Orange cup coral in Florida and the Gulf of Mexico

Tonya Shearer

Georgia Institute of Technology

In Brazil (dePaula & Creed 2004, Creed 2006)

Tubastraea coccinea

widespread throughout Indo-Pacific

Tubastraea taguensis

endemic to Galapagos

Introduced through the Panama Canal

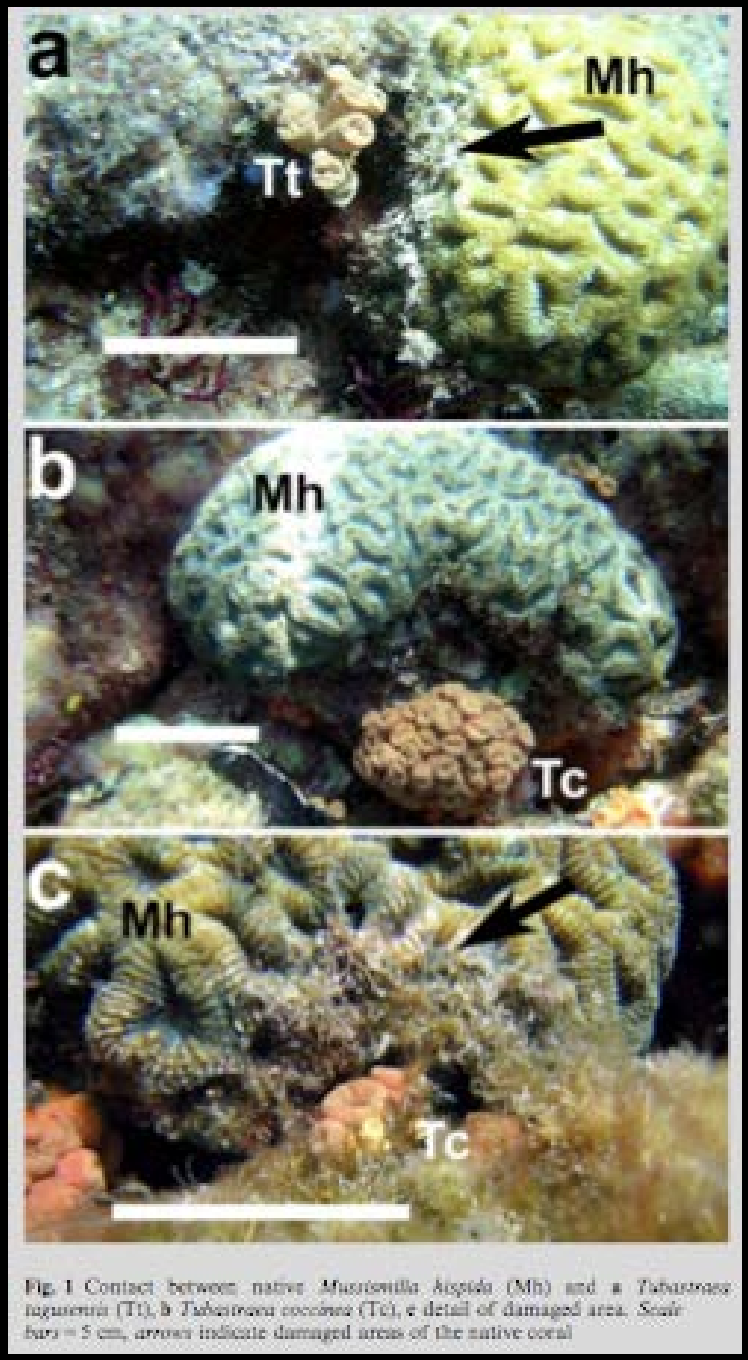


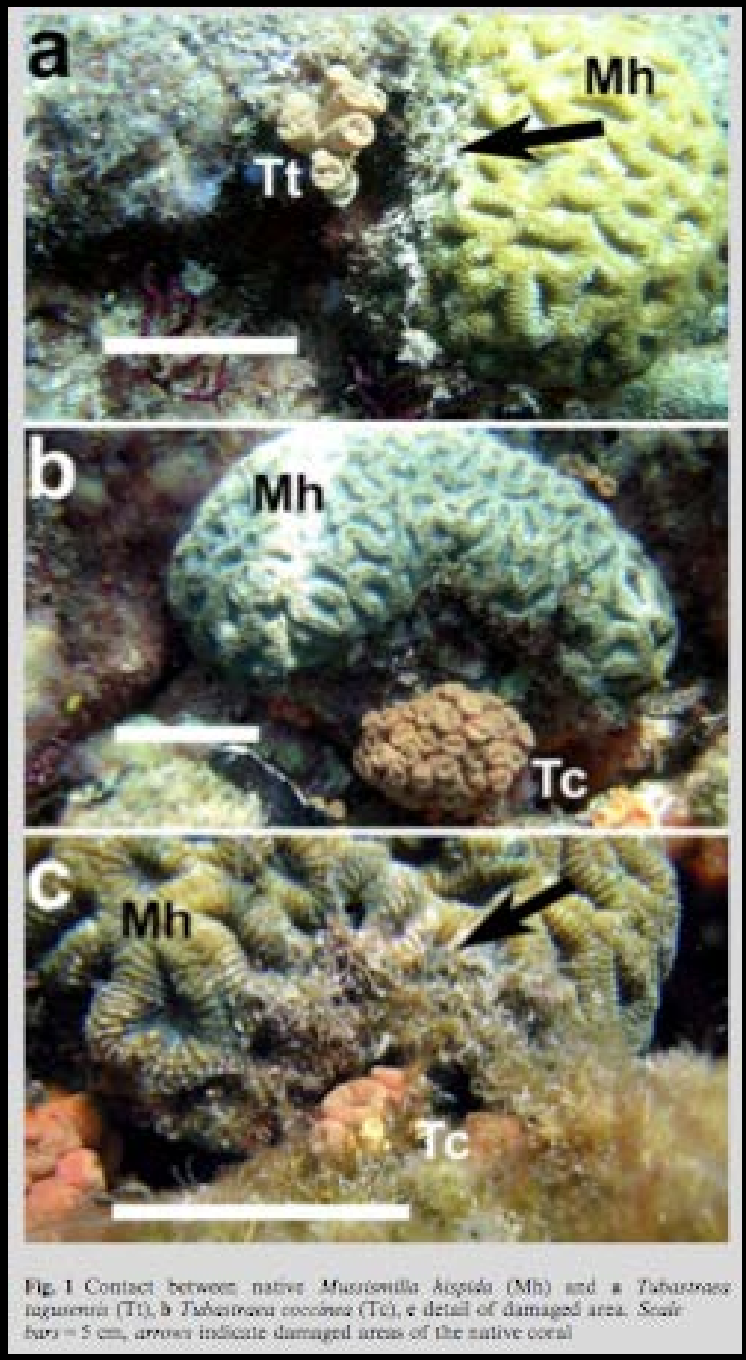
Fig. 1 Contact between native *Mussismilia hispida* (Mh) and a *Tubastraea taguensis* (Tt), b *Tubastraea coccinea* (Tc), c detail of damaged area. *Scale bars* = 5 cm, *arrows* indicate damaged areas of the native coral

In Brazil (dePaula & Creed 2004, Creed 2006)

T. coccinea

T. taguensis

"two of the nine worst marine exotic invasive species in Brazil" J. Creed pers comm



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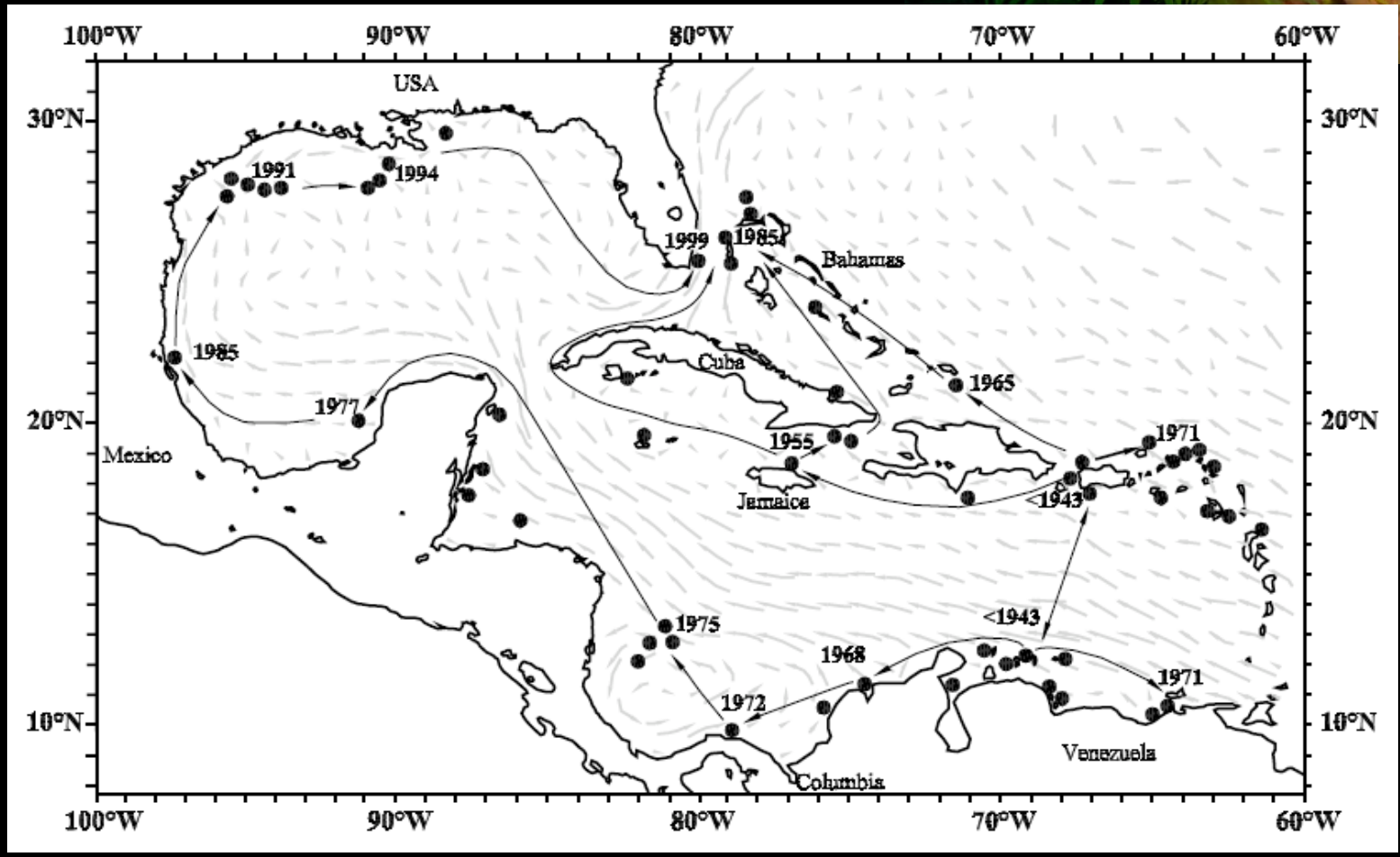
“Tubastraea coccinea”

Fenner & Banks 2004



“Tubastraea coccinea”

Sammarco et al 2004

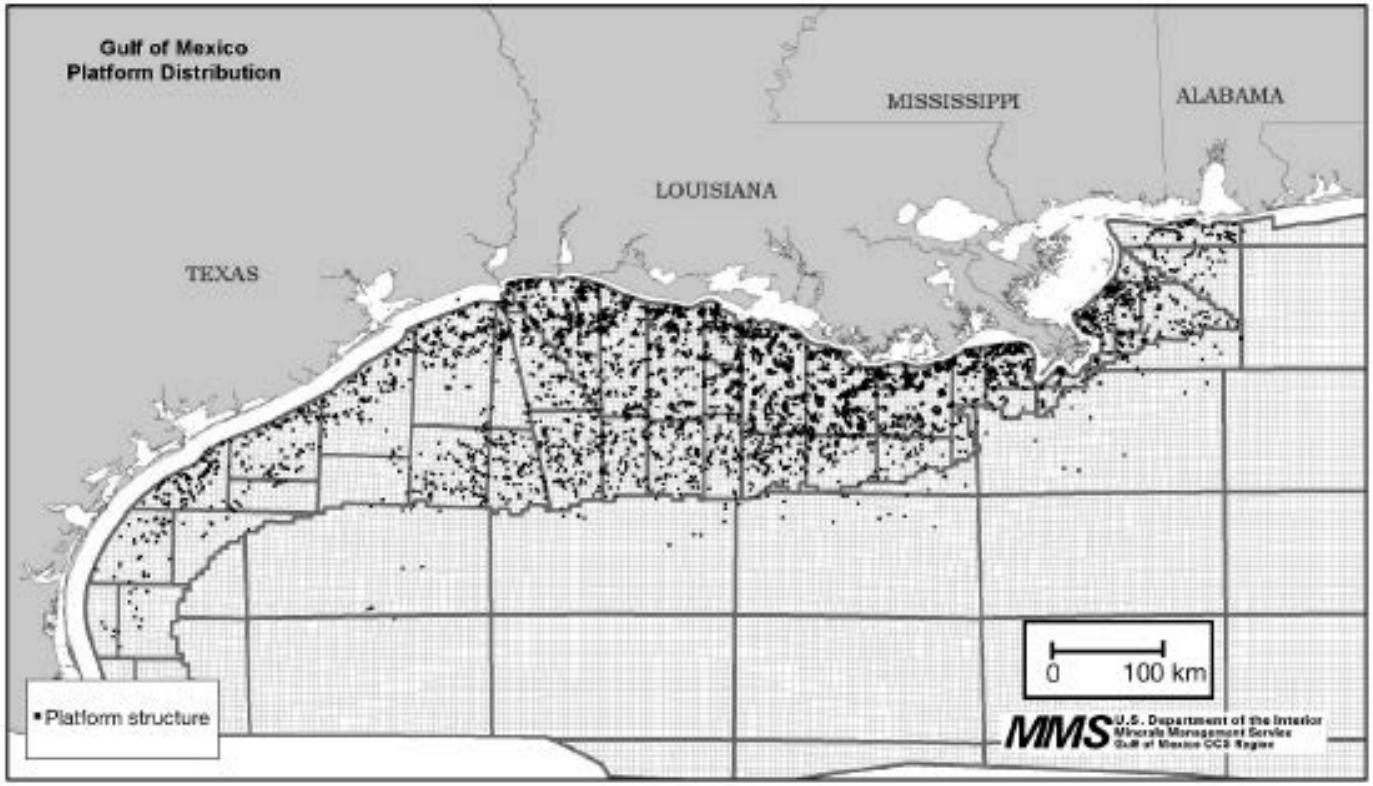


Fig. 1. Northern Gulf of Mexico, showing location of oil and gas platforms present in 2003. Total number of platforms: ~4000, total number of wells drilled since the 1940s: ~40 000

Both *T. coccinea* and *T. taguensis* are present in the GOM

Sampled from W&T Offshore HI-A 385D Oct 2010

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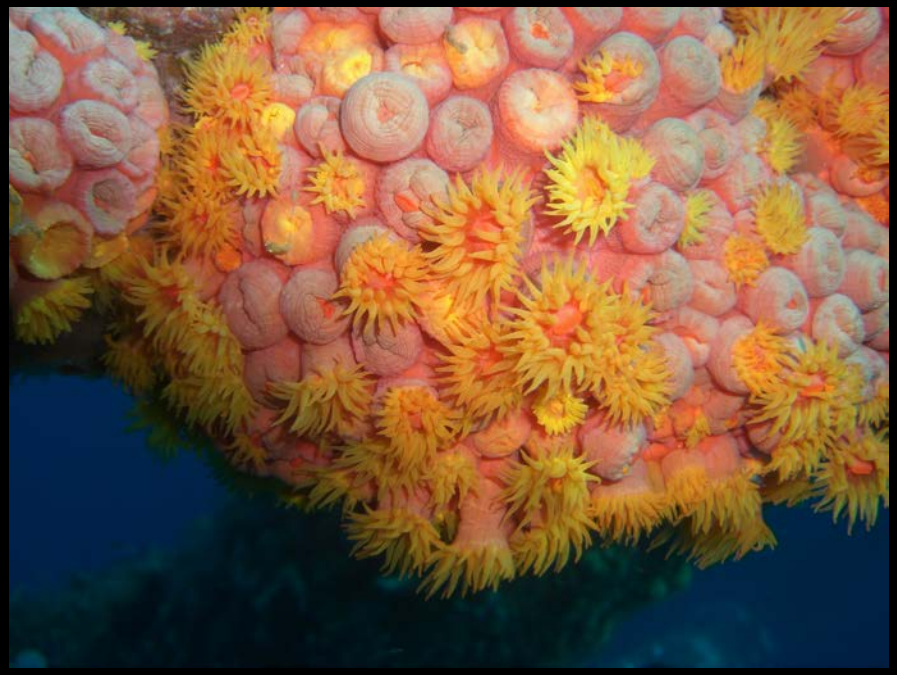
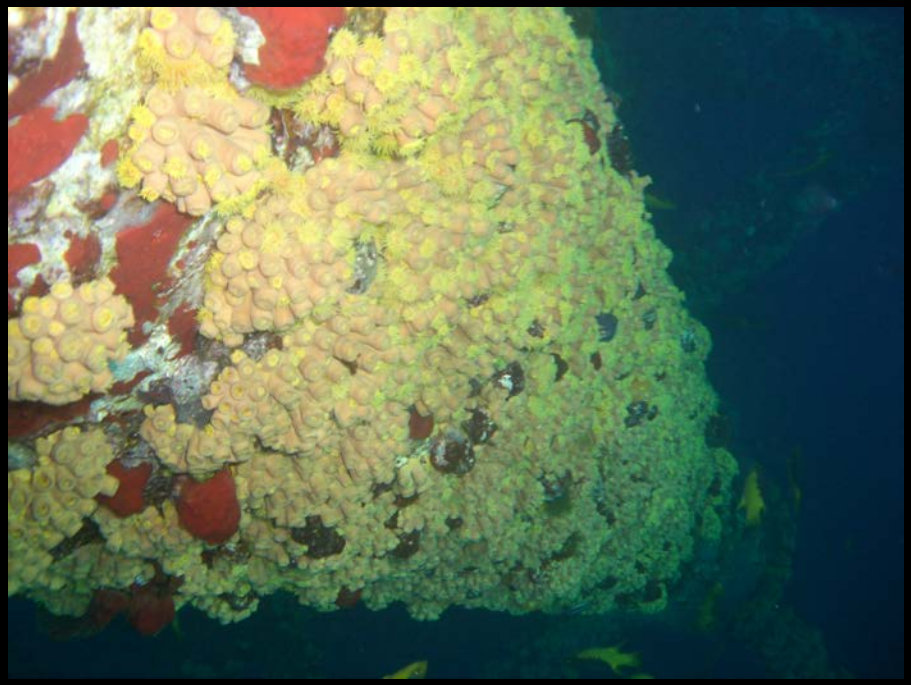


THIS IS THE FIRST OBSERVATION OF *T. TAGUENSIS* OUTSIDE OF THE GALAPAGOS AND BRAZIL

T. taguensis is abundant on platforms



THIS IS THE FIRST OBSERVATION OF *T. TAGUENSIS* OUTSIDE OF THE GALAPAGOS AND BRAZIL

T. micranthus is present in the GOM

Sammarco et al 2010

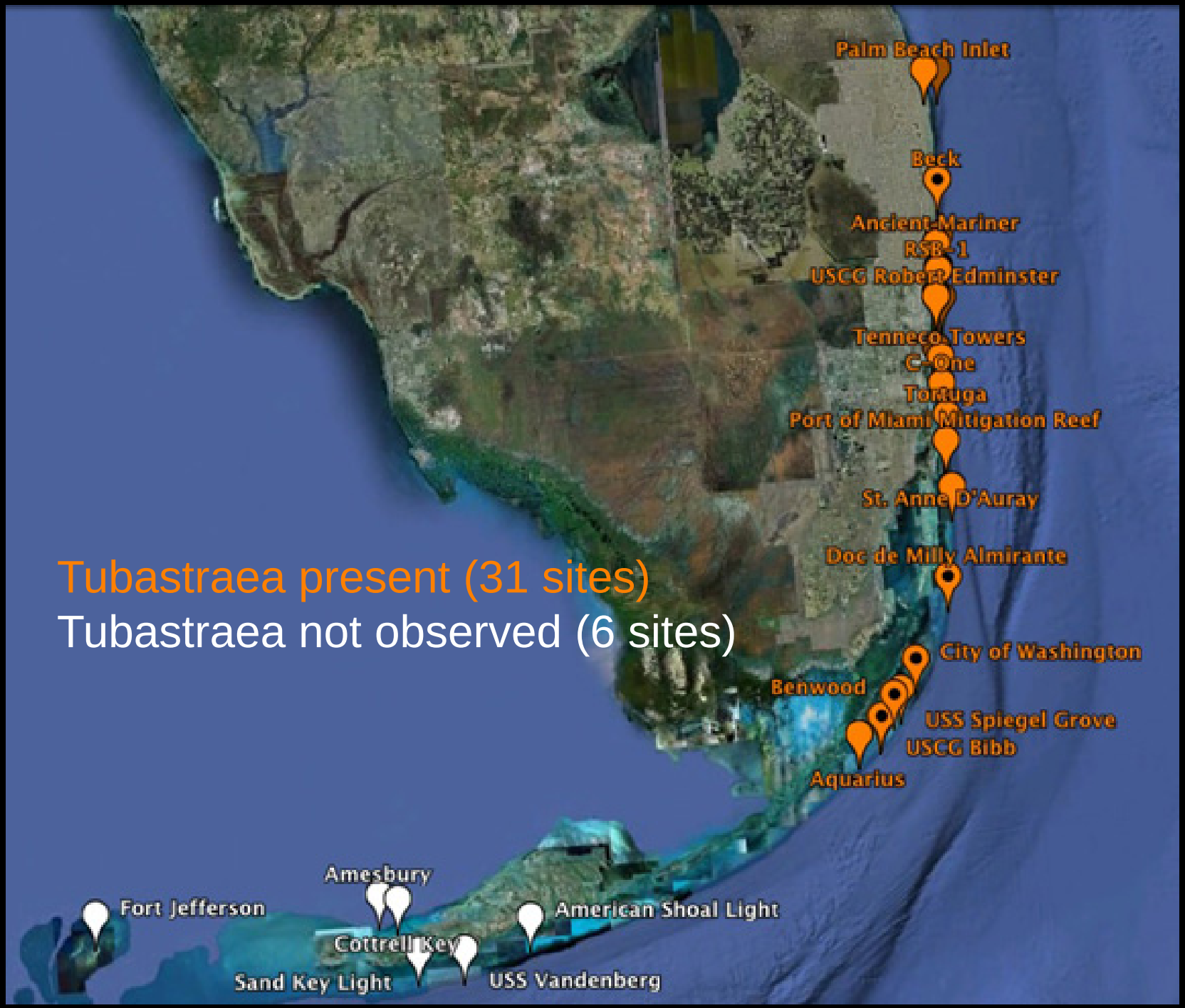
T. taguensis is present in Florida

USCGC Duane Key Largo, FL
www.divertom.com

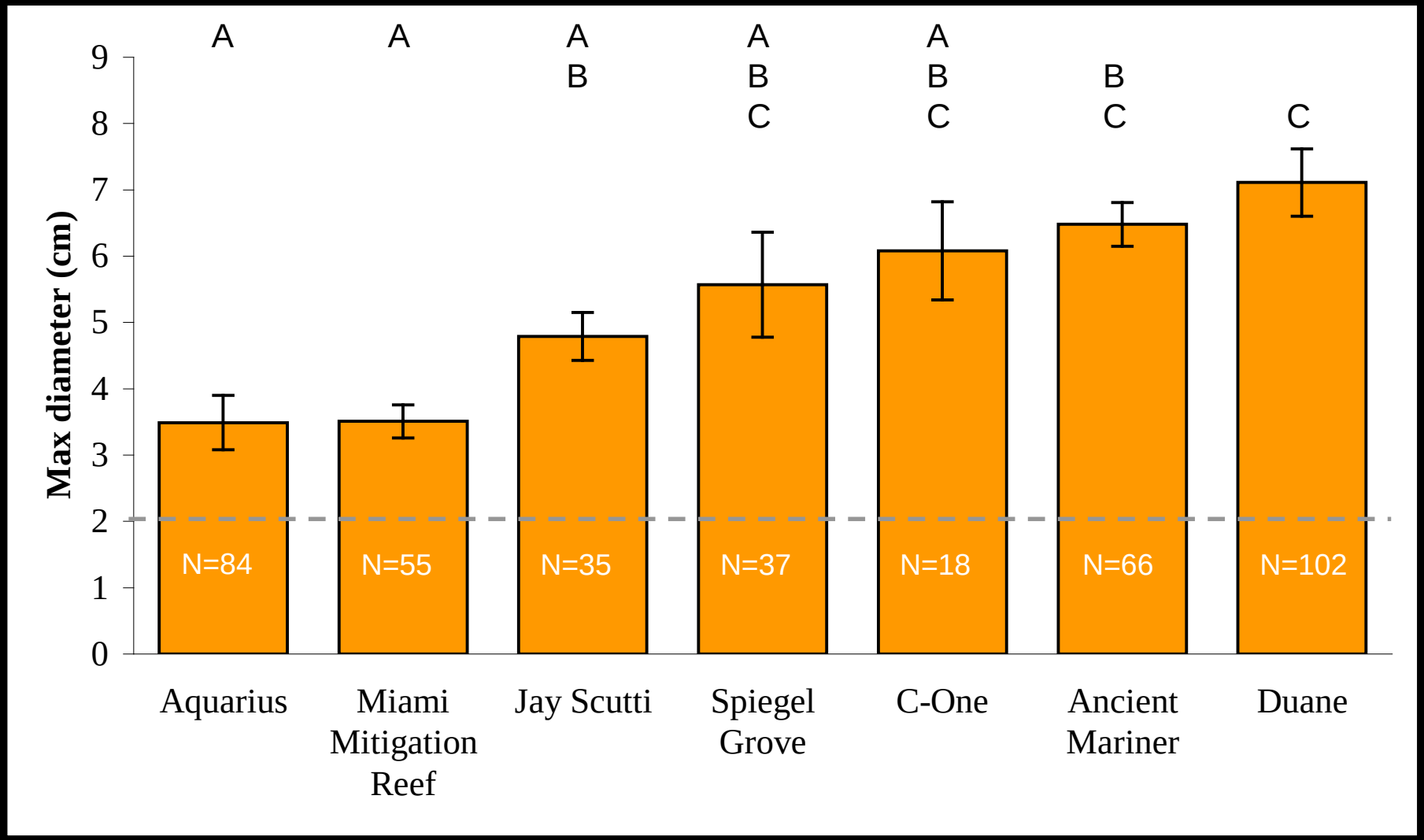
C-One wreck Ft. Laud., FL

T. taguensis is present in Florida

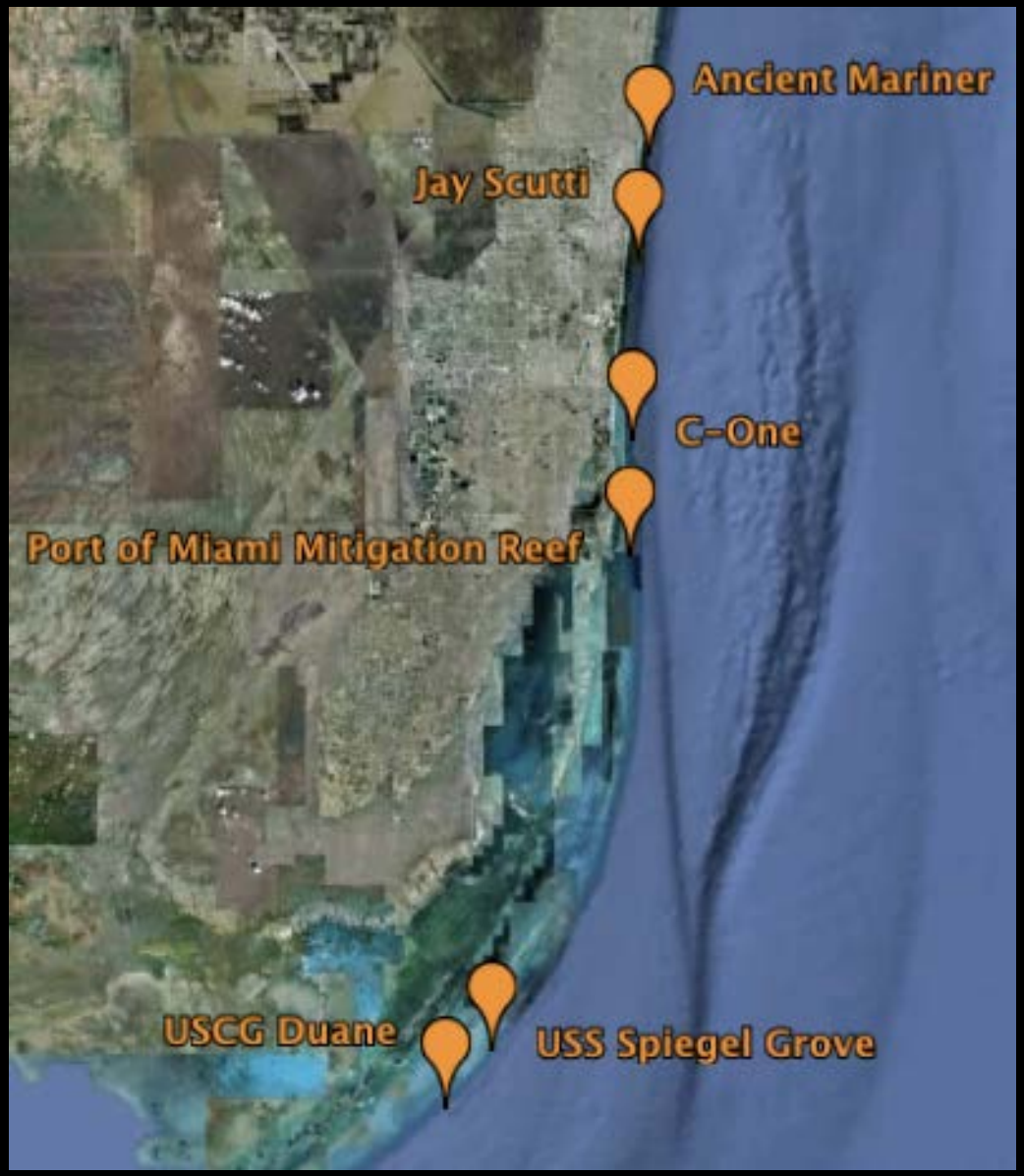
- Population sizes have significantly increased since 2002
- Numbers of populations have increased since 2002

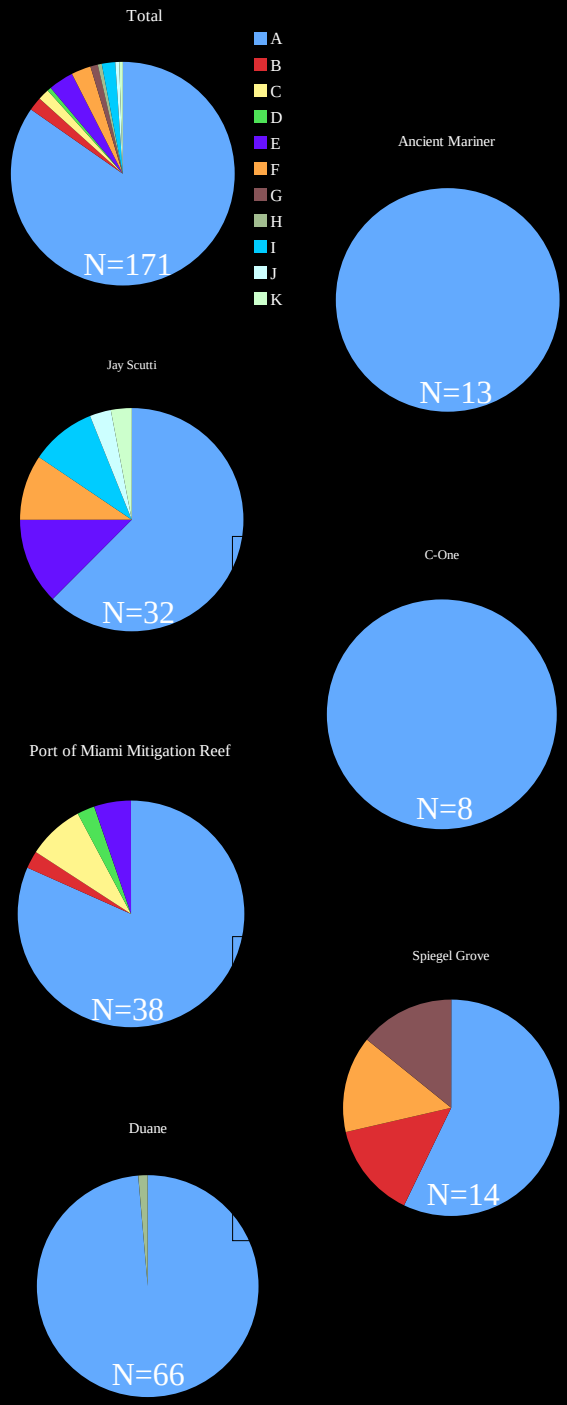

Palm Beach Inlet
Beck
Ancient Mariner
RSB-1
USCG Robert Edminster
Tenneco Towers
C-One
Tortuga
Port of Miami Mitigation Reef
St. Anne D'Auray
Doc de Milly Almirante
Tubastraea present (31 sites)
Tubastraea not observed (6 sites)
City of Washington
Benwood
USS Spiegel Grove
USCG Bibb
Aquarius
Amesbury
Fort Jefferson
American Shoal Light
Cottrell Key
Sand Key Light
USS Vandenberg

Size distribution (Florida)



Genetic diversity





Genetic diversity

Florida *T. taguensis* populations are dominated by a single clone

How does this happen??

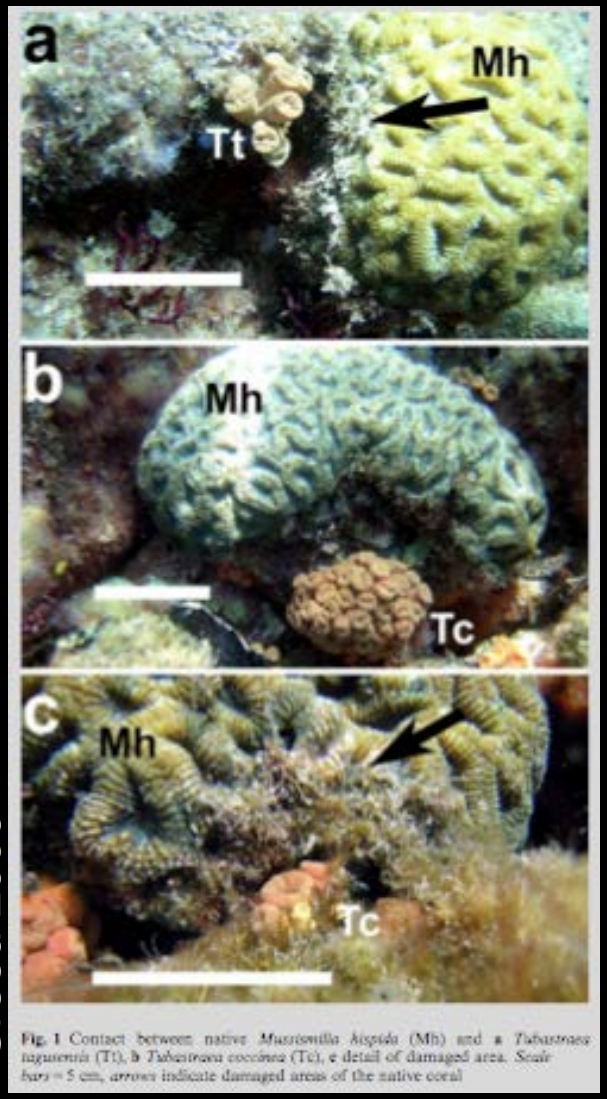
Characteristics (of *T. coccinea*, assumed for *T. taguensis)*

- Azooxanthellate
- Produces sexual and asexual larvae
- High local recruitment
- Widespread larval dispersal

Competitive capabilities

- Highly prolific
- Reproduces at small colony size (2 polyps)
- No natural predators in Caribbean
- Allelopathic chemicals toxic to coral tissue and larvae

Allelopathic interactions



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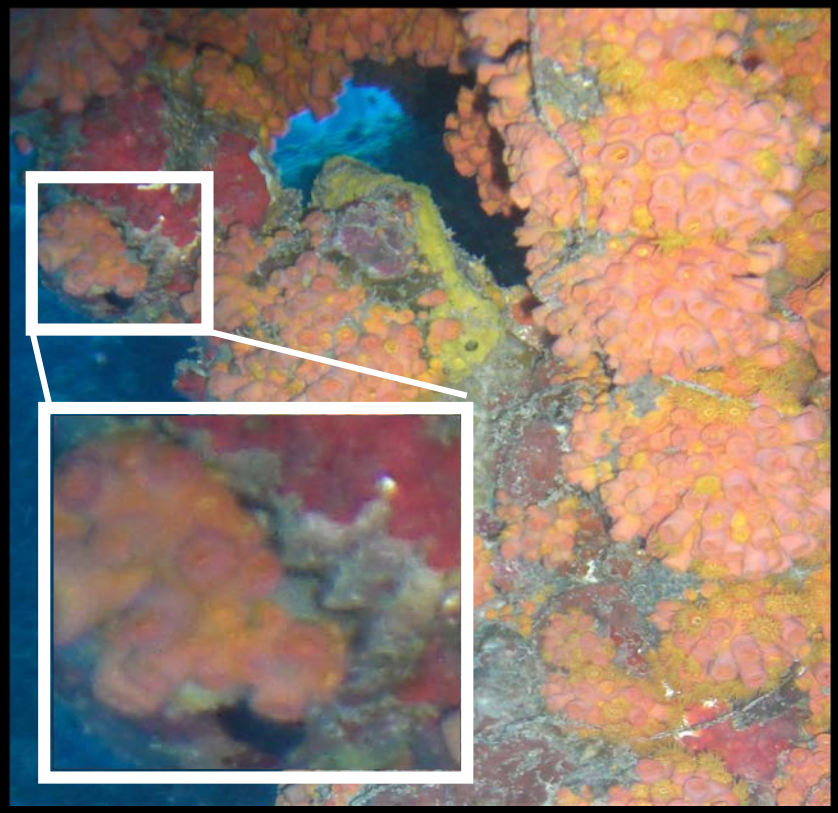
Creed 2006

Preference for artificial substrate?

- Found on artificial habitats in Florida
- Common on oil and gas platforms

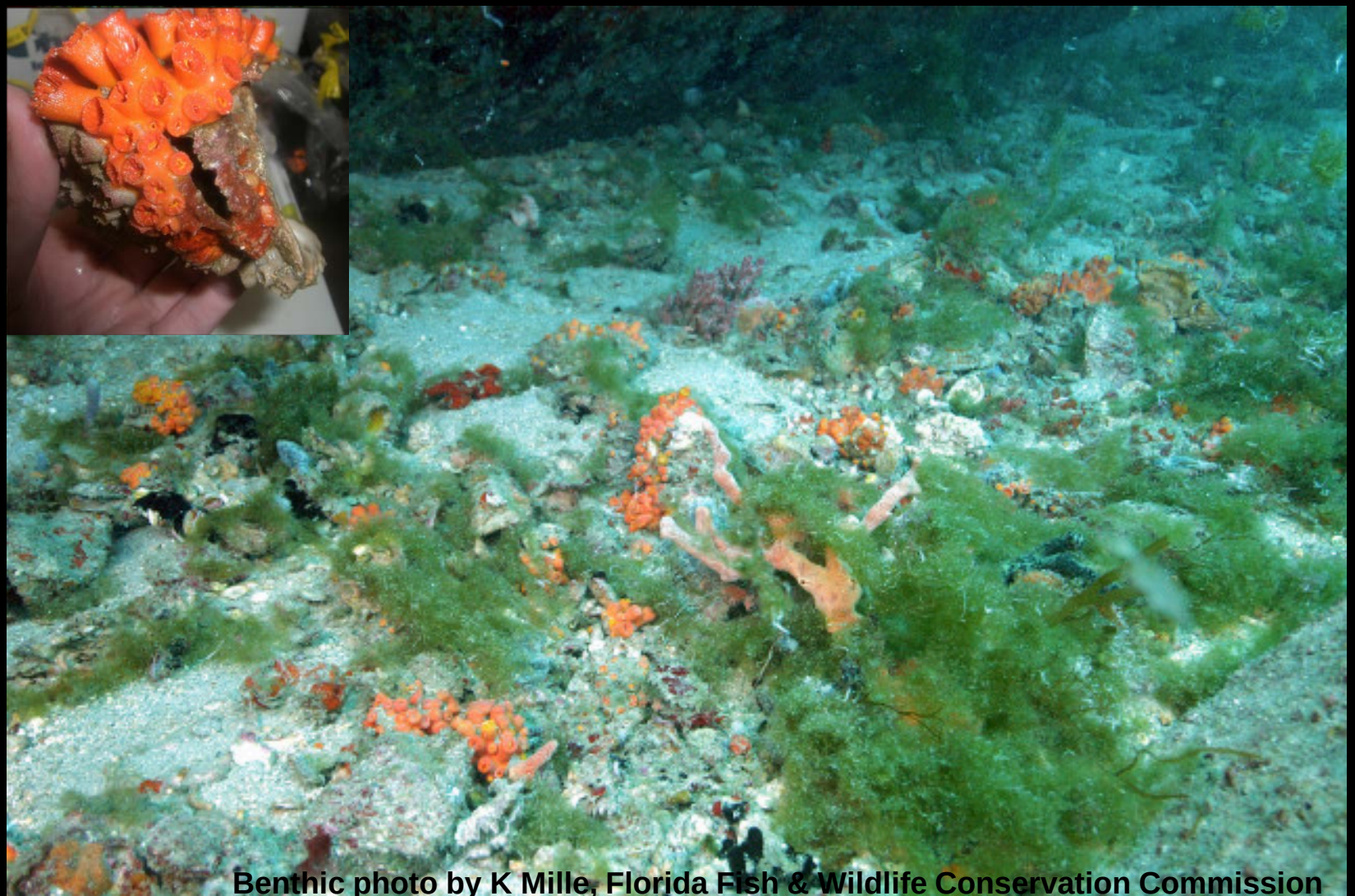
BUT

- Often growing on bivalves on these structures



Tubastraea on bivalve shells

Ancient Mariner wreck (FL) April 2010



Benthic photo by K Mille, Florida Fish & Wildlife Conservation Commission

Observations on natural substrate

Observations on natural substrate

West and East Flower Garden Banks Oct 2010
FIRST OBSERVATION OF *TUBASTRAEA* ON WFGB

Observations on natural substrate

- *T. taguensis* was observed at 7 out of 8 dive sites at the FGBNMS, but was never encountered during a rapid coral survey simultaneously on the same reefs.

- Could be present on natural substrate in Florida, but common survey methods do not detect these species.

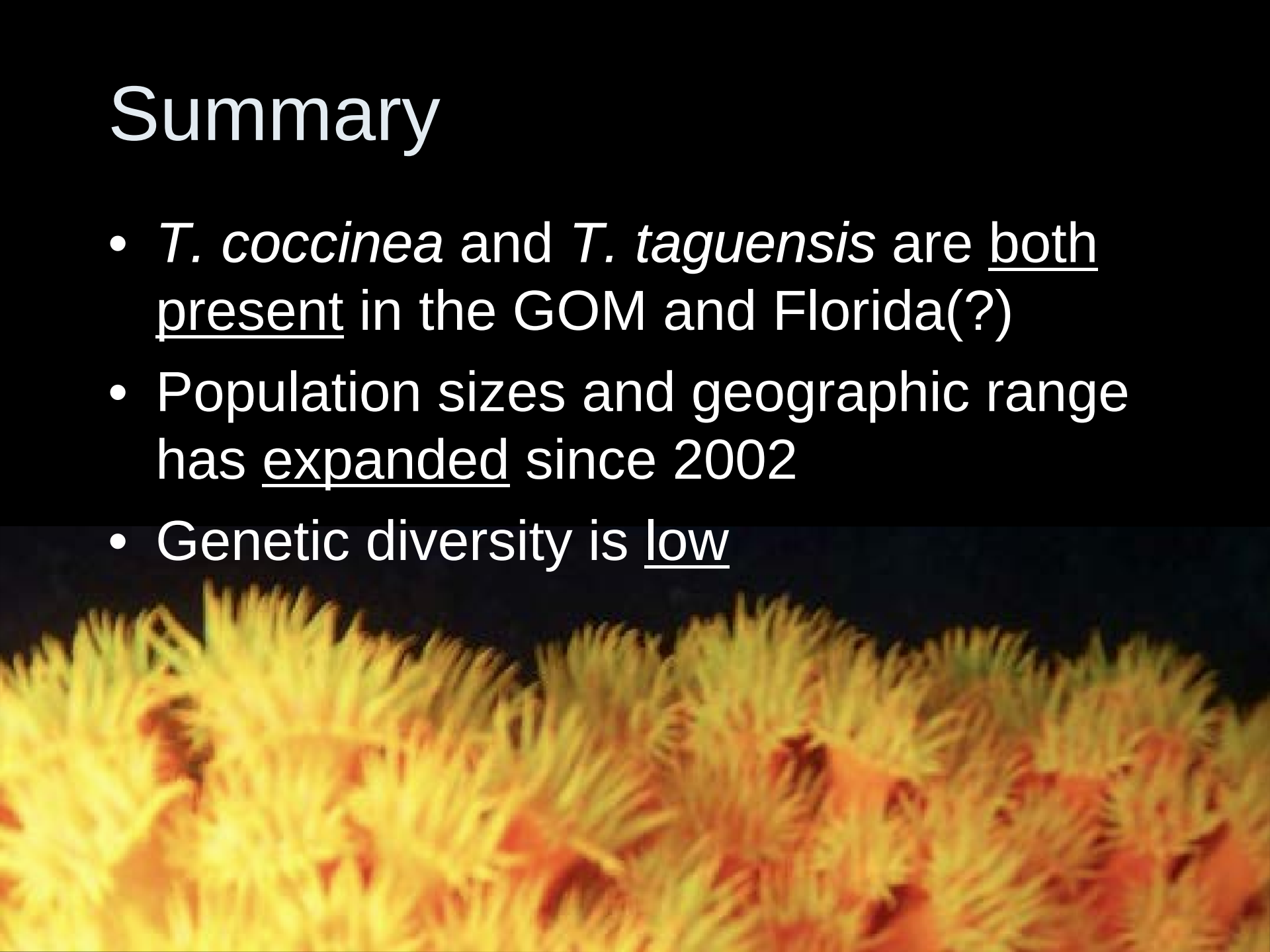
T. taguensis was reproductive

- Eggs and larvae were present in colonies in October

- *T. coccinea* did not have eggs or larvae

Summary

- *T. coccinea* and *T. taguensis* are both present in the GOM and Florida(?)
- Population sizes and geographic range has expanded since 2002
- Genetic diversity is low



Summary

- Evidence of allelopathy and overgrowth competition
- *T. taguensis* is present on natural substrate the Flower Garden Banks
- *T. taguensis* may not necessarily prefer artificial substrate - opportunistic

Summary

- *T. taguensis* was reproductive in Oct, *T. coccinea* was not

Summary

- This species is increasing in abundance while all other corals in the Caribbean have suffered significant declines

Potential ecological impacts

- Spatial and numerical dominance
- Decreased biodiversity
- Increased mortality of native species
- Reduced native coral recruitment
- Coral disease implications
  - Pathogen sink
  - Pathogen spill-back

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

GEORGIA AQUARIUM at Pemberton Place

ANAMAR Environmental Consulting, Inc.

Coral Reef Targeted Research & Capacity Building for Management

Thank you