

Analysis of *Symbiodinium* Adaptations in Corals with Earth's Increasing Ocean Temperatures

Sarah Hall

Department of Oceanography, Texas A&M University, College Station, Tx 77843; sarahhall@tamu.edu



I. Introduction

The Ocean:

- ◆ 71% of Earth
- ◆ Billions \$\$ - Tourism
- ◆ Millions tons - Food

Coral reefs provide:

- ◆ Protection
- ◆ Home
- ◆ Biodiversity

- ◆ Common zooxanthellae genus: ***Symbiodinium***

Adaptations seen in *Symbiodinium* types:

- ◆ Clade A – Parasitic Characteristics
- ◆ Clade B – Slight thermo-tolerance
- ◆ Clade C – Temperate-tolerance
- ◆ Clade D – Most thermo-tolerance



Figure 1: modified from <http://www.10tons.dk/coralpolyp>. Coral polyp sculpture with pigmented zooxanthellae that share a mutualistic relationship.

II. Problem

Coral Bleaching with increasing Earth temperatures.

- ◆ Zooxanthellae leave coral
- ◆ Coral won't survive

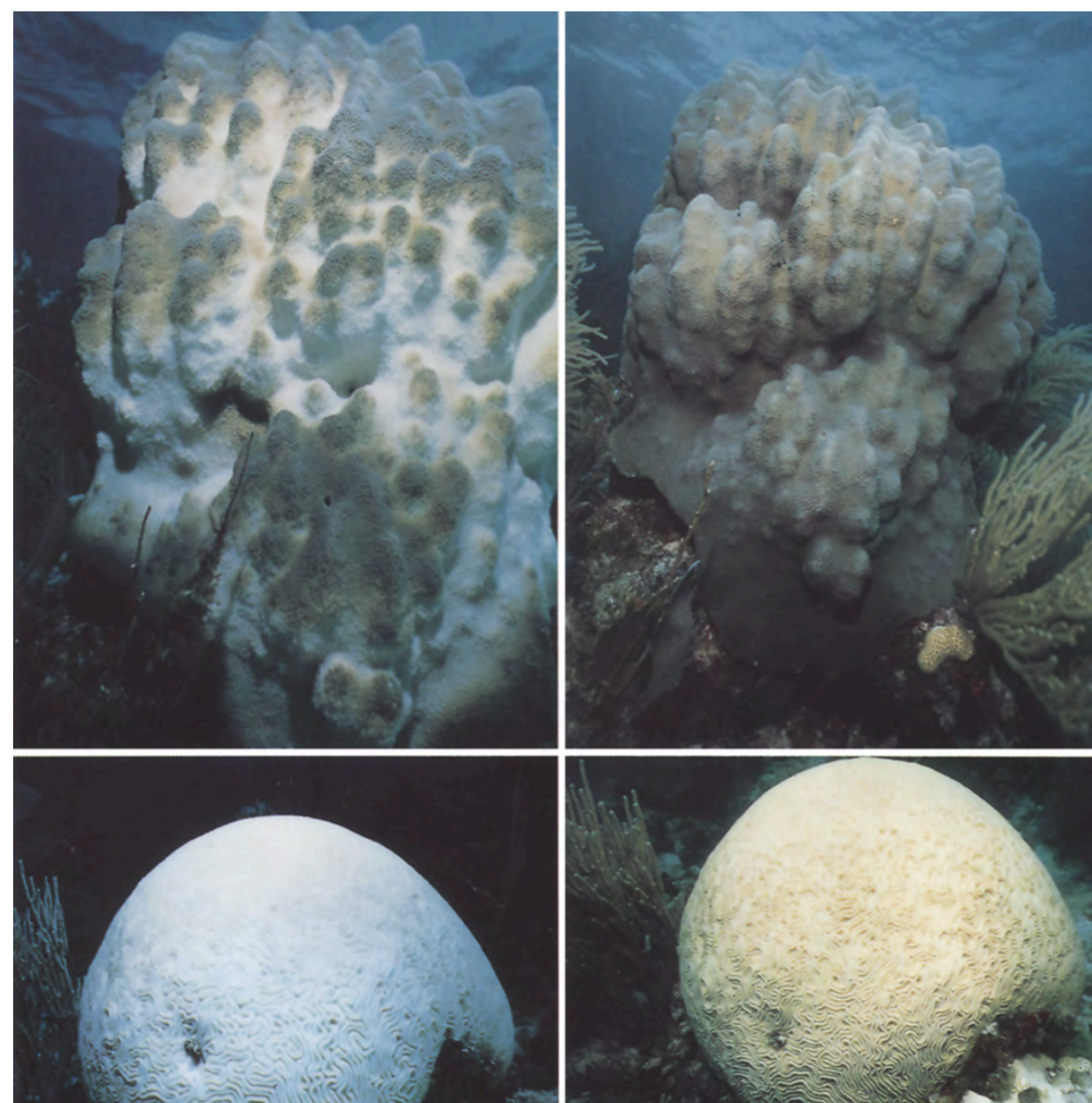


Figure 2: from Fitt, W.K., et al 1993: Corals bleached (left) vs. healthy corals (right).

III. Research

Clade D most thermo-tolerant

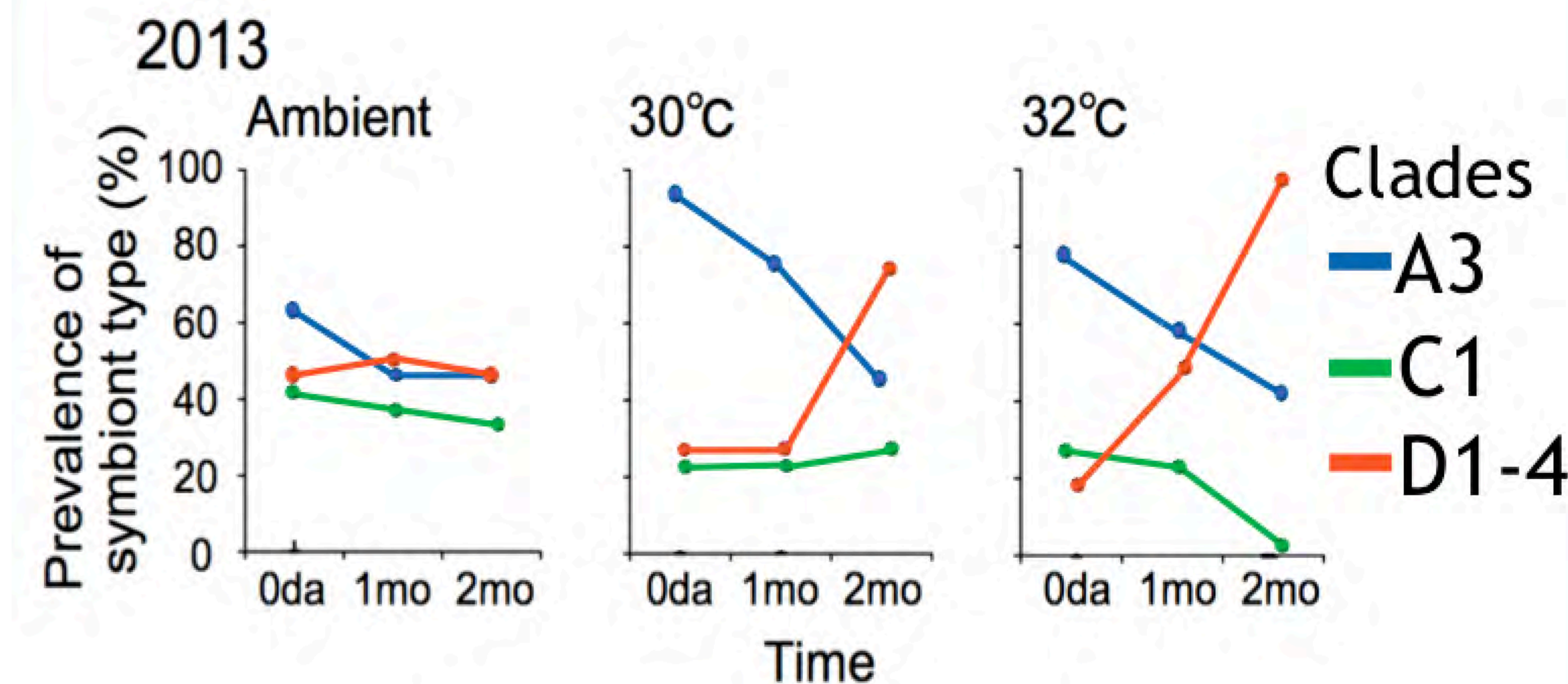


Figure 3: Modified from Yorifuji, 2017. Increased temperature environments shows increase in Clade D abundance.

- ◆ Proteins help thermo-tolerance
- ◆ Long-term dominance = decrease biodiversity
- ◆ Clade D more abundant with high temperature, but reaching limit

Tolerance based within clade strains

- ◆ Strain = a type of clades
- ◆ Each strain has its own characteristic

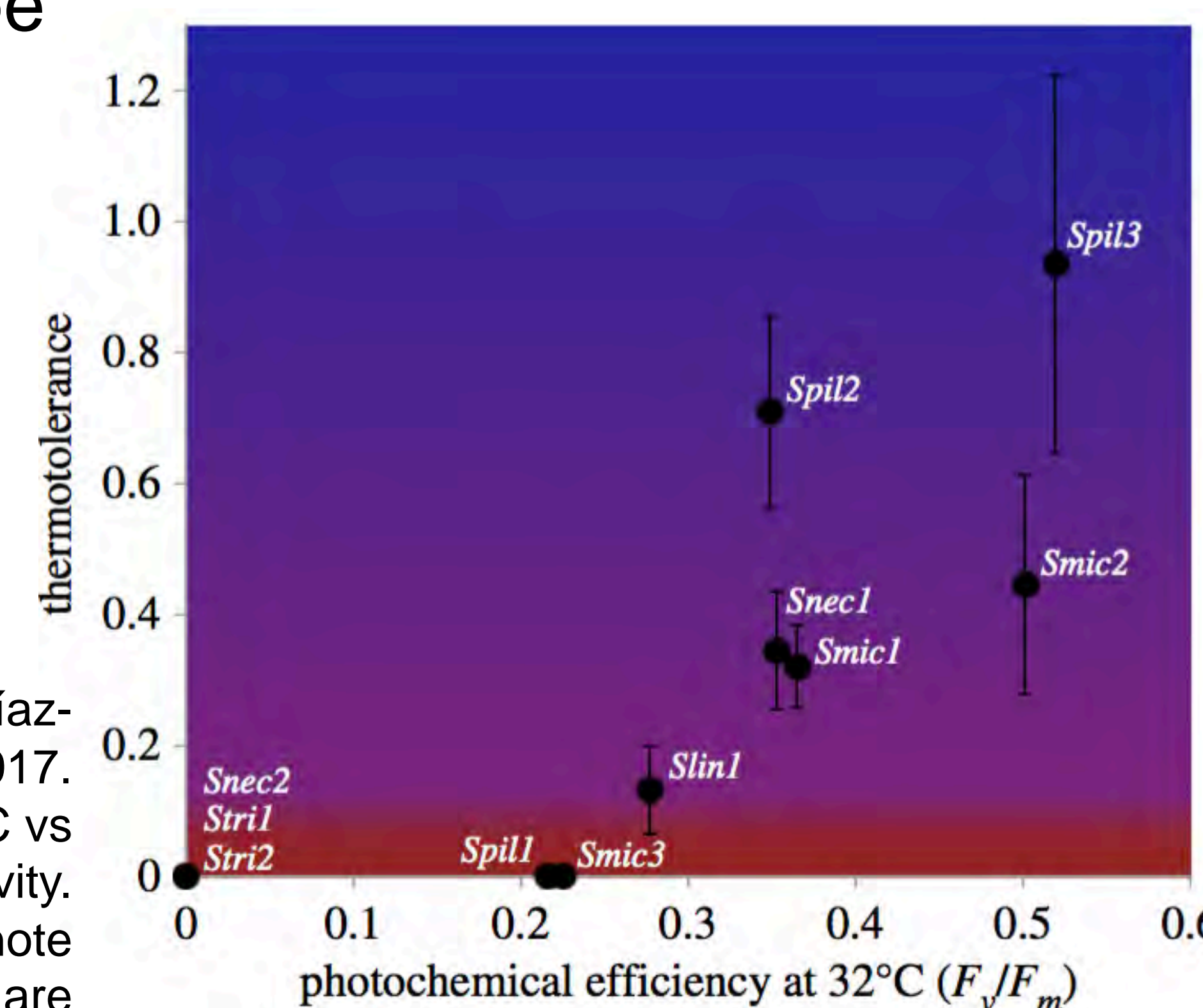


Figure 4: from Díaz-Almeyda, 2017. Thermotolerance at 32°C vs photochemical productivity. Error bars denote standard error. Points are different strains of Clade A.

Survivability in location and host species

- ◆ Locations vary in temperature and light intensity histories
- ◆ Coral hosts differ in tolerance and sensitivity

Juvenile Corals

- ◆ Smaller and more sensitive to change
- ◆ Produced late spring
 - max average temperatures
- ◆ “Switching” clades is more common in juveniles than adult corals



Figure 5: from online resource. Juvenile Coral (polyp)

Minimize anthropogenic stressors

- Coastal development
- Destructive commercial fishing
- Burning fossil fuels
- Pollution and plastics

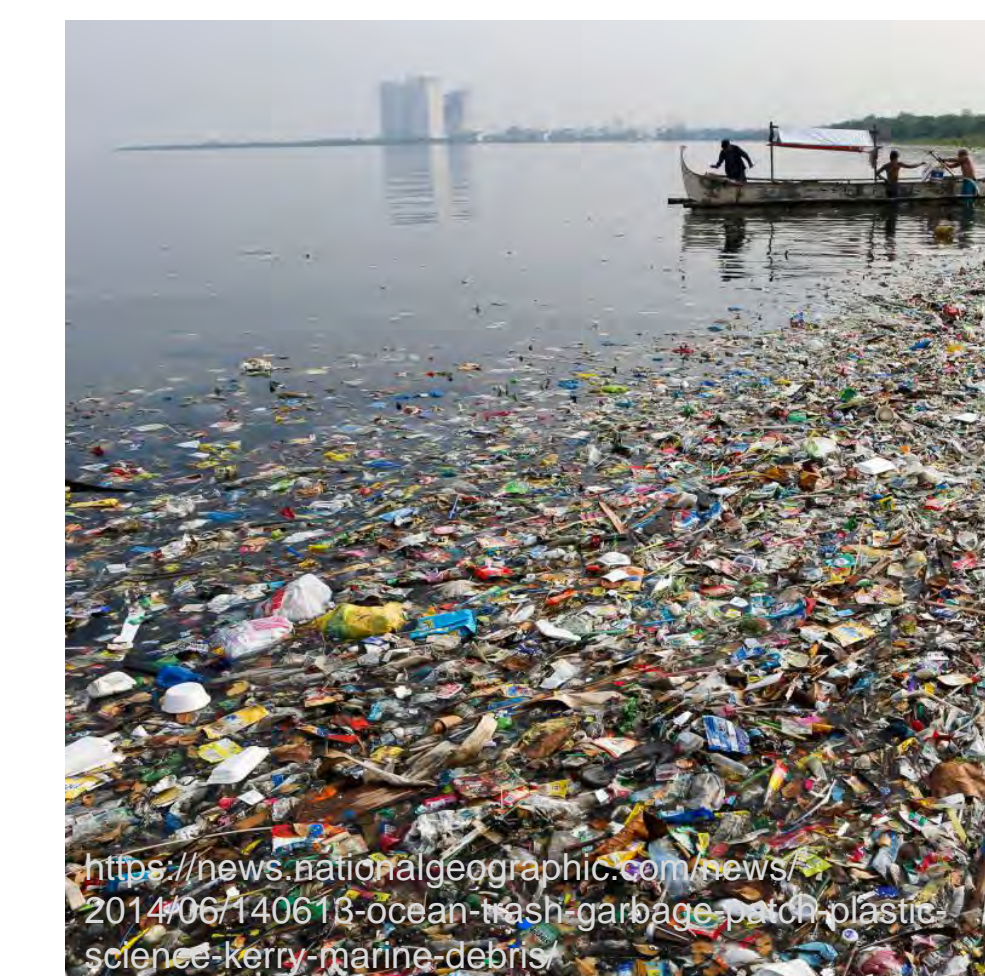


Figure 6: from online resources. Polluted coastal waters with plastics (left) and smoke stacks from industry releasing carbon dioxide and other emissions(right)

IV. Conclusion

- ◆ Clade D is most generally thermo-tolerant. However, long-term dominance could decrease biodiversity
- ◆ Tolerances are based on clade strains
- ◆ Survivability is limited to type of clade, location, and host species
- ◆ Juvenile coral sensitivity is a good indicator for future corals
- ◆ Need to minimize anthropogenic stressors