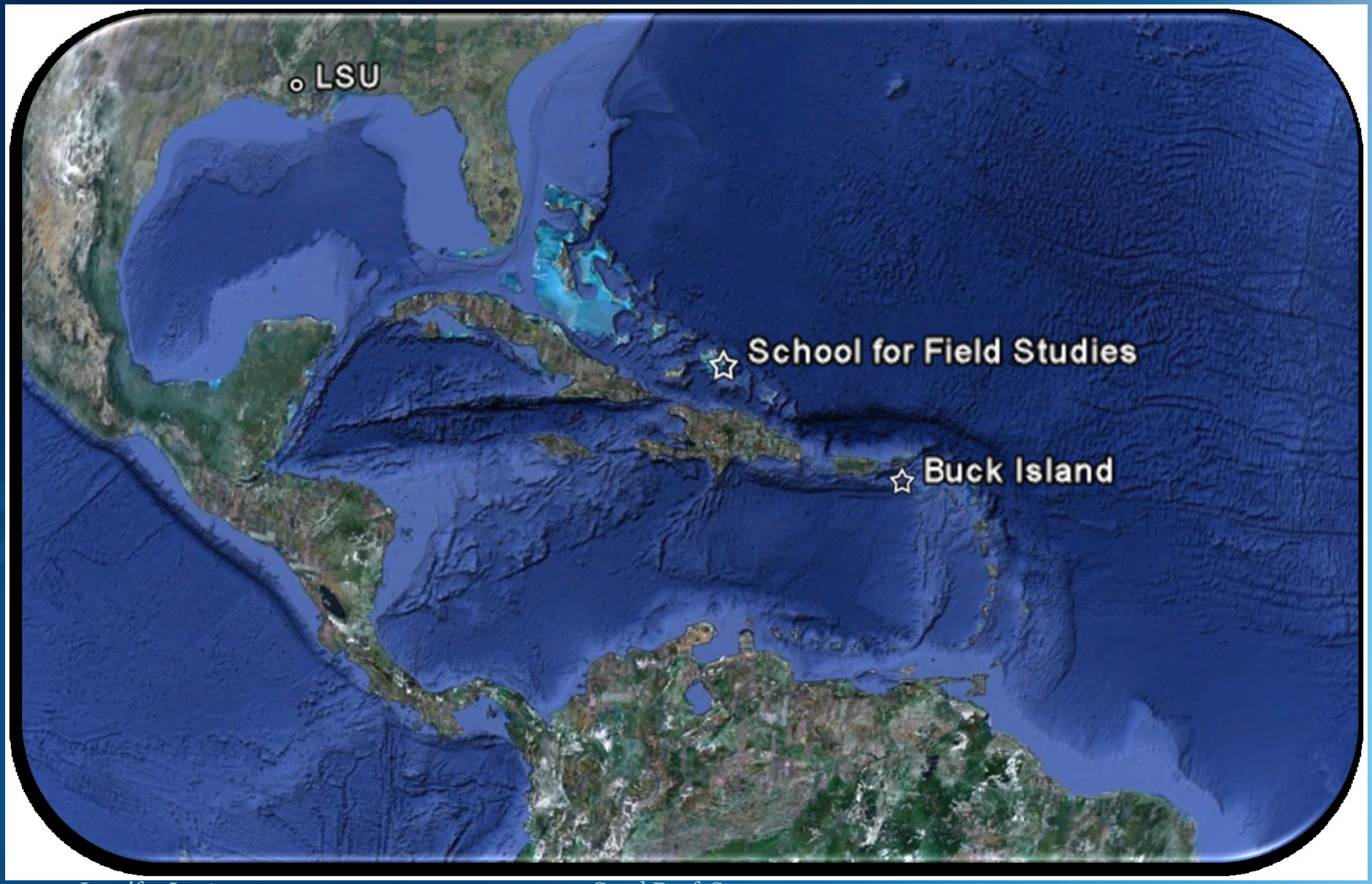
Coral Reef Stressors

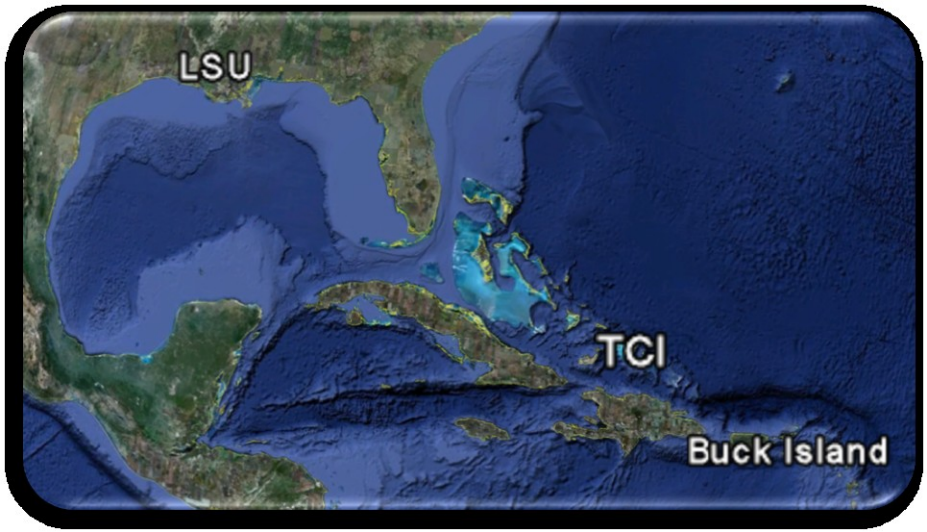
Introduction to Oceanography
(OCS 1005-3)

April 29, 2010

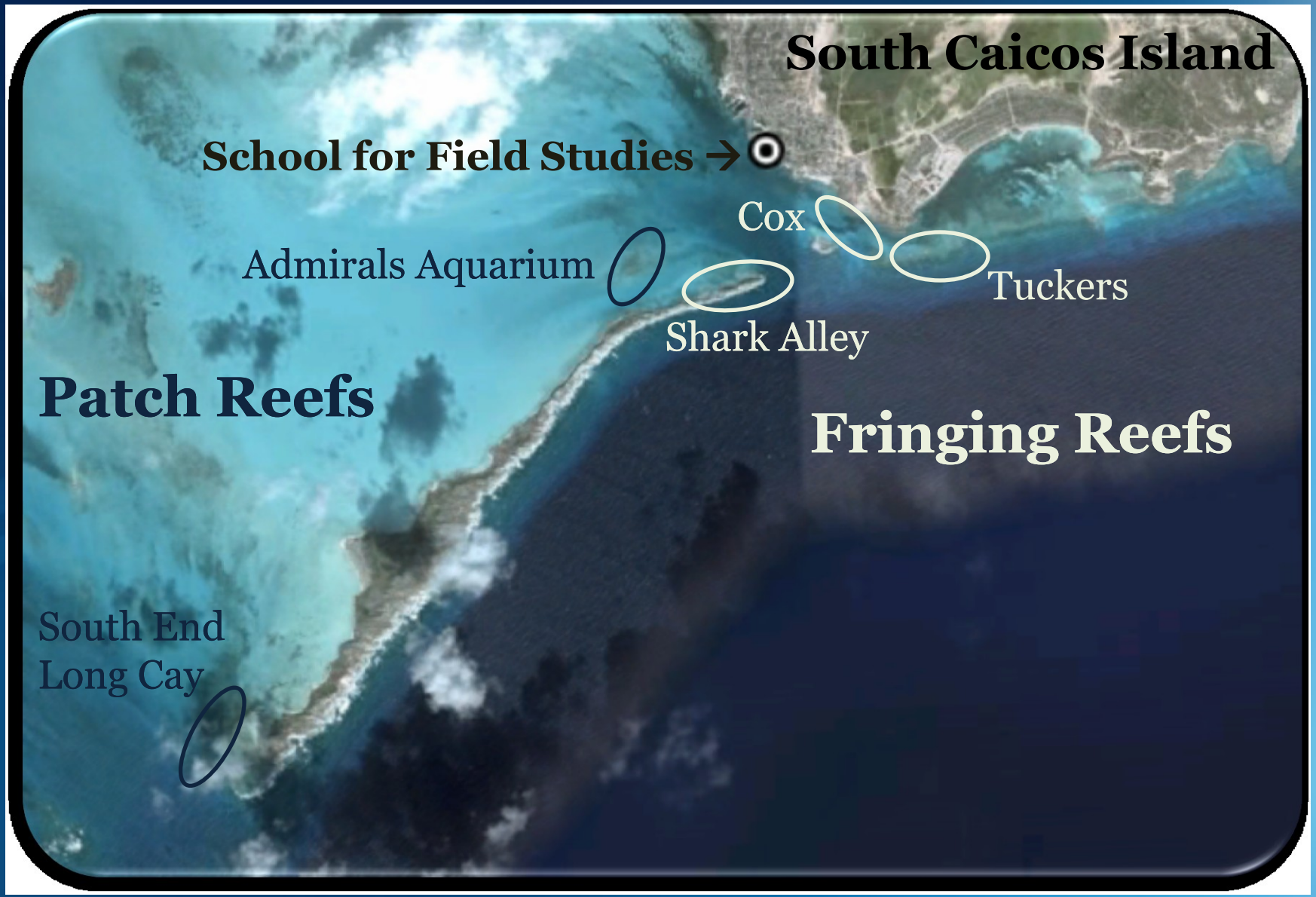
Jenny's Background in Corals



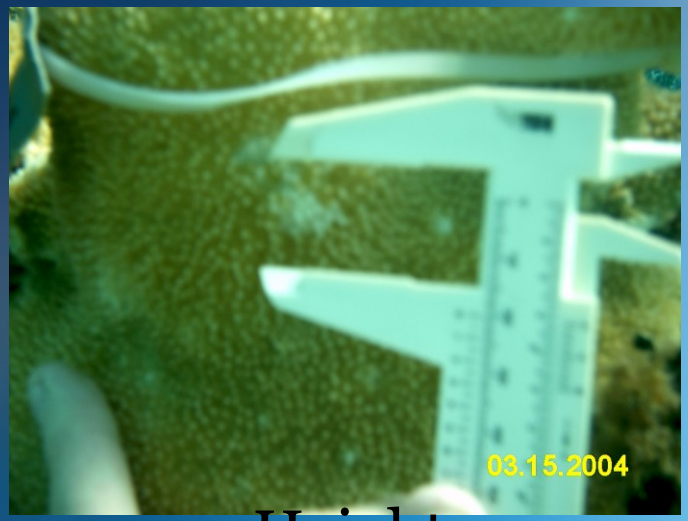
Jenny's Background in Corals



Study Sites

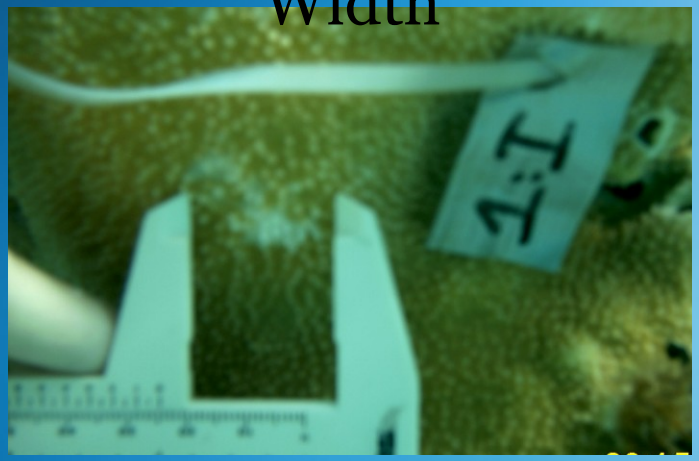

South Caicos Island
School for Field Studies →
Cox
Admirals Aquarium
Tuckers
Shark Alley
Patch Reefs
Fringing Reefs
South End
Long Cay

How I measured the Diseases



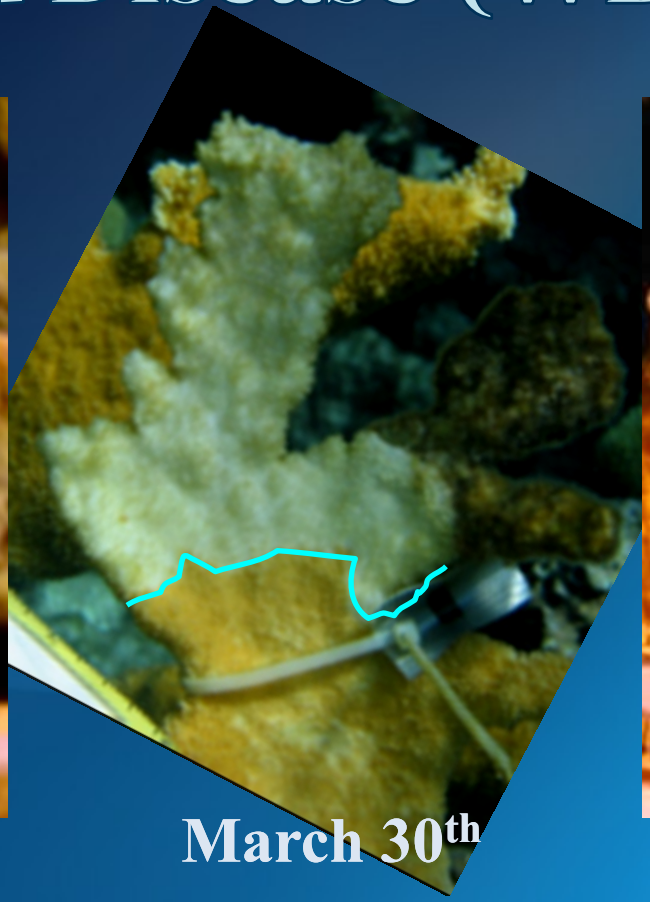
Height

Width



Photographic Analysis of White-band Disease (WBD) Spread

March 24th



March 30th

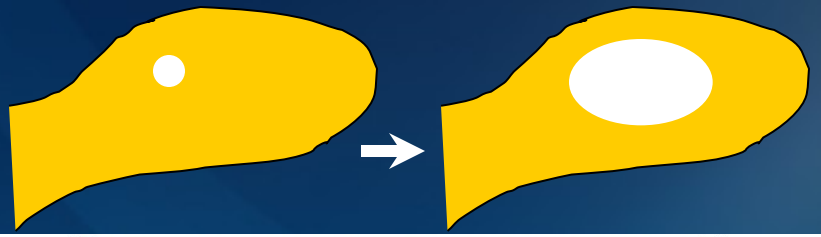
April 9th

0.21 cm^2/day higher mean rate of tissue loss with photo measurements

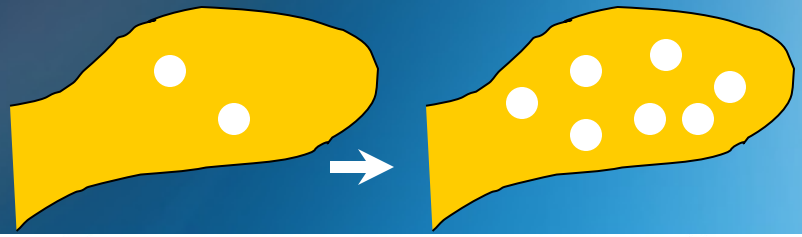
White Pox Disease (WPD)

The two methods of disease spread that I found

WPD **a**

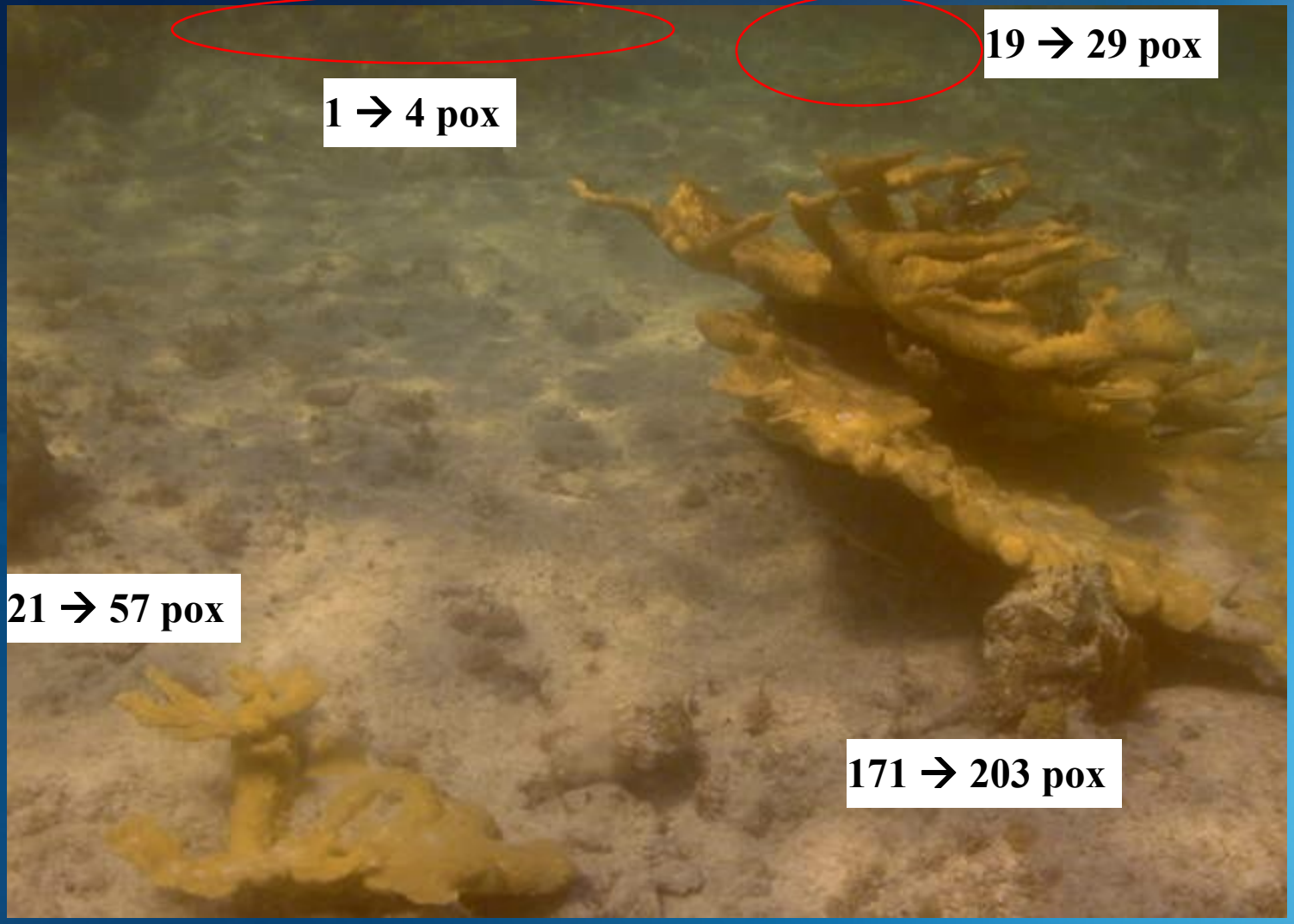


WPD **b**



WPDb Distribution and Spread

(March 27th & April 3rd)



Current Status of Corals

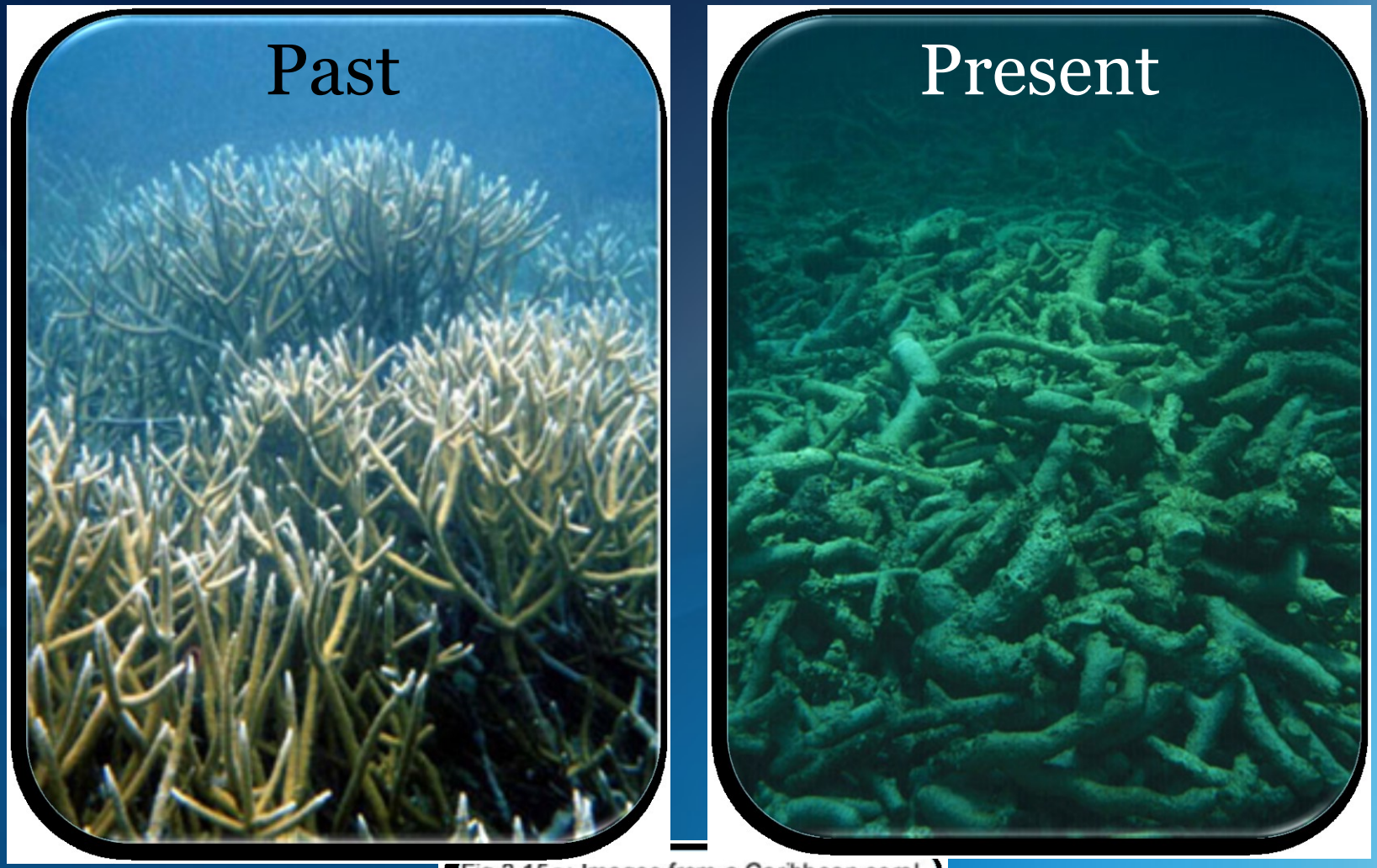
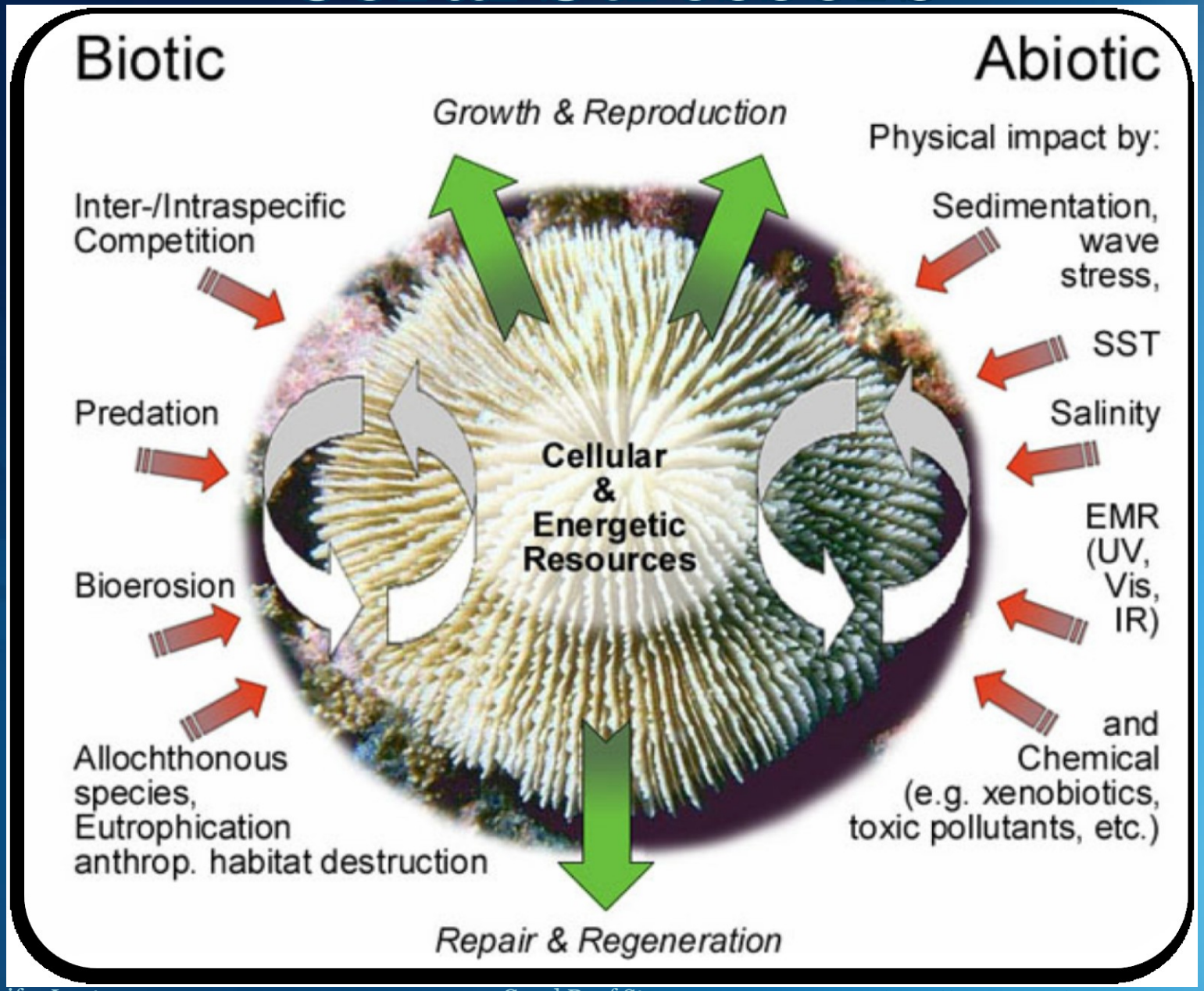


Fig.3.15a: Images from a Caribbean coral reef. Major storm events change a reef from a more or less intact community to one dominated by dead coral, algae and bioeroders.

(Madl 2005; Fig. 3.15a)

Coral Stressors

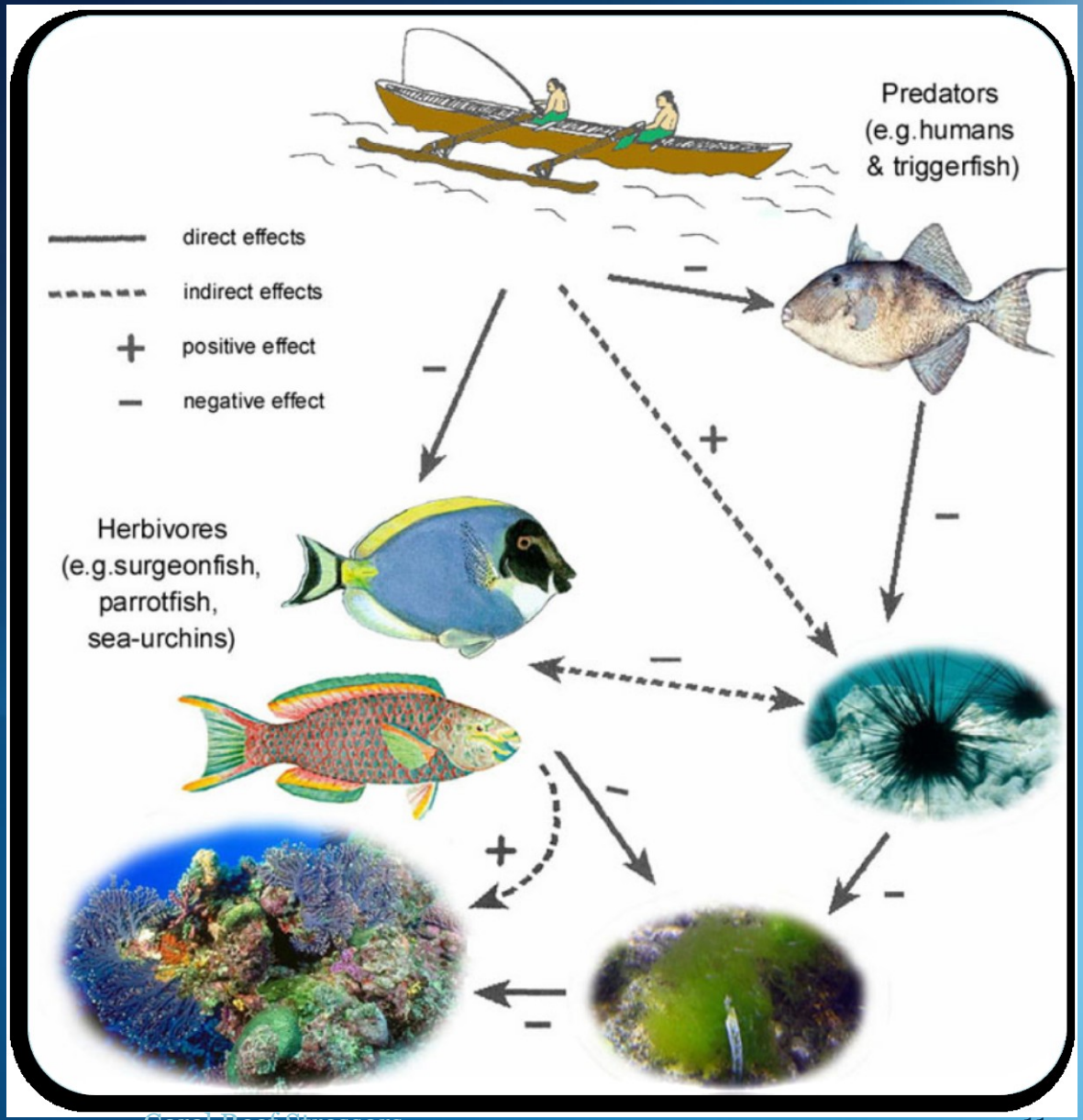


(Madl 2005; Fig. 4.1)

Coral Stressors

Over-fishing

"Herbivorous feeding pressure: Since herbivorous fish and sea urchins consume algae any fishing pressure exerted on these species by humans does interfere with the sensitive balance of feeding pressure and algal blooms"



(Madl 2005; Fig. 3.7)

Coral Stressors

Dynamite or Blast fishing

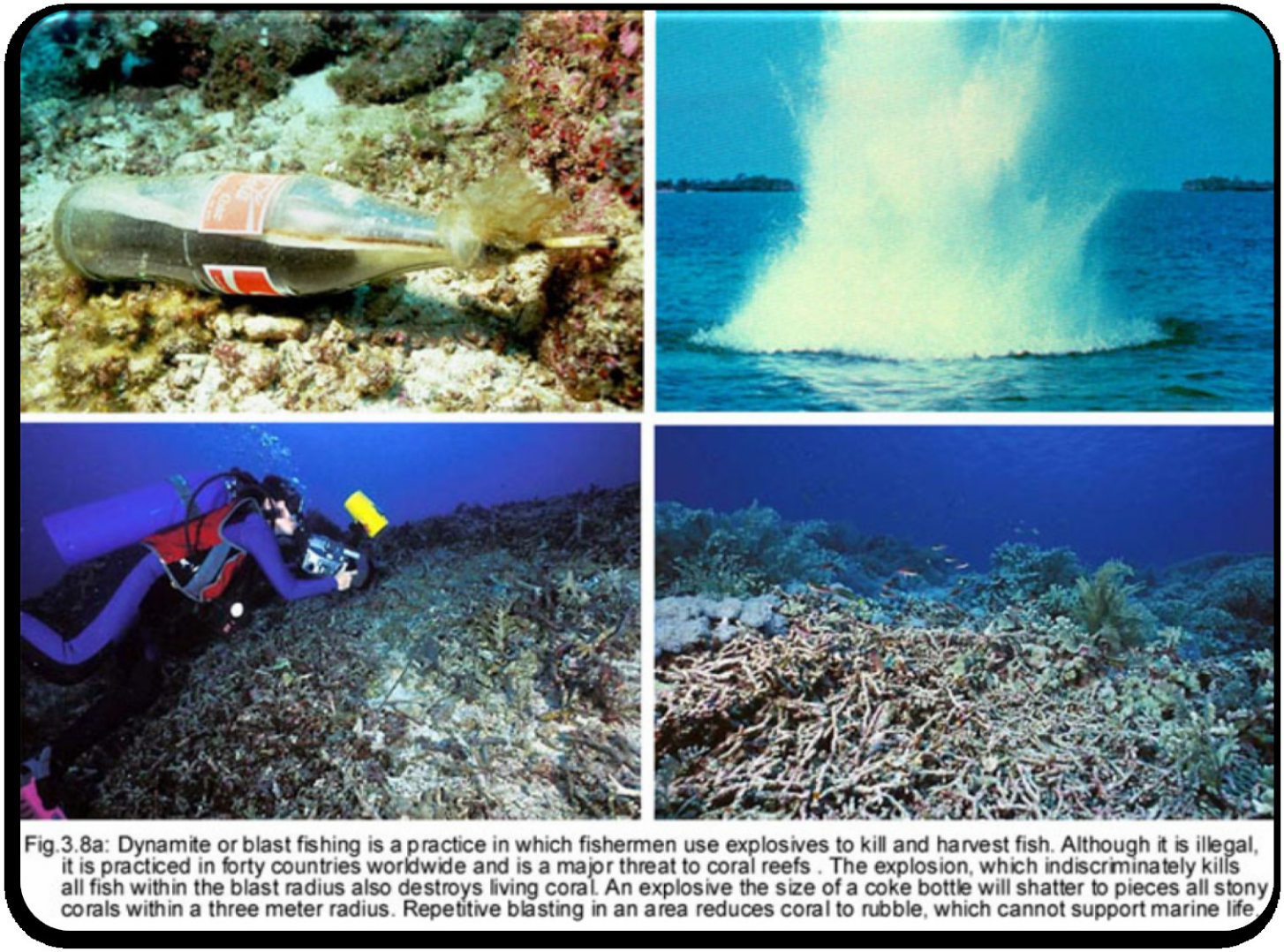


Fig.3.8a: Dynamite or blast fishing is a practice in which fishermen use explosives to kill and harvest fish. Although it is illegal, it is practiced in forty countries worldwide and is a major threat to coral reefs . The explosion, which indiscriminately kills all fish within the blast radius also destroys living coral. An explosive the size of a coke bottle will shatter to pieces all stony corals within a three meter radius. Repetitive blasting in an area reduces coral to rubble, which cannot support marine life.

(Madl 2005; Fig. 3.8a)

Coral Stressors

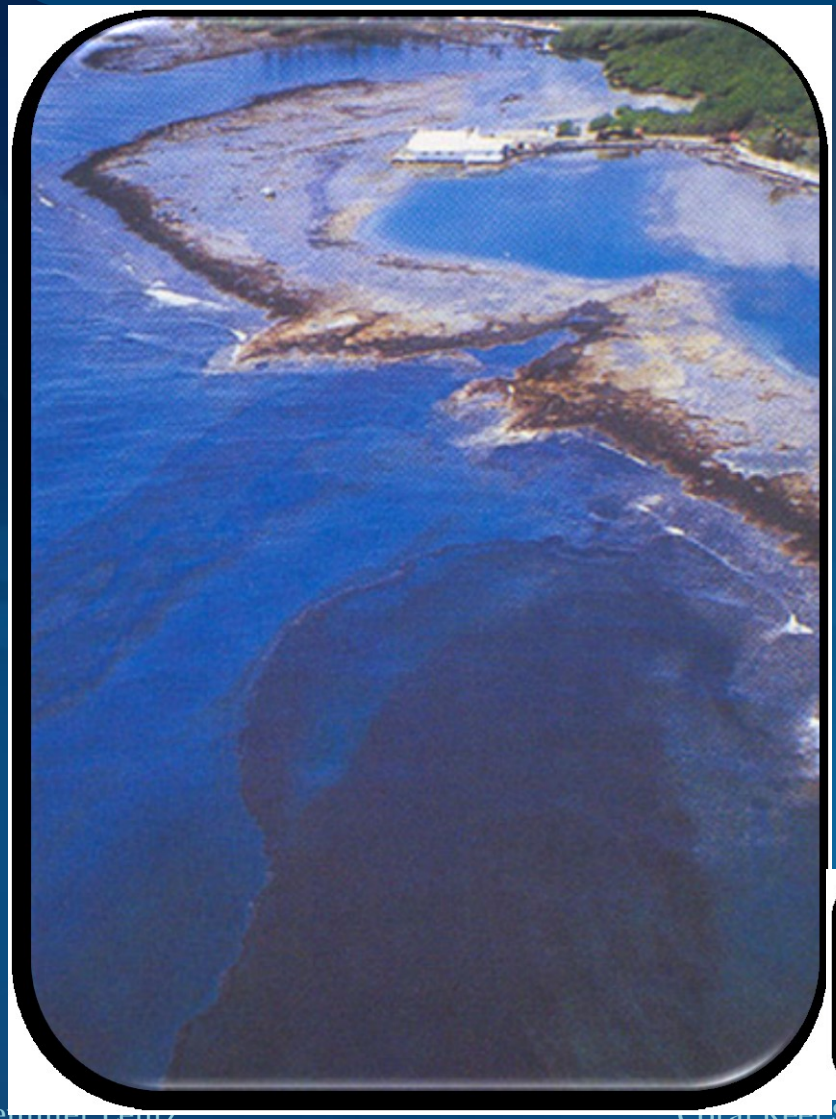
Cyanide-fishing

Fig 3.8b: Although the practice has been outlawed in most countries, and despite many importers of of reef fish refuse to acept cyanide-tainted fish, widespread use of cyanide continues to devastate huge areas.

(Madl 2005; Fig. 3.8b)

Coral Stressors

Hydrocarbon Pollution from Oil Spills



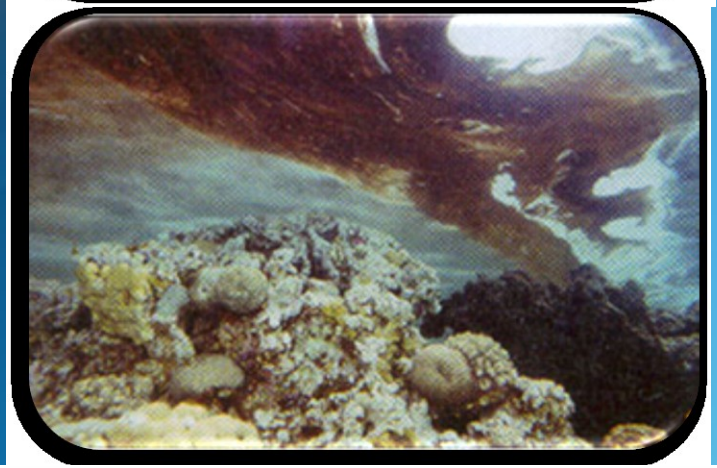


Fig.3.10a: Crude oil polluting reefs in the Caribbean (left), oil washing on the coast of the northern Gulf of Aqaba / Eilat following an oil spill (right).

(Madl 2005; Fig. 3.10a)

Coral Stressors

Sedimentation

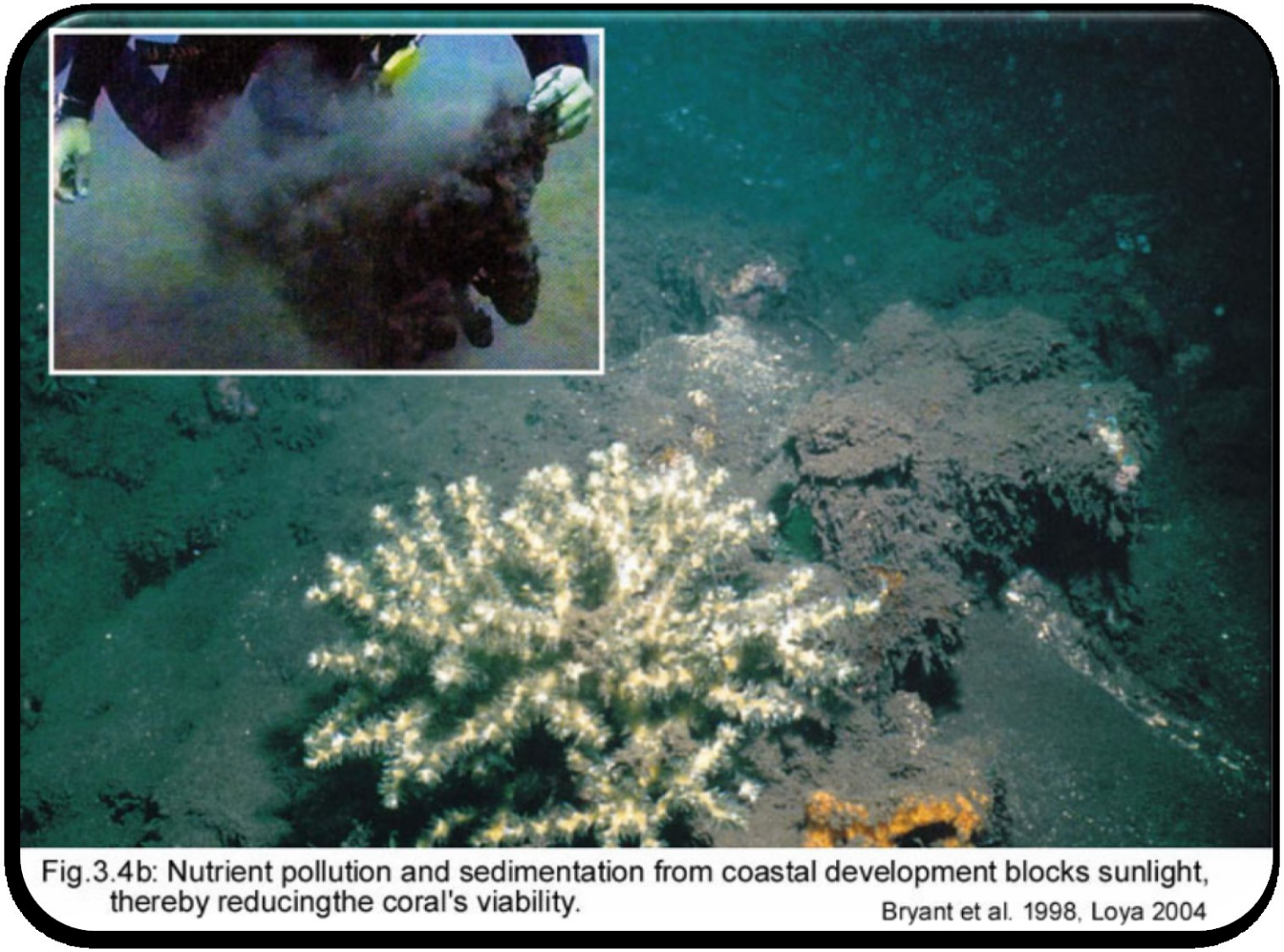
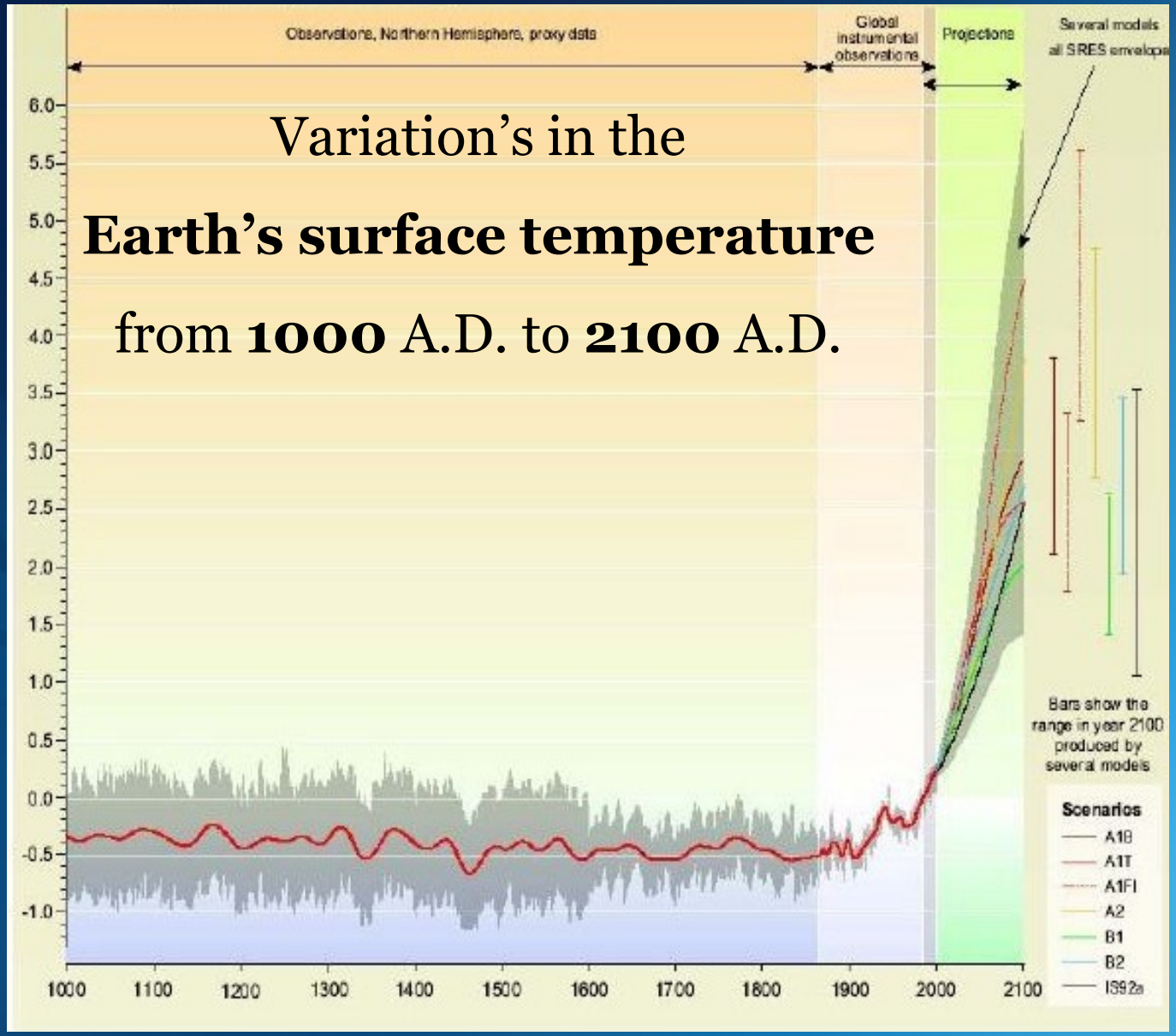


Fig.3.4b: Nutrient pollution and sedimentation from coastal development blocks sunlight, thereby reducingthe coral's viability. Bryant et al. 1998, Loya 2004

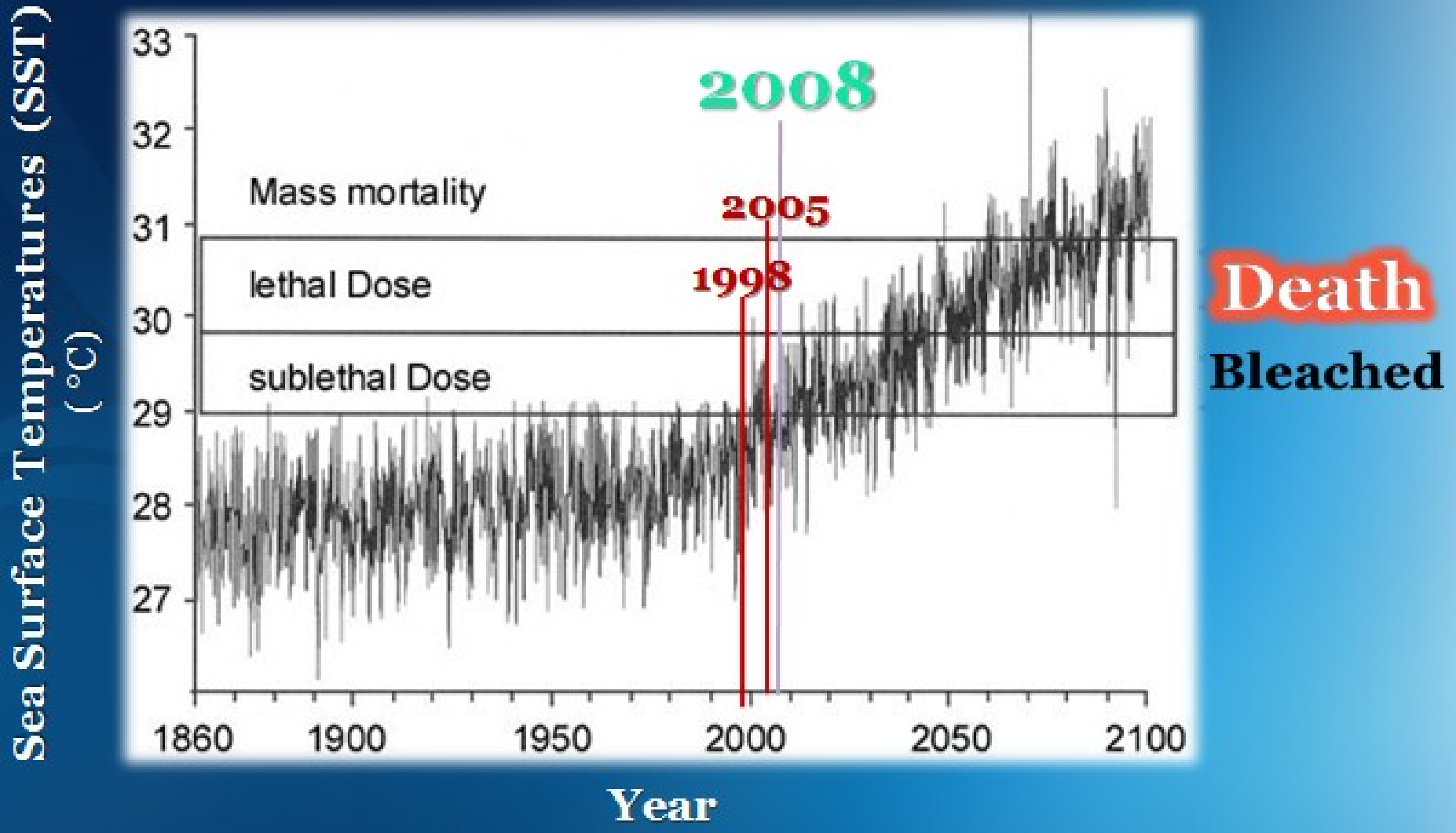
(Madl 2005; Fig. 3.4b)

Coral Stressors: Temperature



(Grimsditch & Salm 2005; Fig. 2, pg. 5)

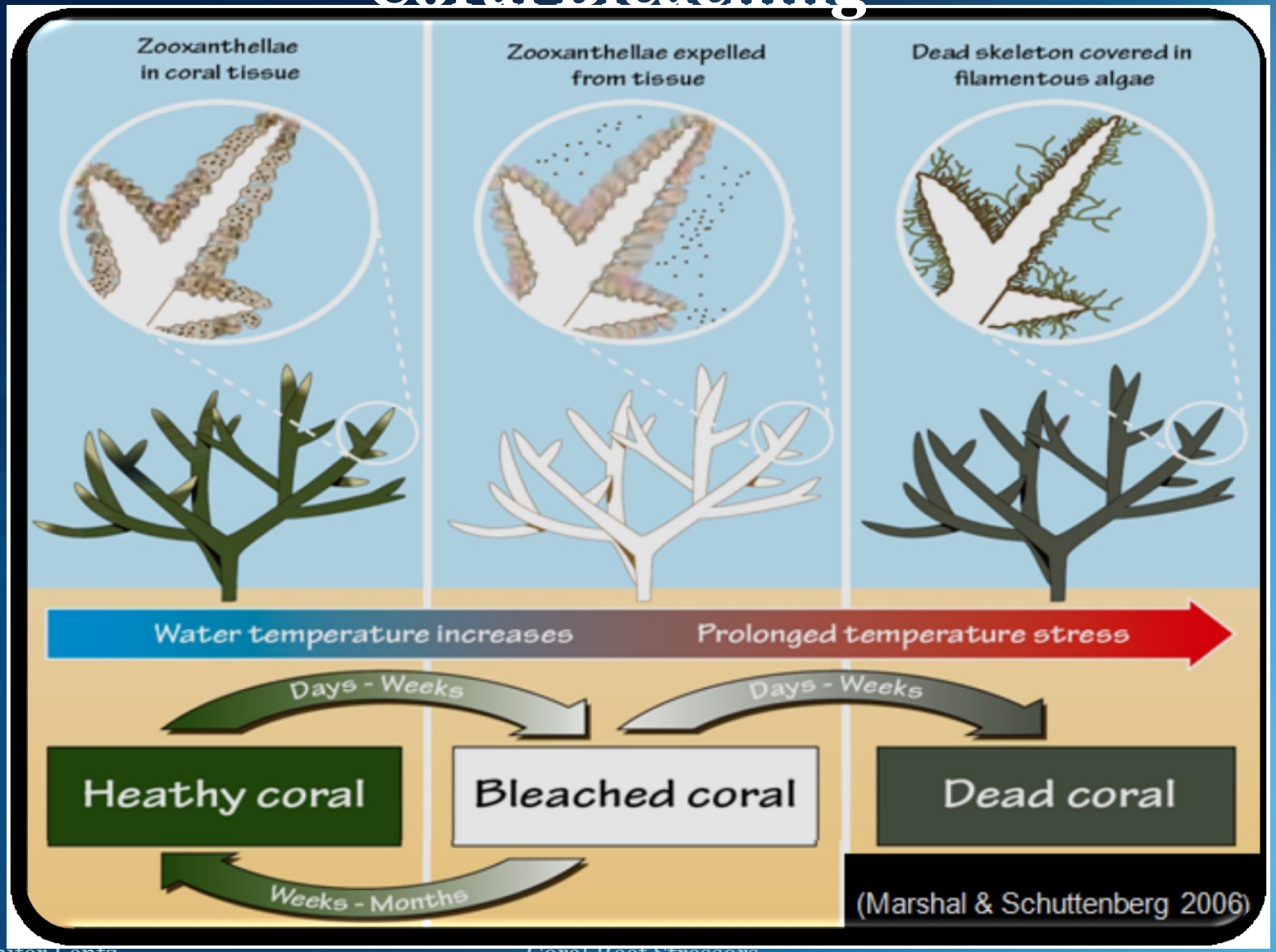
Coral Stressors: Temperature



(Hoegh-Guldberg 2004; Fig. 2; p. 14)

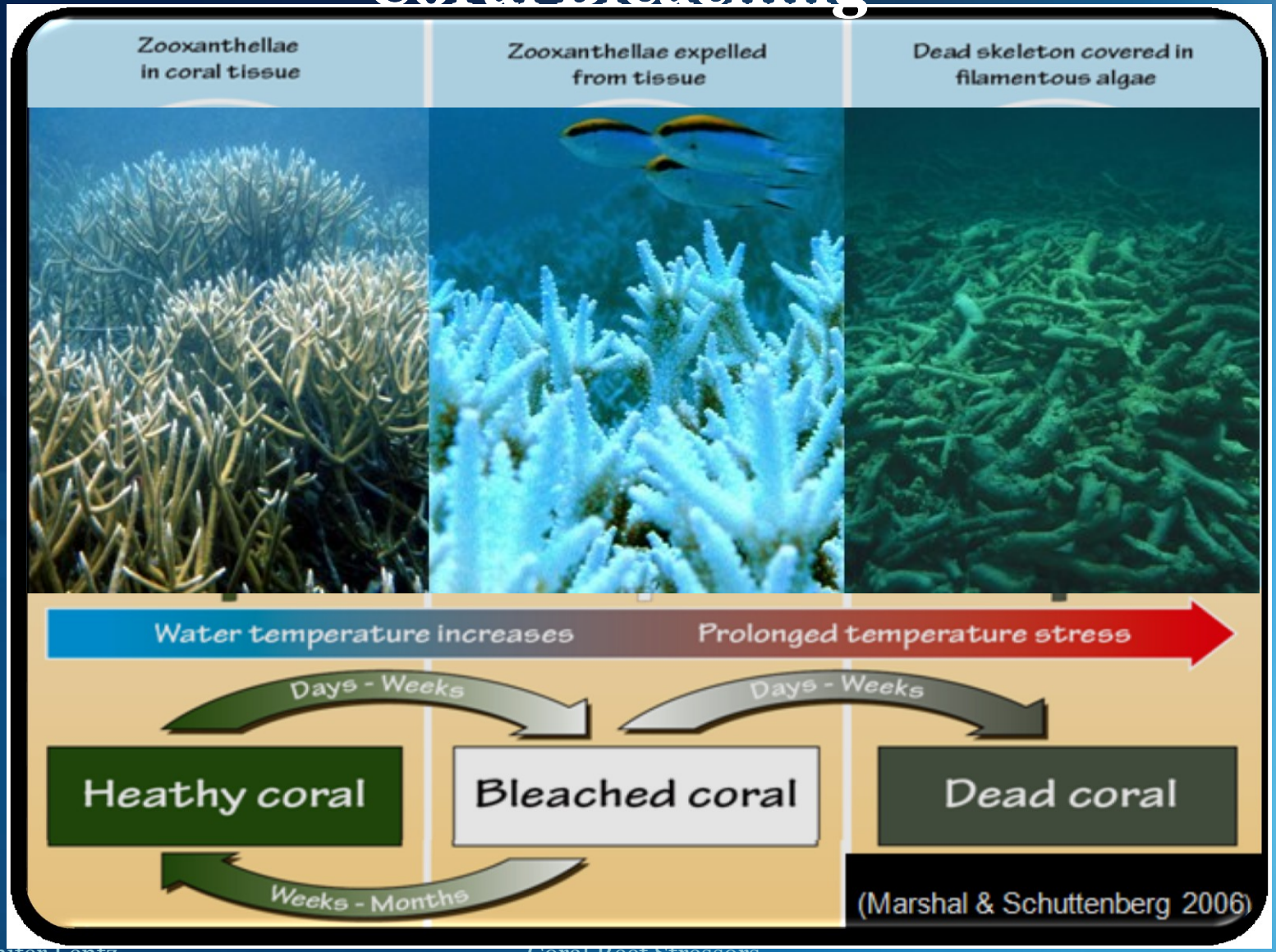
Coral Stressors: Temperature

Coral Bleaching



Coral Stressors: Temperature

Coral Bleaching



Coral Stressors: Temperature

Coral Bleaching

(Grimsditch & Salm 2005; Fig. 1, pg. 4)

"Disease"

"**Disease** is defined as

any impairment of an organism's **vital functions, systems, organs, or cells**."

"**Infectious diseases** are characterized **both** by an **identifiable group** of **signs** and the presence of the **recognized etiologic** or **causative agent**."

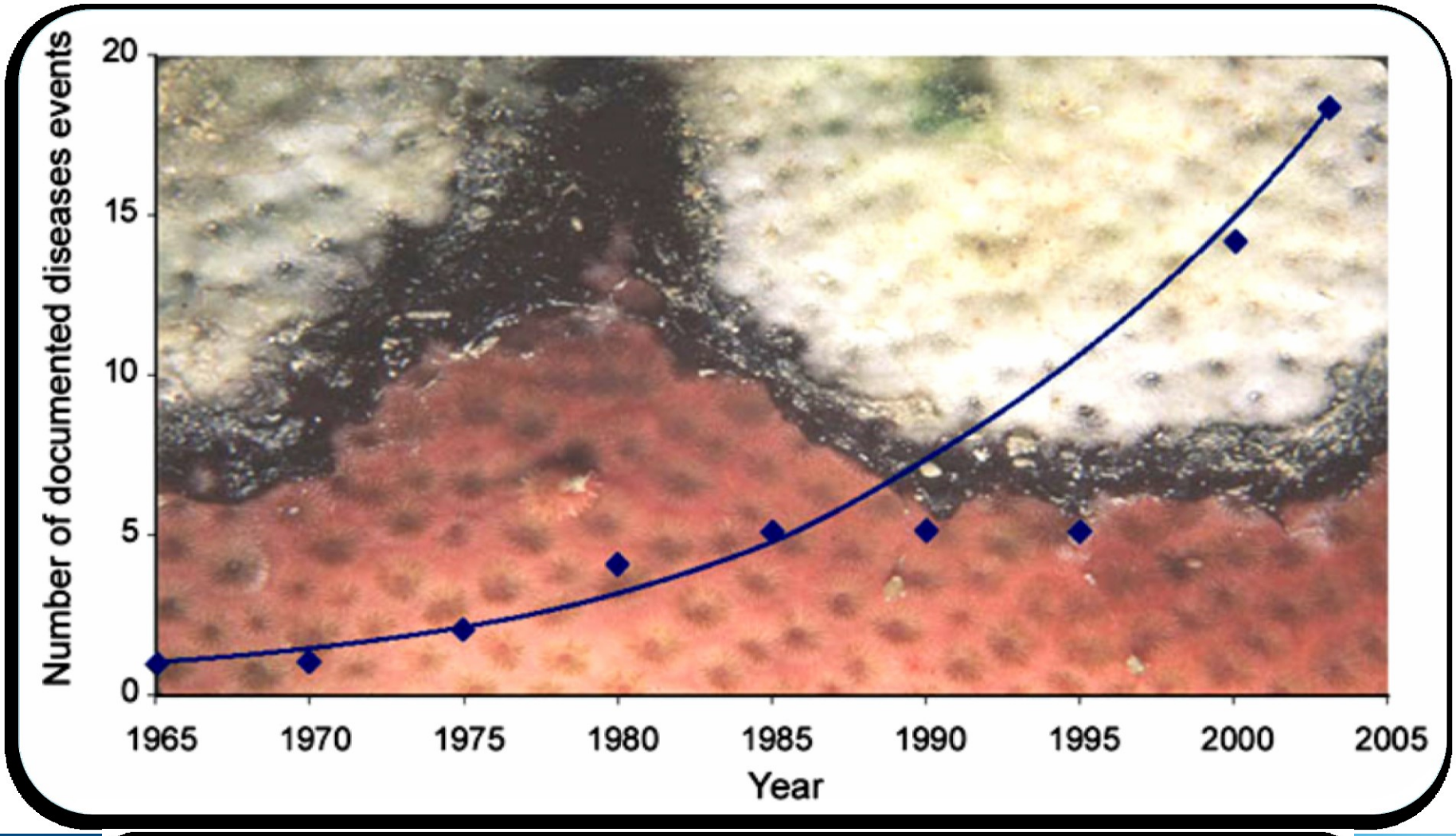
(Ben-Hiaim and Rosenberg, 2002)

Marine Diseases

As of 2000 as many as 34 mass mortalities **had been reported in a wide variety of marine groups, each affecting more than 10% of the infected population**

(Harvell et al. 1999, Green & Bruckner 2000)

Coral Diseases

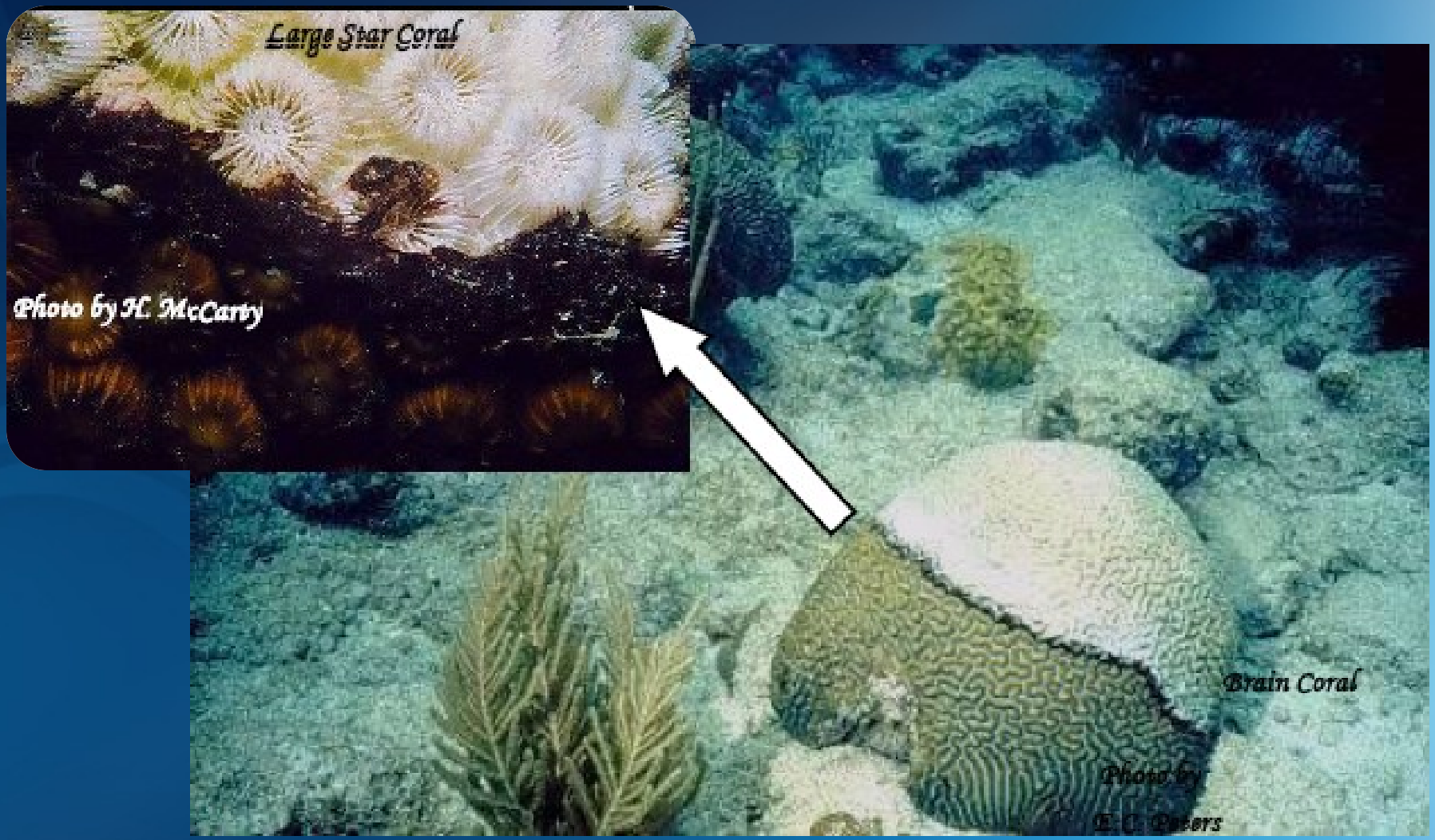


Exponential increase in the number of described coral diseases since the first since the first report of disease in 1965.

(Madl 2005; Fig. 4.5)

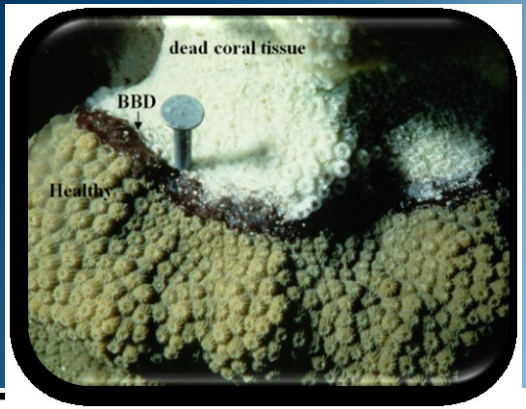
Coral Diseases

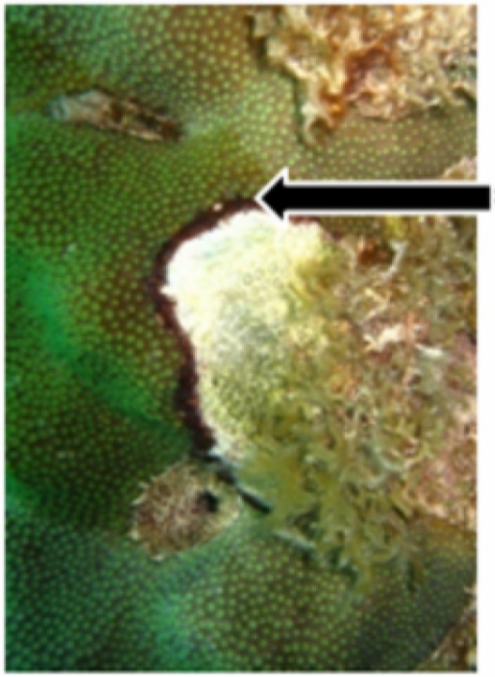
Black Band Disease (BBD)

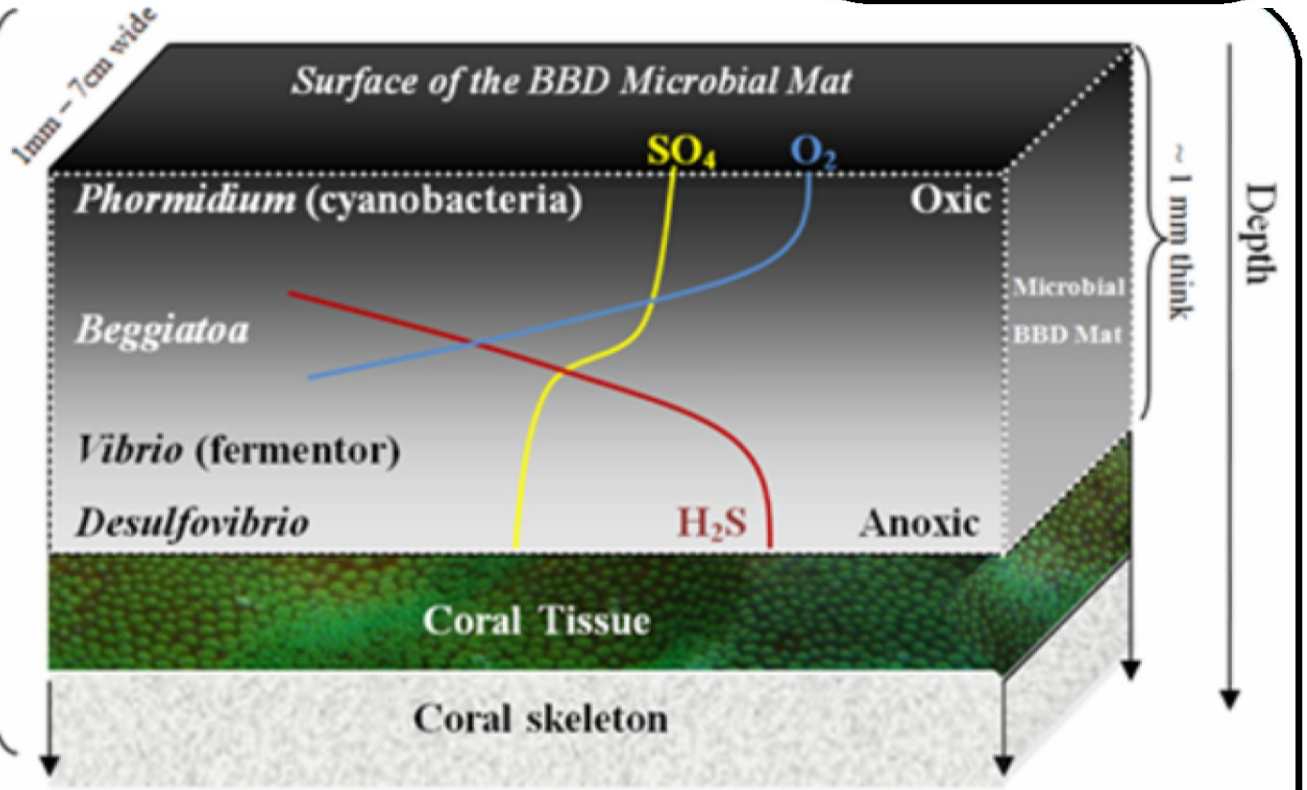


Coral Diseases

Black Band Disease (BBD)







Stylistic cross-section of the dominant microbes of the microbial consortium making up the BBD mat. *Note: this diagram is not done to scale.*

(Lentz 2006, unpublished.)

Coral Diseases

White Band Disease (WBD)

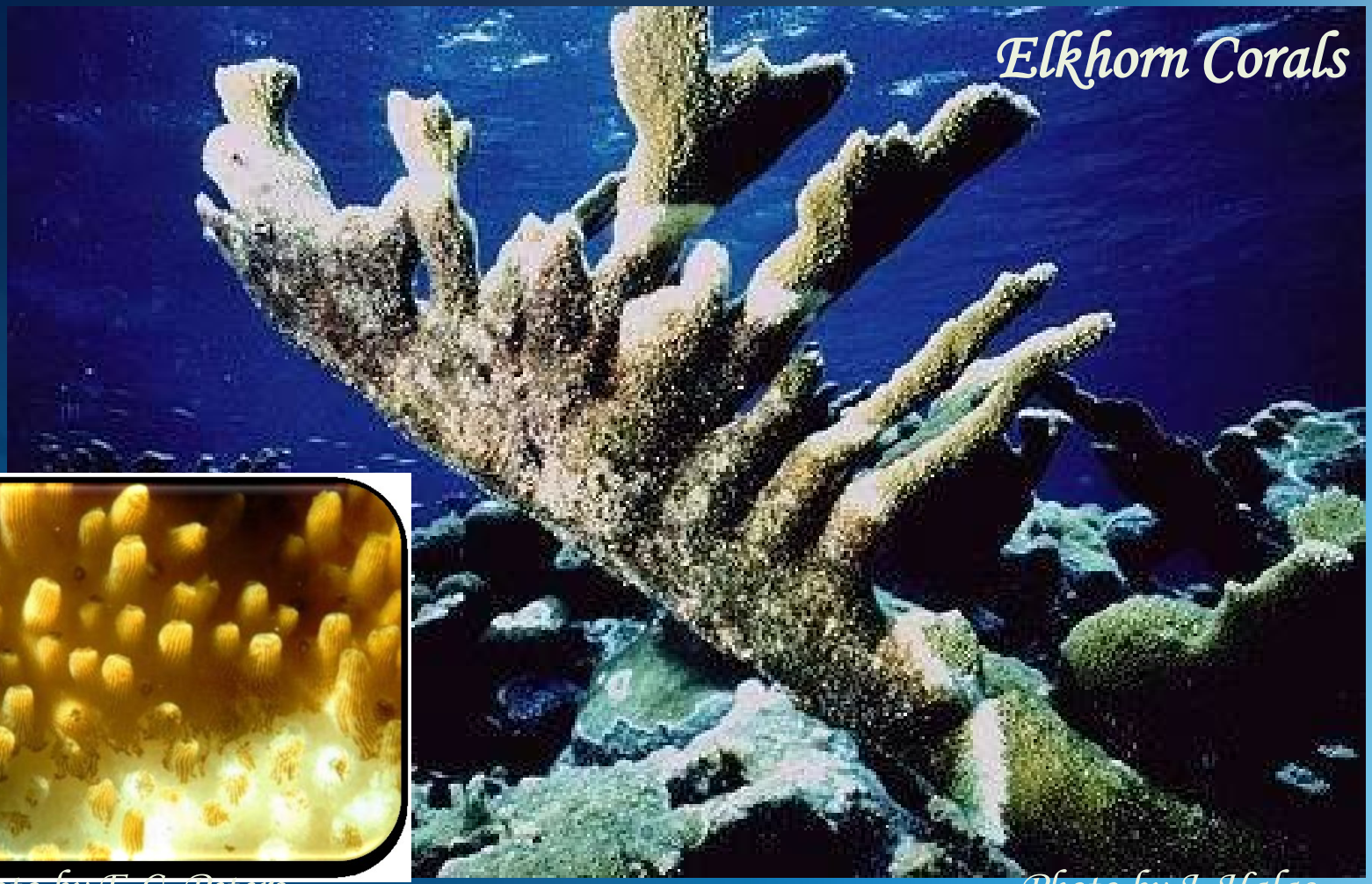


Photo by E.C. Peters

Photo by J. Halas

Coral Diseases

White Band Disease (WBD)

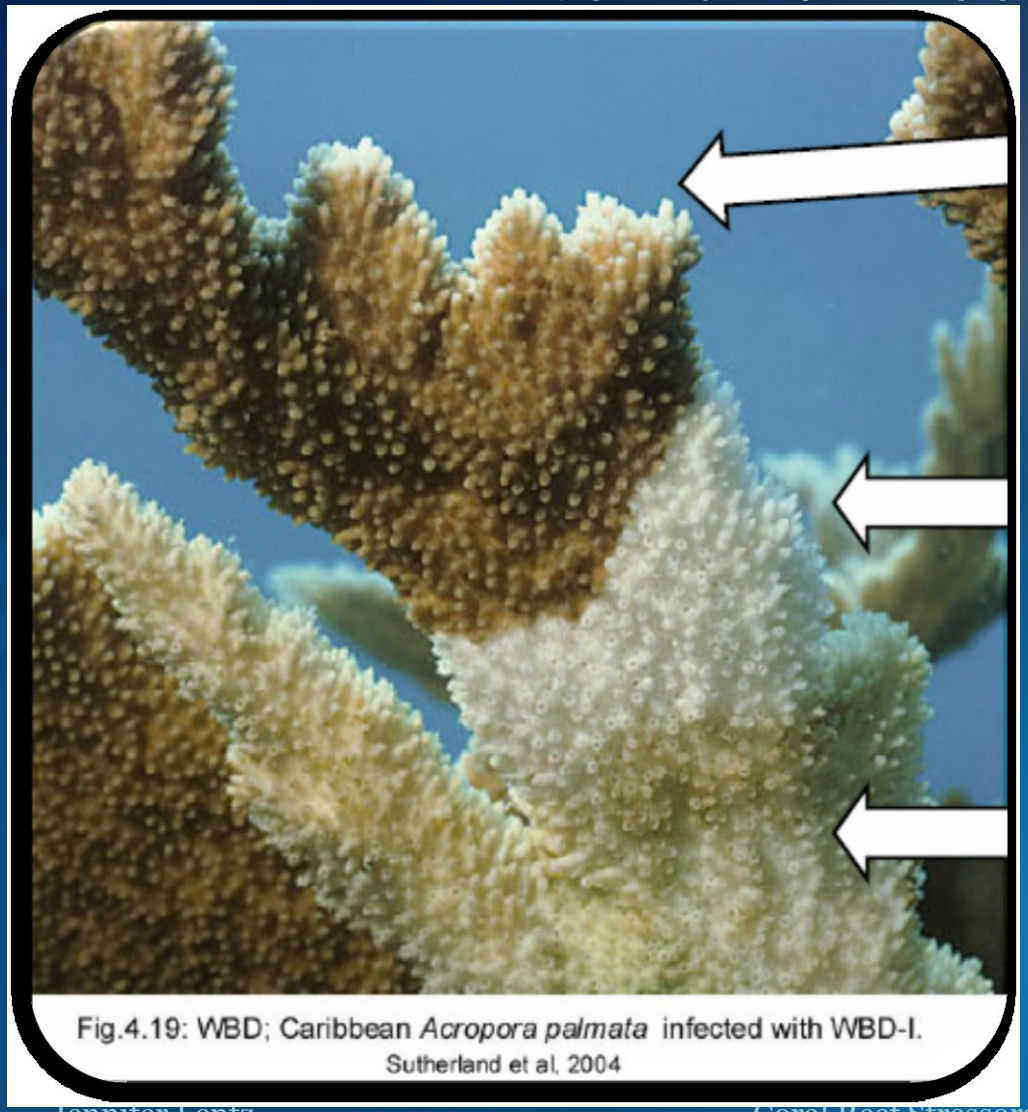


Fig.4.19: WBD; Caribbean *Acropora palmata* infected with WBD-I.
Sutherland et al. 2004

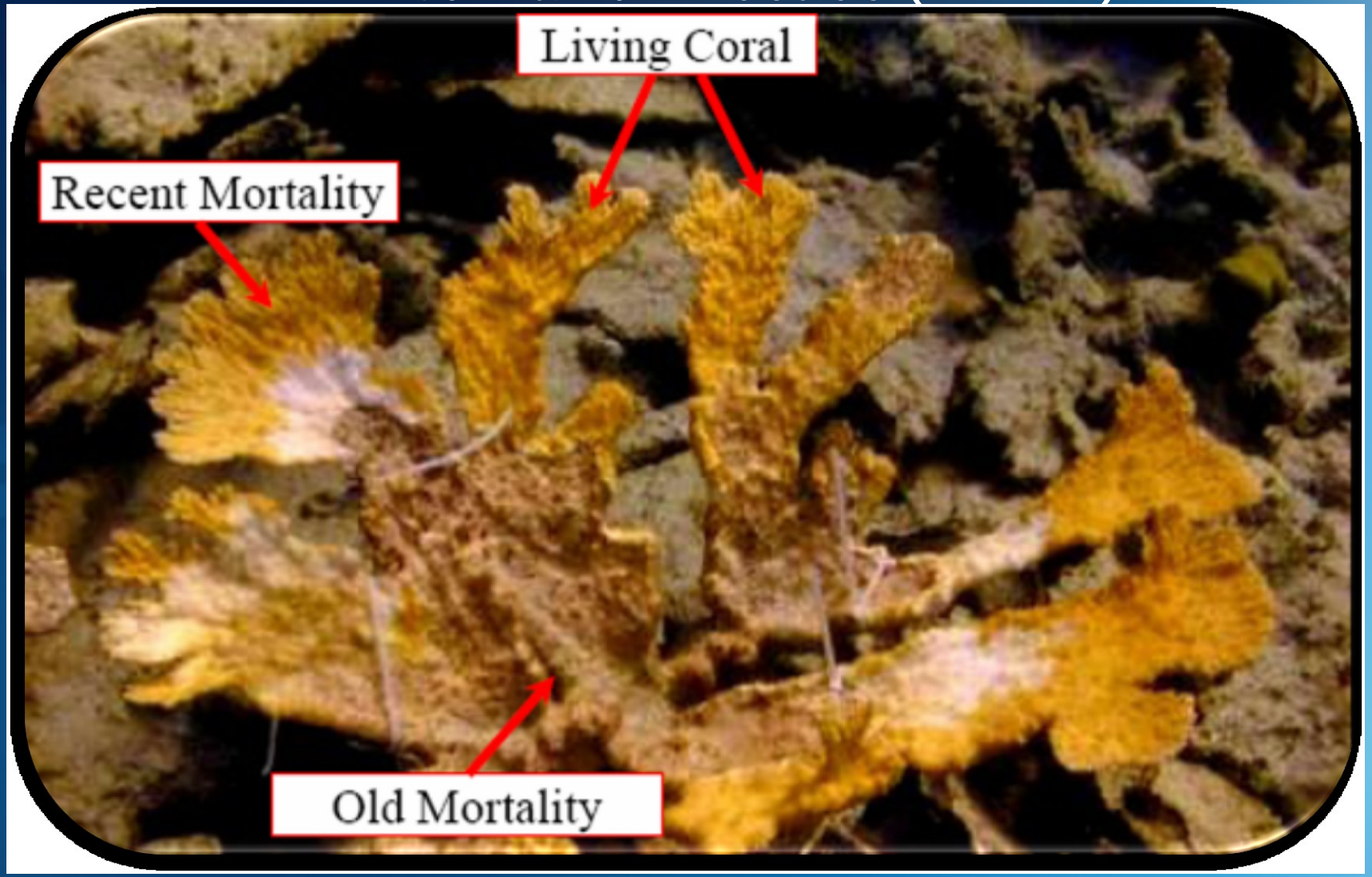
Healthy Tissue

Active WBD

Dead Tissue
killed recently by WBD

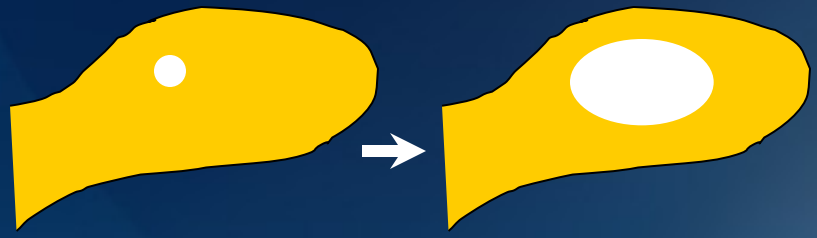
Coral Diseases

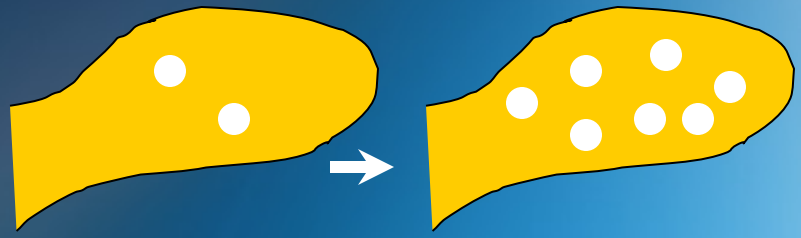
White Band Disease (WBD)



Coral Diseases

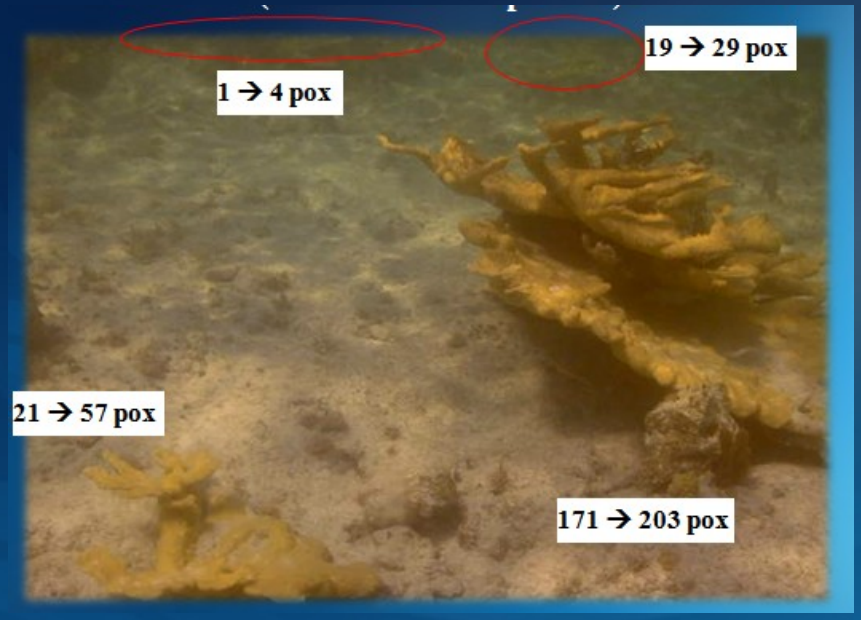
White Pox Disease (WPD)





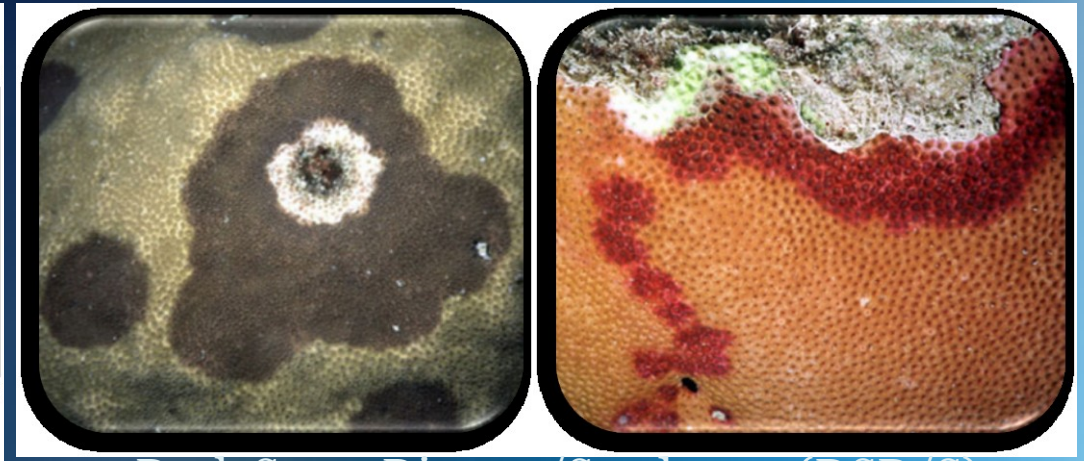
Coral Diseases

White Pox Disease (WPD)



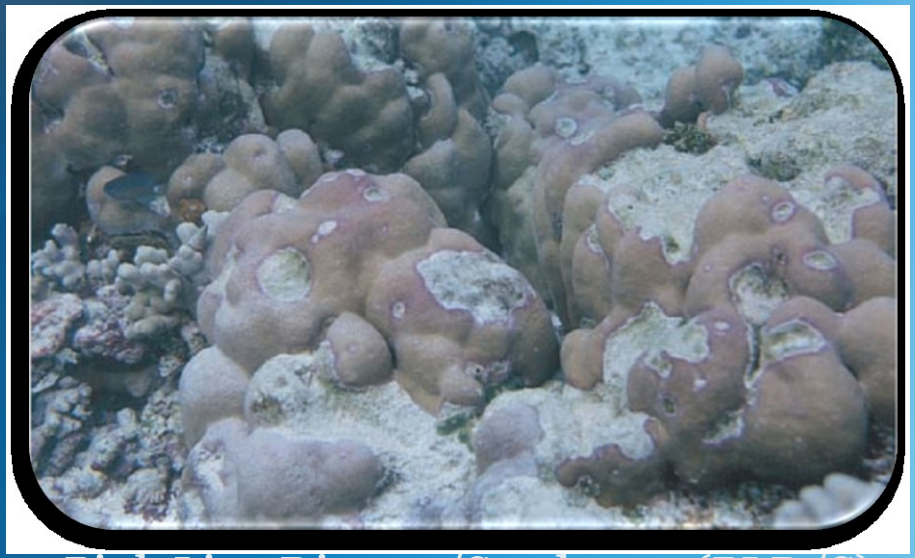
Coral Diseases

Coralline Lethal Disease (CLD)



Dark Spots Disease/Syndrome (DSD/S)

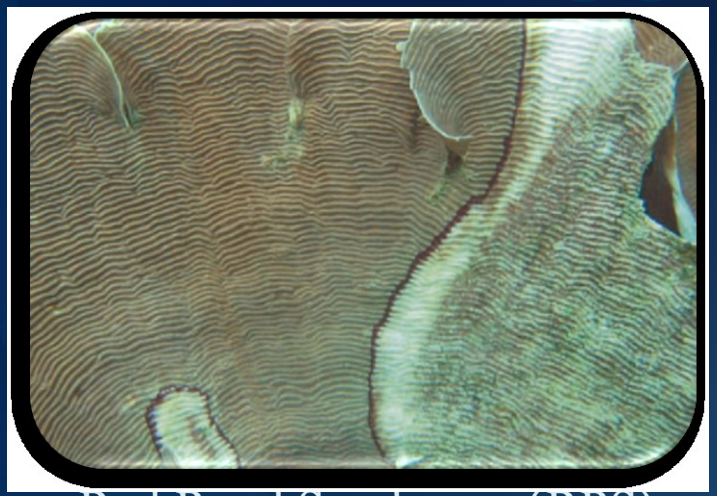
Coralline Lethal Orange Disease (CLOD)



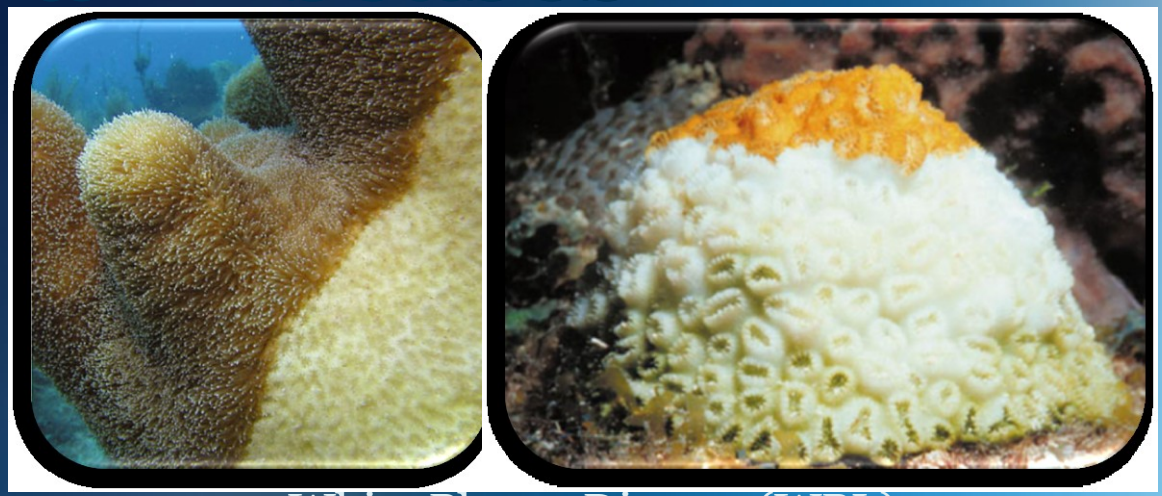
Pink Line Disease/Syndrome (PLD/S)

(Madl 2005; CLD: Fig. 4.7; CLOD Fig. 5.8; DSD/S: Fig. 4.9; PLD/S: Fig. 4.10)

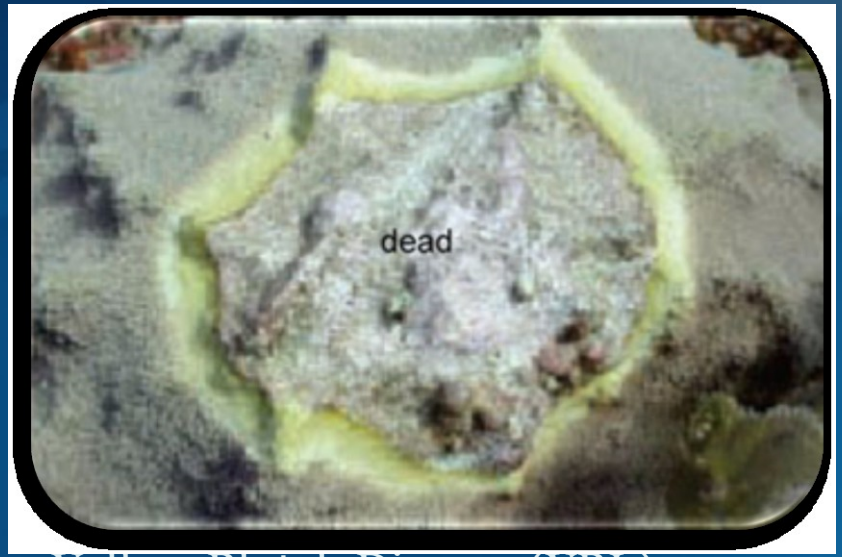
Coral Diseases



Red Band Syndrome (RBS)



White Plague Disease (WPL)



Yellow Blotch Disease (YBL)

Rapid Wasting Disease (RWD)

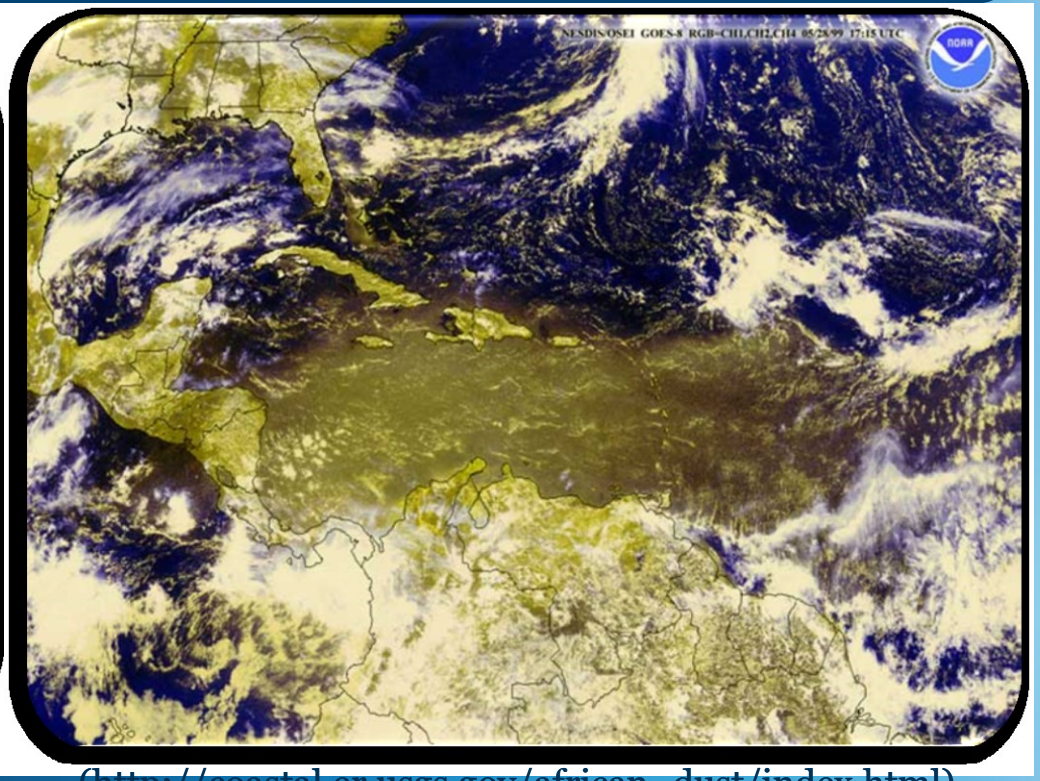
(Madl 2005; RBS: Fig. 4.11; WPL: Fig. 4.20-4.21; YBD: Fig. 4.23)

Coral Diseases

Aspergillosis (ASP)

- Caused by the terrestrial **fungus**, *Aspergillus sydowii*
- Causes irregularly shaped white crumbly patches on *Gorgonian* sea fans
- Visually identified by the **purple** line inbetween the diseased & healthy coral
- The fungus is carried from Africa to the Caribbean by the trade winds

(Madl 2005; Fig. 5.7a



(http://coastal.er.usgs.gov/african_dust/index.html)

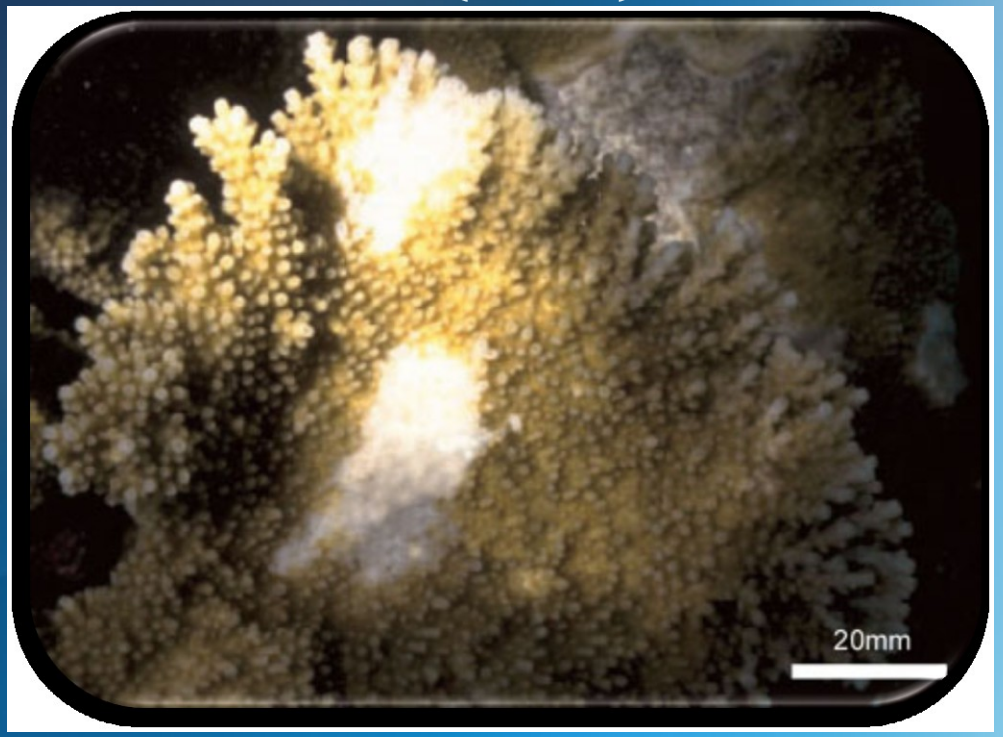
Importance of Coral Reefs

- Protection from **Wave Erosion**
- Mitigate **Hurricane Damage**
- Base of the **food chain**, providing habitat & protection
- Economic reasons – **Food/Tourism**
- Enhances **Quantity** & **Quality of Life**
- **Beauty**

Coral Diseases

White Band Disease
(WBD)

White Pox Disease
(WPX)



in the Caribbean WBD & WPD only affect the coral genus *Acropora*

(Madl 2005; WBD: Fig. 4.19; WPX: Fig. 4.22)

Current Status of Corals

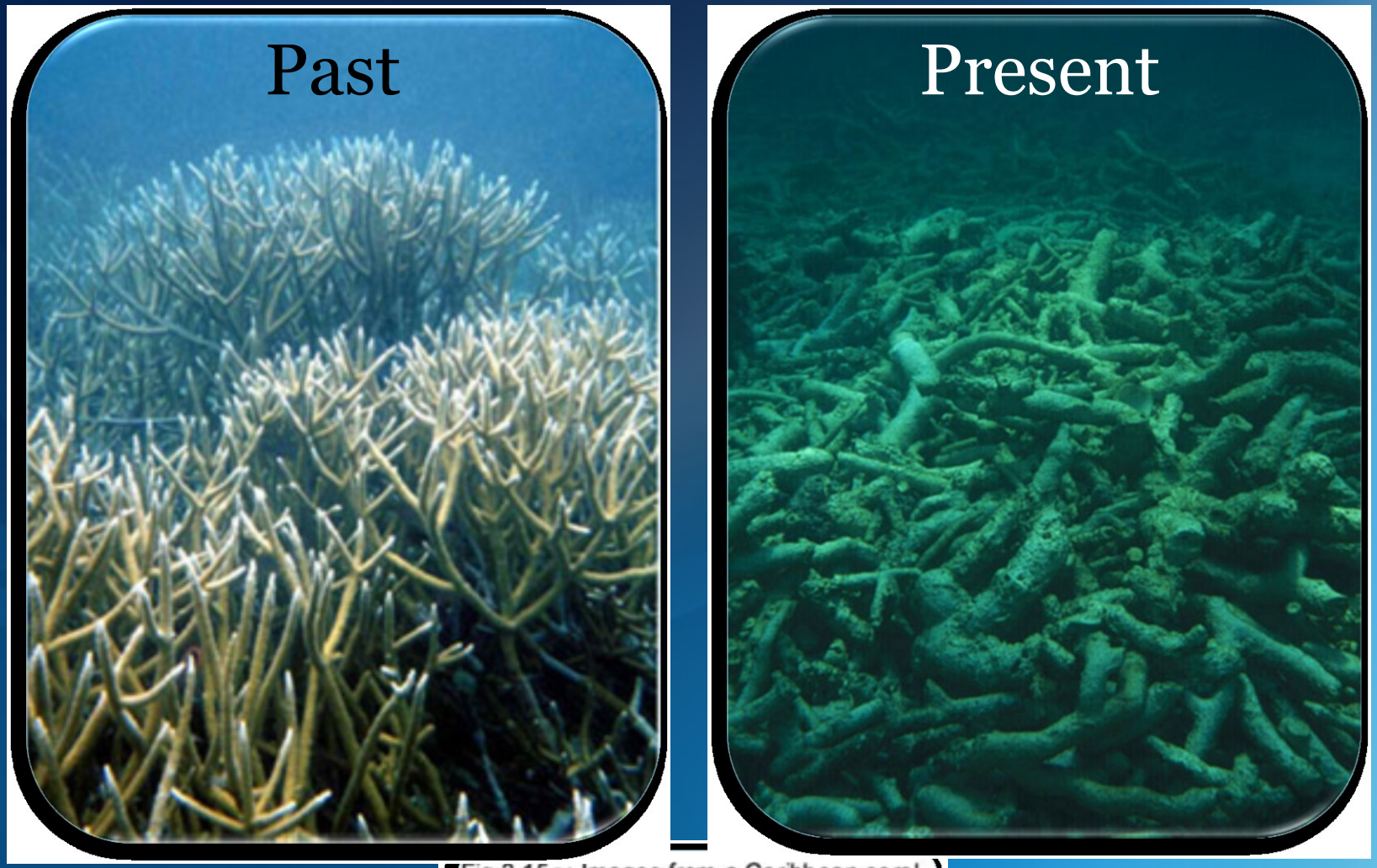


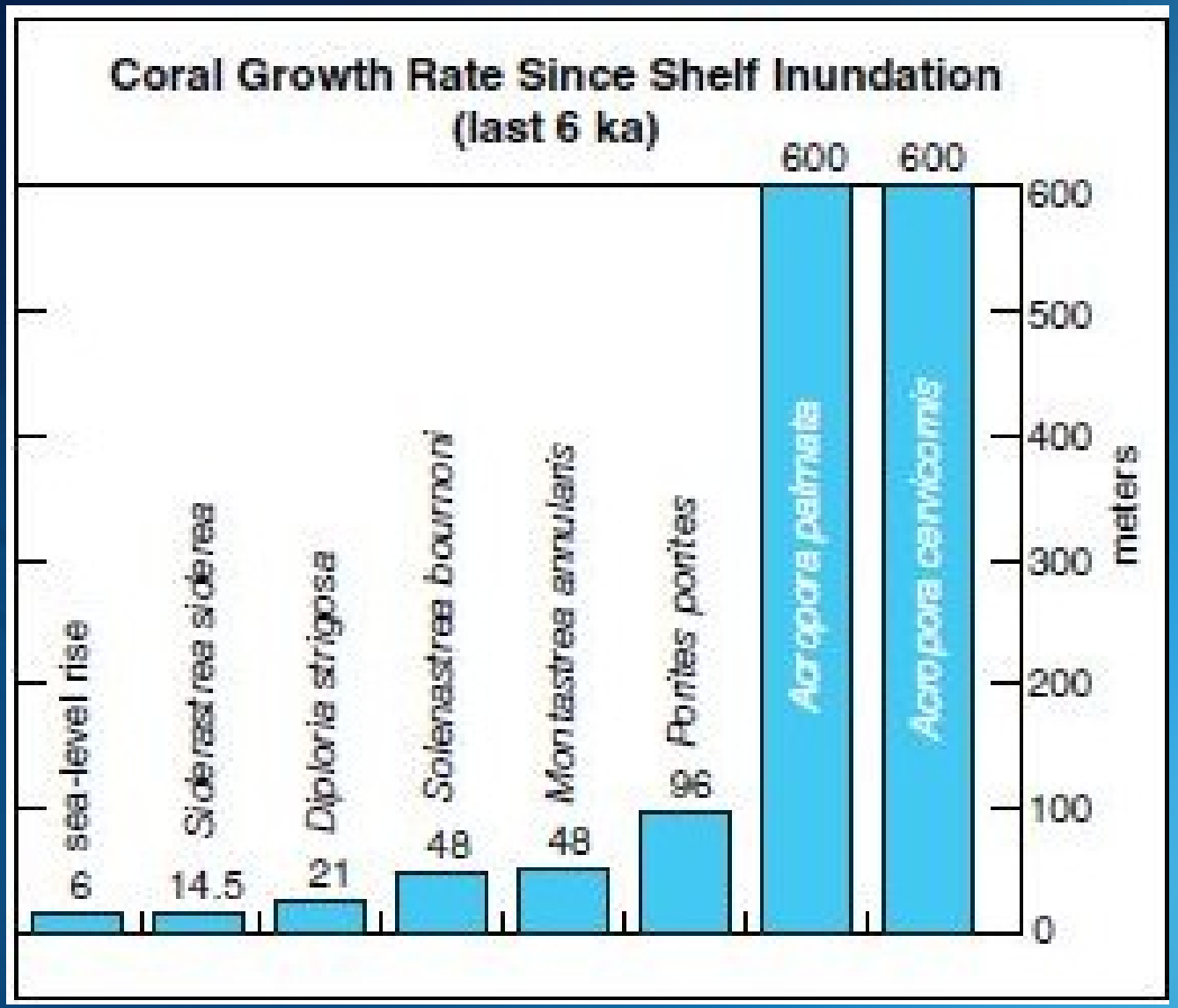
Fig.3.15a: Images from a Caribbean coral reef. Major storm events change a reef from a more or less intact community to one dominated by dead coral, algae and bioeroders.

(Madl 2005; Fig. 3.15a)

Current Status of Corals

(Jaap et al. 2008; ch. 3 in Riegl & Dodge 2008; Fig. 3.20, pg. 98)

Growth Rates of Different Corals



(Lidz et al. 2008; ch. 2 in Riegl & Dodge 2008; Fig. 2.19, pg. 36)

What can be done?

- Marine Reserves- preserve breeding stocks!
- No Anchoring
- Reduce stressors – pollution, sediment, cruise ships!
- Ban humans after bleaching events
- Seed reefs with fast growing *Acropora* spp.
- Re-introduce Diadema urchins
- Clean algae off dead corals to increase
- Create Artificial hard substrate for coral recruitment

Positive Note

Flower Garden Banks National Marine Sanctuary

- 110 miles from coast
- 66 ft-150 ft deep
- No anchoring
- No discharges
- Fishing by hook/line
- No take zone

- Reefs Healthy and
- provide breeding stock
- for Caribbean reefs
- Bathed in Loop Current
- Warm Eddy water

http://www.csmonitor.com/2007/0314/csmimg/p13b.gif

Window in the Waves: The Flower Garden Banks

10 minute Documentary Video

April 29th's Quiz

Question:

Name a coral disease

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