Linking land-based activity to the marine environment – health indicators

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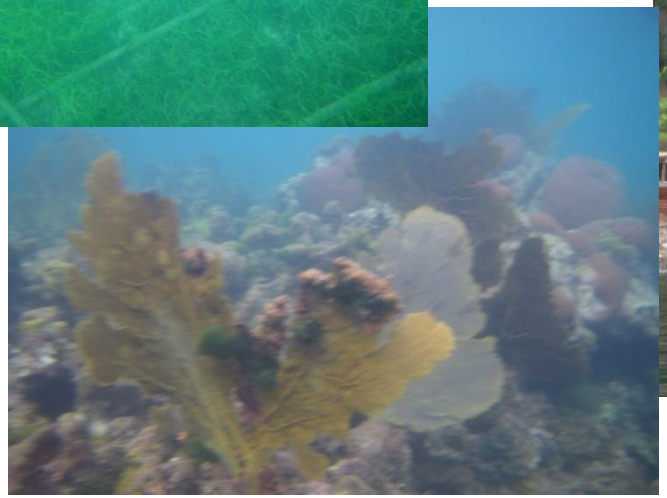
Close

Overview

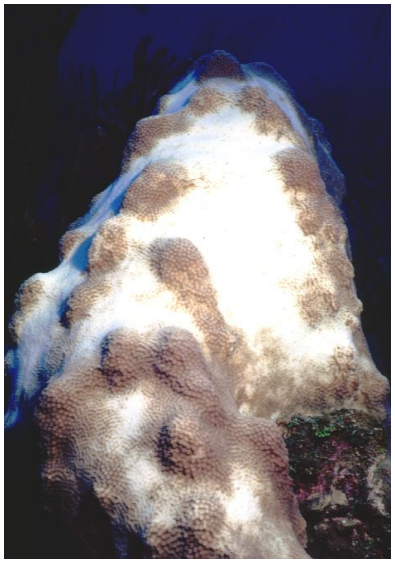
- Are St Lucia's coastal habitats healthy?
- What are the critical issues?
  - Global
  - Regional
  - National
  - Local
- Using bioindicators
- Linking indicators to watershed management

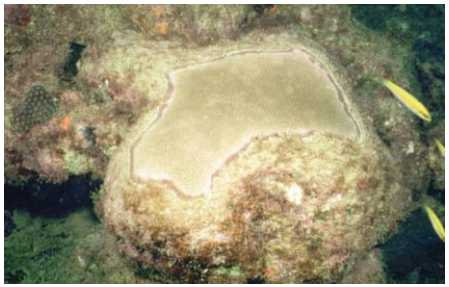
Are St Lucia's coastal habitats healthy?

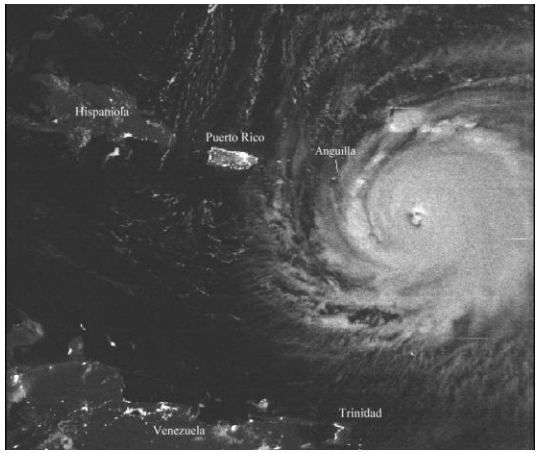


Critical issues - GLOBAL

- Climate change and ocean acidification impacts:
  - Mass coral bleaching e.g. 2005 Caribbean event
  - Increased coral disease prevalence
  - Increased storm frequency and severity







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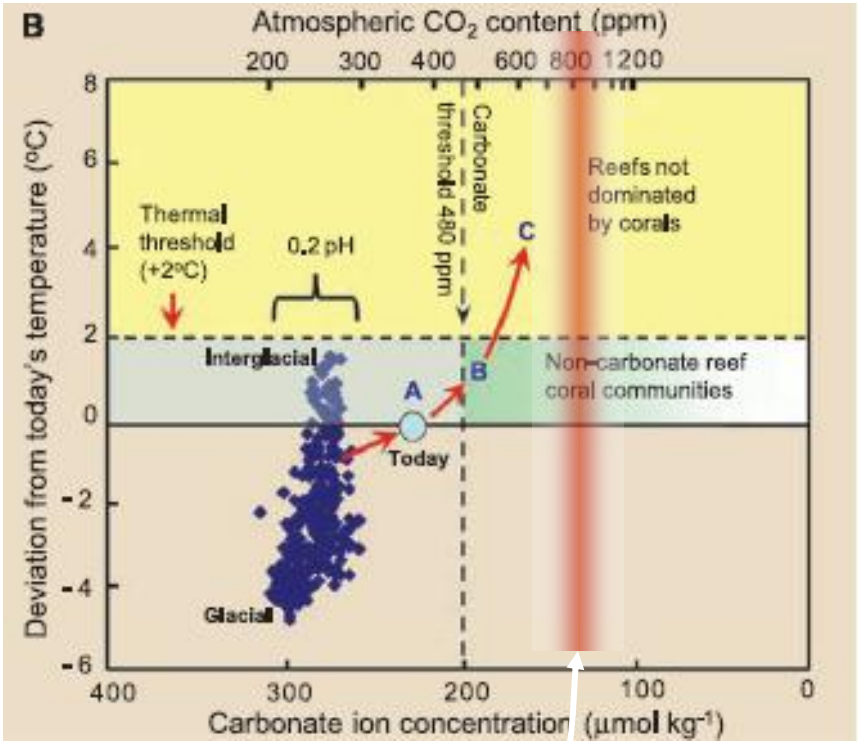
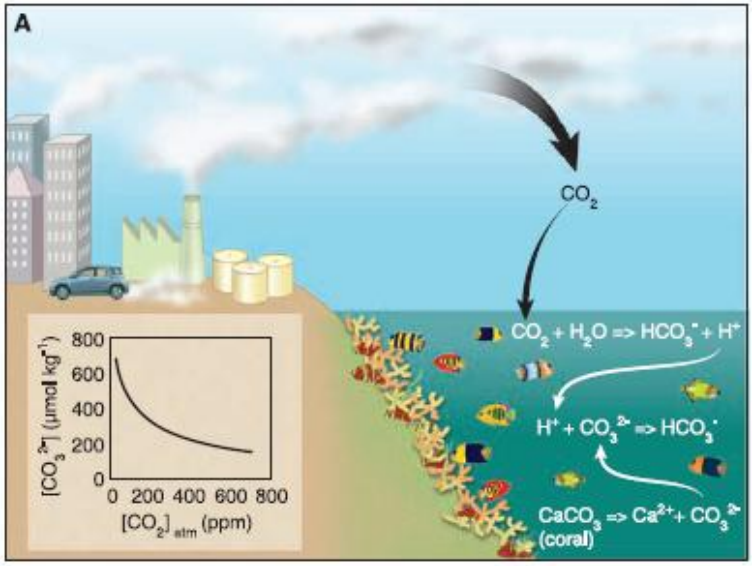
Hoegh-Guldberg et al. (2007) Coral reefs under rapid climate change and ocean acidification. *Science* **318:**1737-1742.

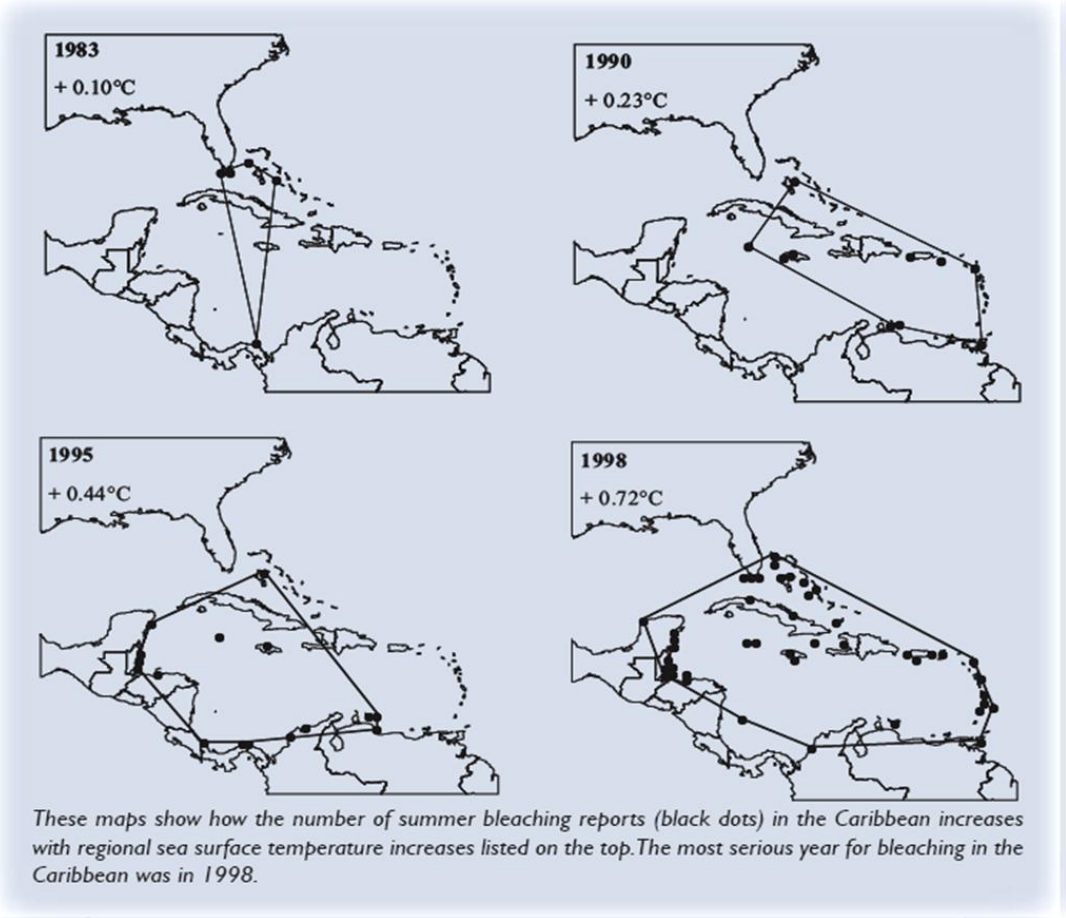




Temperature deviations and carbonate saturation in the oceans for the past 420,000 years

IPCC low- and high-emission scenarios are 550 and 800 ppm CO_2 by 2100

Bleaching reflects temperature anomalies



These maps show how the number of summer bleaching reports (black dots) in the Caribbean increases with regional sea surface temperature increases listed on the top. The most serious year for bleaching in the Caribbean was in 1998.

Source: Status of Coral Reefs of the World: 2004 (Ed. Wilkinson C)

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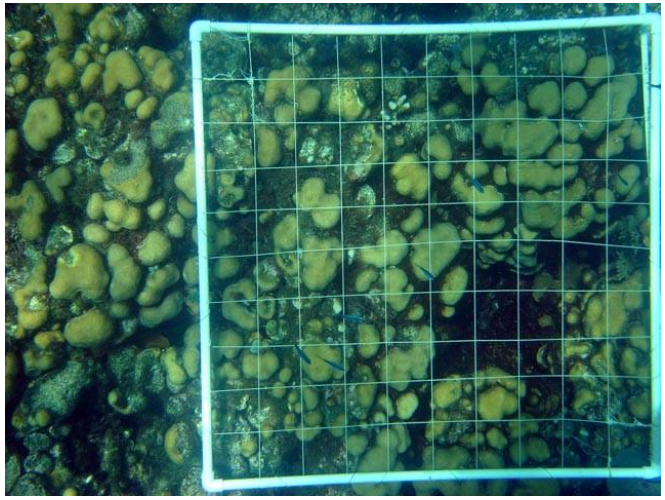
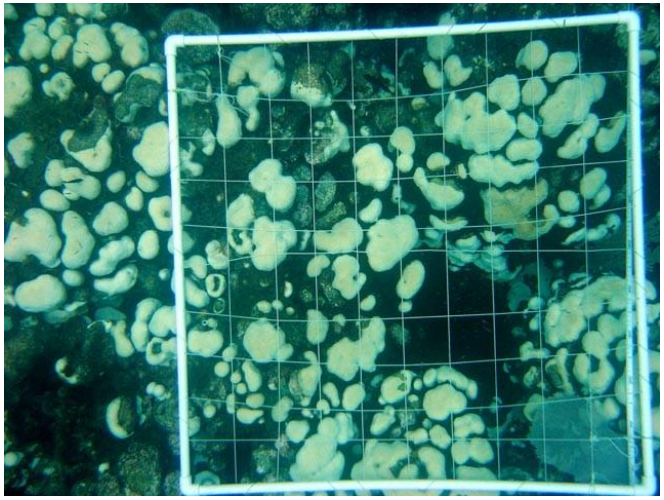
CORAL BLEACHING AND MORTALITY

St John, USVI 2005 (Jeff Miller & Caroline Rogers USGS)

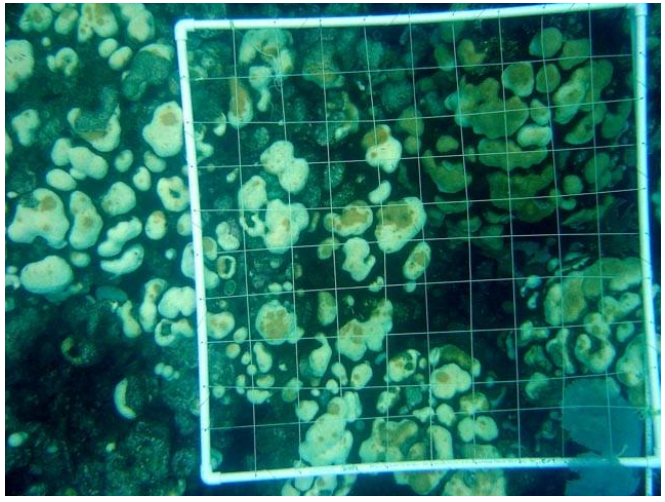
August pre-bleaching



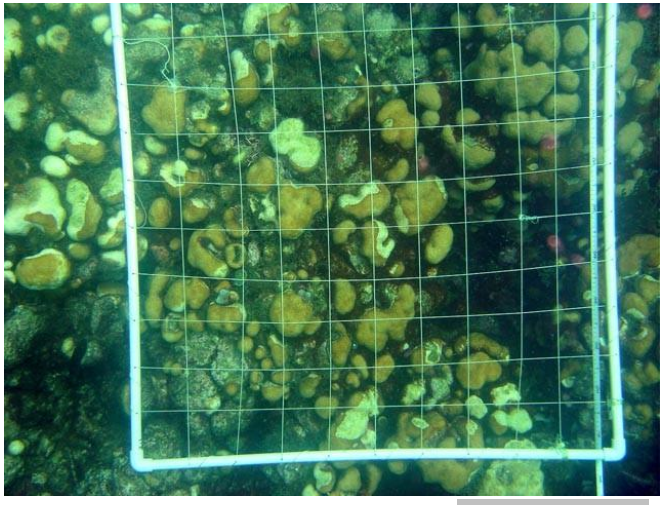
September - full bleaching



October - partial recovery

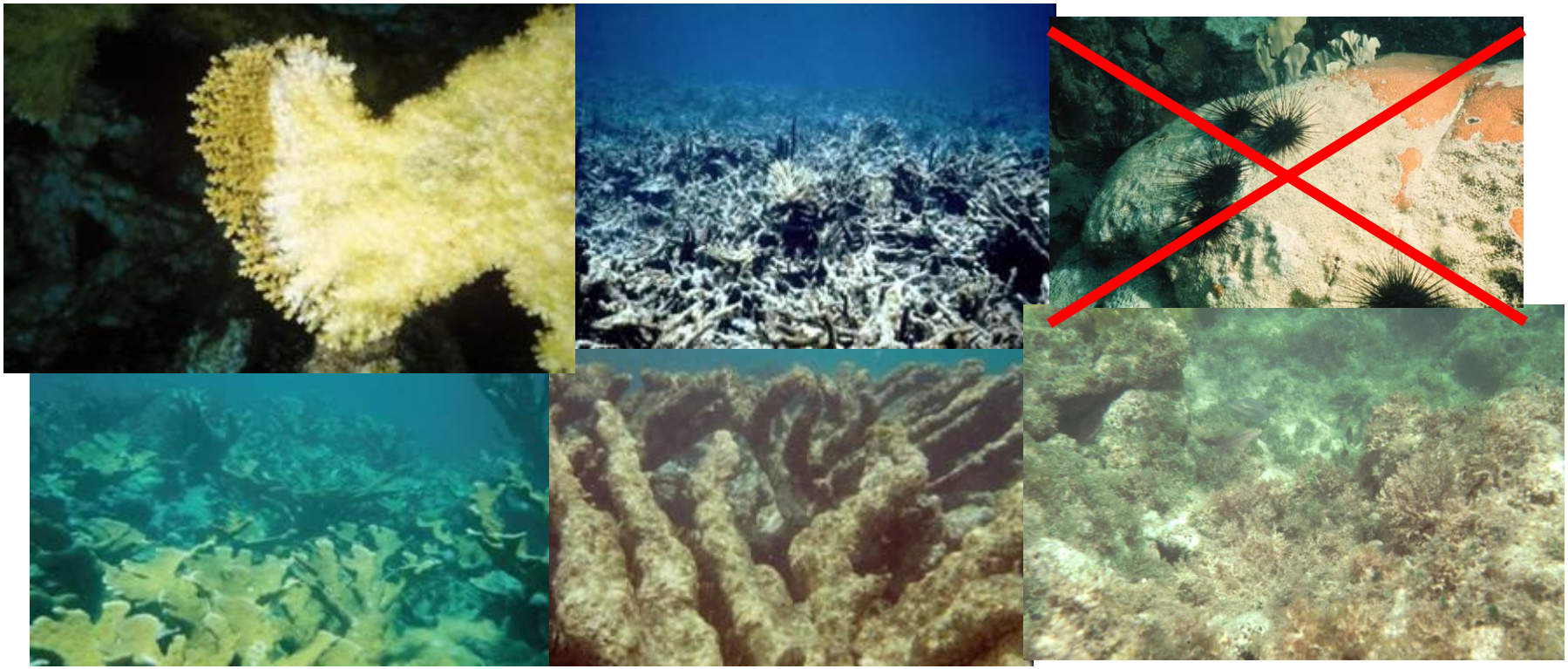


November – plague epizootic

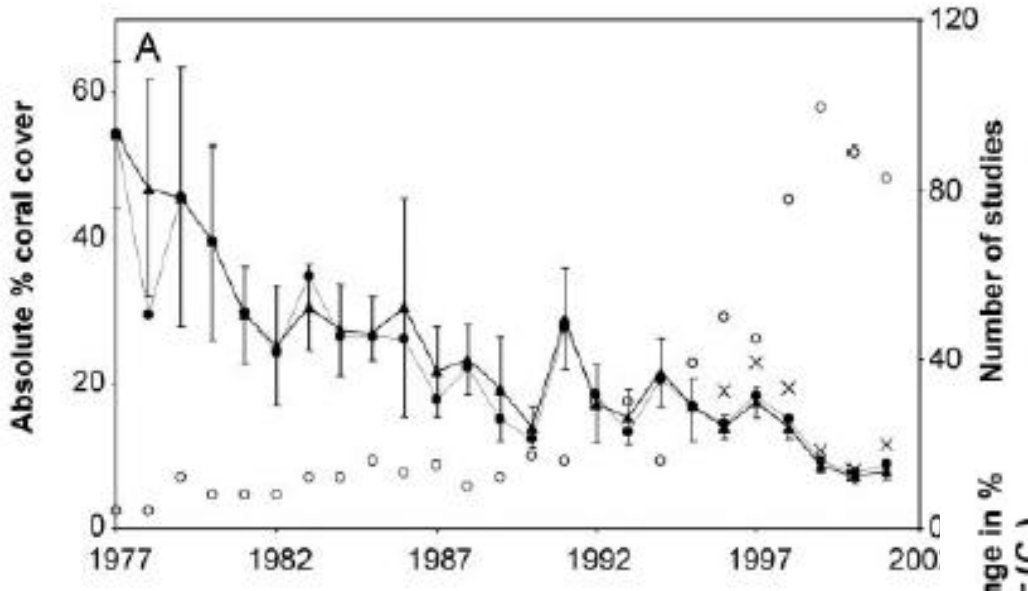


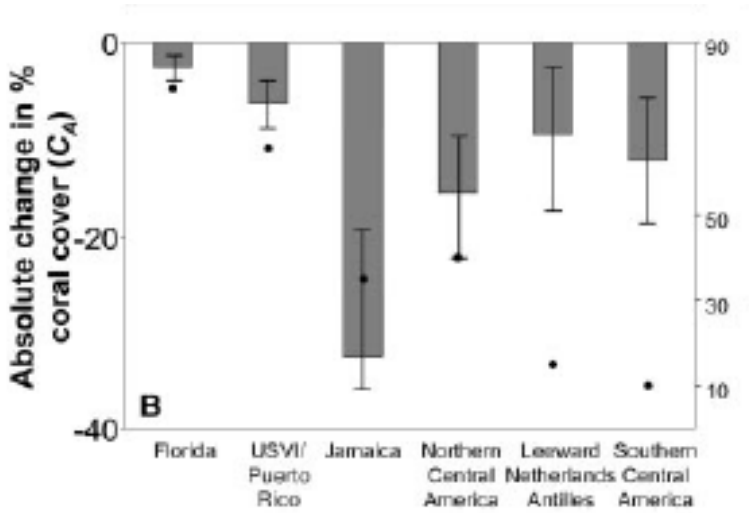
Critical issues - REGIONAL

- The loss of staghorn and elkhorn coral to disease (1970s)
- Loss of spiny sea urchin *Diadema* to disease (1983-4)

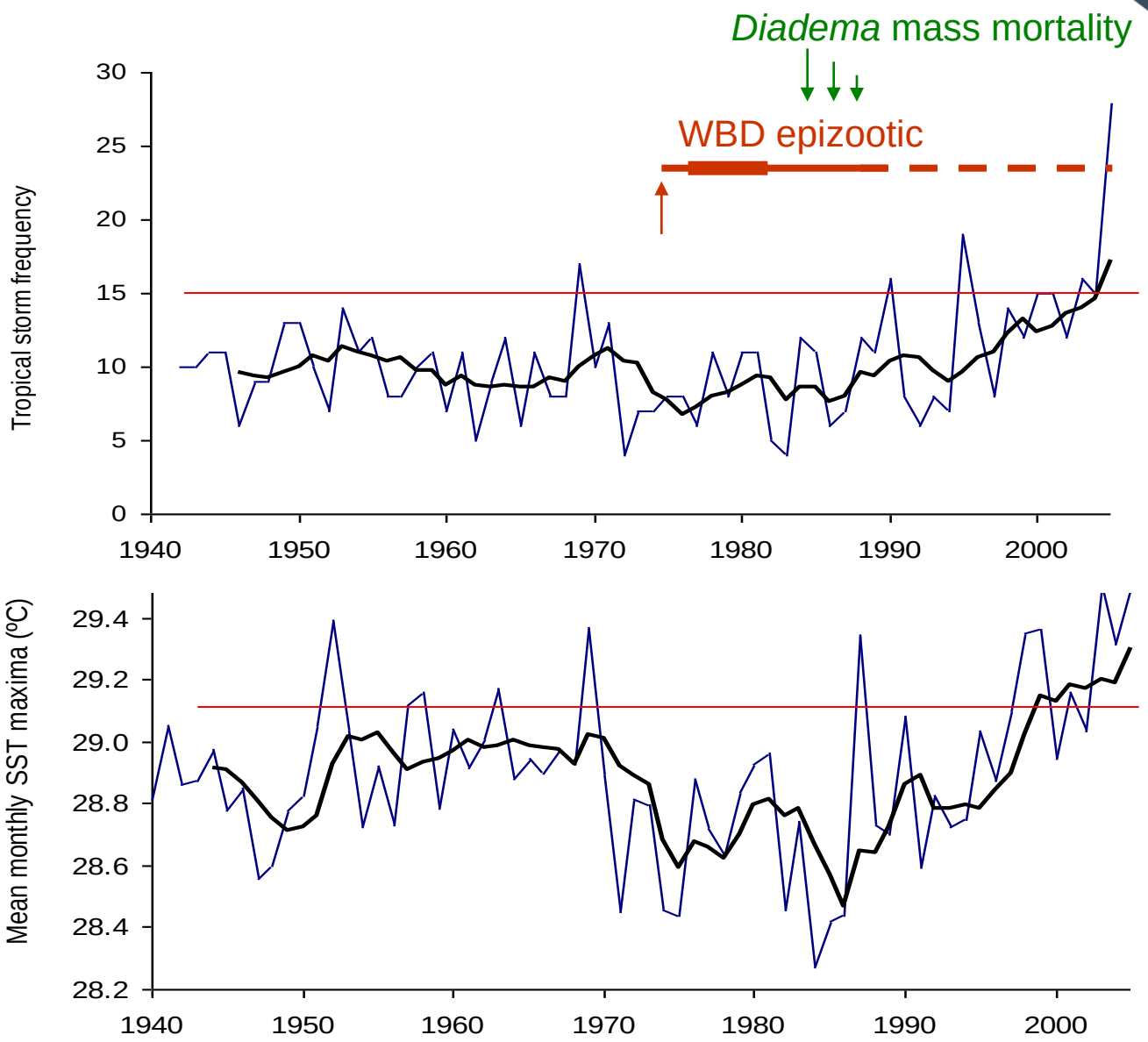


Critical issues - REGIONAL

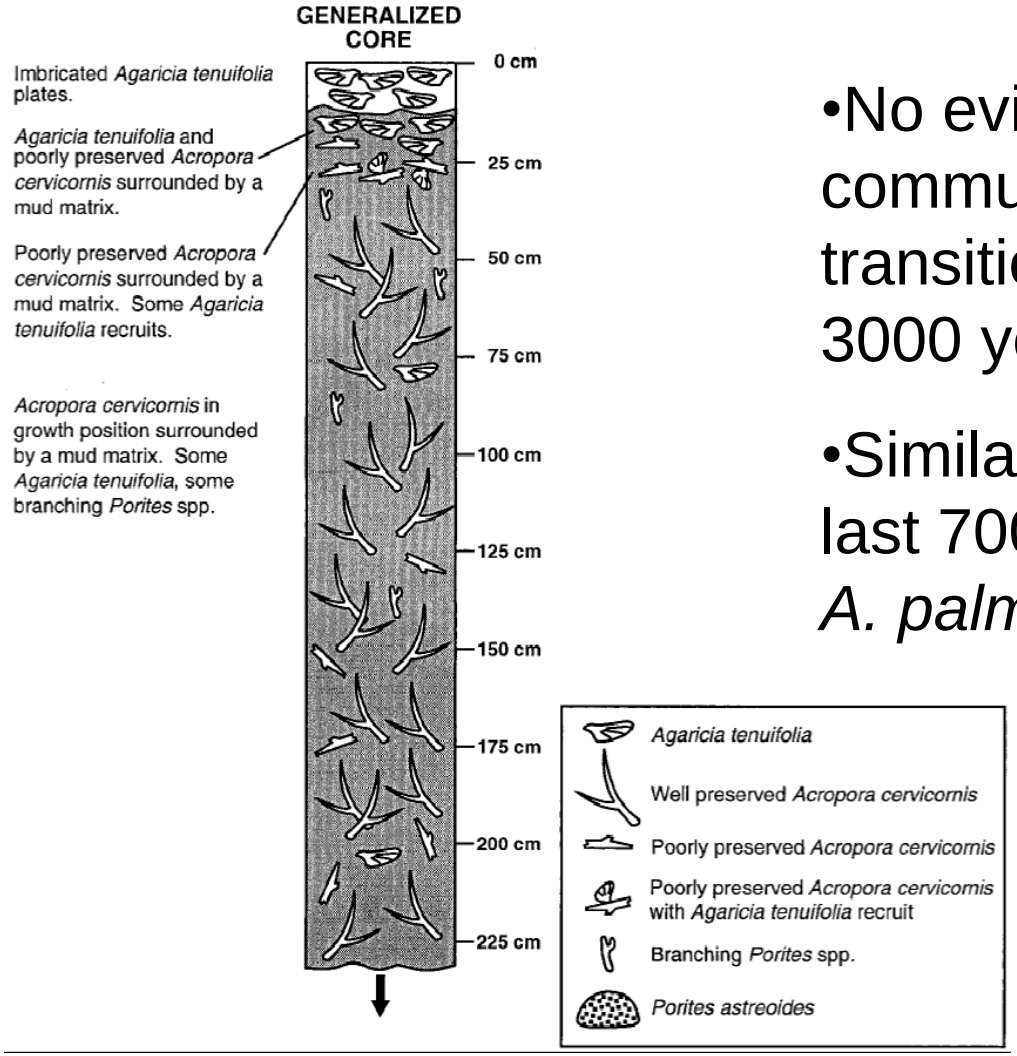




Source: Gardner TA et al. (2003) *Science* **301:**958-960


Diadema mass mortality
WBD epizootic
Tropical storm frequency
30
25
20
15
10
5
0
1940
1950
1960
1970
1980
1990
2000
Mean monthly SST maxima (ºC)
29.4
29.2
29.0
28.8
28.6
28.4
28.2
1940
1950
1960
1970
1980
1990
2000

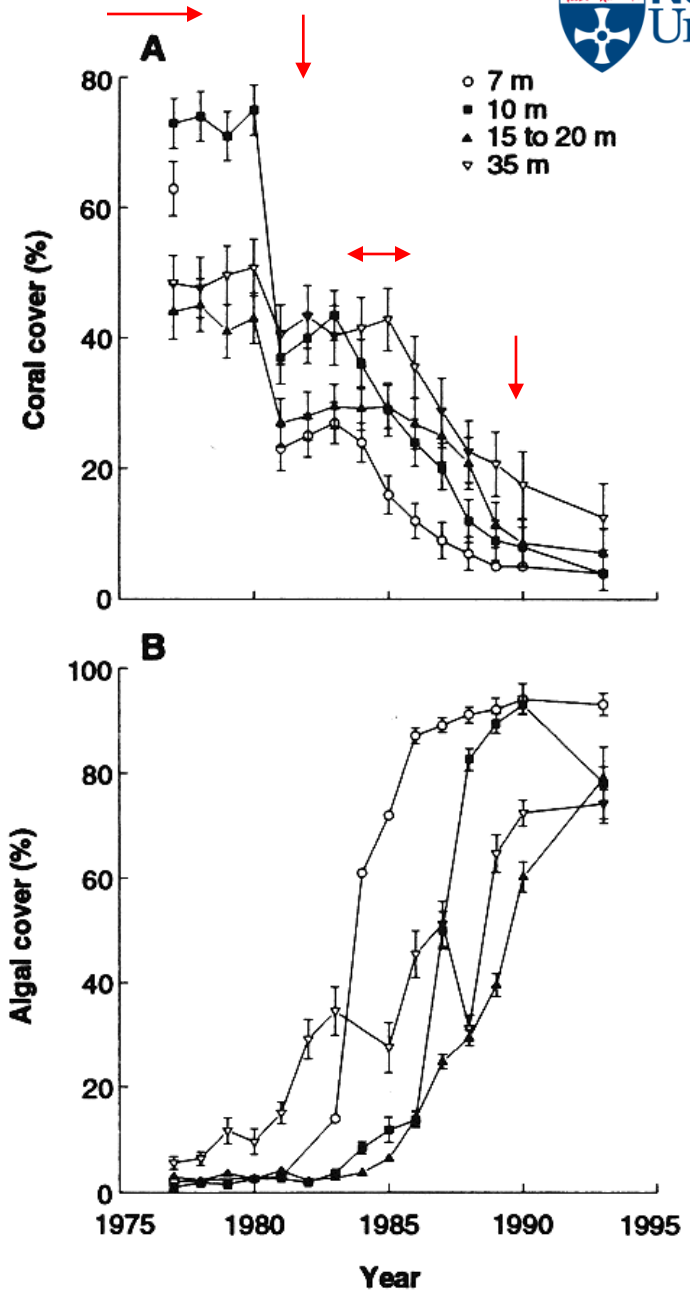
What about the geologic record?



- No evidence of community transitions in last 3000 years
- Similar data for last 7000 years for *A. palmata*

"The implication is that WBD is an emergent disease of *Acropora*"

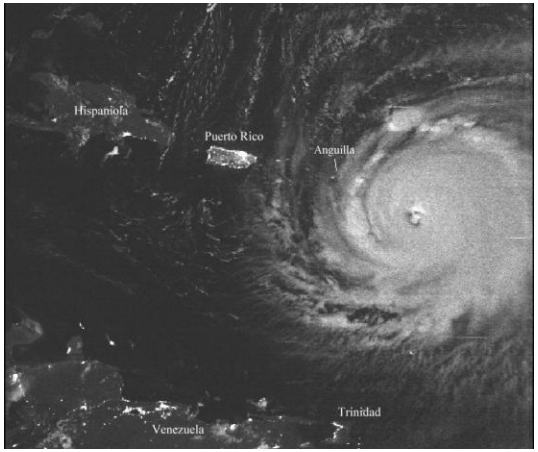
Aronson RB, Precht WF (2001) *Hydrobiologia* **460:**25-38



- Overfishing since 1960s
- Initial impact of Hurricane Allen (1980)
- Regional *Diadema* die-off (1983-84)
- Hurricane Gilbert (1988)

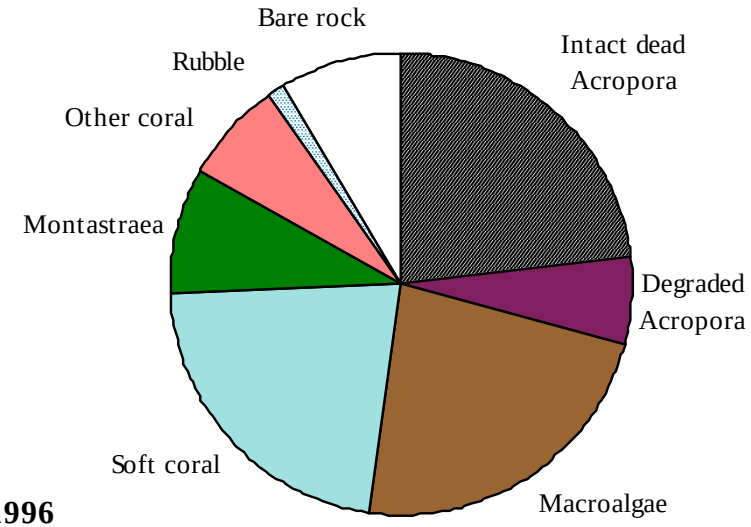
Source: Hughes TP (1994) *Science* **265:**1547-1551

Reef habitat types, Anguilla, 1994-96

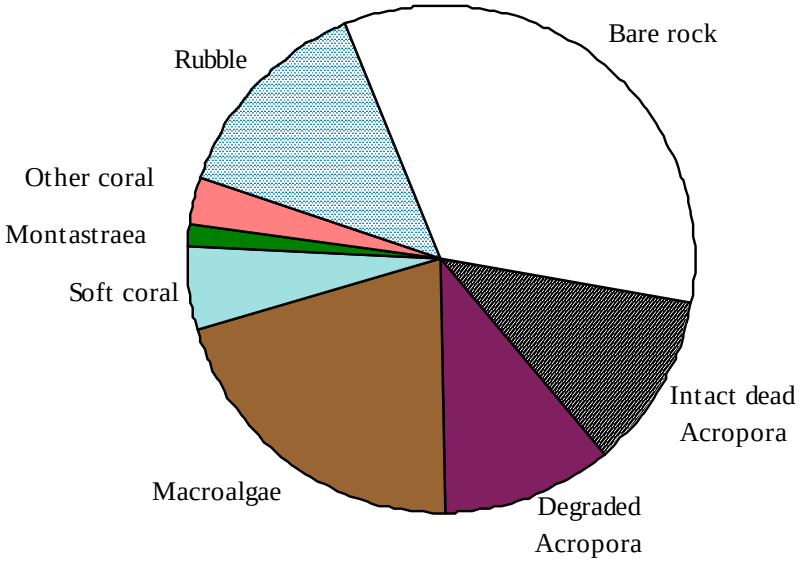


Hurricane Luis (1995)

1994

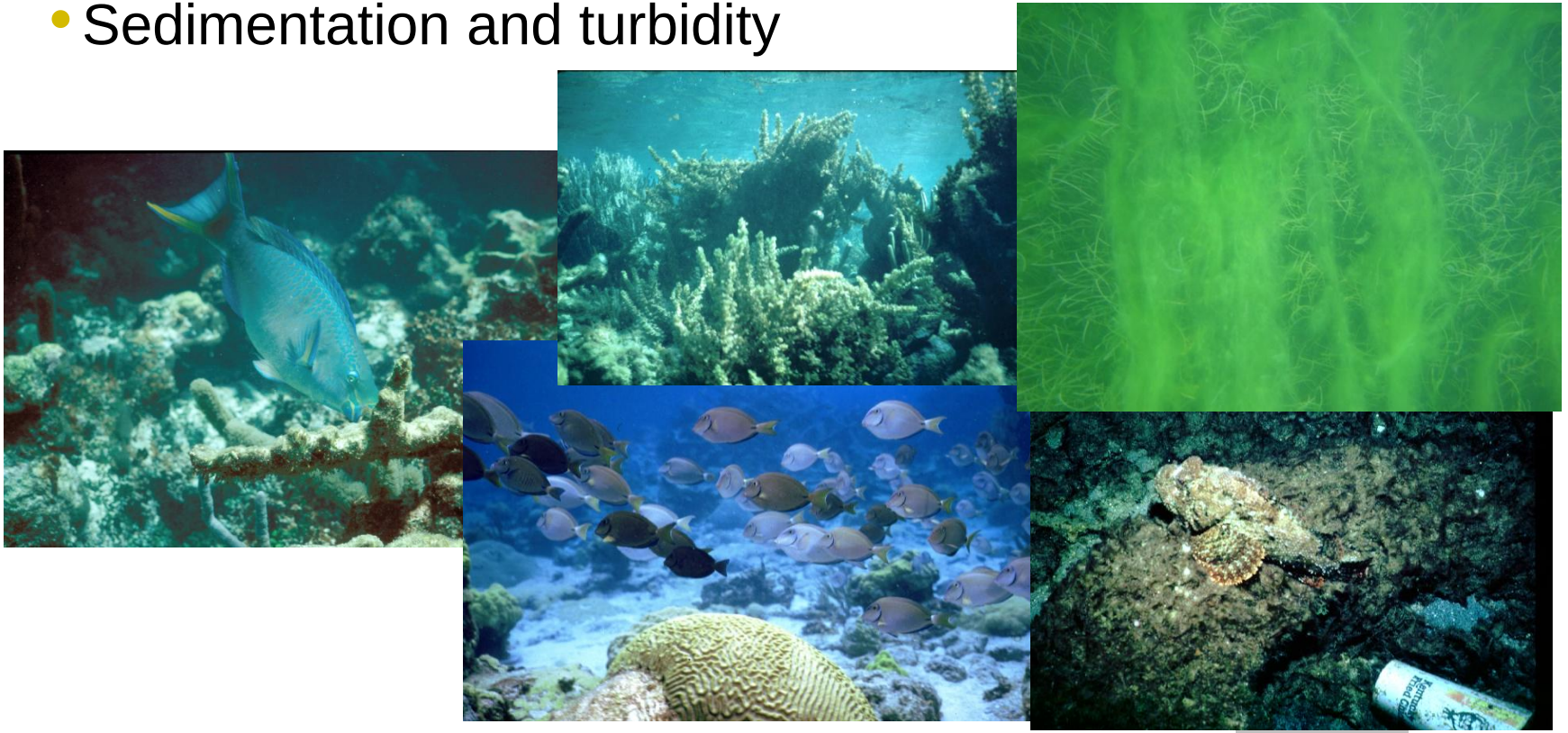


1996

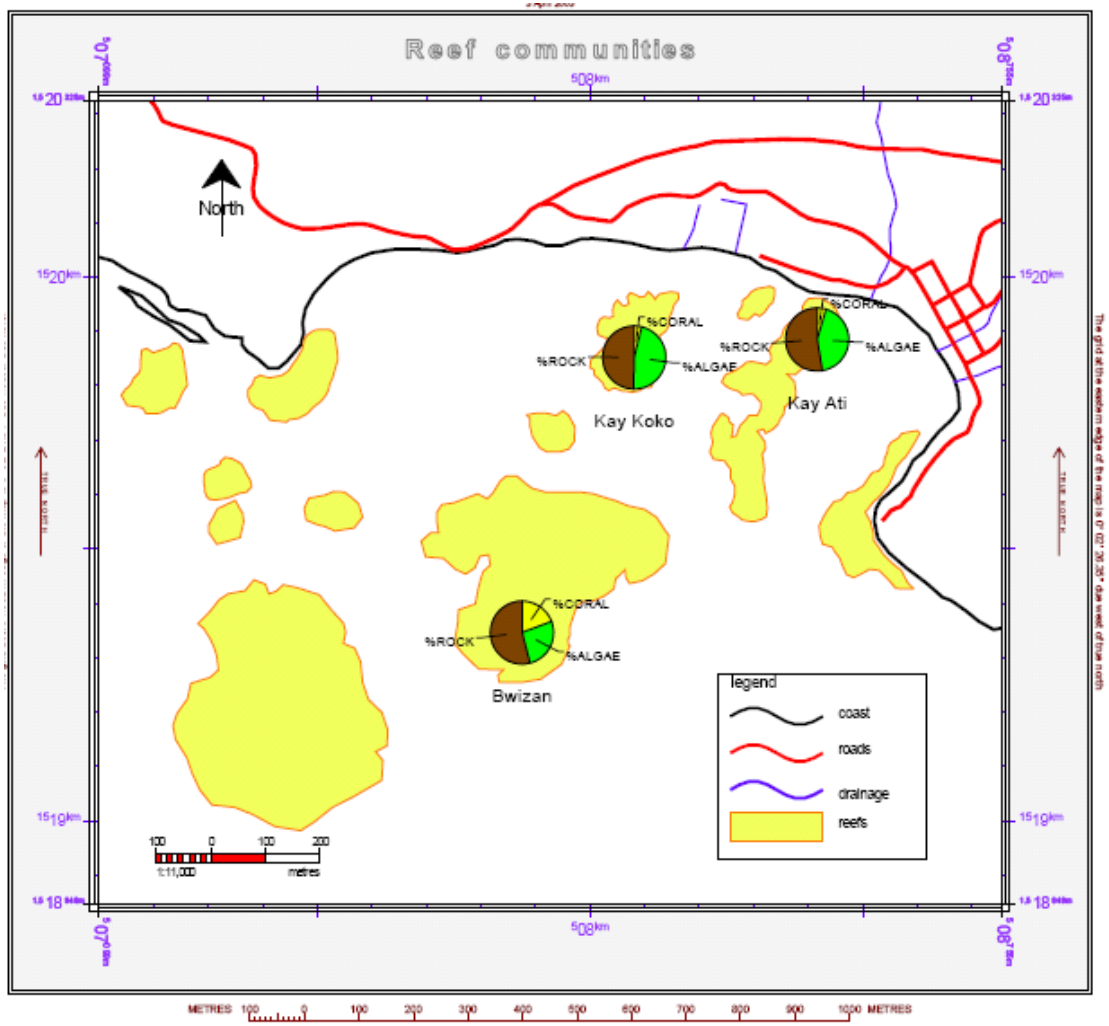


Critical issues – NATIONAL and LOCAL

- Overexploitation (e.g. loss of grazers)
- Water quality deterioration (eutrophication)
- Sedimentation and turbidity



St Lucia shows typical Caribbean status



Source:
CANARI (2003)

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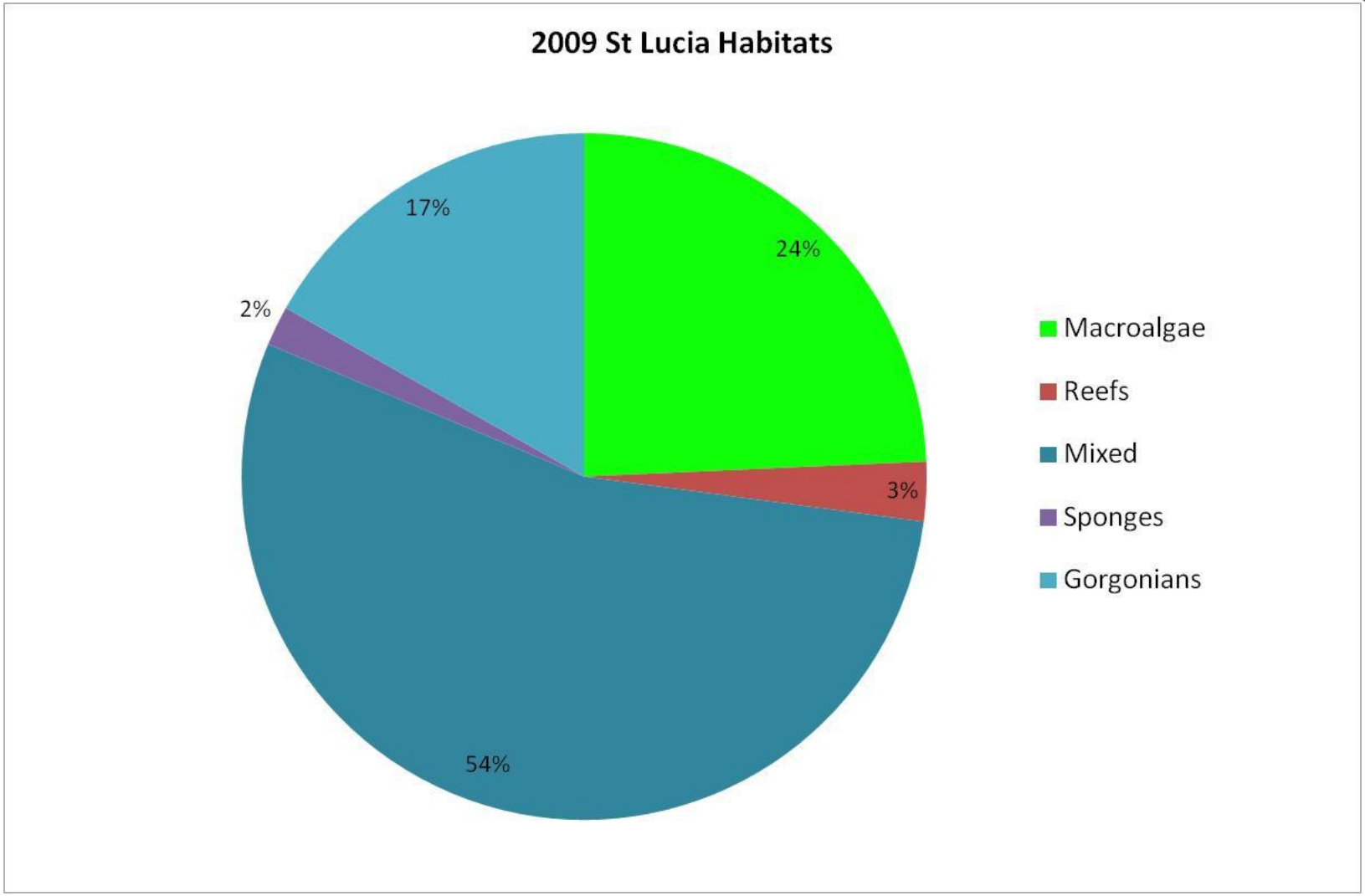
Headline News!


2009 St Lucia Habitats
17%
24%
2%
3%
54%
Macroalgae
Reefs
Mixed
Sponges
Gorgonians

Overview

- Are St Lucia's coastal habitats healthy?
- What are the critical issues?
  - Global
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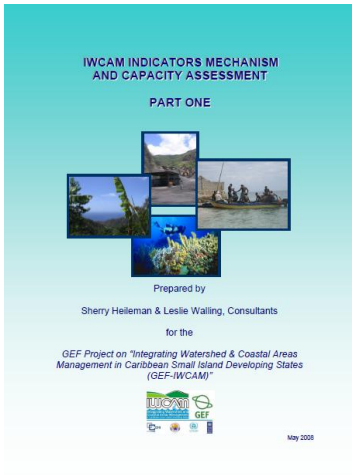
  - Local
- Using bioindicators
- Linking indicators to watershed management

Why bioindicators?



Indicators (IOC definition):

Quantitative/qualitative statements or measured/observed data that can be used to describe *existing situations* (state) and measure *changes or trends* (process) over time.

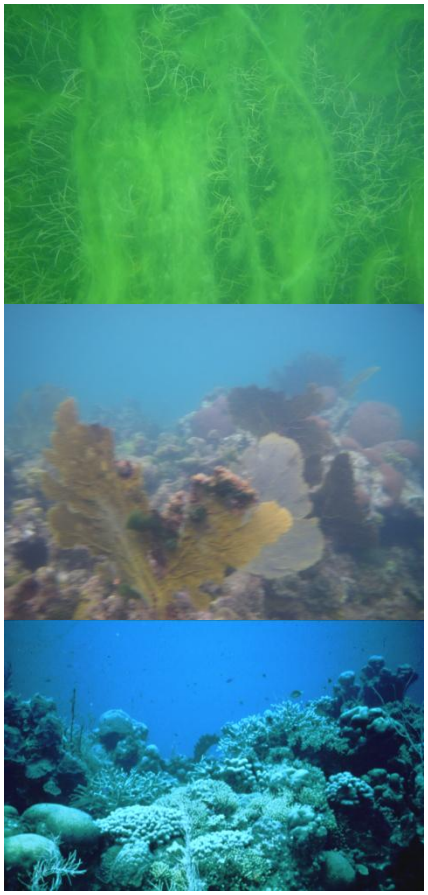
Bioindicators are low cost, quick, effective options in comparison with comprehensive analysis of biological, physical and chemical analyses to assess ecosystem 'health'.

Why bioindicators?

- Provide a decision-making tool for planning and management to reduce risks and costs;
- Early identification of risk or emergency (early warning systems) to allow for prompt responses;
- Impact (positive or negative) identification to allow corrective or mitigating actions;
- Measure the level of performance in the achievement of spcific objectives, policy success, process efficiency or the quality of a system;
- Compare the state of a system or the results achieved in time (e.g. from one year to the other) or in space (e.g. between one watershed and another);
- Communicate and convey information in an effective way

Using bioindicators

- Some examples of indicators from video field survey:



Green algal cover as an indicator of nutrient inputs (process)

Disease and damage as an indicator of water quality (process)

Coral cover as an indicator of reef health (state)

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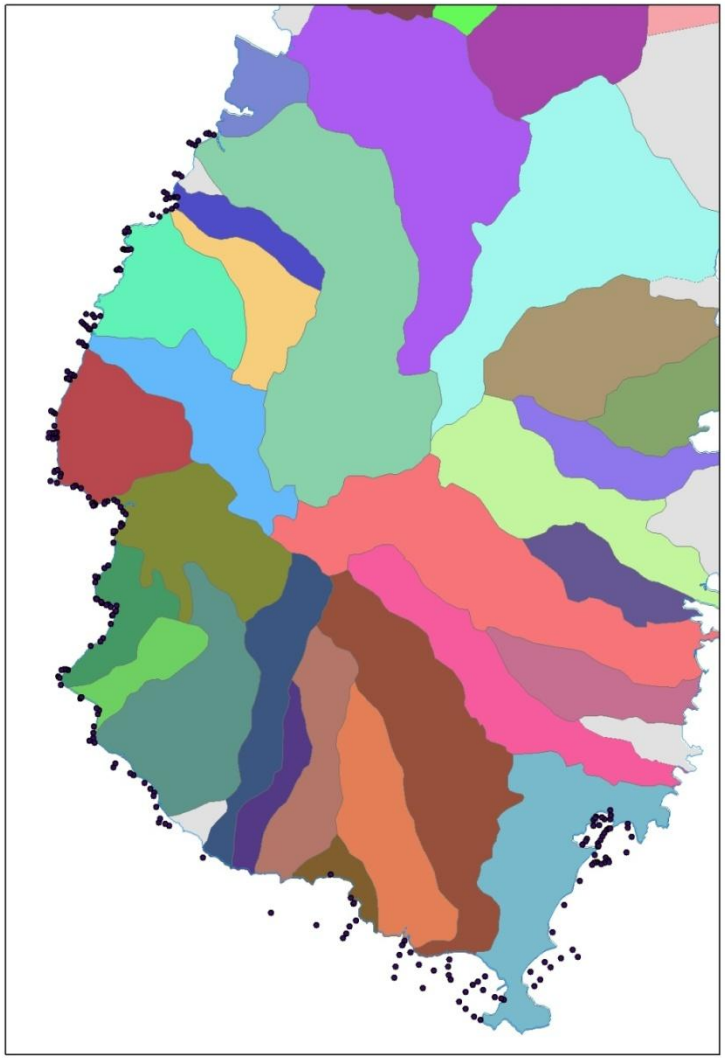
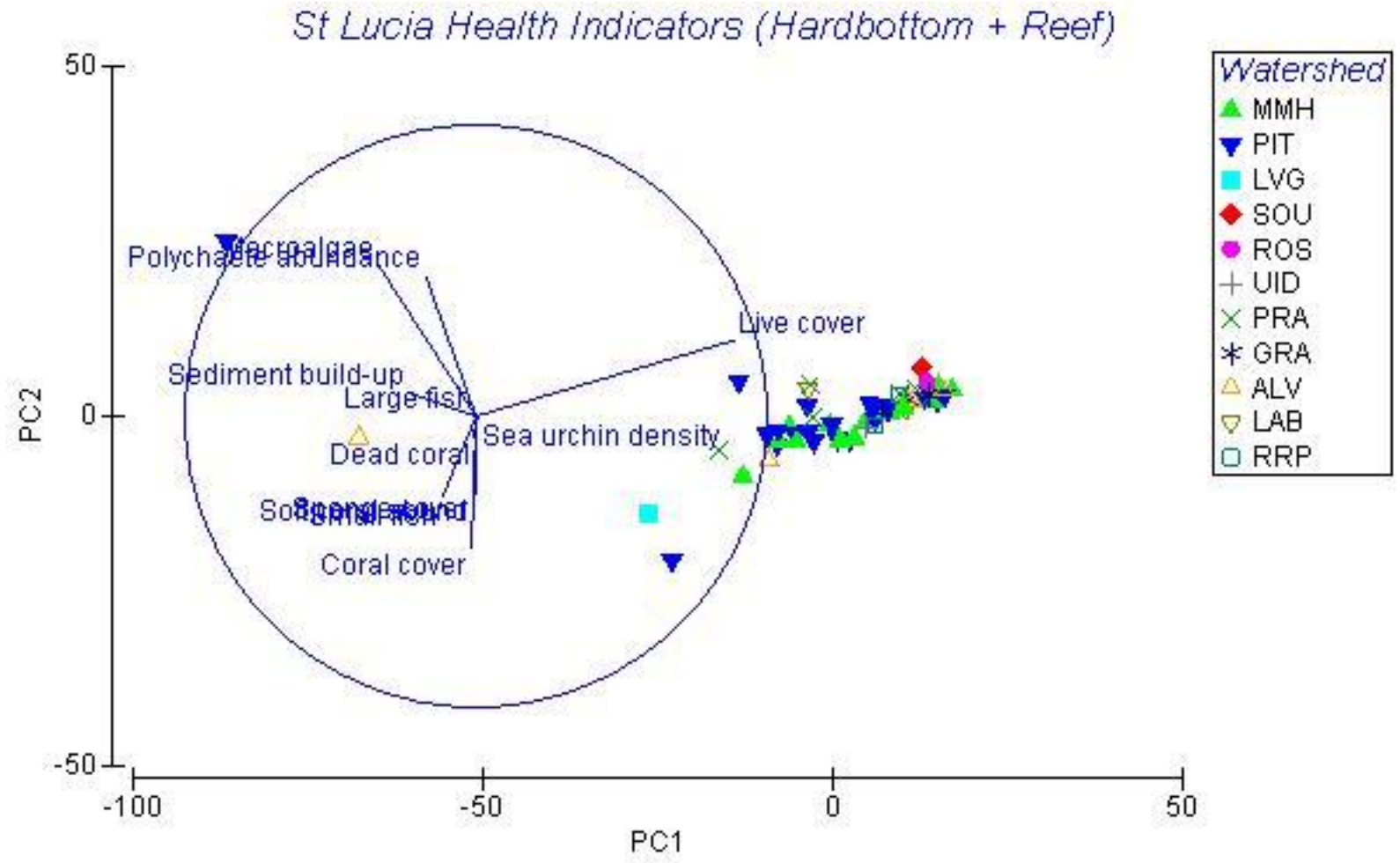
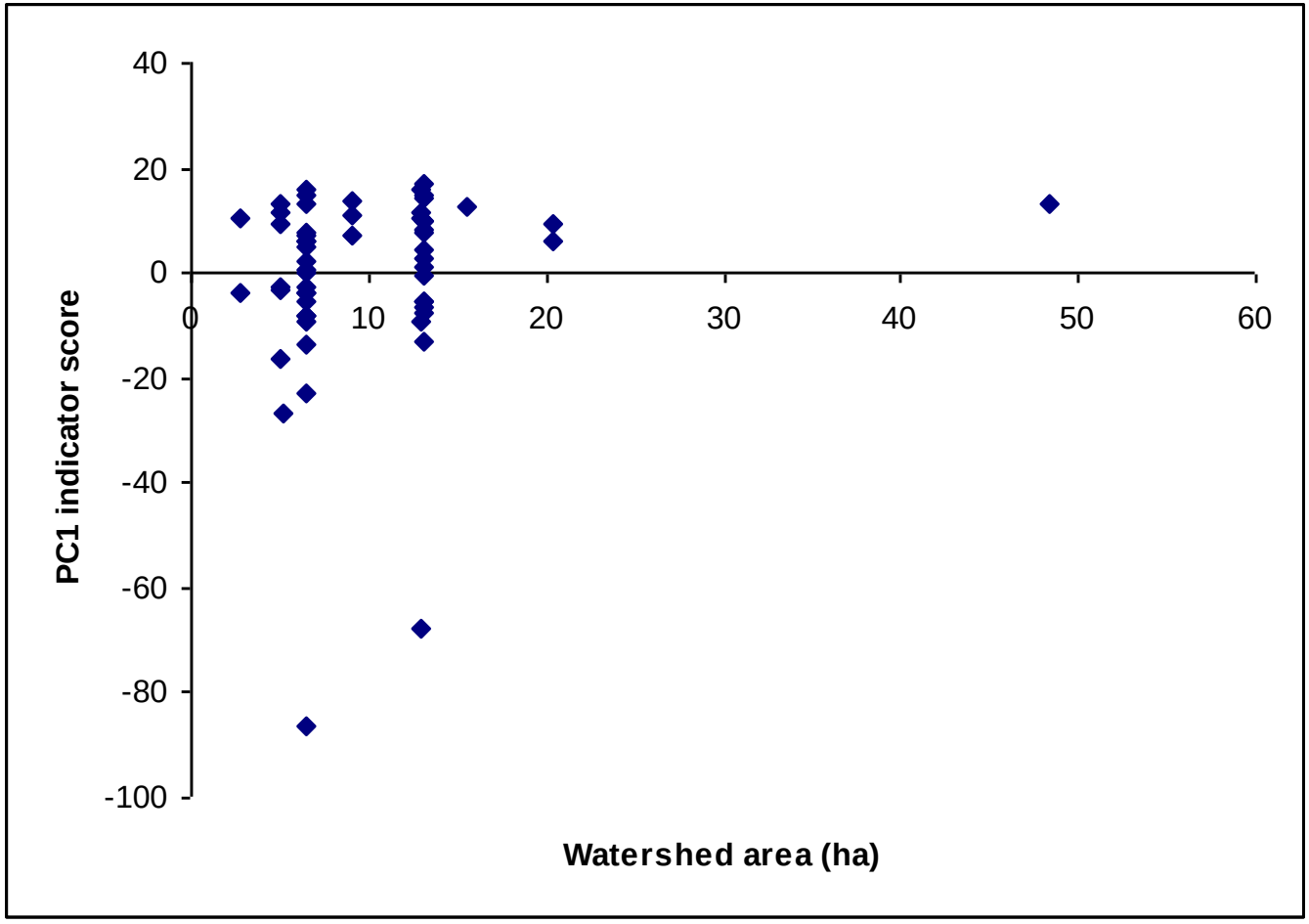
Linking indicators to watershed management



Linking indicators to watershed management



Linking indicators to watershed management



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Conclusions

- The coastal zone of St Lucia has historically been affected by a range of global, regional and national/local scale impacts
- Planning needs to recognise and respond to impacts at all these scales – a seemingly insurmountable task!
- Bioindicators are a relatively easy way to get large scale, rapid assessment of health (state and process) in the coastal zone
- The habitat mapping database can be used to identify similar habitat types for bioindicator assessment and then relate indicators to land-based activities and management practices