

Status of Caribbean Coral Reefs

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Atlantic and Gulf Rapid Reef Assessment

June 10, 2024

Coral Reefs in the “Before Times”

1957. “Among the factors that enable corals to dominate reef communities are their remarkable adaptability to a wide range of ecological conditions, their editatory? growth, and their near immunity from predators... Little is known about the competition for *Lebensraum* among the coral dominants of reef associations....”

JW Wells in *Coral Reefs* chapter of J. Hedgpeth’s *Treatise of Marine Ecology and Paleoecology*

Breaker Zone, 6 m, 1972, Discovery Bay, Jamaica

APAL
elkhorn corals

smaller corals

ACER
staghorn corals

APAL

1960's-1970's: In well-developed Jamaican reefs zones:

- * high live coral cover (~ 60->100%) and low fleshy seaweed cover (~ <1-2%).

Yet:

- * narrow N. Coast reefs already **overfished** (had been true for centuries),
- * *Diadema antillarum* (herbivorous sea urchin) was very common but it **lacked serious competitors** for food and **had few predators** (J.D. Woodley, 1977, *Proc. Is. Mar. Labs. Carib.* 13:27).
- * **elkhorn corals** were mysteriously **dying** in St. Croix (from what is now called white band disease¹)
+ other diseases (**black band, white plague**) were first noticed on other reefs

¹White Band Disease (WBD)

gradually eliminated most Caribbean acroporid corals in the following decades.

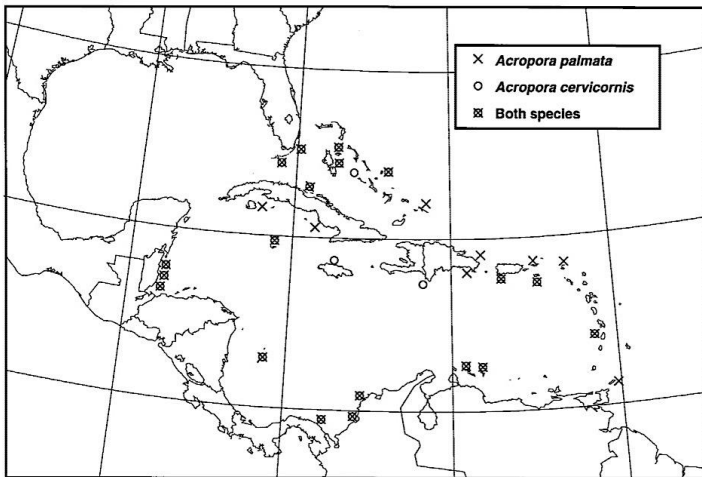
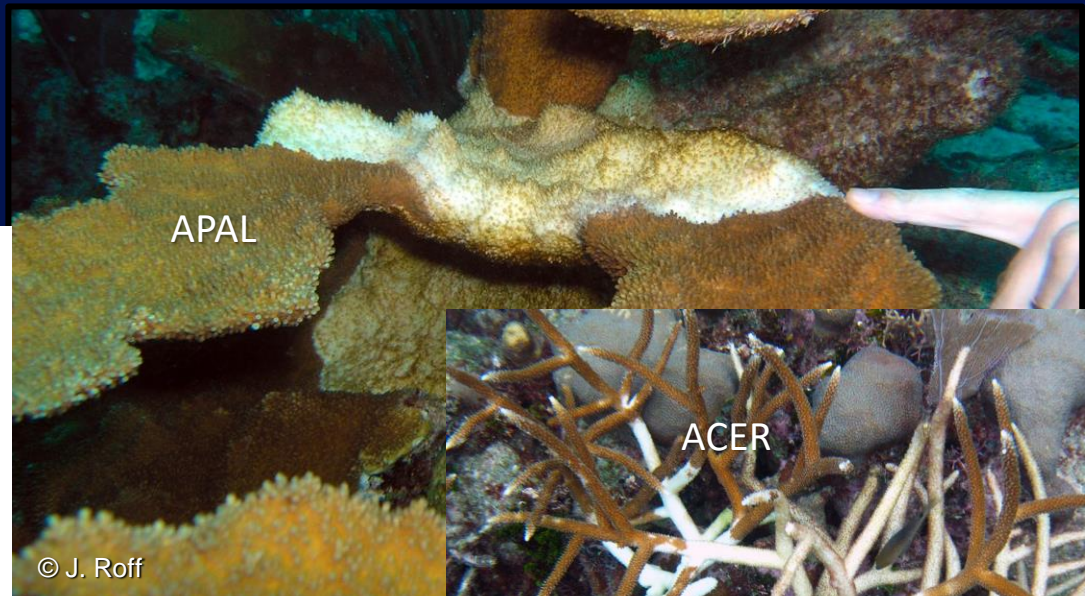
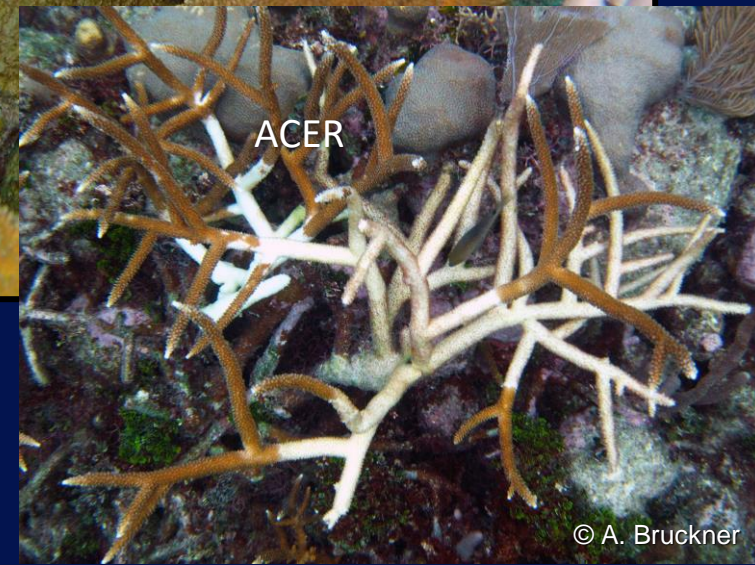


Figure 1. Reports of white-band disease as a cause of significant *Acropora* mortality on Caribbean reefs over the past few decades. Data from Wilkinson (2000) and Aronson & Precht (2001).

Aronson & Precht. 2001. White-band disease and the changing face of Caribbean coral reefs. *Hydrobiologia* 460:25-38.



In June 1980, a large colony of ACER in Discovery Bay, north Jamaica, might have been infected with WPD.



Major stresses accumulated quickly, starting in the 1980's

* Years of largest Caribbean hurricanes since 1980 by–

wind speed in kph: Allen, 1980 (306) > Gilbert, 1988 = Wilma, 2005 = Dorian, 2019 (298)
min. pressure in mb: Wilma, 2005 (882) > Gilbert, 1998 (888) > Rita, 2005 (895) > Allen, 1980 (899)

Jamaica, 1980: many *Coralliophila* (predatory snails that prefer acroporids and grow much larger on them than on other corals) survived H. Allen and consumed the scattered acroporid fragments + the storm may have spread the presumed WBD pathogen. Acroporids in areas unaffected by H. Allen were dying within several years.



* Years of large mass *Diadema antillarum* mortality events in–

1983-1984: started in Panama, spread over 14 months throughout Caribbean, Florida, Flower Garden Banks, Bermuda, primarily by currents, killing ~98% of all *Diadema*.

Jamaica, 1983: After *Diadema* died, fleshy macroalgae grew on the abundant coral skeletons created by H. Allen, restricting settlement of coral larvae, and eventually overgrew adult corals.



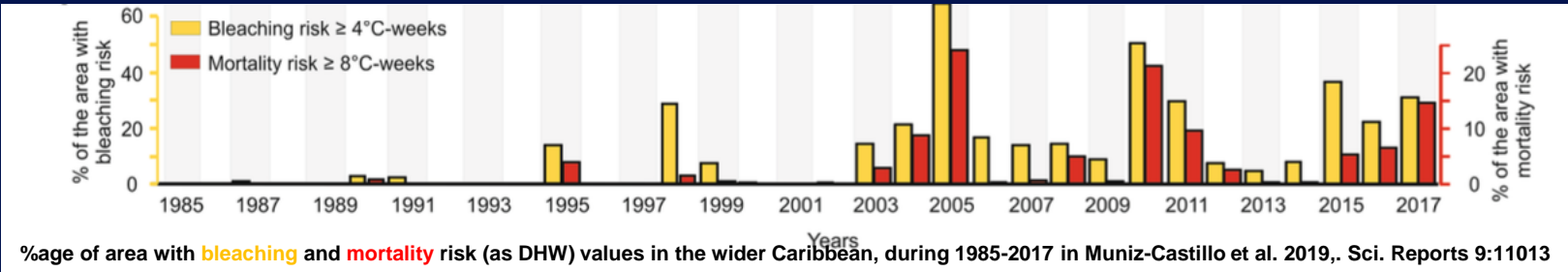
2022-2023 : started in USVI, soon seen in many other N, E and SE Caribbean areas, Primary dispersal mechanisms presumed anthropogenic, locally spread by currents.



* First Caribbean-wide bleaching event in –

1987: caused limited mortality on most reefs but initiated great interest in seawater temperatures (almost no data).

1st significant bleaching mortality in 1998; frequency and intensity have increased ever since.



1990's – Today, in the Caribbean as a whole₁:

- * Stronger & more frequent **hurricanes** + now coral nursery and outplants are damaged.
- * **Diseases** have increased in abundance...



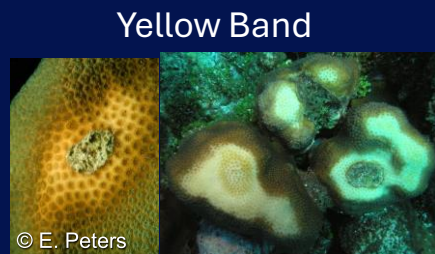
Black Band



White Plague



...and number, e.g.,



Yellow Band



Dark Spots

Caribbean Ciliate Infection



Siderastrea White-blotch Syndrome



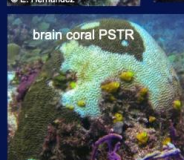
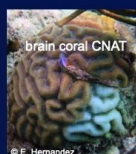
** Stony Coral Tissue Loss Disease

Invasion

Early Epidemic

Late Epidemic

Endemic



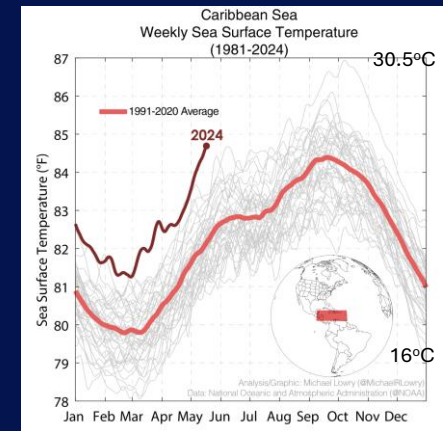
Lettuce corals and smooth flower corals may die—or may not yet die.



...any massive starlet corals may also be dying—or they may not!

1990's – Today, in the Caribbean as a whole_2:

* **Bleaching** is stronger & more frequent + now coral nursery and outplants are damaged.



But not all is lost



Acropora spp.: shallow nursery outplants that bleached in July 2023 in southern Belize had regained zooxanthellae with remarkably little mortality overall by February 2024 (L. Carne, pers. comm.).



On May 11, 2024, corals that had bleached in 2023, including *Agaricia tenuifolia* (ATEN) and the SCTLD-susceptible meandrinid + brain corals were regaining zooxanthellae (A. Borcsok, pers. comm.).

Carnivores



Corallivores



Herbivores



Corals



Benthic Algae

