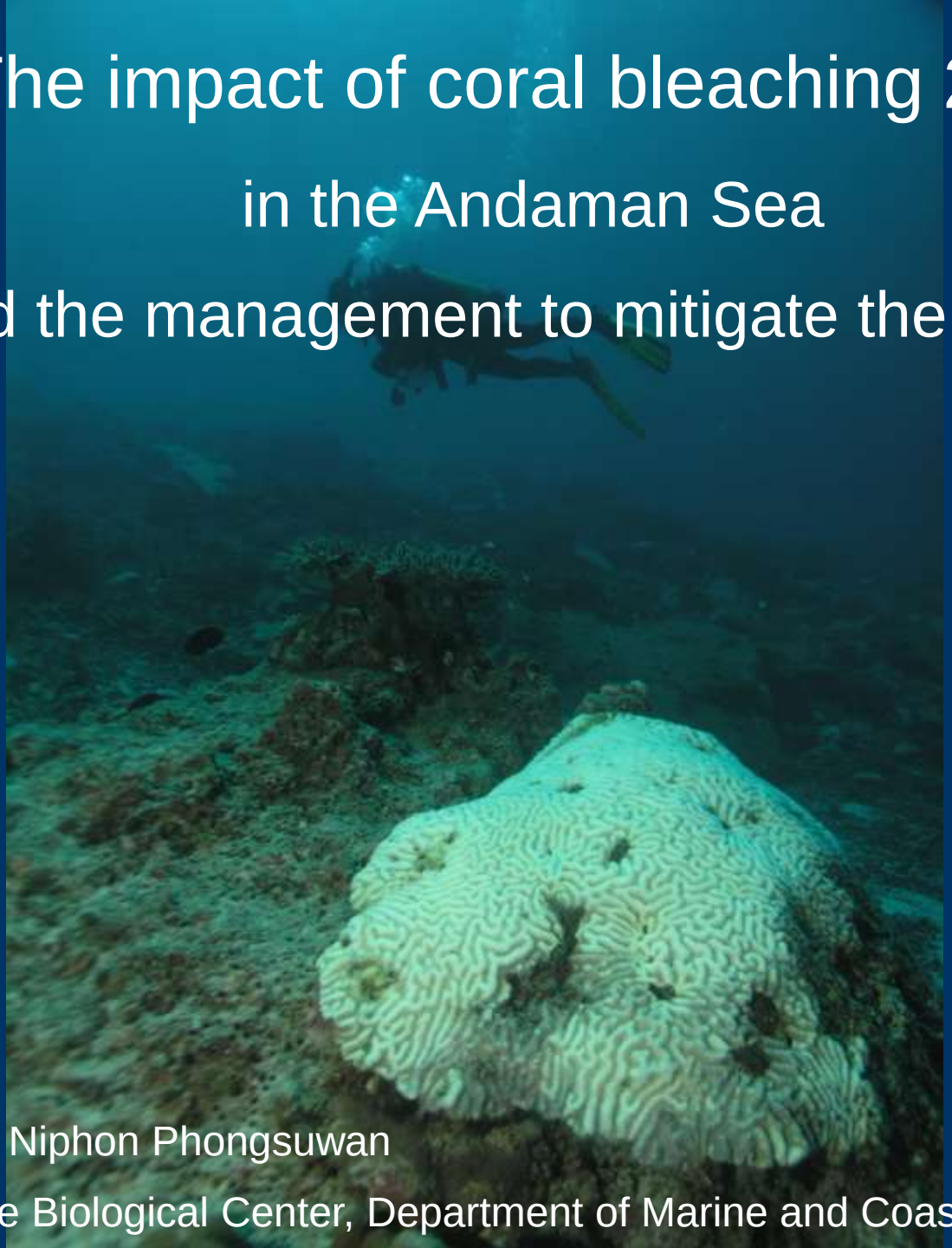
The impact of coral bleaching 2010

in the Andaman Sea

and the management to mitigate the impact

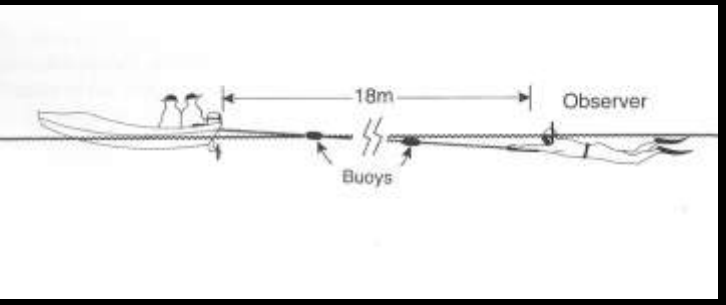


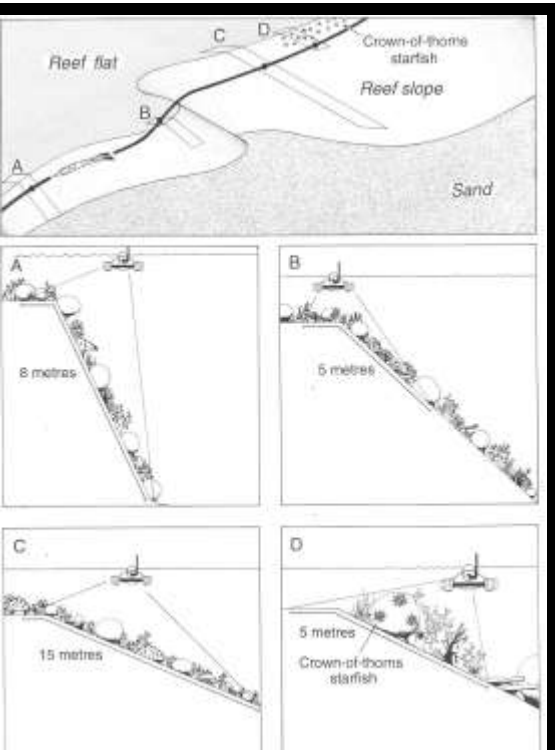
Presented by Niphon Phongsuwan

Phuket Marine Biological Center, Department of Marine and Coastal Resources

Long-term monitoring on coral reefs since 1986

Manta-tow survey

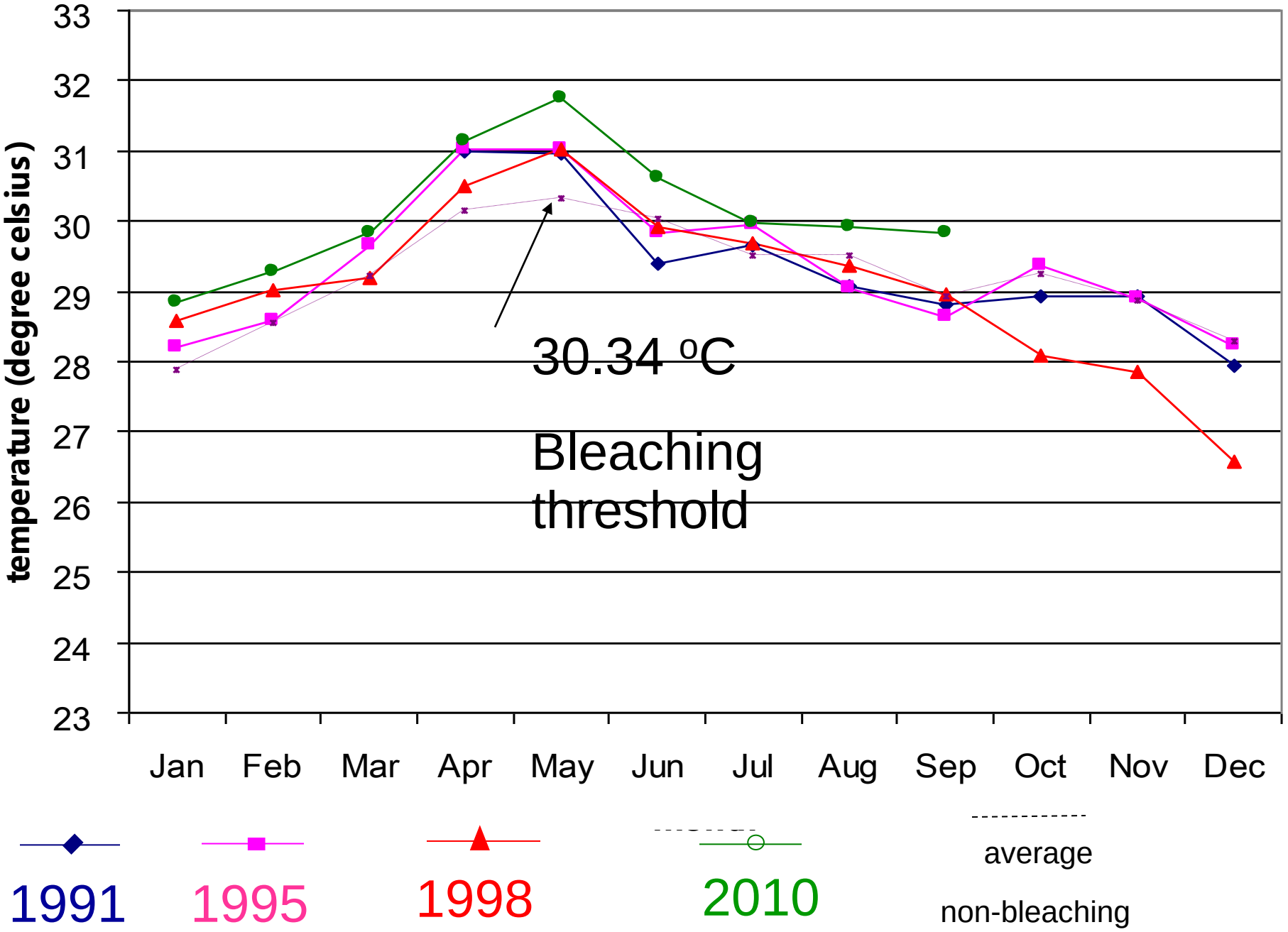




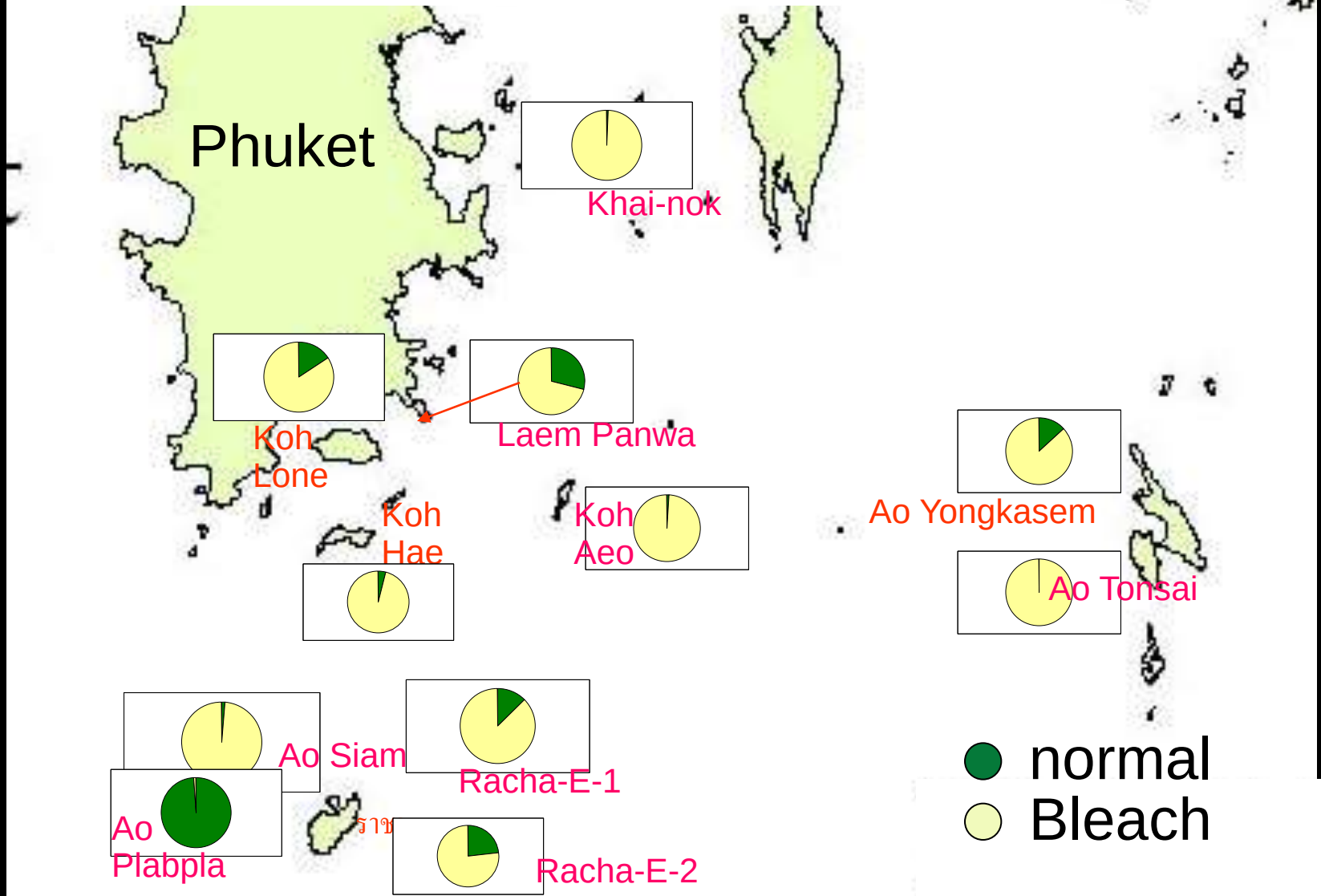
Line intercept transect :
100 m permanent transect

year	Andaman Sea	Gulf of Thailand
1991	Very extensive bleaching – moderate mortality	
1995	Very extensive bleaching – moderate mortality	
1998	Moderate bleaching – low mortality	Very extensive bleaching – high mortality
2003	Moderate bleaching – very low mortality	
2005	Minor bleaching – no impact	
2007	Minor bleaching – no impact	
2010	Very extensive bleaching – very high mortality	Very extensive bleaching – low to high mortality

Monthly mean SST recorded in the Phuket area



Fraction (%) of normal and bleached corals in May-June 2010

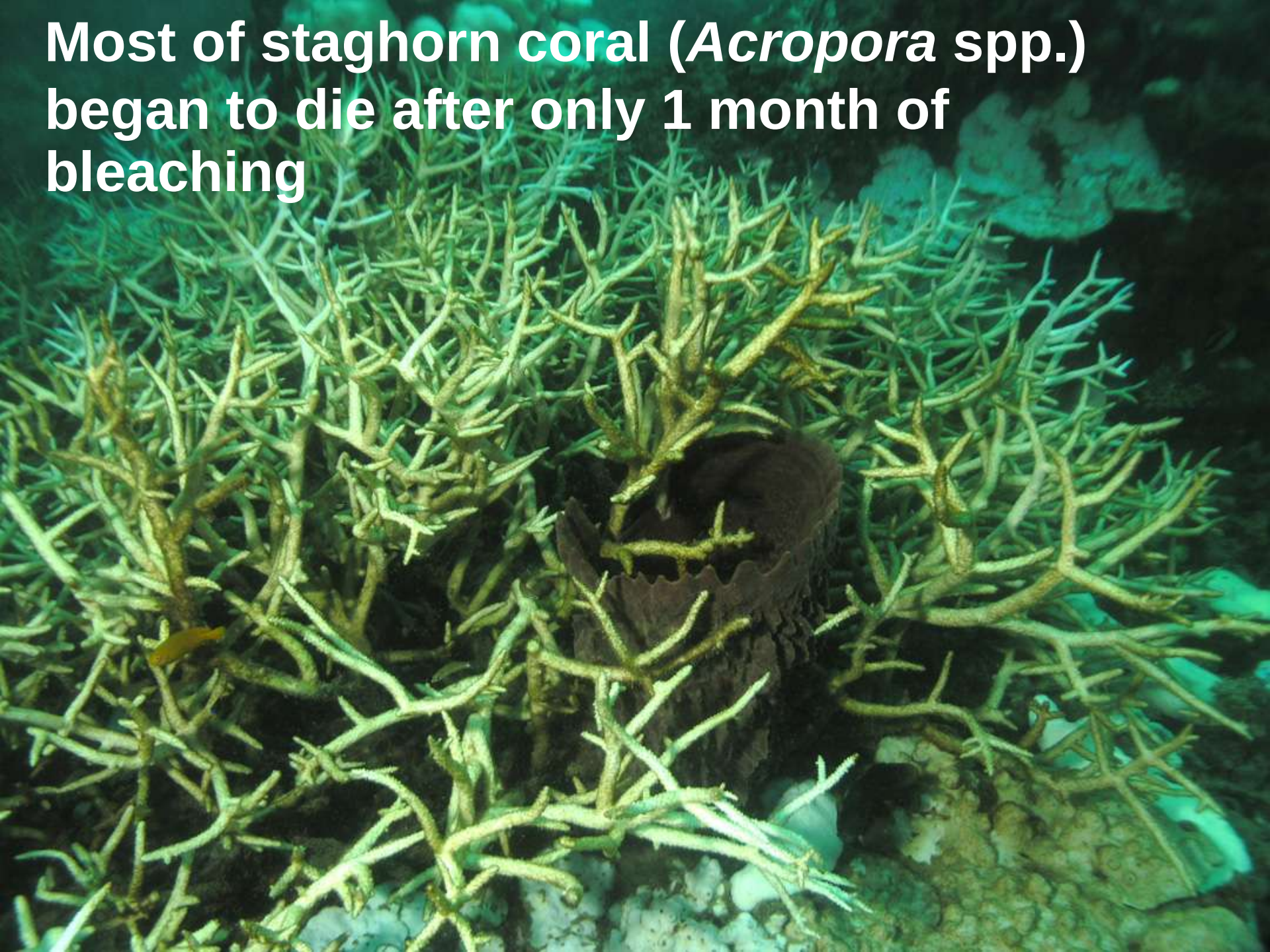


The impact varied widely from place to place depending on

- the structure of coral communities
- The intensity of current / waves shattering the reef structure

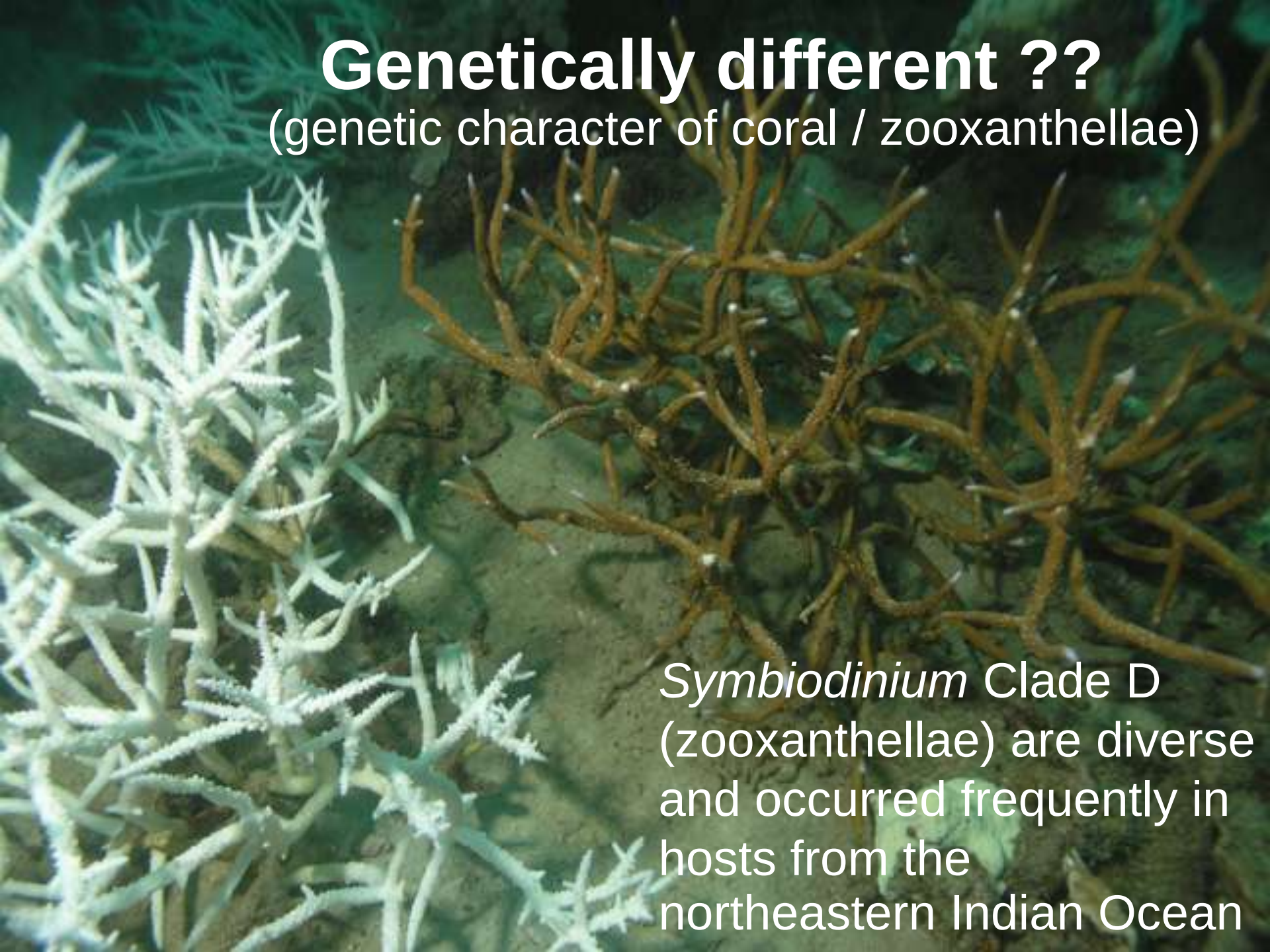
Coral bleaching impact in 1991 & 1995

- not much impact in the area where water flow is good (in blue circle)
- high impact in the area where water is stagnant (red circle)


Most of staghorn coral (*Acropora* spp.) began to die after only 1 month of bleaching

Response of corals to temperature rising is very variable

- some species can resist to bleaching while some are very susceptible



Genetically different ??

(genetic character of coral / zooxanthellae)

Symbiodinium Clade D (zooxanthellae) are diverse and occurred frequently in hosts from the northeastern Indian Ocean

Very susceptible group

Acropora spp.

Porites rus

Hydnophora rigida

Fast growing/high metabolic

Pavona clavus

Merulina ampliata

Montipora sp.

Pectinia spp.

Very few species of *Acropora* show moderate resistance to bleaching

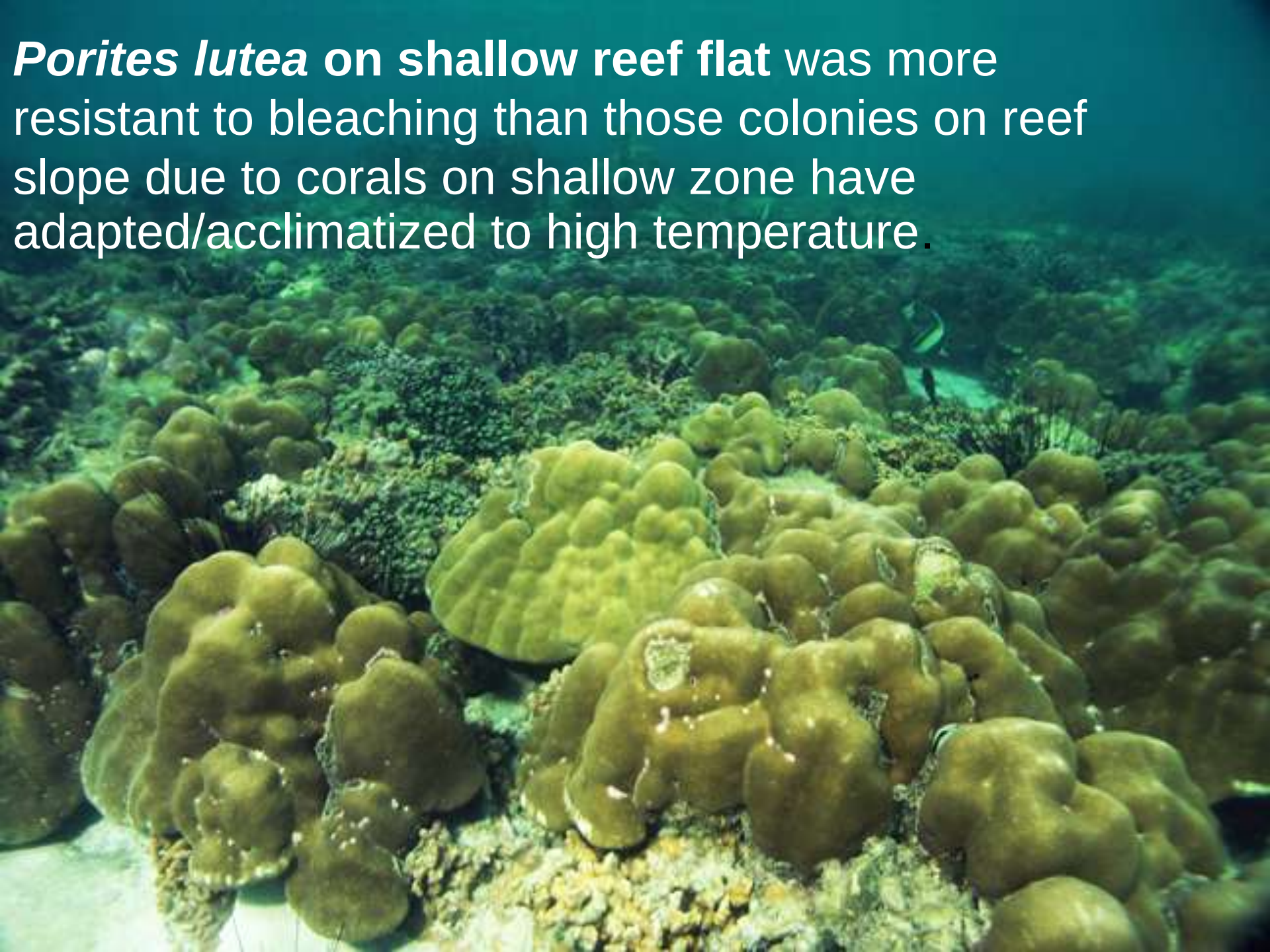
Acropora valida

Acropora divaricata

Acropora secale

The most resistant group

***Porites lutea* on shallow reef flat** was more resistant to bleaching than those colonies on reef slope due to corals on shallow zone have adapted/acclimatized to high temperature.

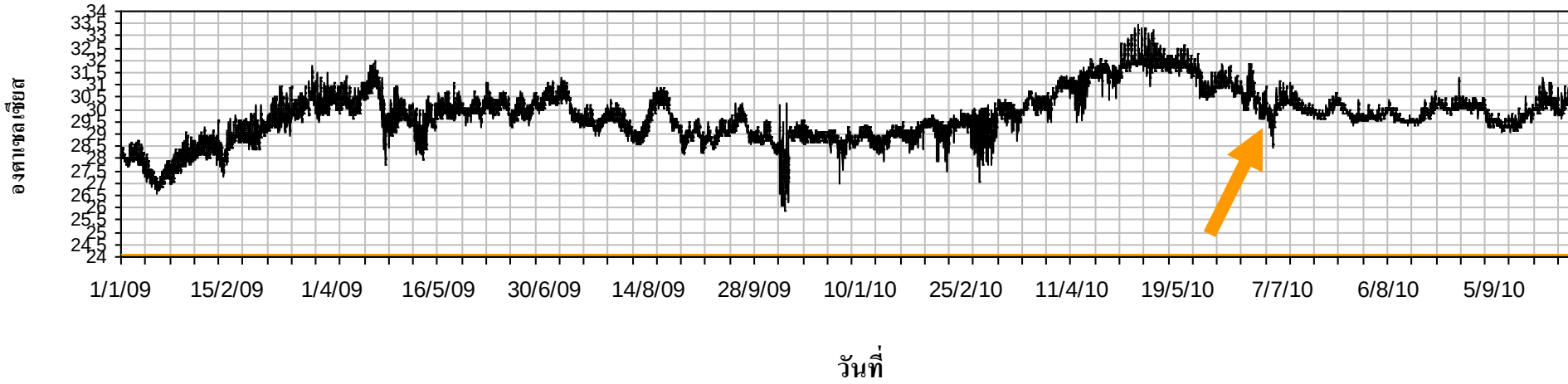


west of Payu Island

west of Similan Island

Coral reefs in the sheltered coves on the western aspects of islands in Andaman are sometimes influenced by internal waves which bring up cold water, leading to variable and on average lower sea temperatures. As a result, the impact of coral bleaching was not as severe and mortality was less than on coral reefs located on other aspects of the islands.

SST during 2009-2010 at Phuket

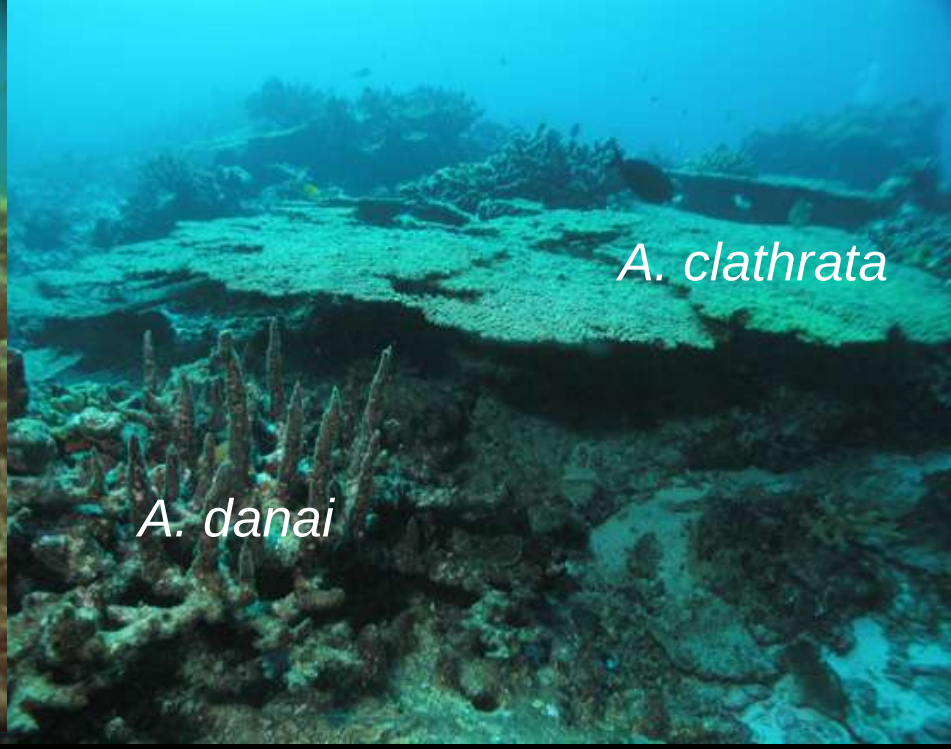


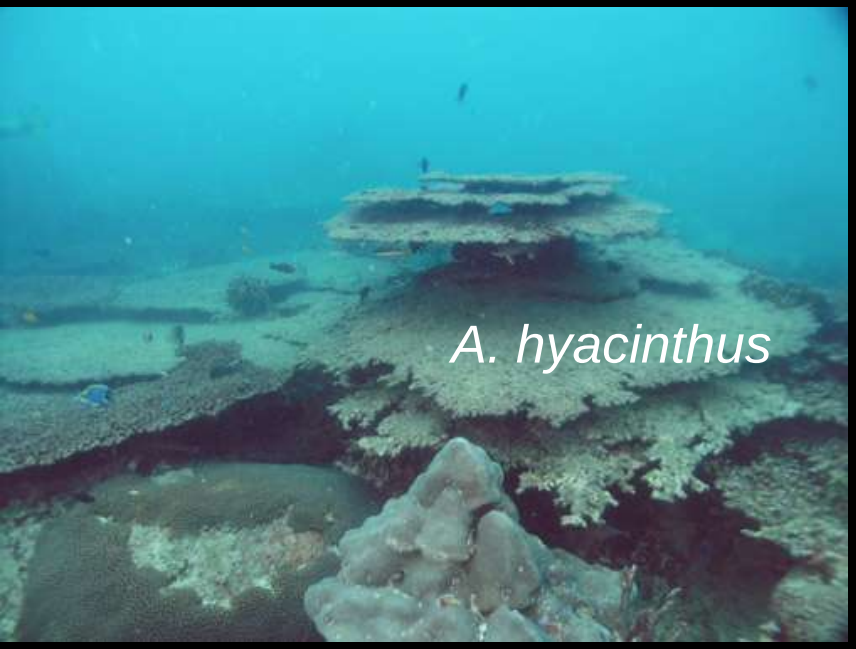
Sea temperature started to drop to 29 – 30 ^{o}C (nearly normal climatic state) at the end of June (orange arrow)

Some corals can tolerate high temperature for a period of time. They are gradually gaining symbiotic algae when temperature drops to normal

Porites lutea which forms the main structure of coral reefs, was the first group transforming back to brown indicating its slow recovery.

Approximately 50-80% of the *Porites lutea* survived the bleaching event





Acropora species either branching or table shape used to be dominant but after the bleaching event they became the rarest species in all areas surveyed.

- Coral larvae settlement were already found during late 2010 survey

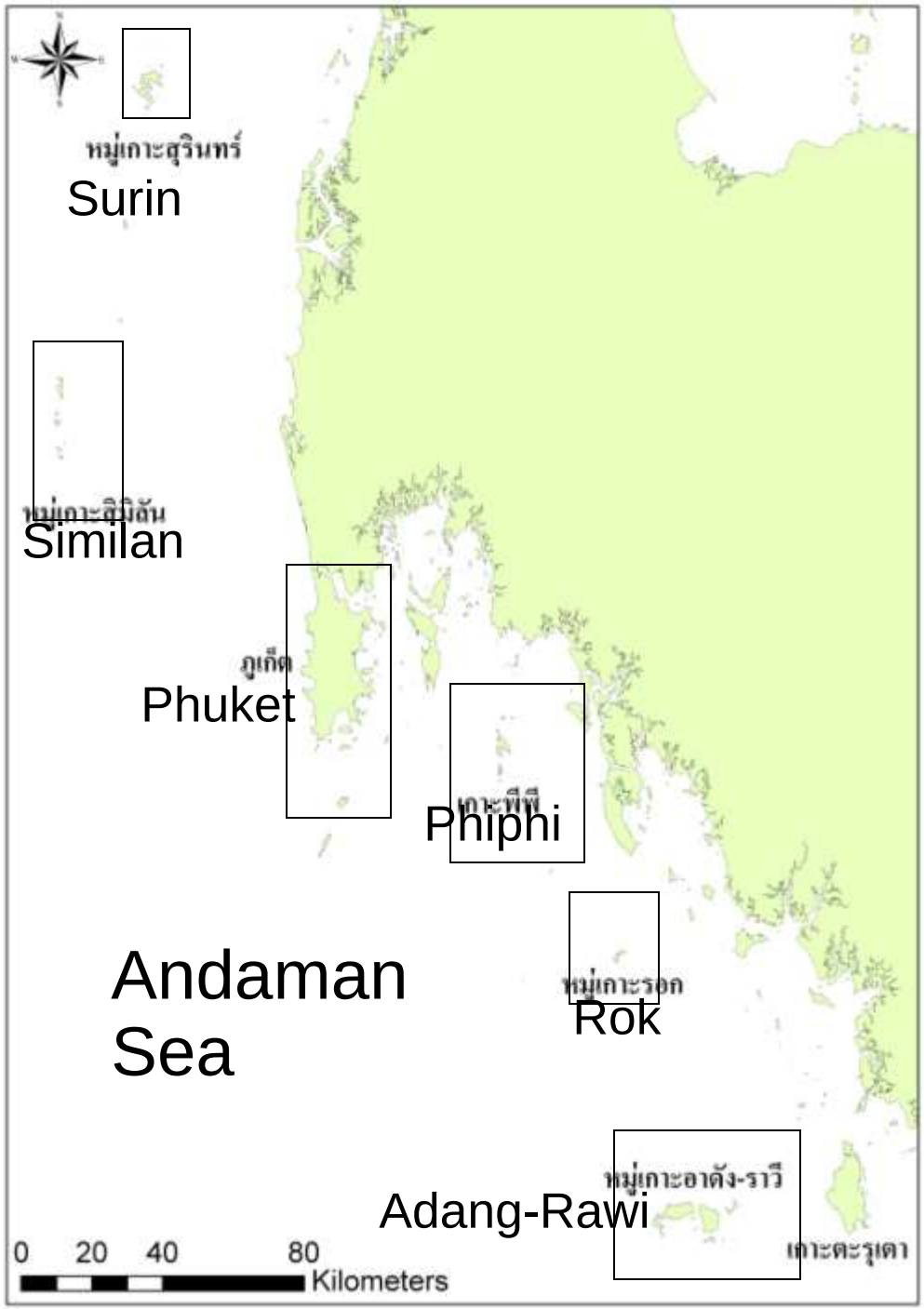
The damage that occurred to the coral reefs during the 2010 bleaching event will definitely take different lengths of time to recover in each location

The bleaching event in 1991 and 1995 was fairly disastrous but not nearly as severe as the event in 2010.

After 1991 & 1995 bleaching, the coral reefs took a minimum 5 years to recover to a similar condition *without any disturbance from humans*. In some areas there was some improvement over pre-bleaching conditions, but the structure of coral community was different from prior to the event

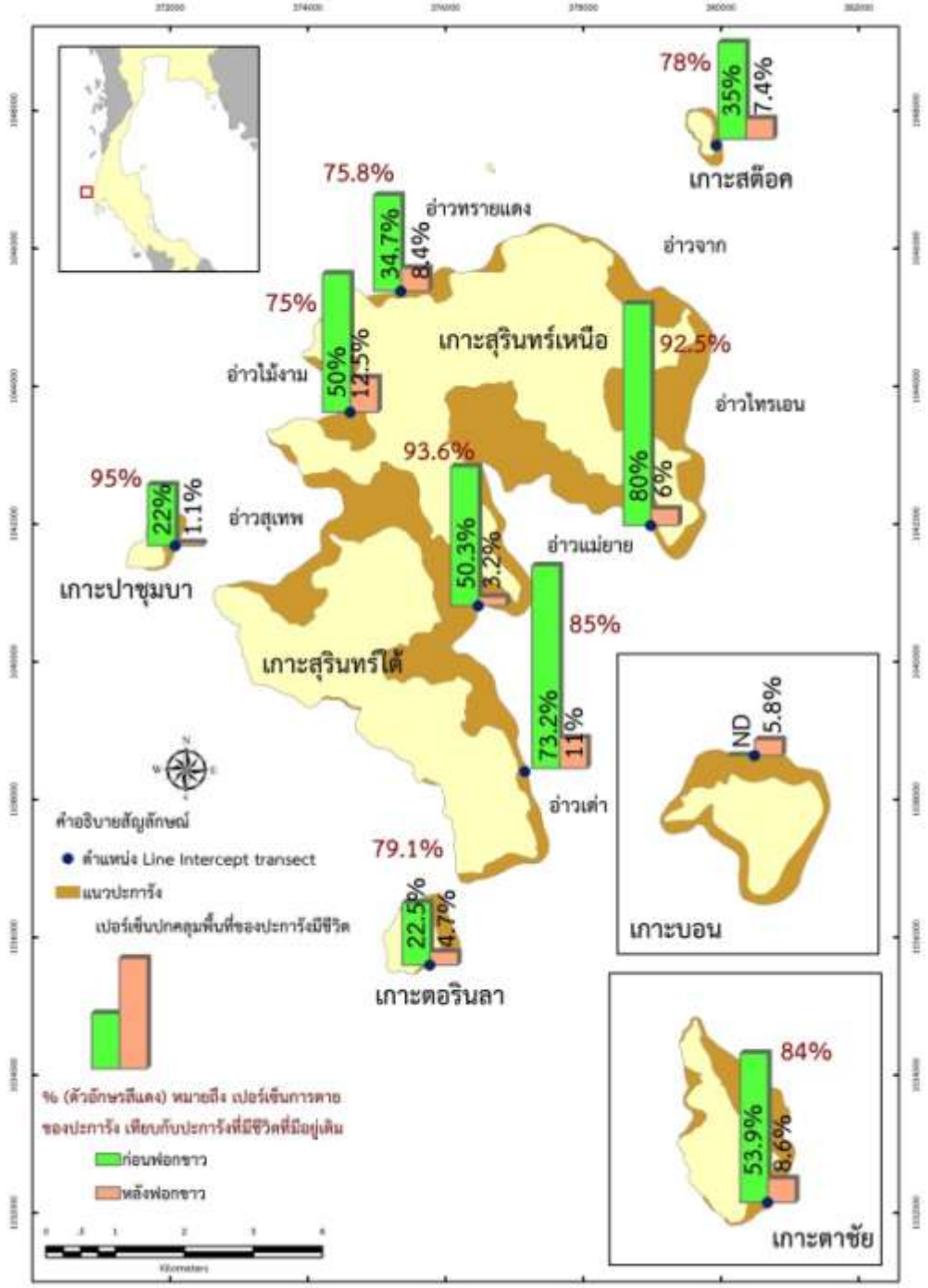
% Live coral cover at site A, Surin Island

Change of coral species structure over time



Survey sites in the Andaman Sea

approx. 100 permanent transect sites (50 sites surveyed in 2010)

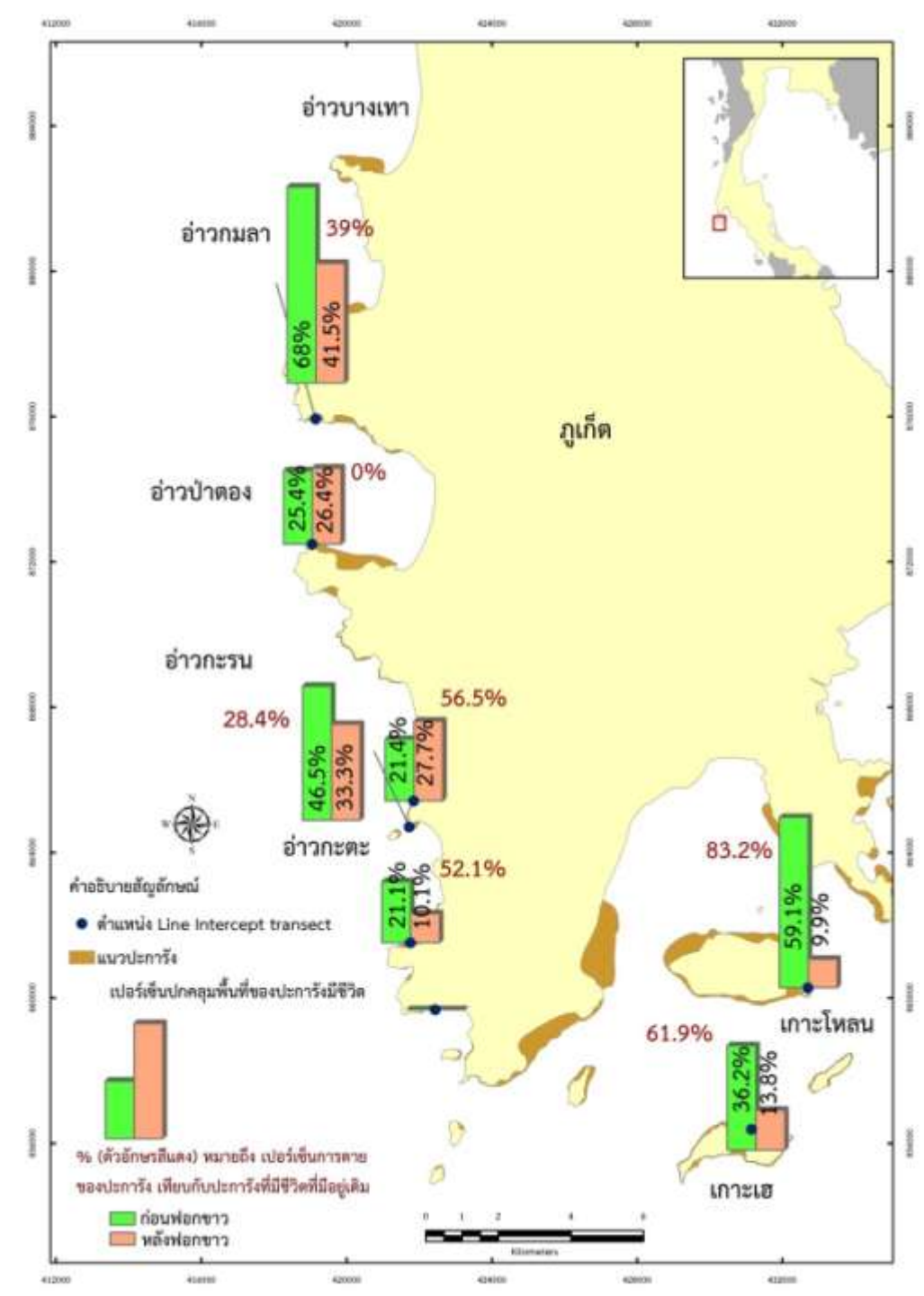


Surin Islands

Live coral cover

Before bleaching

After bleaching

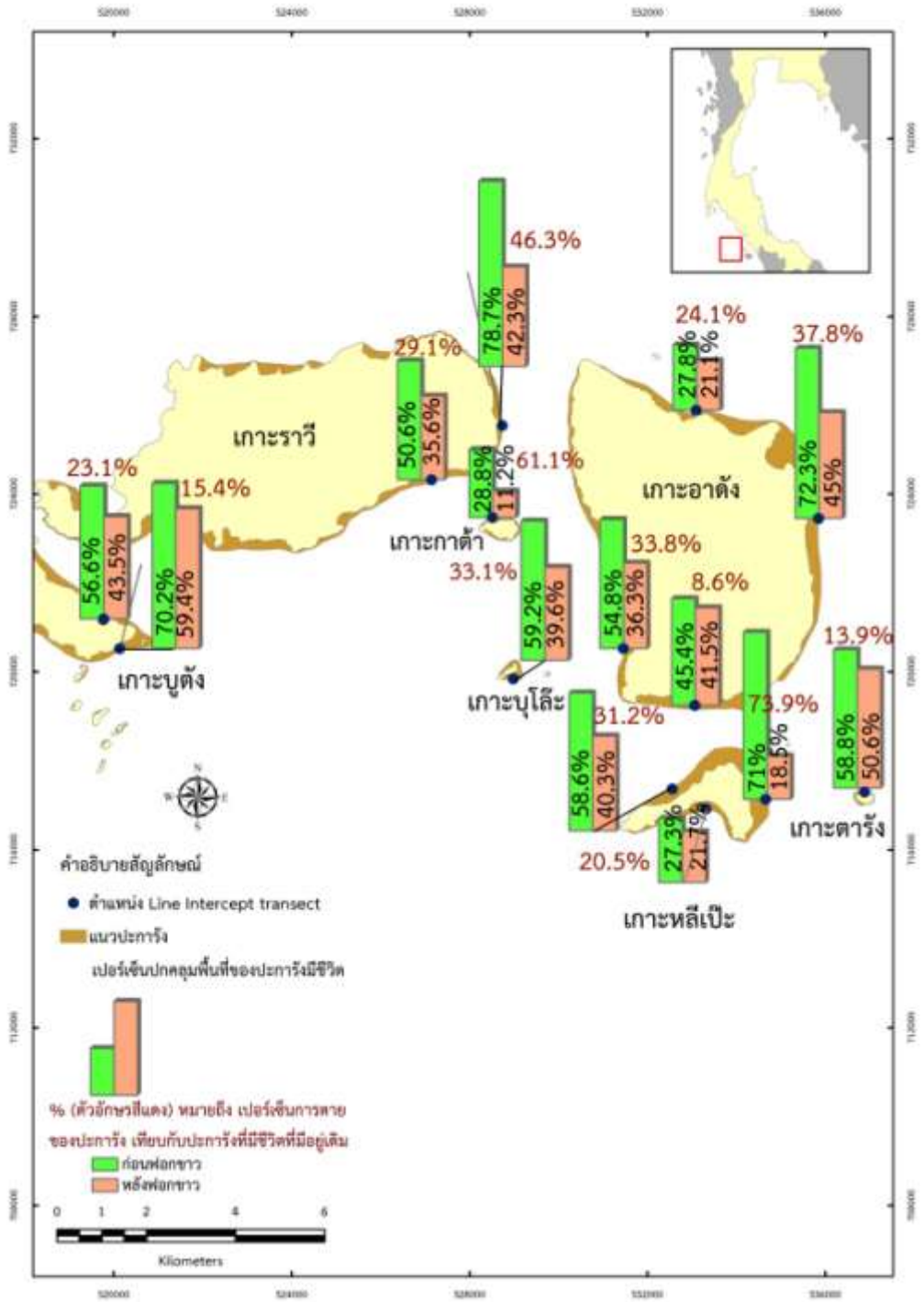


Phuket Islands

Live coral cover

Before bleaching

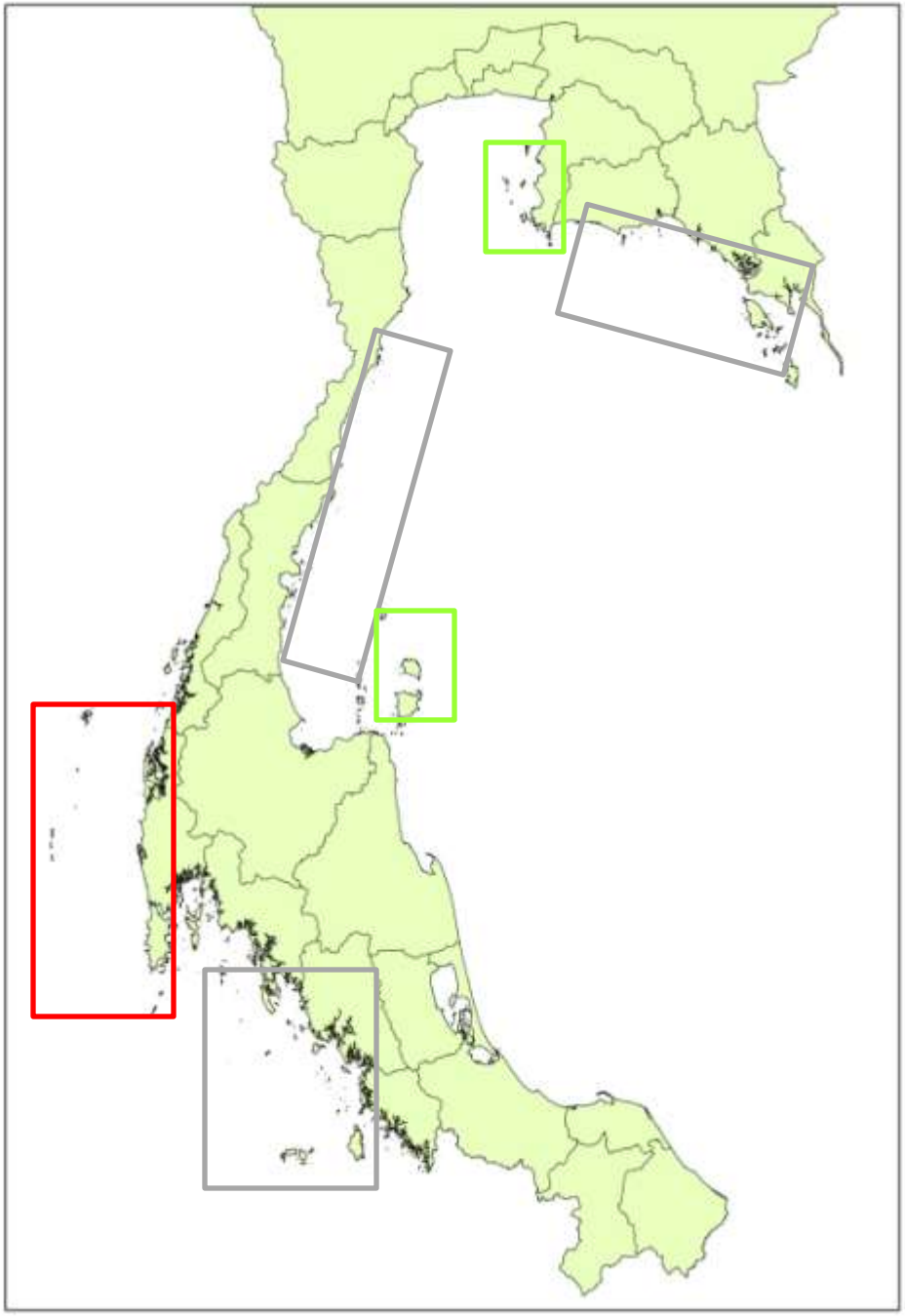
After bleaching



Adang-Rawi Islands

Live coral cover

- Before bleaching
- After bleaching



Bleaching severity in 2010

Very high impact (mortality > 70%)

moderate impact (mortality ~ 50%)

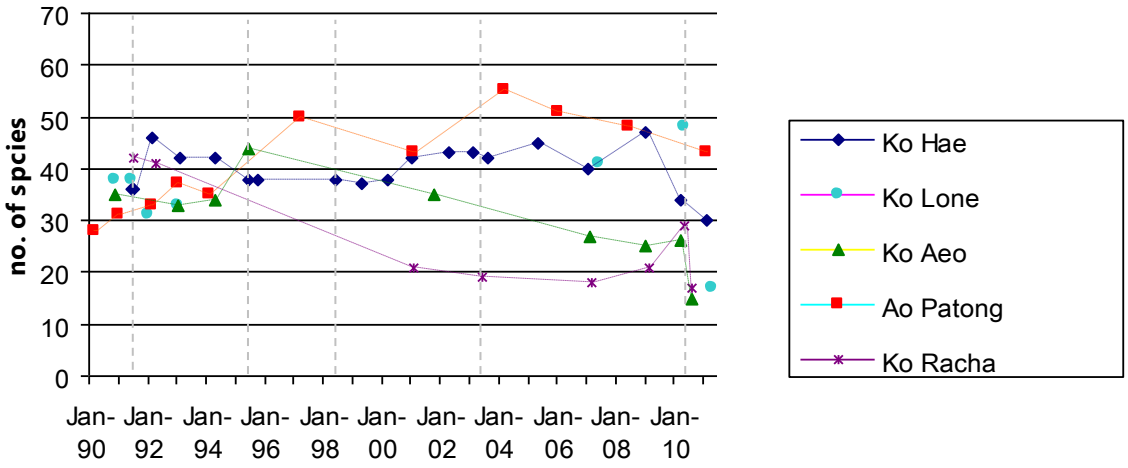
Very low impact (mortality < 10%)

In summary ….What happened after 2010 coral bleaching?

- Many of coral reefs have transformed from being in a healthy state to a very poor condition

- Those corals which survived would adapt to high temperature in future ??!!??

- Coral community (biodiversity) changed ??!!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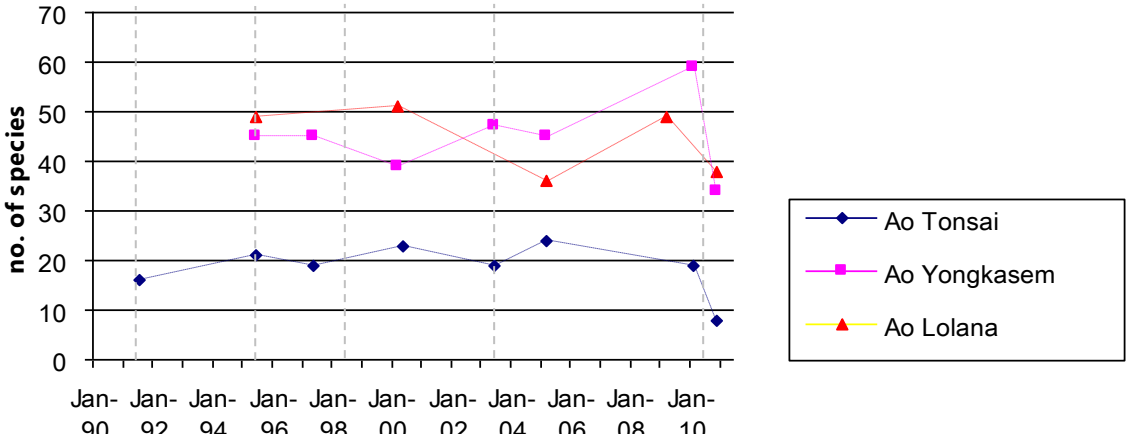
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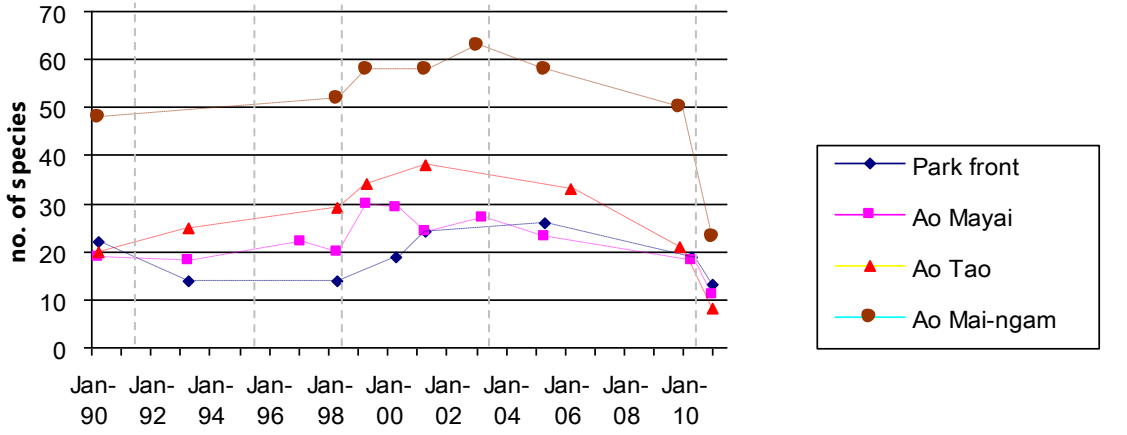
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Park front
Ao Mayai
Ao Tao
Ao Mai-ngam

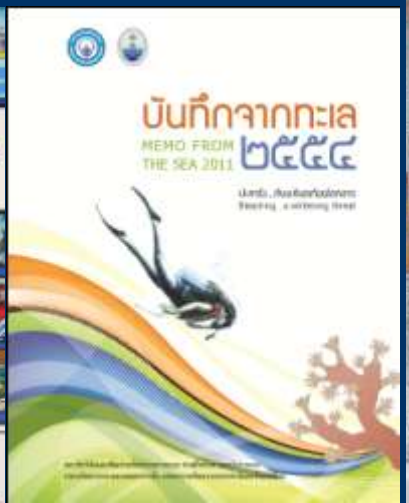
Management to mitigate the impact and accelerate recovery

Short term activities

- Rapid surveying the impact of coral bleaching and identifying the locations of resilient reefs.

- Closing down some coral reef areas completely without allowing for any human activities or use. Some coral reef areas will require strict protection, such as some areas in national parks that have significant impacts from tourism – for examples, reefs with shallow areas where people are able to stand.

- Building the knowledge and understanding of residents, tourists, business operators, and anyone who benefits from coral reefs in order to increase knowledge of coral bleaching situation and its impacts. A PR campaign has been created aimed at encouraging diving business owners to be environmental friendly.



Medium and long-term activities

- Decreasing the impact from tourism activities affecting the reefs by establishing proper zoning for levels of use and types of diving activity, and creating suitable rules for anyone benefit from coral reefs.




- Creating and enforcing strict development and management plans in order to decrease sediment runoff from the shore. Measures should also be put into place for controlling top-soil turn over and for preventing soil erosion

- Preventing fishery activities that lead to coral reef damage, in particular, the smuggling of ornamental and food fishes in coral reefs in national park boundaries and other marine protected areas. Programs should be put into place to monitor fishing activities and regulations should be strictly enforced.

- Building a new diving area or supplemental artificial reefs in a suitable location to reduce the usage of coral reefs.

- Conducting researches in order to understand the natural process of reef recovery, the obstruction of reef recovery and the mechanisms to accelerate reef recovery



Thank you