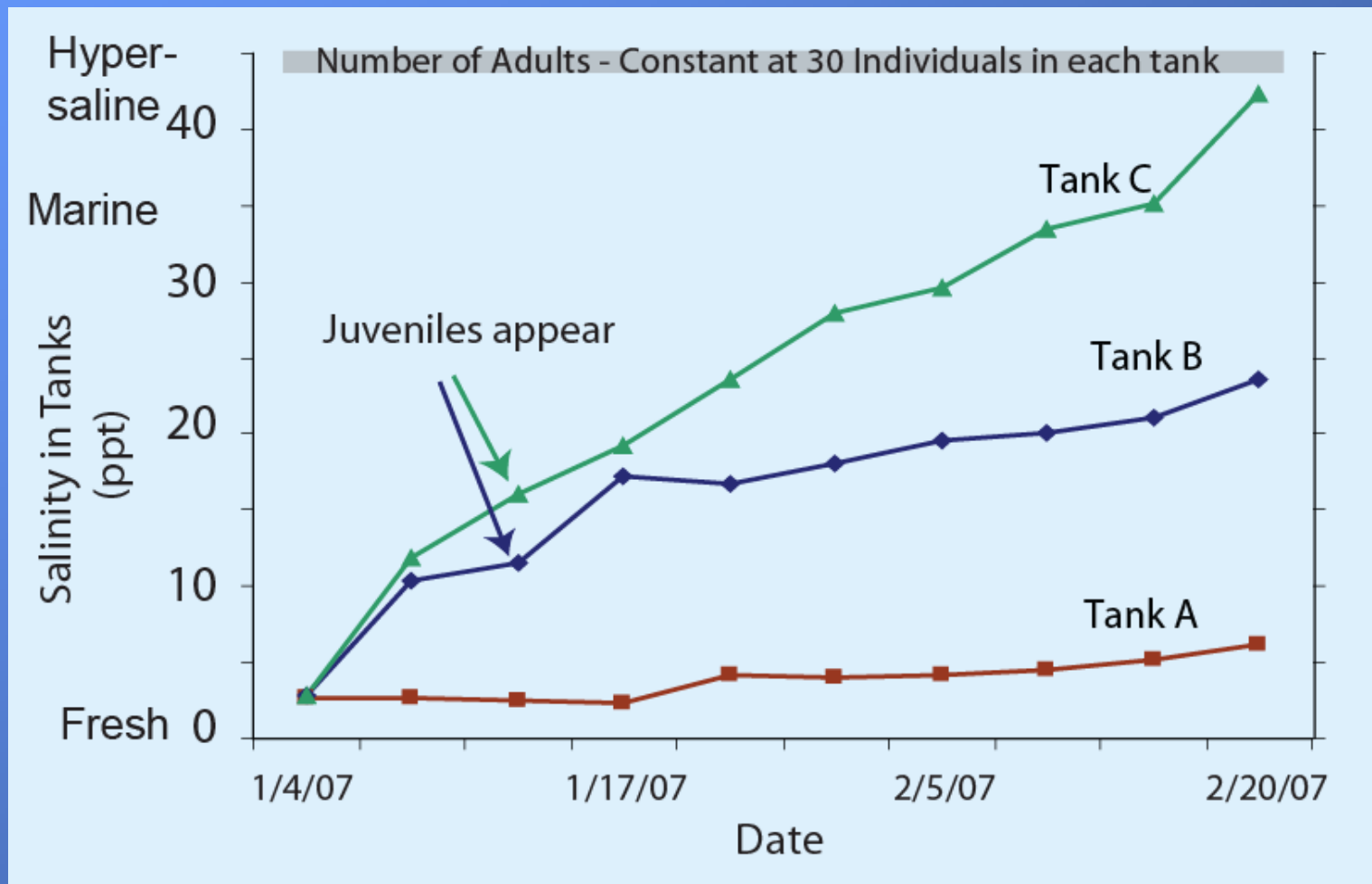
What factors are controlling the distribution of *Melanoides*?

- Considered a freshwater species in its native habitat
- Will the estuarine/marine boundary of Biscayne Bay stop expansion
- Collected live *Melanoides* up to 33 ppt

Experiments set up to test salinity tolerances



Is salinity a factor in controlling the distribution of *Melanoides*?



Rapid salinity changes that mimic tidal/weather changes

- ❖ *Melanooides* has the ability to retract into its shell for long periods



What factors are controlling the distribution of *Melanooides*?

- ❖ Temperature - appears to be a limiting factor
- ❖ Resistant to chemical disinfectants
- ❖ Resistant to desiccation
- ❖ Resistant to low oxygen levels

How does *Melanooides* impact native animal populations?

Numbers of *Melanooides* found at some sites around Black Point are far in excess of any of the native mollusk species present

- ❖ No direct testing on invertebrates
- ❖ Assume competition for micro-algae

How does *Melanooides* impact native animal populations?

- ❖ Roessler and others (1977) suggested that *Neritina virginea* would be particularly affected -
- ❖ We are concerned about impact on closely related Cerithids and *Batillaria minima*

Additional experiments and field work are needed to determine the precise impact

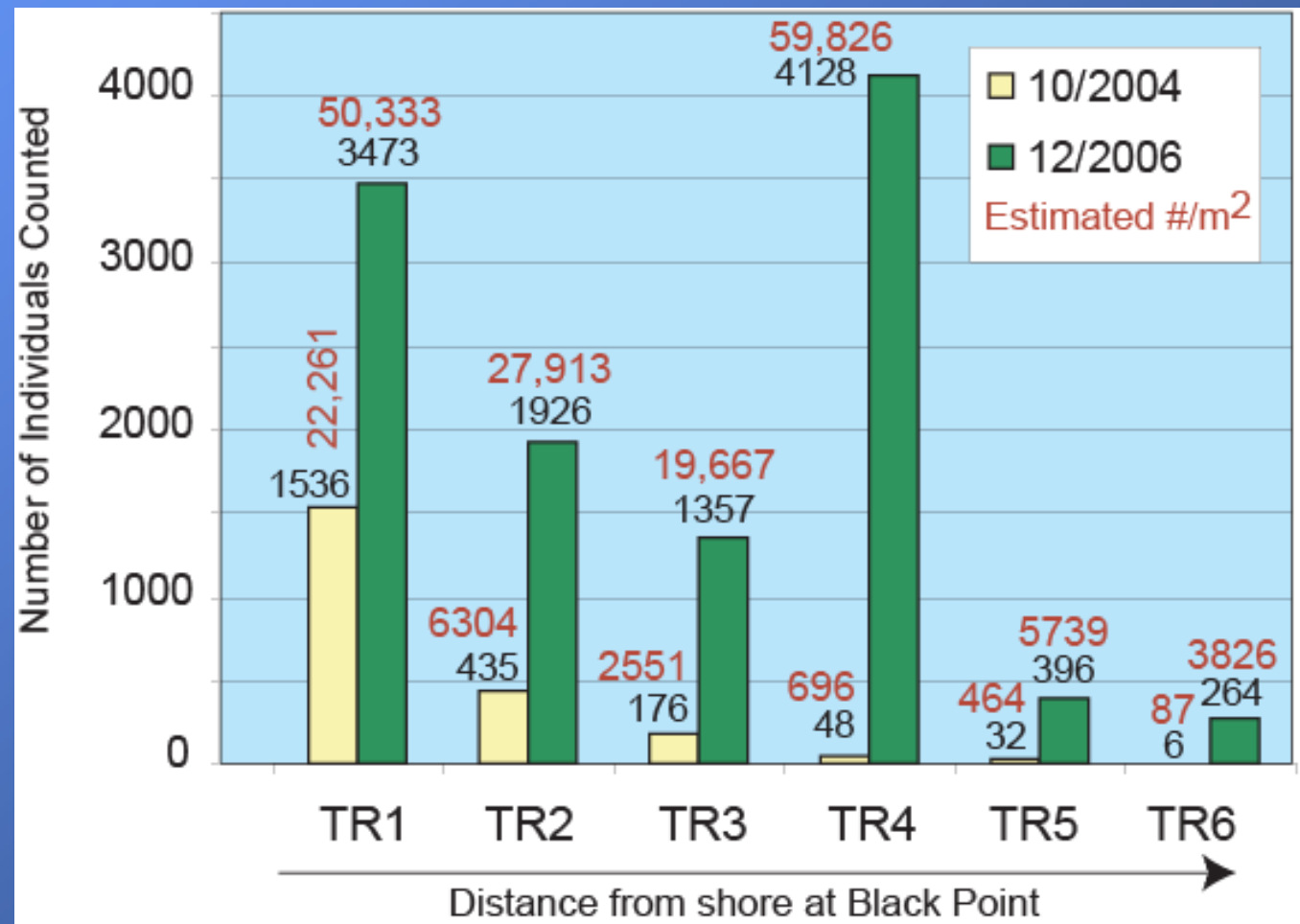
In conclusion:

- ❖ *Melanooides* population in BNP has not revealed evidence of harmful parasites
- ❖ Concentrated near canal mouths
- ❖ Area around Black Point has an especially high concentration
- ❖ One introduction
- ❖ Rapid population growth

In conclusion (cont'd):

- ❖ Both parasites and host snails could spread rapidly
- ❖ All components of the trematode life cycle are in place in BNP
- ❖ Other snails known to carry parasites co-occur with *Melanooides* populations
- ❖ Expansion of natural habitat increases species involvement; blue crabs, spiny lobster, shrimp, stone crabs and other crustaceans and fish
- ❖ Demonstrates ability to adapt and survive
- ❖ Implies distribution of *Melanooides* will likely expand

So what are the risks from *Melanoides tuberculatus* in Biscayne National Park?

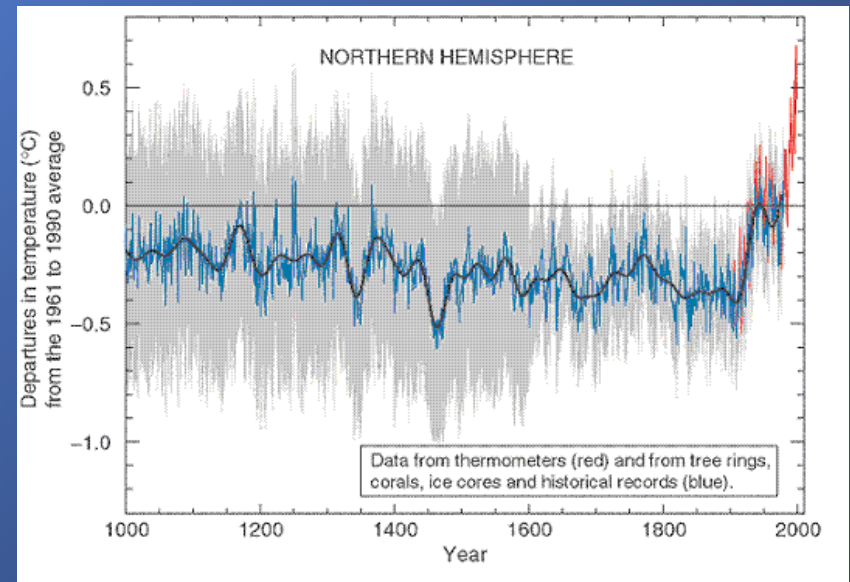


Recommendations:

- Parasites could become a problem in BNP at some point
- Continued monitoring of the snail population is necessary
- Impacts on the native animals of the Park must be observed and tested

Recommendations: Take action now . . .

- Increased flushing of freshwater through canal systems during restoration could further spread the species
- Global warming will likely cause the spread of the species in BNP and beyond



They're coming!

