Coral nursery research at Penn State

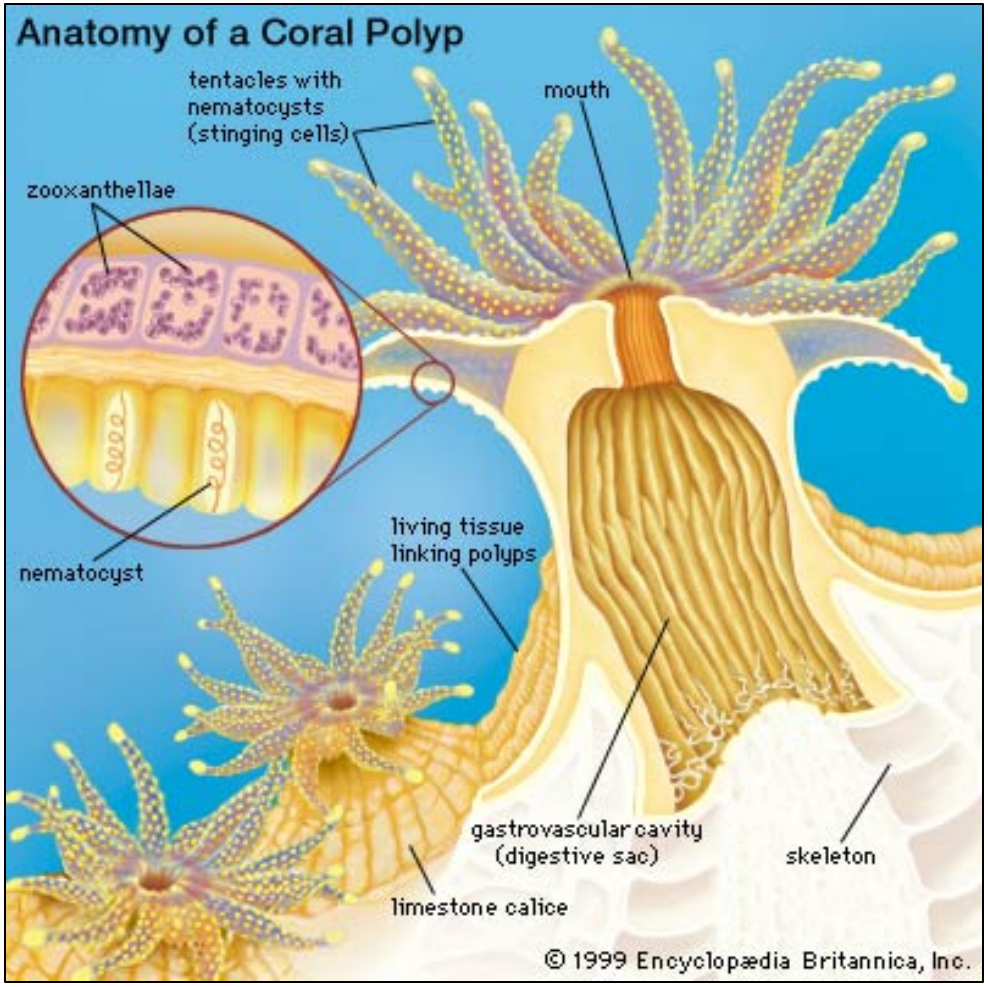
John Parkinson, PhD.

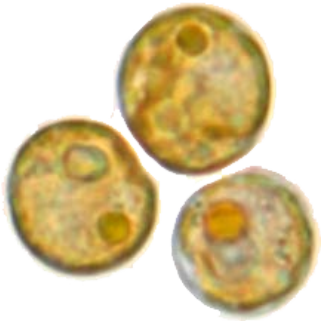
Department of Biology, Penn State University

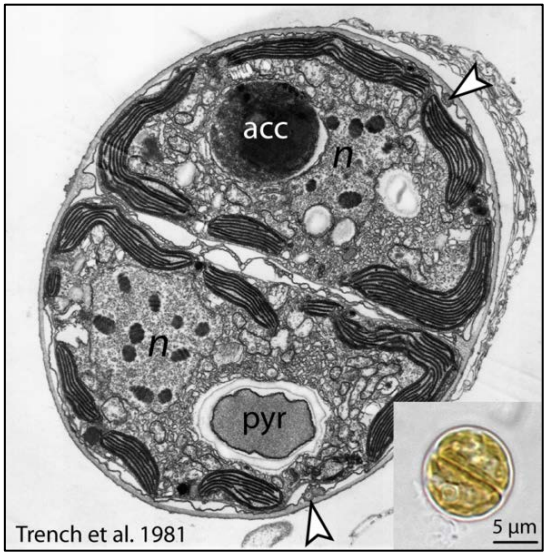
Earth Talks: Exploring the Oceans

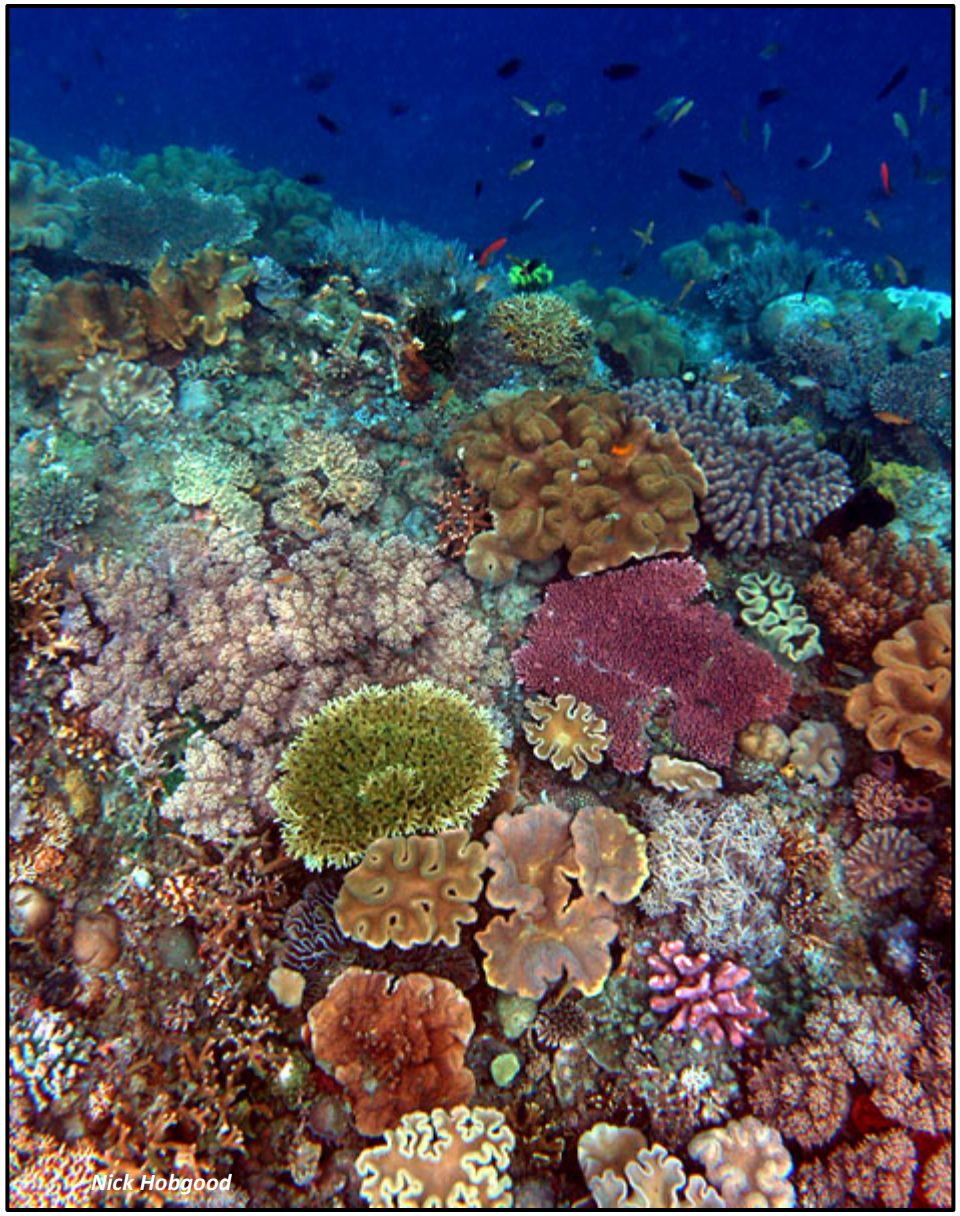
Monday, October 6th, 2014

http://simonsen.photoshelter.com/image/I0000ZBuYFPsbykE


Anatomy of a Coral Polyp
tentacles with nematocysts (stinging cells)
mouth
zooxanthellae
nematocyst
living tissue linking polyps
gastrovascular cavity (digestive sac)
skeleton
limestone calice
© 1999 Encyclopædia Britannica, Inc.




acc
n
n
pyr
Trench et al. 1981
5 µm

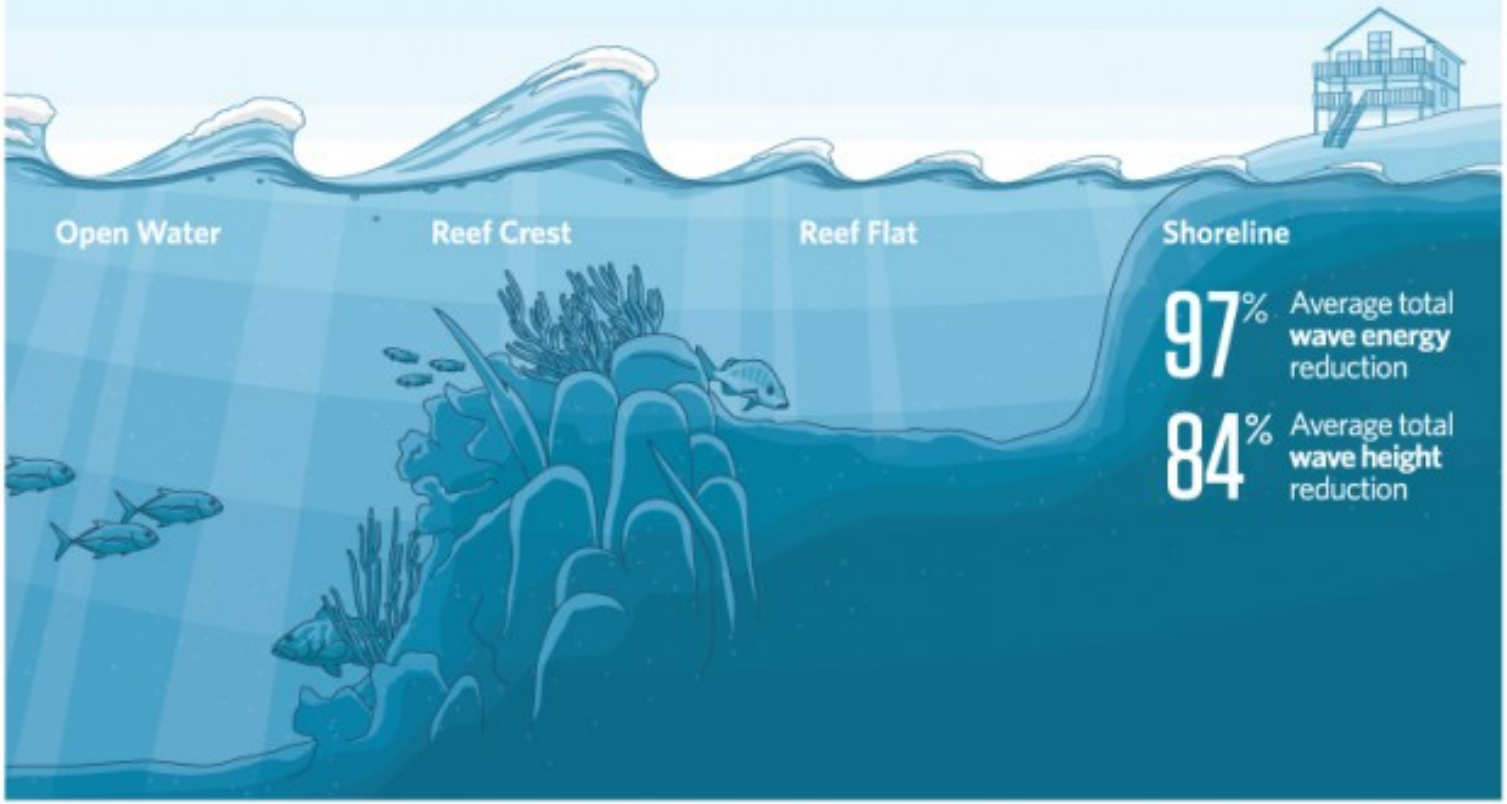

Nick Hobgood


Danielle Dixson


NOAA

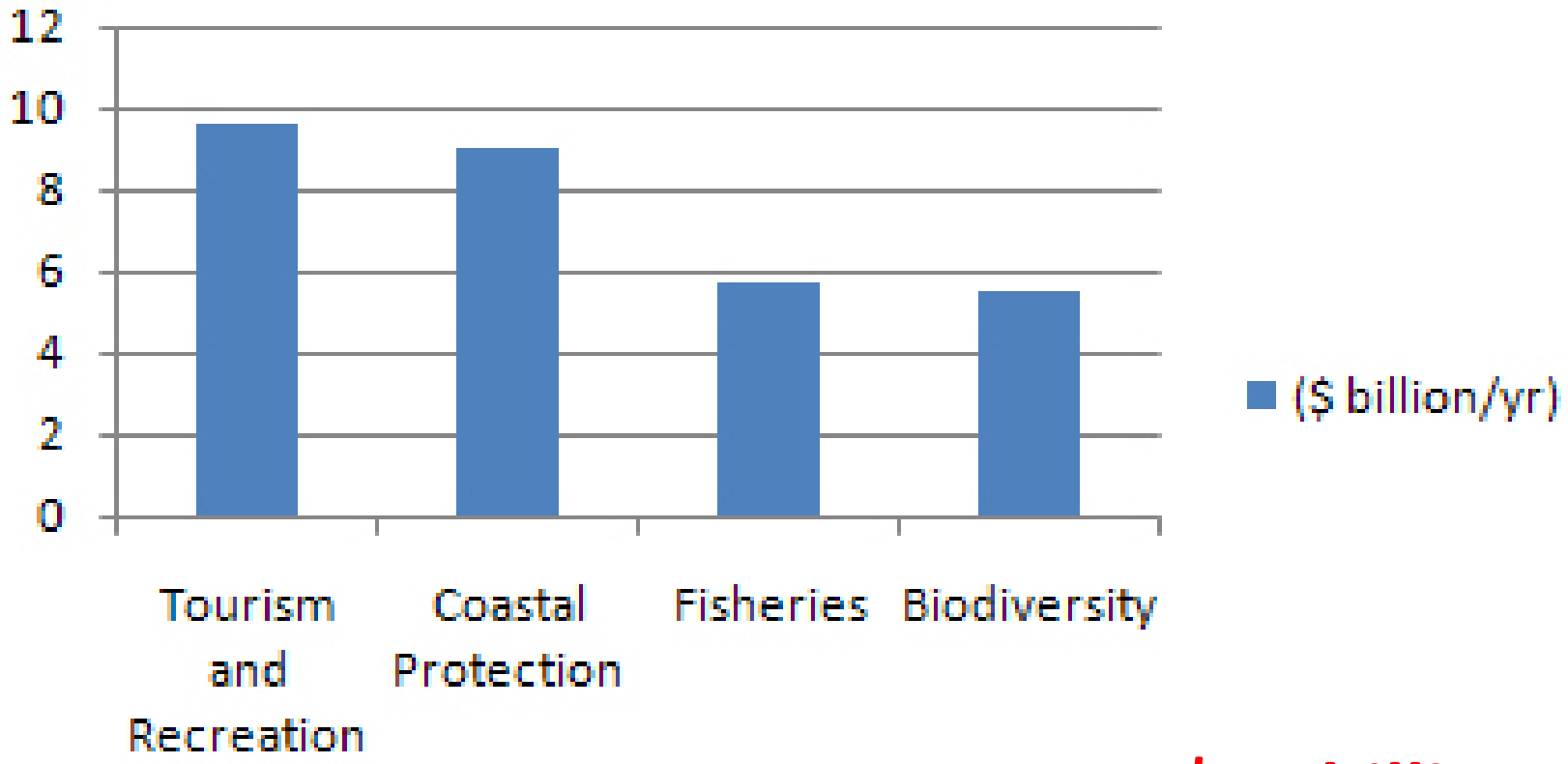
Coral Reefs Reduce Wave Energy and Height

Coral reefs reduce wave energy by an average of 97 percent across all studies globally. The reef crest, or shallowest part of the reef where the waves break first, dissipates 86 percent of wave energy on its own. The whole reef reduces wave height by 84 percent.



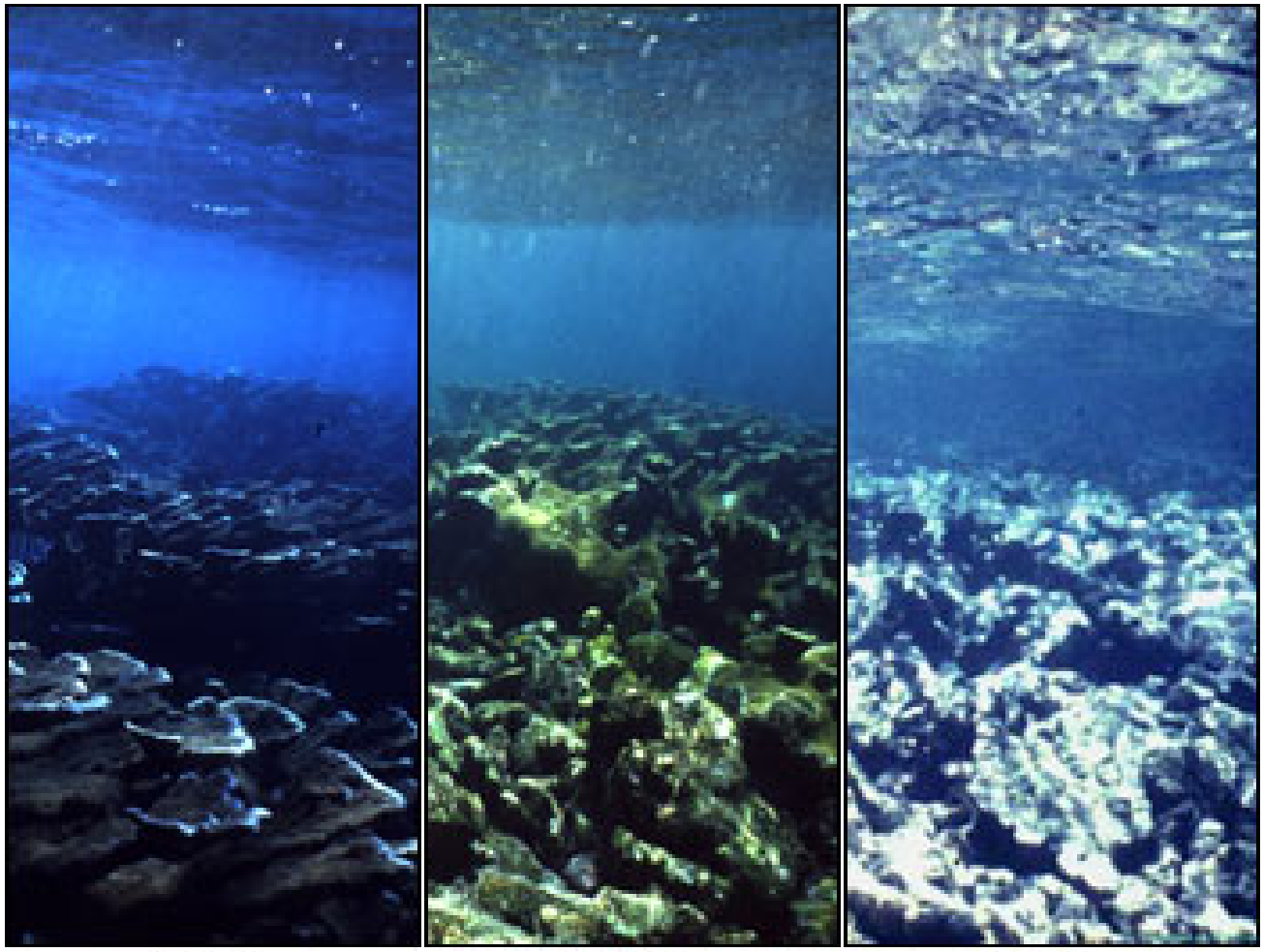
Study Citation: Ferrario, F., M.W. Beck, C.D. Storlazzi, F. Micheli, C.C. Shepard, L. Airoldi. 2014. The Effectiveness of Coral Reefs for Coastal Hazard Risk Reduction and Adaptation. *Nature Communications*. Doi:10.1038/ncomms4794

Economic Value of Reefs



Sum: ~$30 billion

http://coralreef.noaa.gov/aboutcorals/values/resources/cr_econ_value_cht.jpg



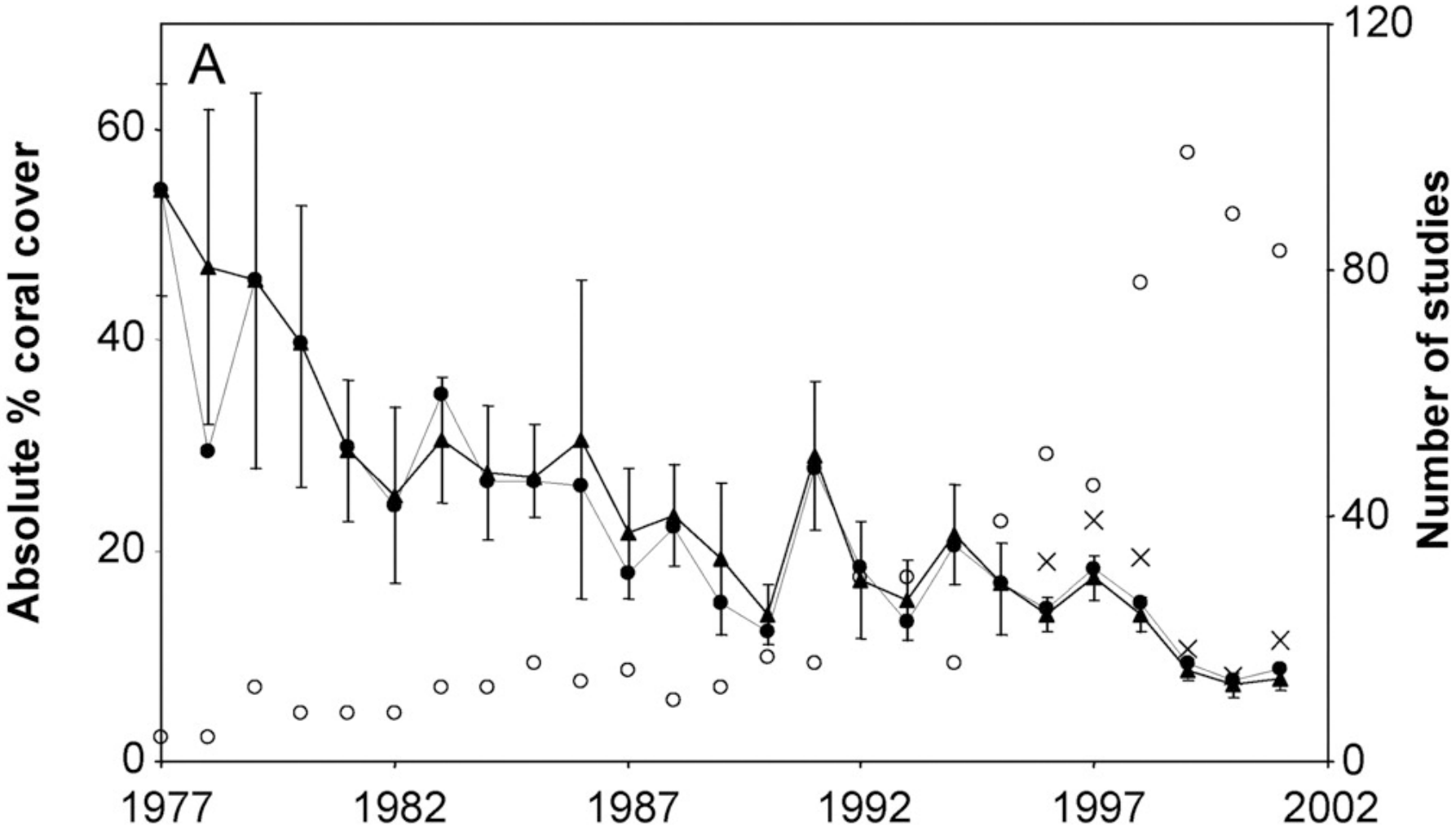
http://earthobservatory.nasa.gov/Features/Coral/Images/carysfort_75-95.jpg

19% of Earth's coral cover lost

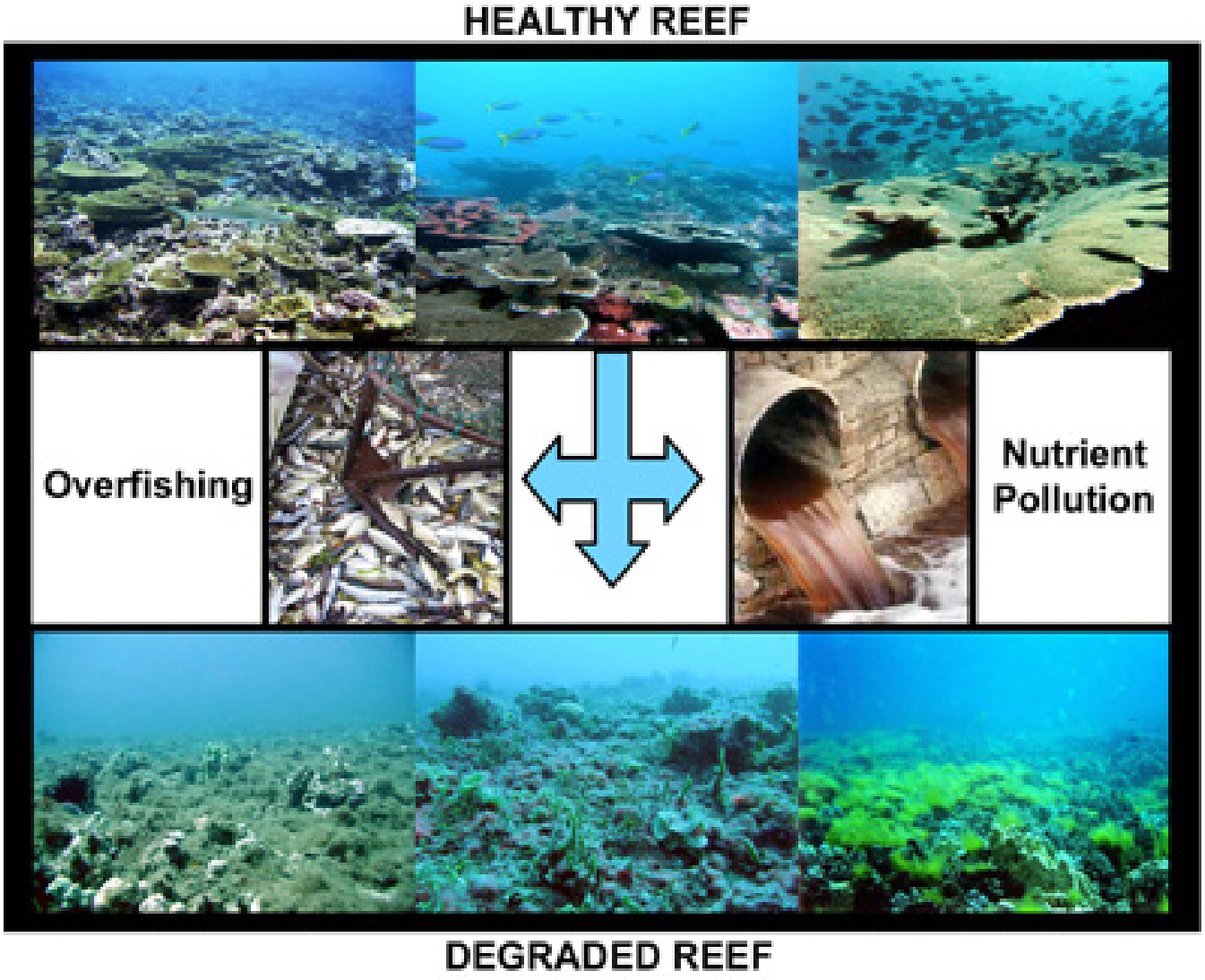
15% projected loss in 10-20 years.

Another **20%** projected loss in 20-40 years.

Wilkinson *et al.* (2008) *"Status of the coral reefs of the world: 2008"*

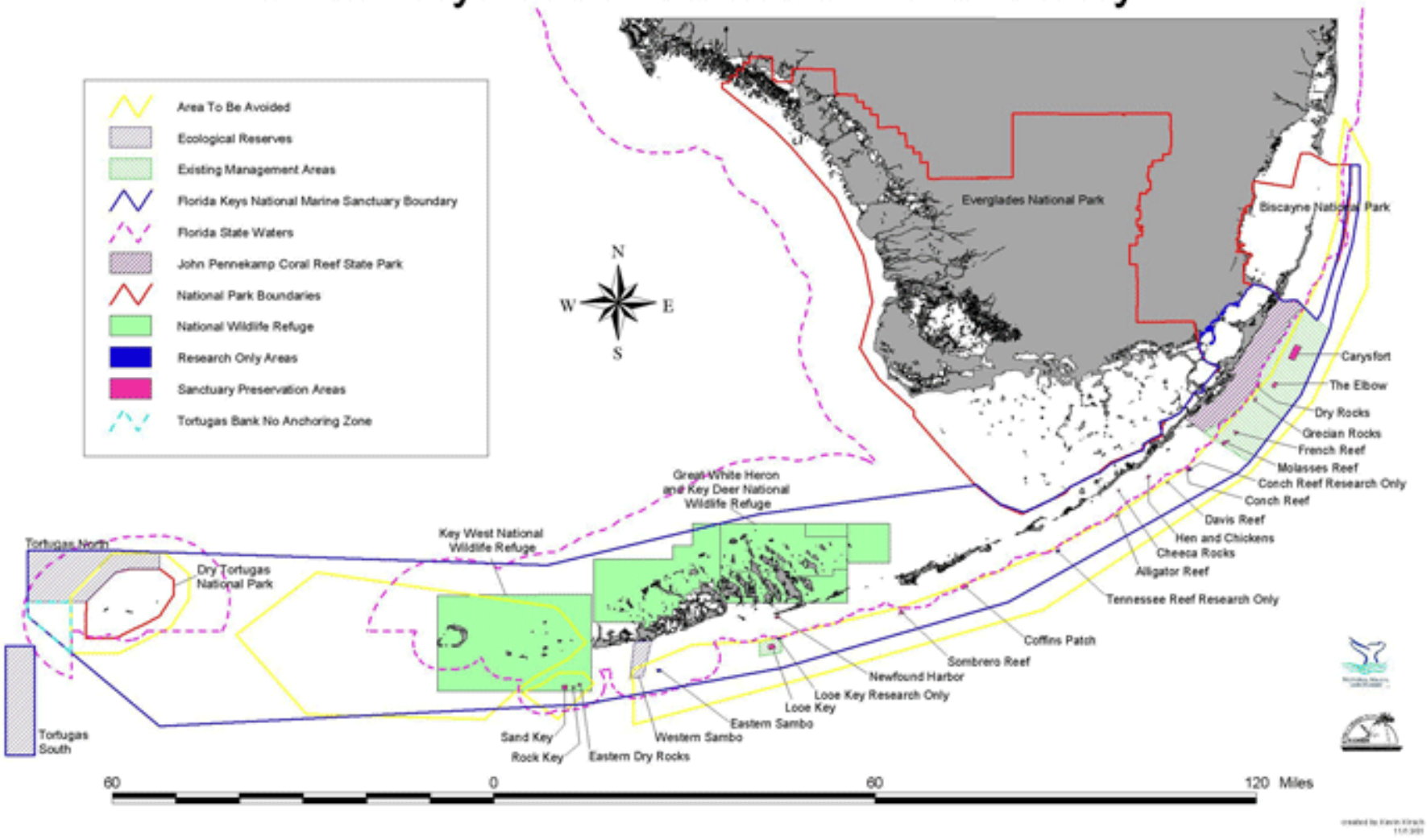


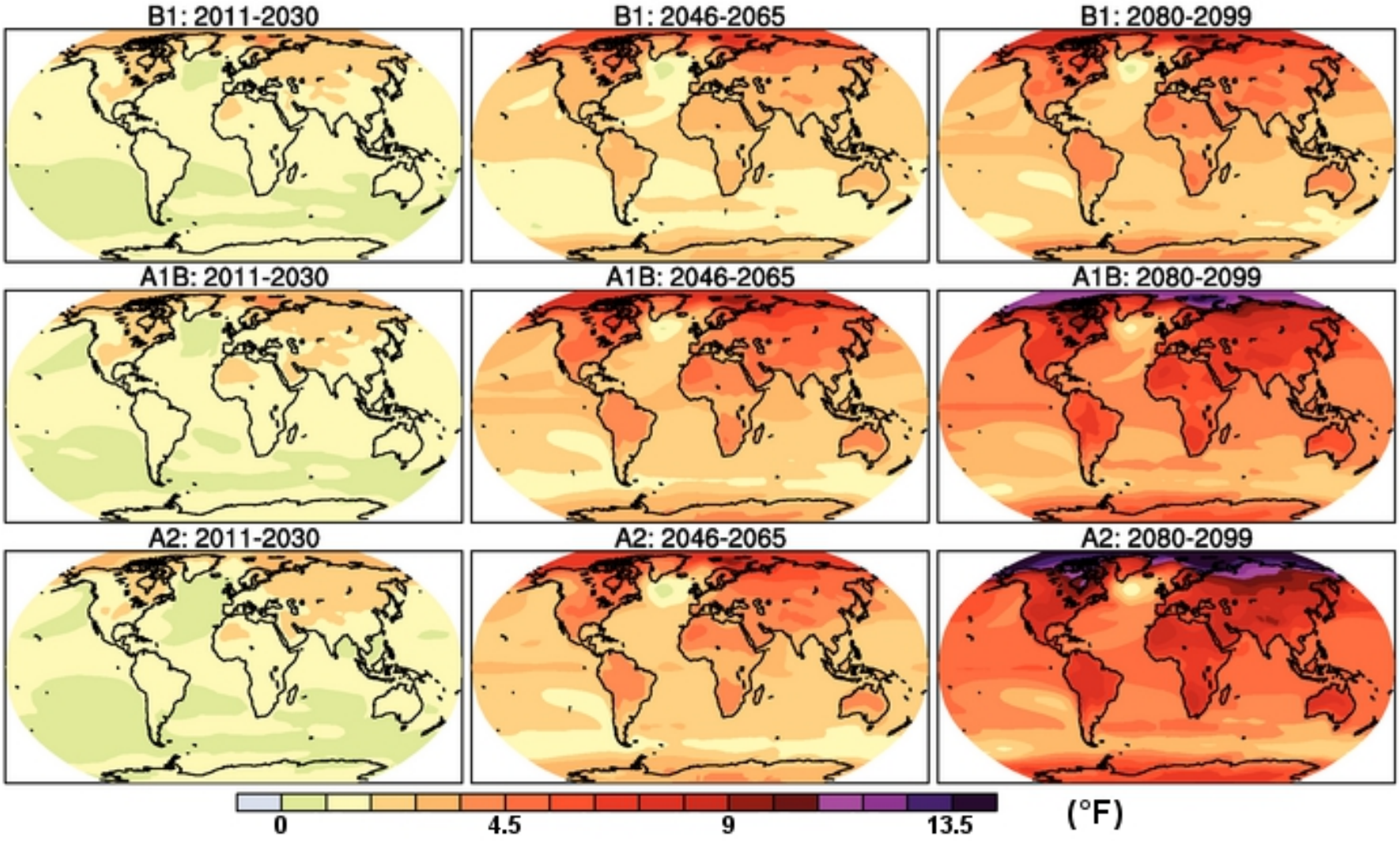
Gardner *et al.* (2002) *Nature*



https://www.nceas.ucsb.edu/files/research/summaries/smith/smith_phaseshifts.jpg

Florida Keys National Marine Sanctuary





http://www.epa.gov/climatechange/images/science/ScenarioGlobalTemp.jpg


Ken Nedimyer, Coral Restoration Foundation


Ken Nedimyer, Coral Restoration Foundation


Sorry, lost photo credit…

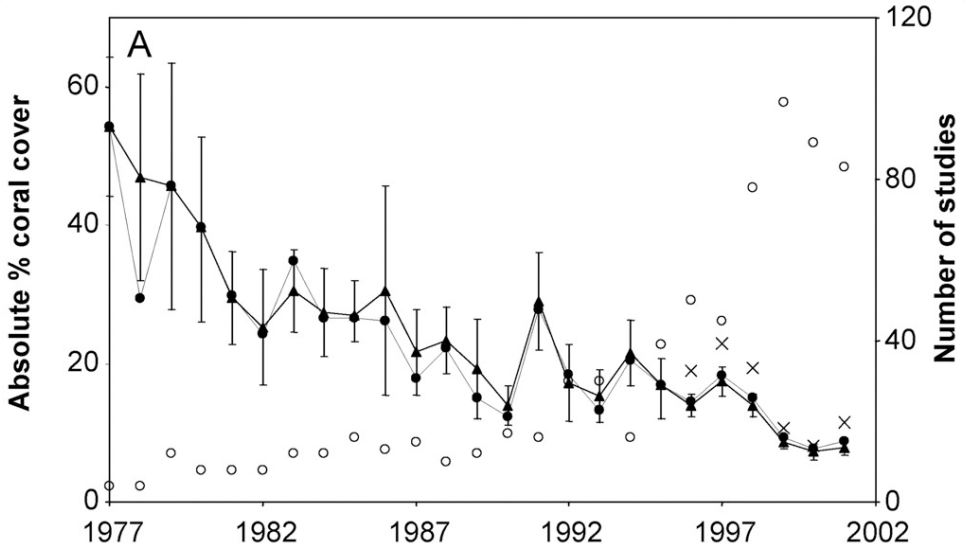

Sorry, lost photo credit…


Ken Nedimyer, Coral Restoration Foundation

Nursery Benefits

- Asexual Propagation:
  - Increase biomass
  - Preserve extant diversity
- Downstream Sexual Recombination
  - Promote new diversity

Why is diversity important?



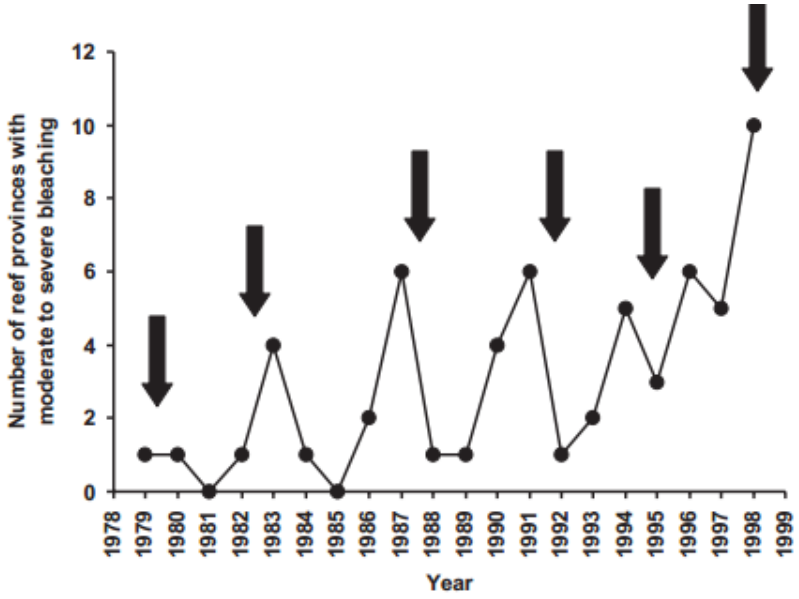
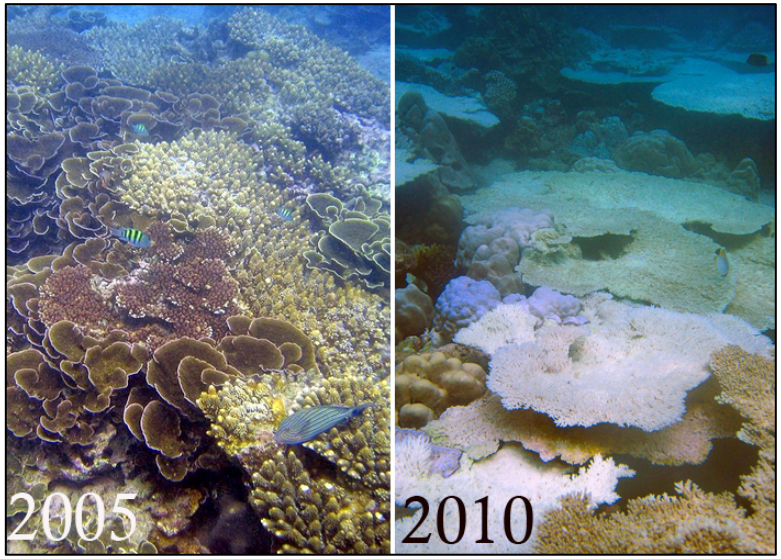
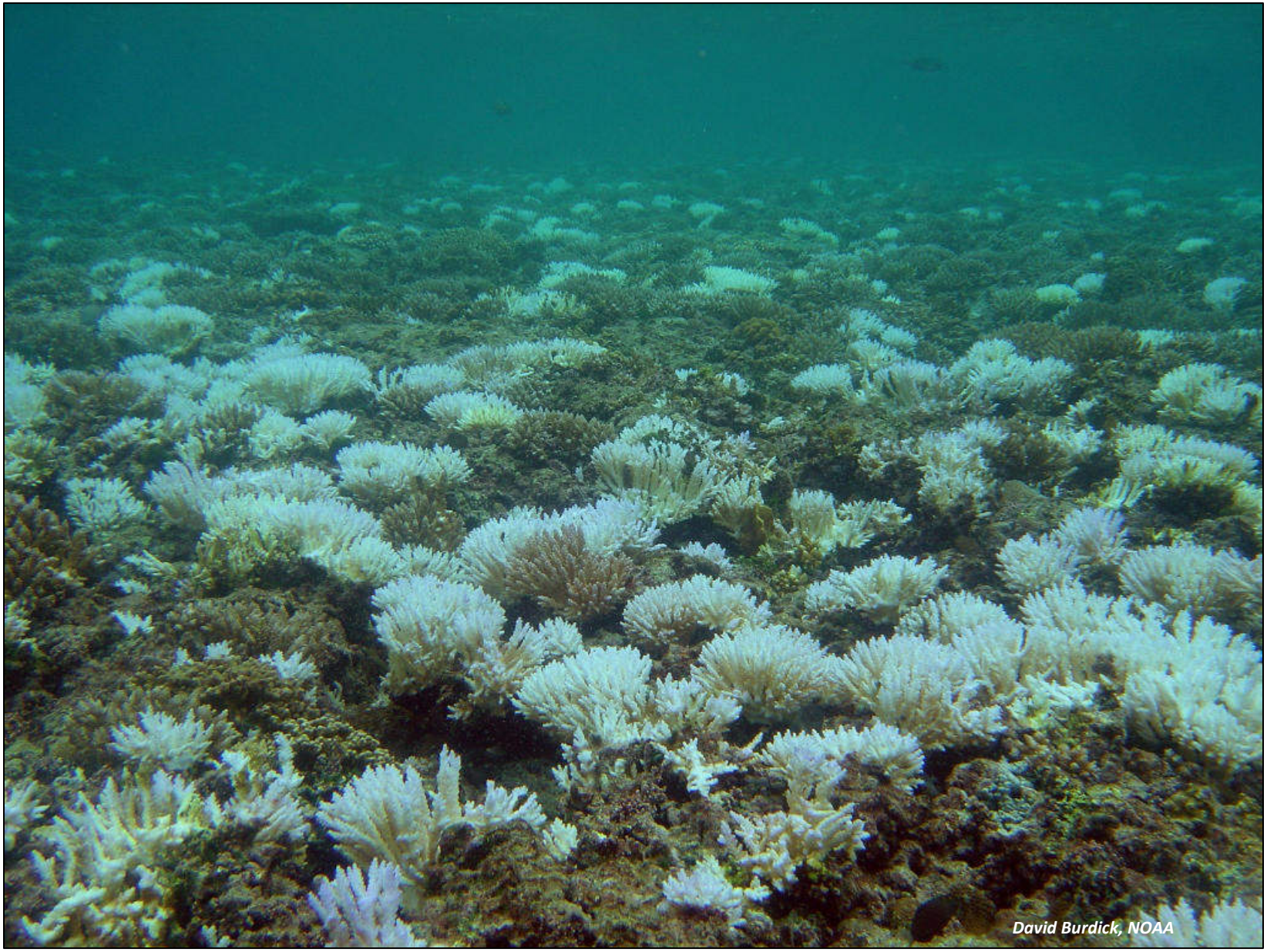


Fig. 3. Number of reef provinces bleaching since 1979. (Graph modified from Goreau and Hayes (1994) with data added for 1992 onwards.) Arrows indicate strong El Niño years.



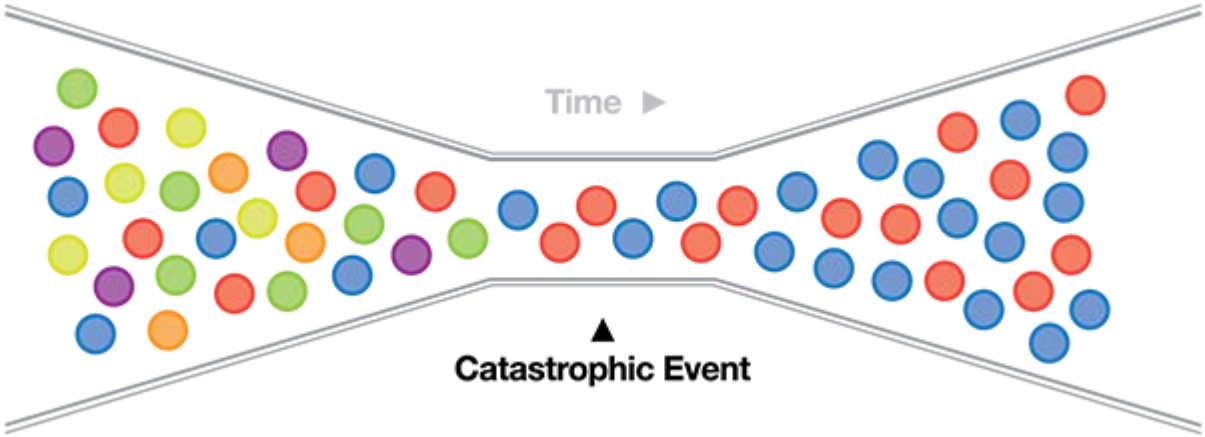
Hoegh-Guldberg *et al.* (1999) *Marine and Freshwater Research*

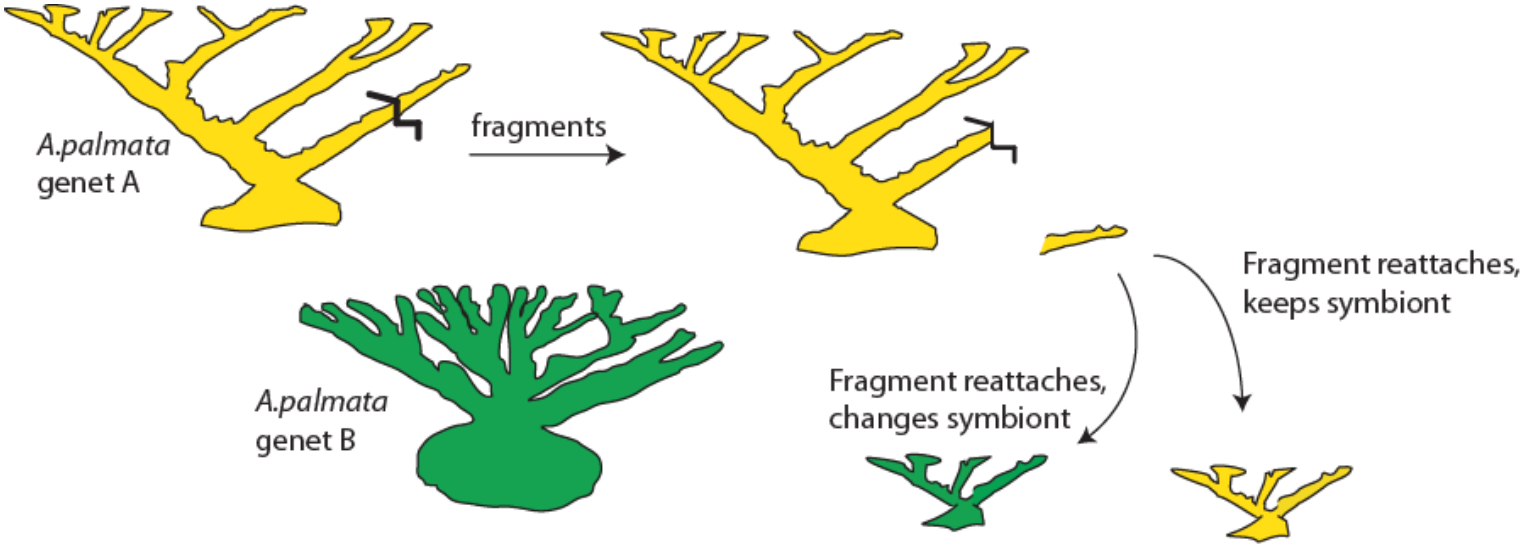
Gardner *et al.* (2002) *Nature*

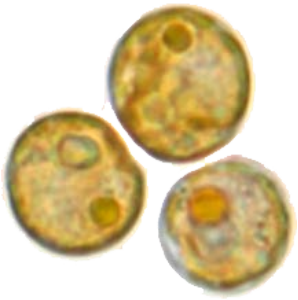

David Burdick, NOAA

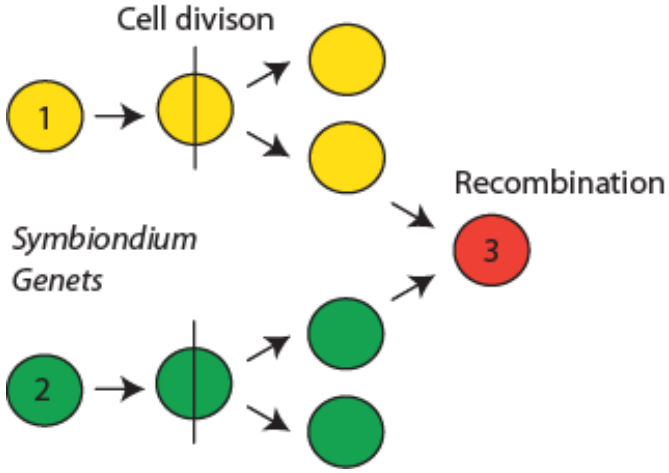
Major question in coral biology:

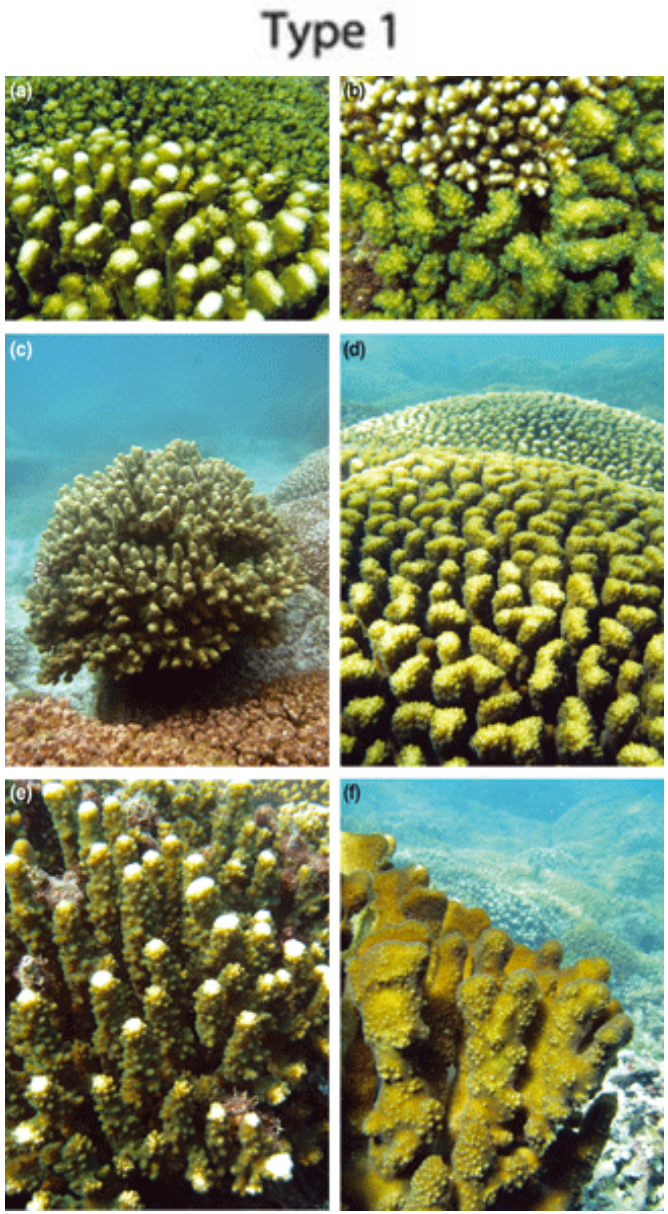
Can corals adapt to climate change?

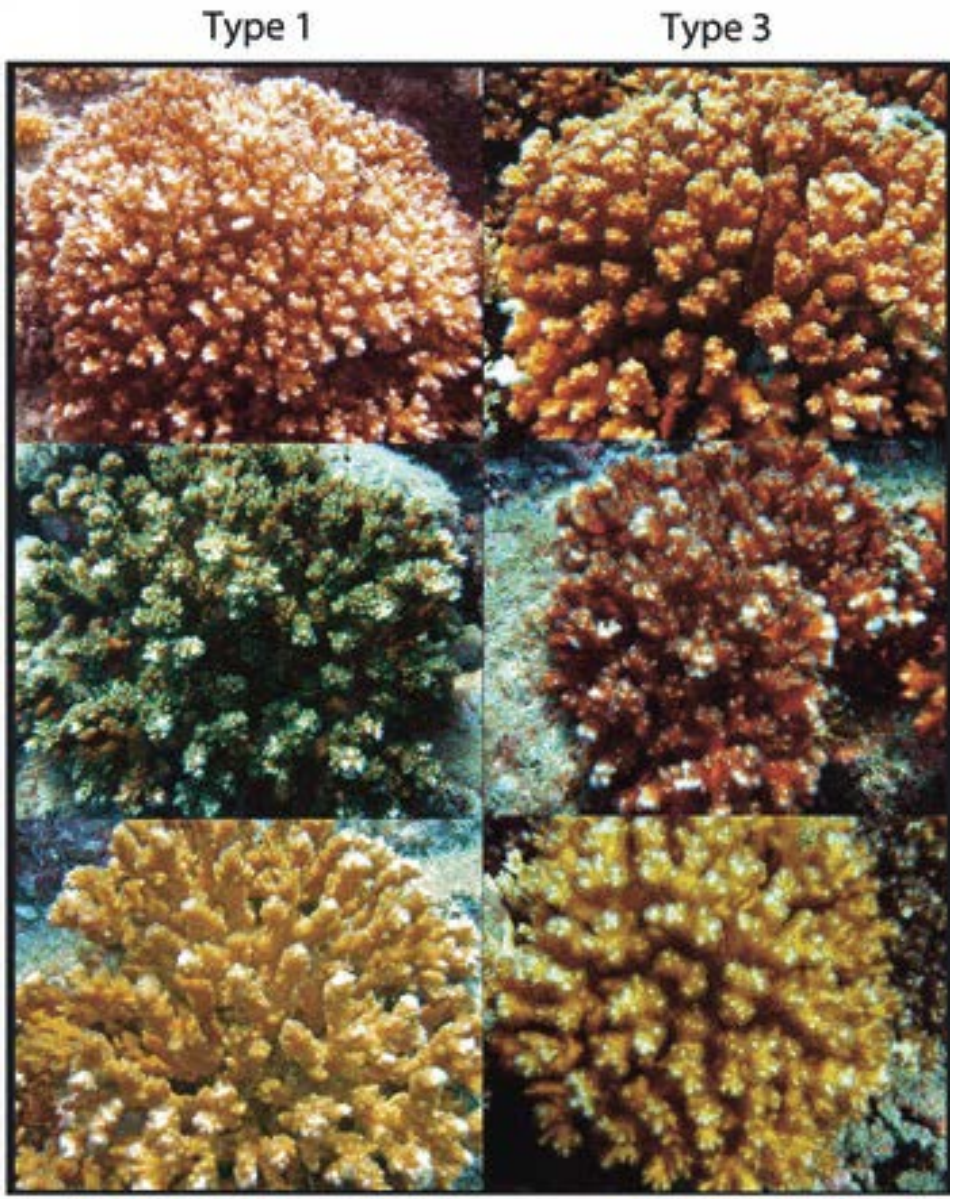



A.palmata
genet A
fragments
A.palmata
genet B
Fragment reattaches,
keeps symbiont
Fragment reattaches,
changes symbiont



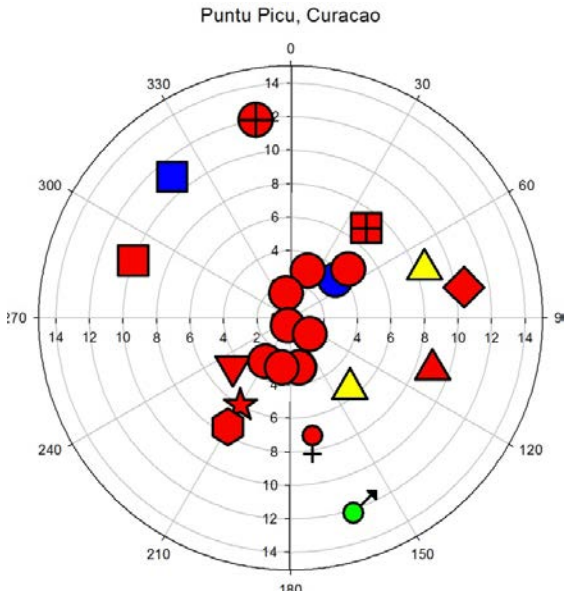

Cell divison
1
Recombination
3
Symbiondium
Genets
2

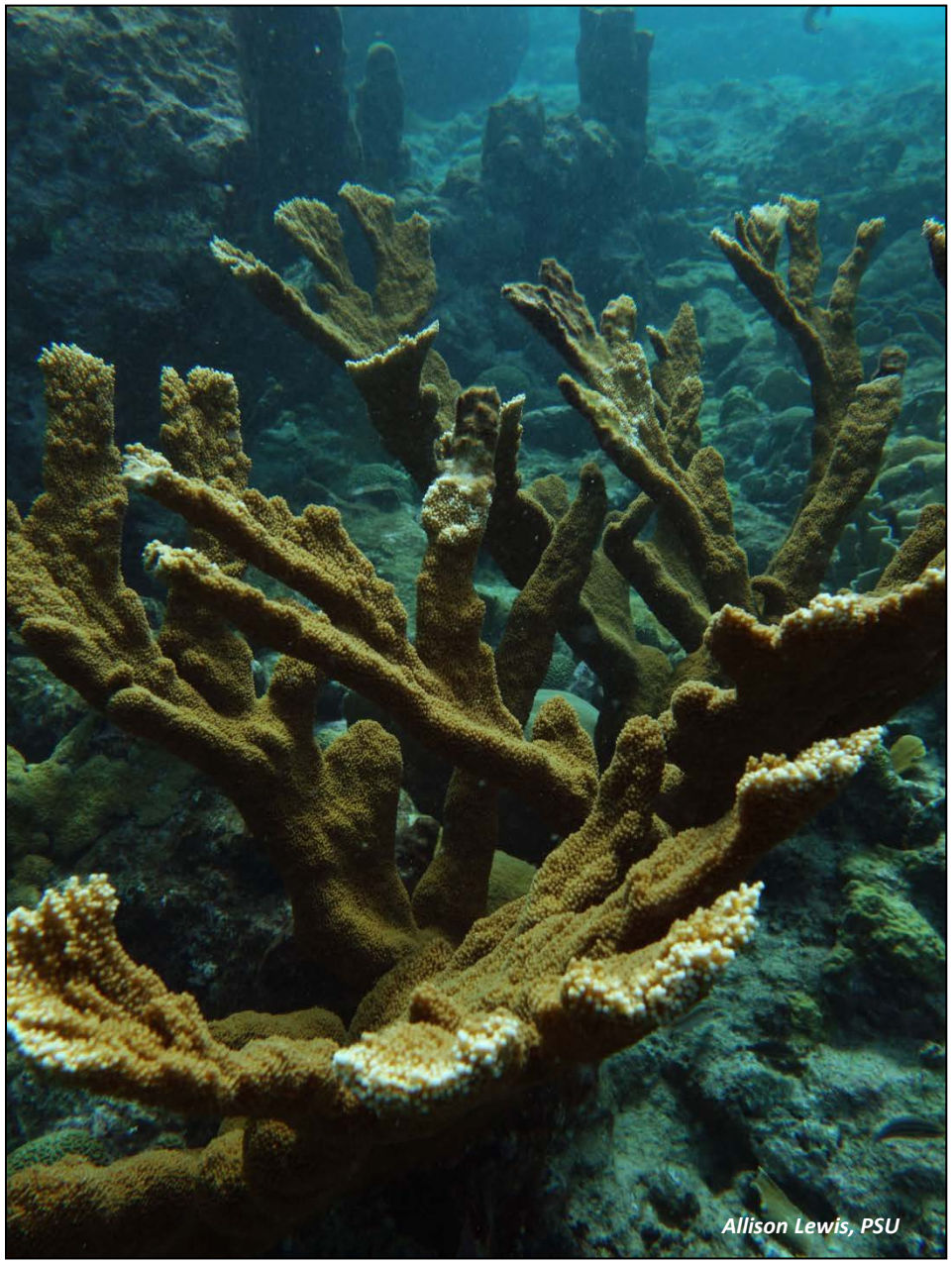




Pinzon & LaJeunesse (2011) *Molecular Ecology*

Species	# MSATs	P_{ID}
Host: *Acropora palmata*	5	10^{-9}
Symbiont: *Symbiodinium 'fitti'* (A3)	13	10^{-8}





Baums *et al.* (2014) *Molecular Ecology*

- **Acknowledgements:**

Baums & LaJeunesse Labs

(Members Past & Present)

Dissertation Committee

Iliana Baums (advisor)

Todd LaJeunesse (chair)

Jim Marden

Andrew Read

Istvan Albert

Mary Alice Coffroth

- **Funding:**

Penn State University Graduate Fellowship, NSF GRFP (DGE-0750756), NSF (OCE0825979), NSF (OCE0928764), NOAA (NA08NMF4630462), TNC-NOAA/ARRA, the Clyde and Connie Woodburn Foundation, Columbus Zoo and Aquarium, Dallas Zoo and Children's Aquarium at Fair Park, the National Aquarium, Washington and Baltimore, Henry Doorly Zoo, Green Foundation, Morris Animal Foundation, Shedd Aquarium, and the Smithsonian's National Zoological Park.