TARGETING NEW VECTORS THAT CONTRIBUTE TO THE INTRODUCTION AND SPREAD OF NON-NATIVE MARINE SPECIES

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TRADITIONAL VECTORS

- **Shipping:** >2/3 recent marine species introductions
- **Hull Fouling:** Antifoulant effectiveness; sp. resistance; protected niches; vessel speed; seasons…
- **Ballast Water:** 3 – 5 billion tonnes transferred internationally each year carrying sediment, larval species & pathogens
- **Regulations:** 200 miles exchange, or retained, or treated
  - Safety exemptions; effectiveness of exchange; ship designs holding residual water; not all vessels enter U.S. from 200 nm offshore; treatment technologies still experimental and $ costs
- **Risk:** Southeastern US increasingly important in international shipping trade globally (container, automobile-heavy machinery, & break, breakbulk ports)

SOUTH ATLANTIC BIGHT PORT SURVEYS ATLANTIC BIGHT

- **Project Partners:** Sea Grant, NOAA Coastal Management Program, GA DNR, GA Sea Grant, Fl Sea Grant, UGA, & University North Carolina Wilmington
- **Project Goals:** Detection of non-indigenous molluscan, polychaete, crustacean & fish sp. in southeastern ports
- **Online Reports:** http://www.marex.uga.edu/shellfish
  Click “invasive” link & then “research and monitoring” link

ALTERNATIVE VECTORS

- General public unknowingly introduce/spread marine AIS
- **Recreational Vessels**
  - Coastal GA counties have 37,748 registered vessels (GA DNR)
  - Regional movement intracoastal waterway, and overland trailering
  - Large number of transient recreational vessels pass through state
  - Ramps, docks, marinas increase habitat for fouling species
- **Commercial Fishing Vessels**
  - 18-29% of vessels in GA waters over past 20 years from out of state
  - GA fishing boats also travel out of state
- Species moved on vessel hulls and boat trailers, in live well, bilge and motor water, and on fishing and water sports gear

Mytella Charruana (d'Orbigny, 1846), Charrua Mussel

- **Taxomony:** Phylum Mollusca; Class Bivalvia; Family Mytilidae
- **Synonyms:** *M*. *falcata*, *M*. *strigata*, *M*. *arciformis*
- **Native Distribution:** South America (Venezuela to Argentina) & E. Pacific (El Salvador, Mexico) & Galapagos
- **Habitat:** Intertidal mudflats, shallow lagoons (<10m), rocks, mangrove roots, buoys, pilings, drainage ditches, tolerates wave action and tidal currents (Bacon, 1975; Kishore, 1995)
- **Maximum Densities:** 5,455m^2 in Costa Rica (Sibaja, 1985)
- **Maximum Length:** 69mm in Brazil (Abrahao *et al*., 2007)
- **Salinity Range:** 5-40ppt, 5-23 ppt optimal (Yuan *et al*., 2008)
- **Predators:** crabs, rays, whelks, pufferfish (Kishore, 1995)
- **Commercial Significance:** Brazilian fishery

DIAGNOSTIC FEATURES

- Color: green, yellow, brown, black
- Uniform or banded
- Inside is iridescent purple
- Does not have exterior ribs
- Form: substratum and densities
- Soot-Ryen, T., 1955

USA Interactive - Mozilla Firefox

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http://nas.er.usgs.gov/ARCIMS/interactive/interactive.asp?speciesID=106&InterstatesON=&MajorCitiesON=&AllC

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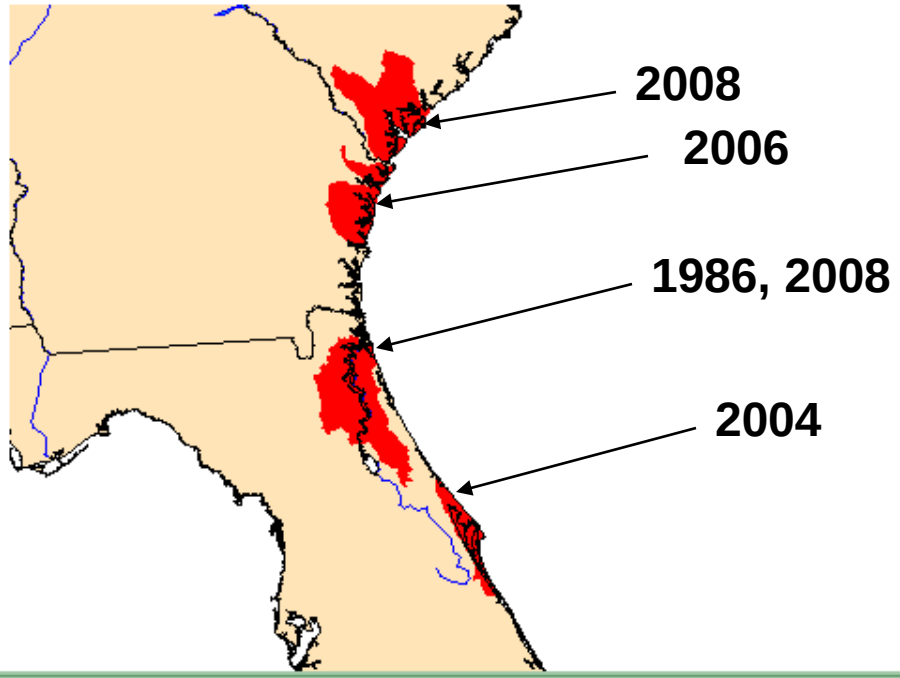
NAS - Nonindigenous Aquatic Species

NAS Program Home | Alert System | Database & Queries | General Taxa Information | Links to Other Resources

Re-centered Map

Mapped collection data for *Mytella charruana*

Navigation: Zoom In Zoom Out Re-center Map



Get Collections in Area:

- State
- HUC6
- HUC8

After selecting one of the above, click a shaded area on the map. The data will be displayed below the map.)

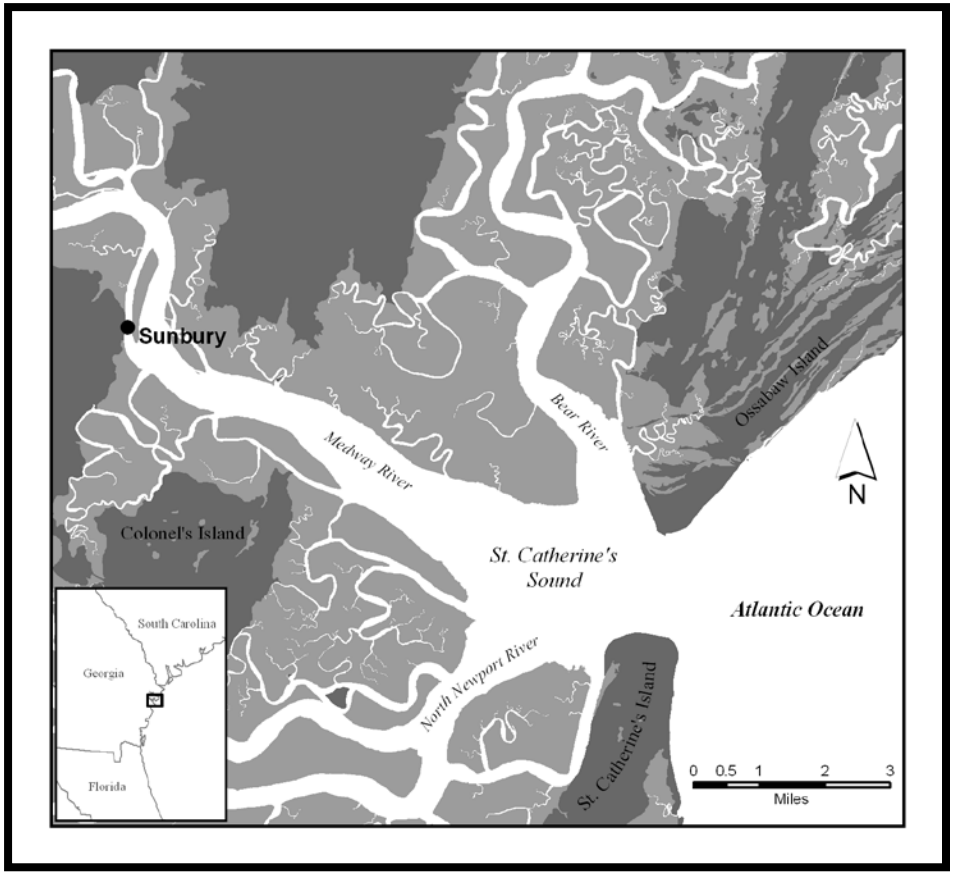
Other Layers:

- Native Ranges
- Water

Optional Layers:

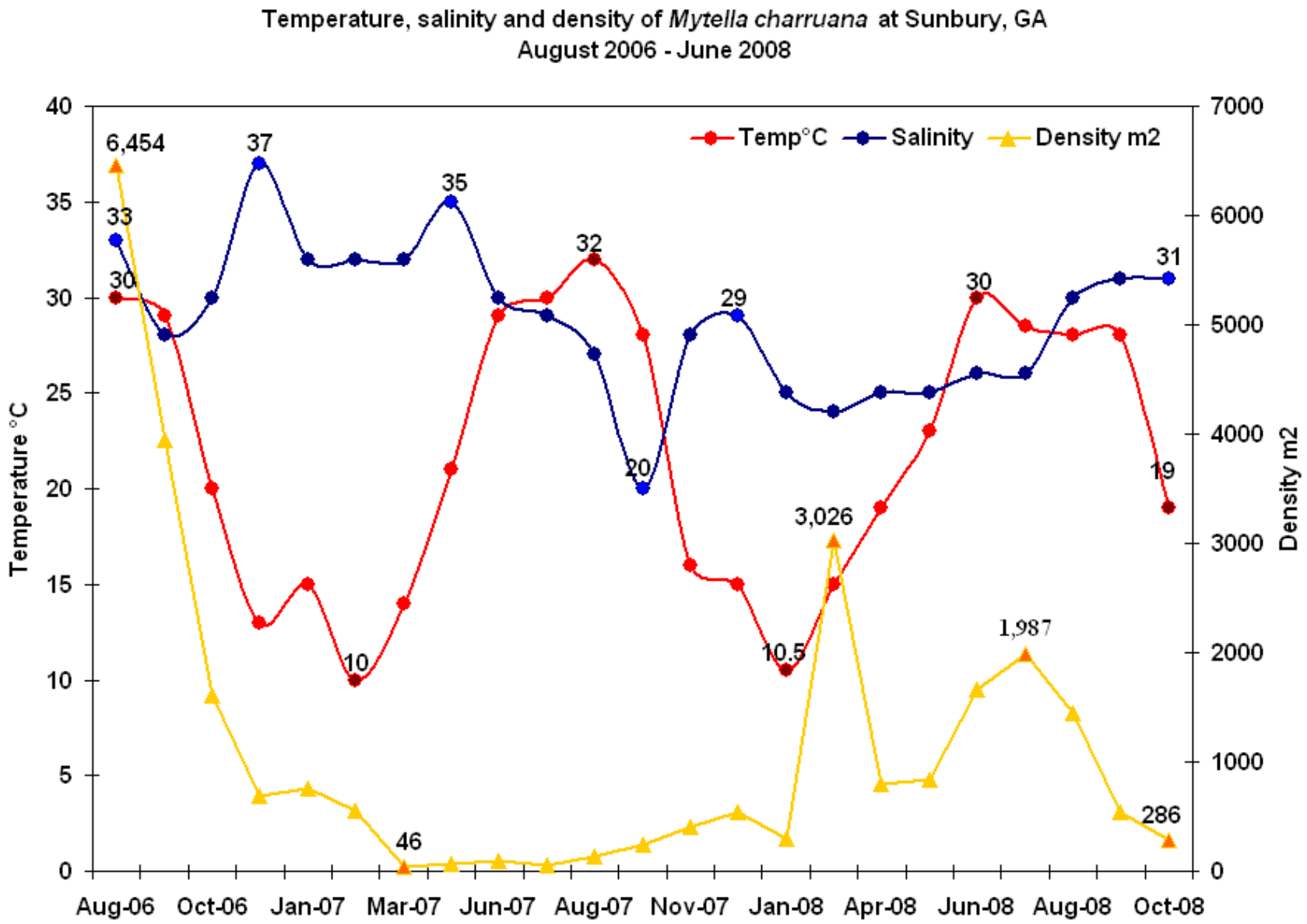
- Major Cities
- All Cities
- Interstates
- Counties
- HUC6 Numbers and Borders
- HUC8 Numbers and Borders

update map

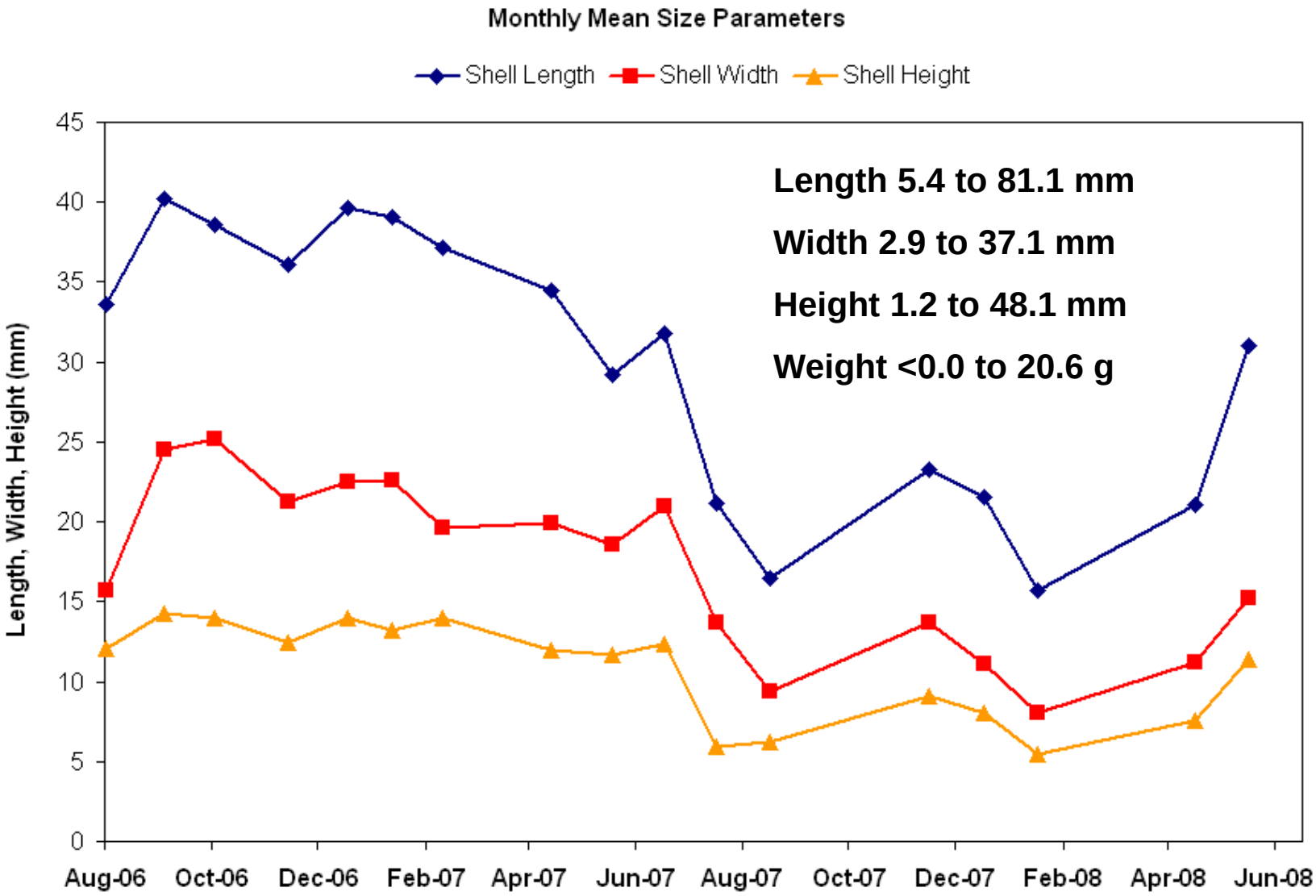


GEORGIA POPULATION

- Monthly collections
- Temp and salinity
- Temporal densities
- Size distributions
- Sex ratios
- Reproductive cycle
- Size at maturity



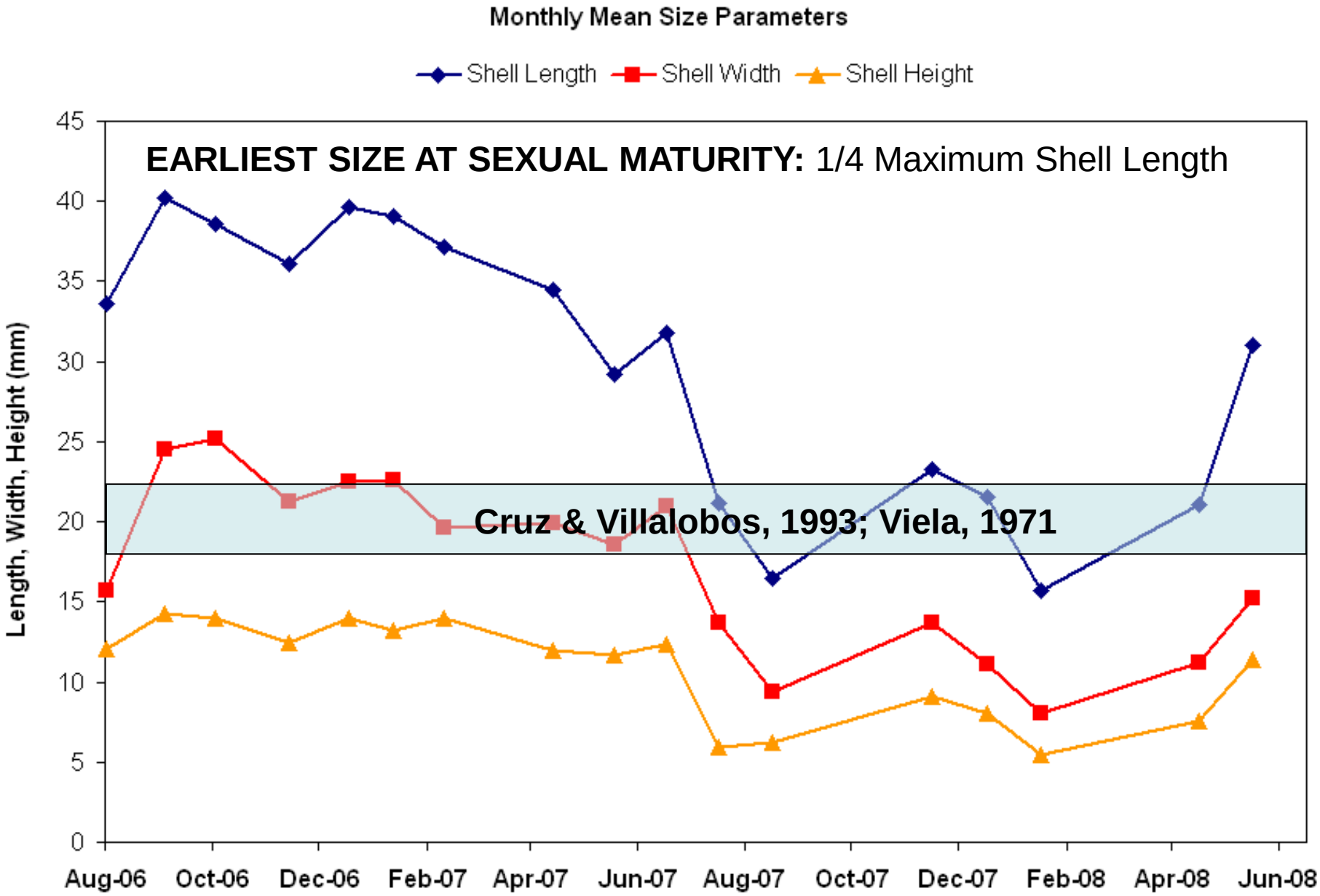
5,455m2 in Costa Rica (Sibaja, 1985); 1,280m^2 in Trinidad (Kishore, 1995)



Max lengths: **69 mm** Brazil (Abrahao *et al*., 2007); **44 mm** Indian River (Boudreaux & Walters, 2006); **43 mm** Costa Rica (Sibya, 1985); **50 mm** in Trinidad (Bacon, 1975)

REPRODUCTIVE BIOLOGY

- **Sex Dist:** 77.3% female, 22% male, 0.7% hermaph
- **Sex Ratio:** 3.52: 1 females to males (Chi-squared 130.37)
  - 1F:0.94M - 1.25M (Cardenas & Aranda, 2000)
  - 1F:1.04M (Vilela, 1971)
  - most related species 1:1 (Cruz & Villalobos, 1993)
  - 3.47F:1M *M. guyanensis* (Sibaja, 1986)
- **Reproductive Cycle:** Incomplete; spawning fall 2006, summer 2007
  - Spawning in Mexico: April to June and September peaks (Cárdenas & Aranda, 2000)


Monthly Mean Size Parameters
Shell Length
Shell Width
Shell Height
EARLIEST SIZE AT SEXUAL MATURITY: 1/4 Maximum Shell Length
Cruz & Villalobos, 1993; Viela, 1971
Length, Width, Height (mm)
45
40
35
30
25
20
15
10
5
0
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Jun-08

IMPACTS

- Zebra & green mussels spread rapidly, cost billions in control measures (chlorine & ozone treatment systems, anti-fouling paints, cleaning)
- Benthic community diversity/abundance
- Impacts of *Mytella* potentially similar
- Vessel and dock fouling already intense
- Power plants clogged pipes already led to decreased efficiency and costs for cleaning

OUTREACH CAMPAIGN

- Awareness among fishermen, marina operators, & recreational boaters of AIS causes & consequences
- Encourage preventative boating practices
- Encourage reporting unusual occurrences
- Boating outreach efforts:
  - Public Service Announcement
  - Boat ramp & marina signage
  - Newspaper & magazine advertisements
  - Rack card
  - Factsheets
  - Booklet
  - Clean Marina BMP's
  - HullHitchers.com website and keychains

ACKNOWLEDGEMENTS

- **Project Partners:** Sea Grant, NOAA Coastal Management Program, GA DNR, GA Sea Grant, Fl Sea Grant, University of Georgia, University of Florida, & University North Carolina Wilmington
- **Species Identification:** Dr. Harry Lee (Jacksonville Shell Club), Dr. Linda Walters (Univ. Central Florida), Dr. James Carlton (Williams College), Amy Benson (USGS)
- **Sample Collection:** Thomas Bliss, Erica LeMoine, Anna Rahn, Angela Bliss
- **Sample Processing:** Courtney Walz