Coral Restoration Techniques in the Western Pacific Region

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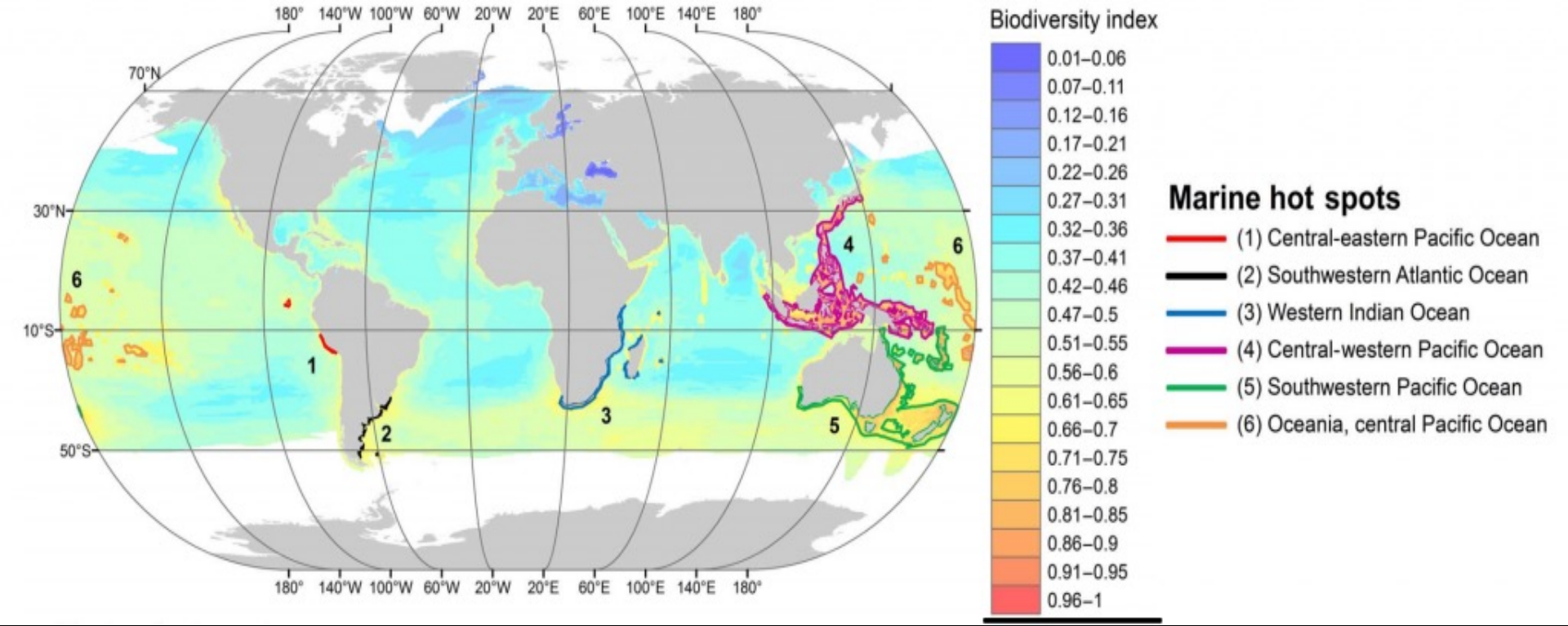
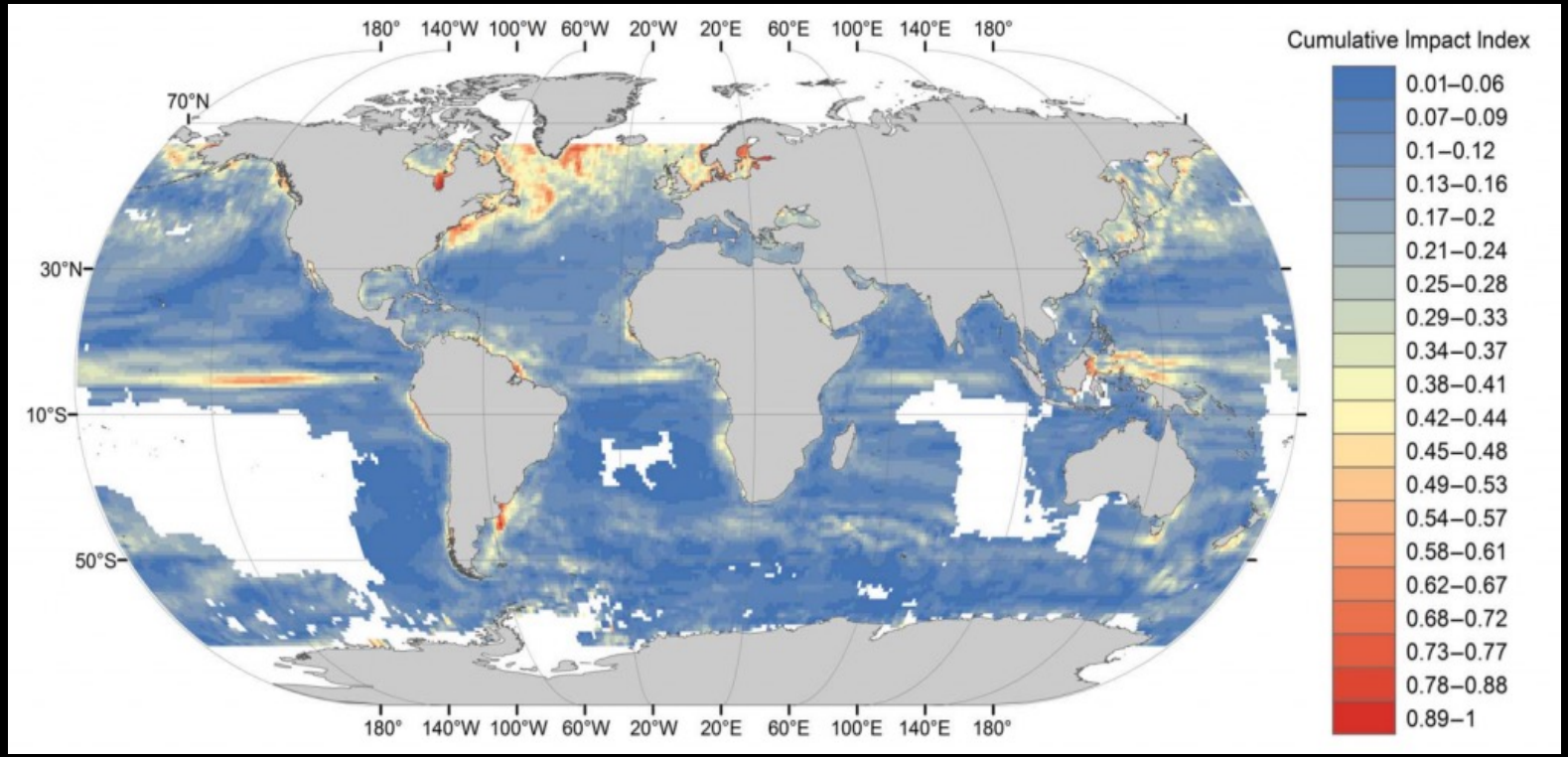
United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

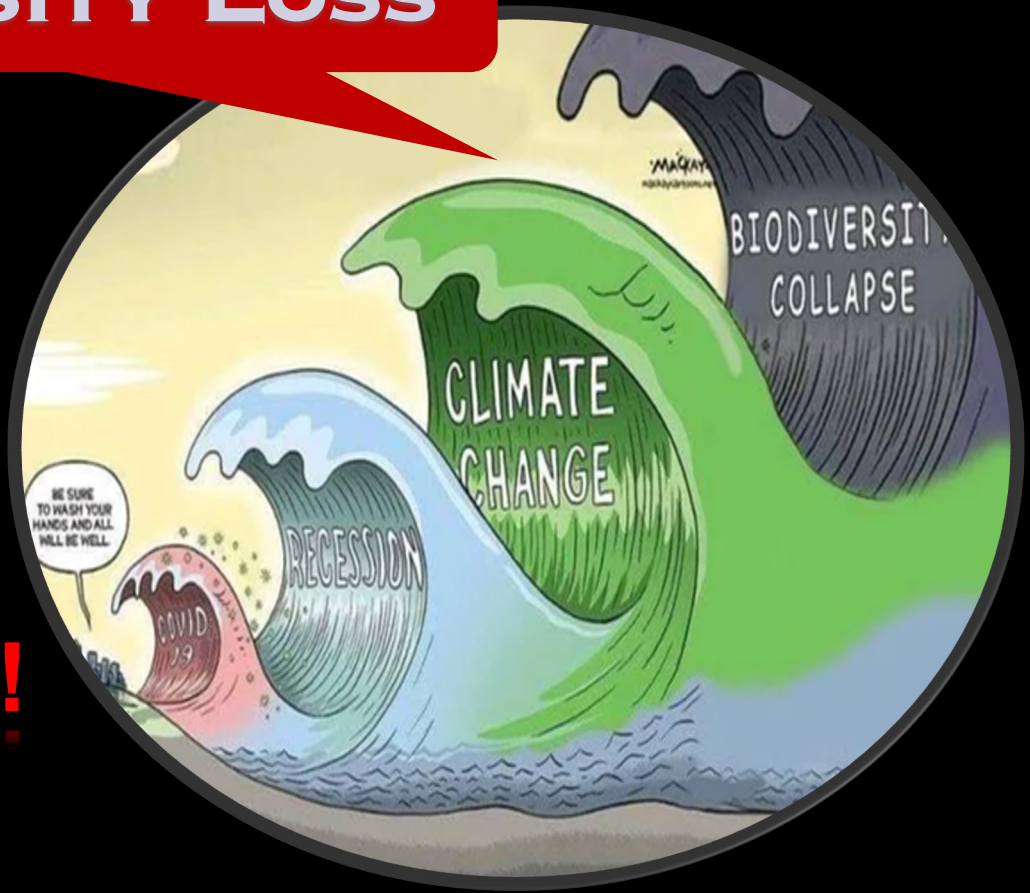
Marine Hot Spots of the World



Global Distribution of Cumulative Environmental Impacts

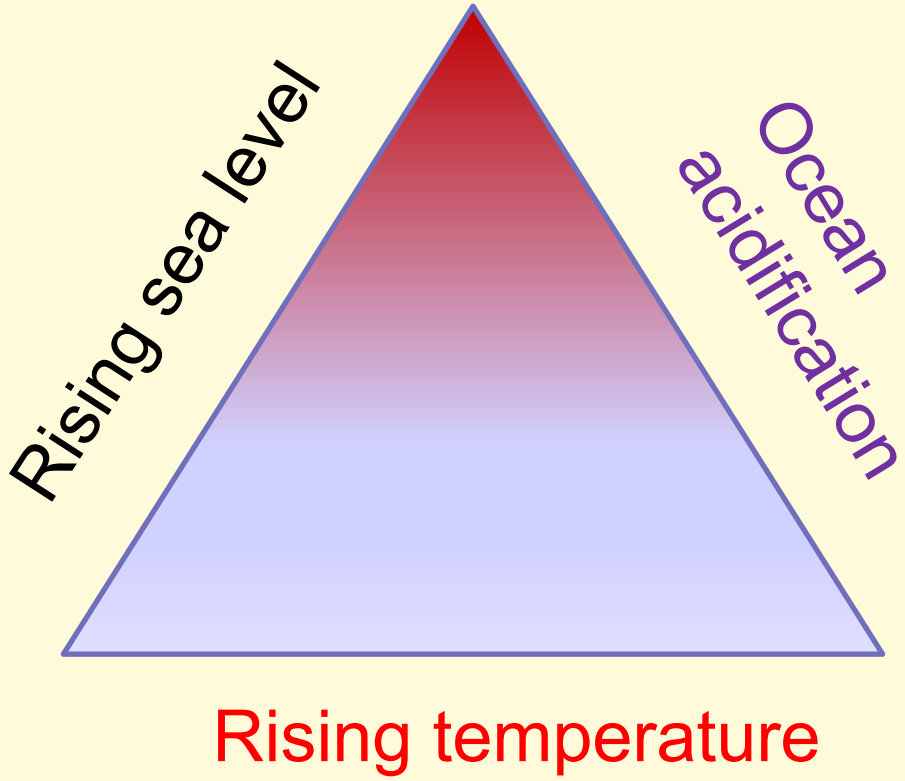


Biodiversity Loss



Worrying Coincidence !!!

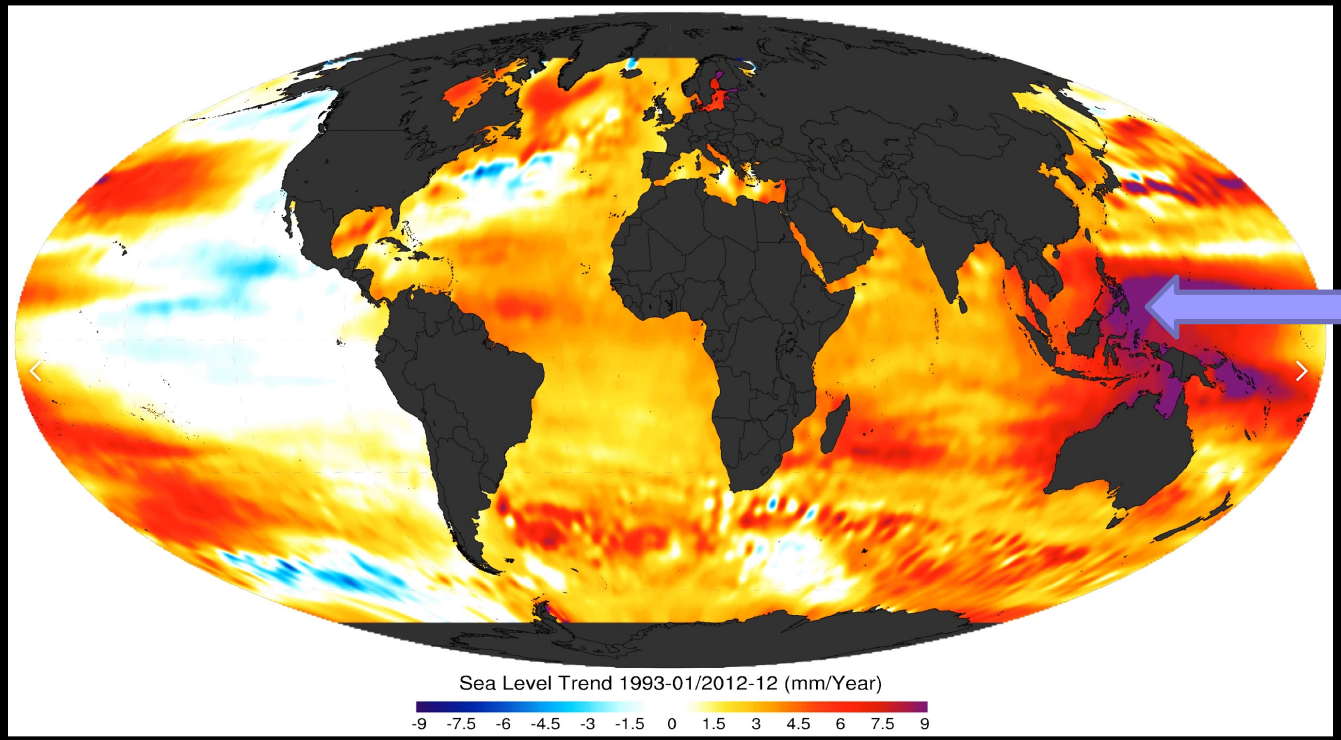
3 THINGS THAT ARE GOING TO AFFECT OUR CORAL REEFS



Coral Bleaching and Ocean Acidification

Sea Level Trends from Satellite Altimetry (1993-2012)

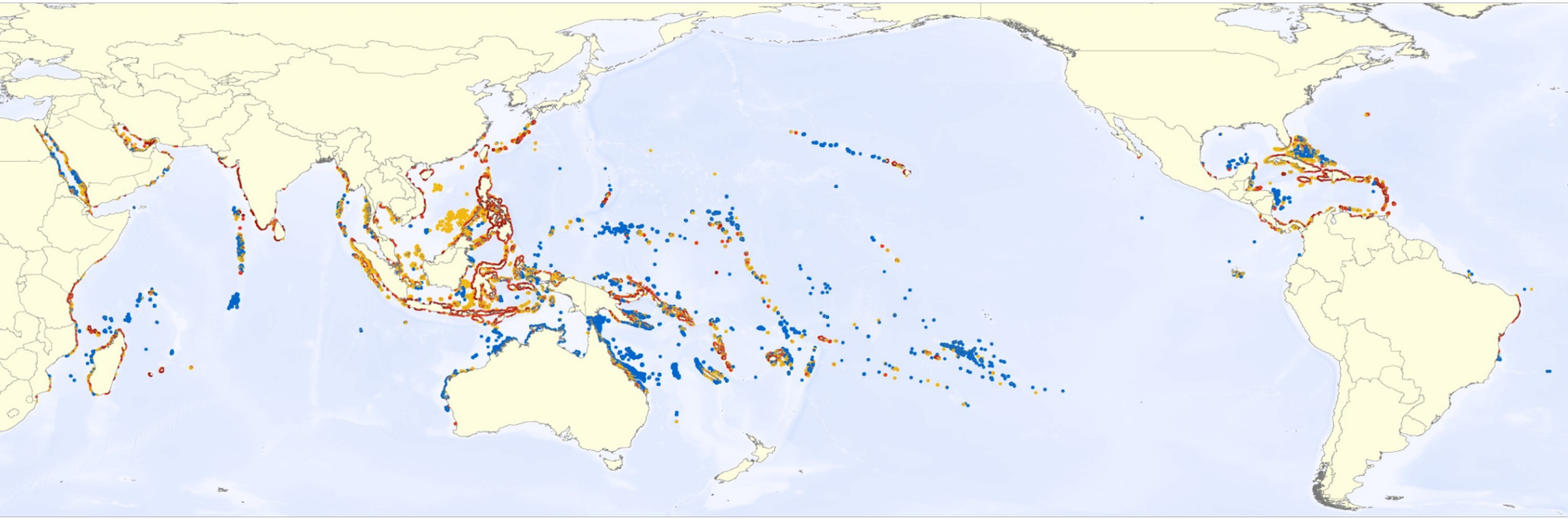
Cities at Risk: Bangkok/Jakarta/Osaka/Los Angeles/Sydney/Alor Star/Ho Chi Minh, Manila, Singapore…



We are above world average in mean sea level rise

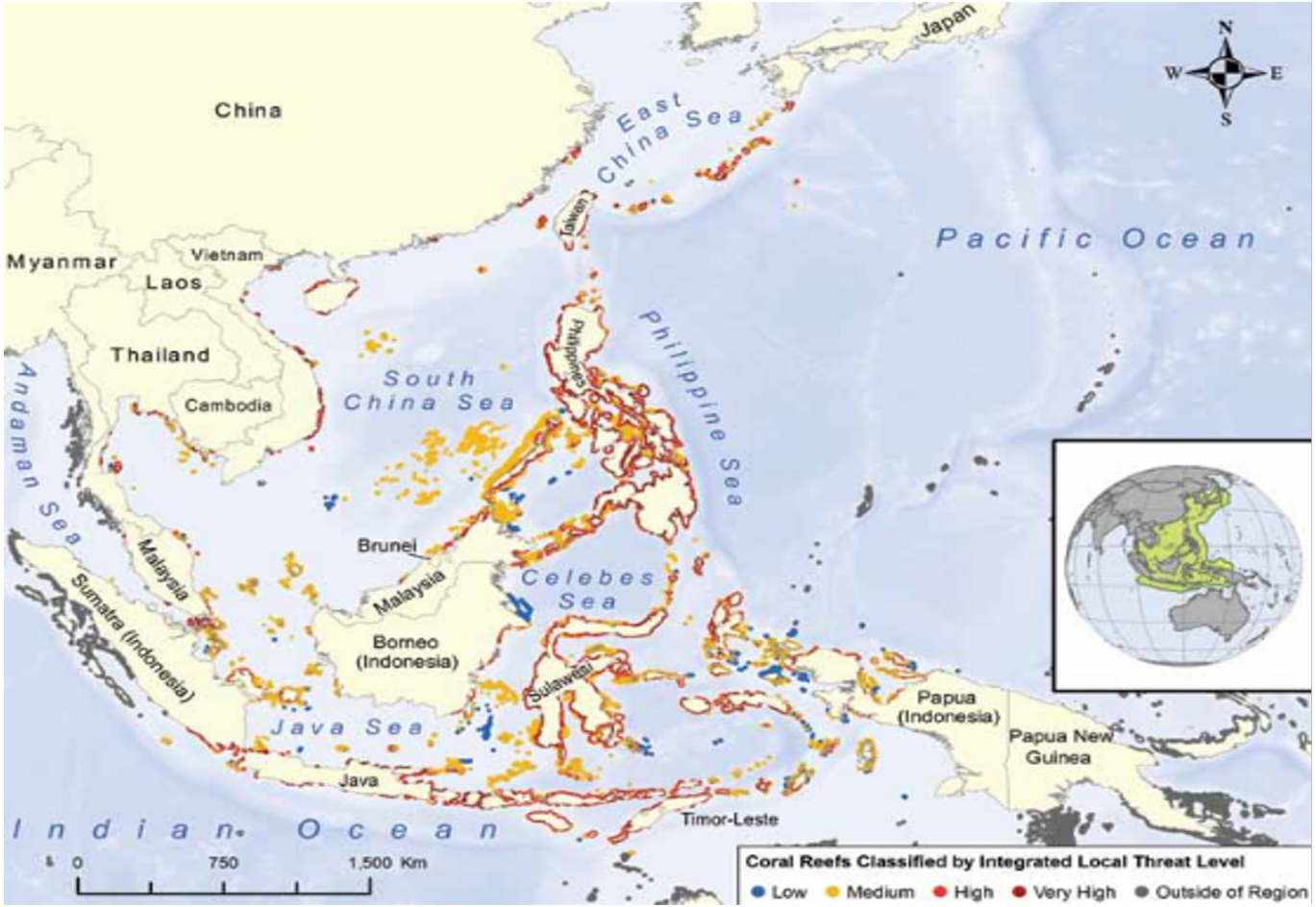
Current situation of coral reefs in the region

Integrated local threats to coral reefs



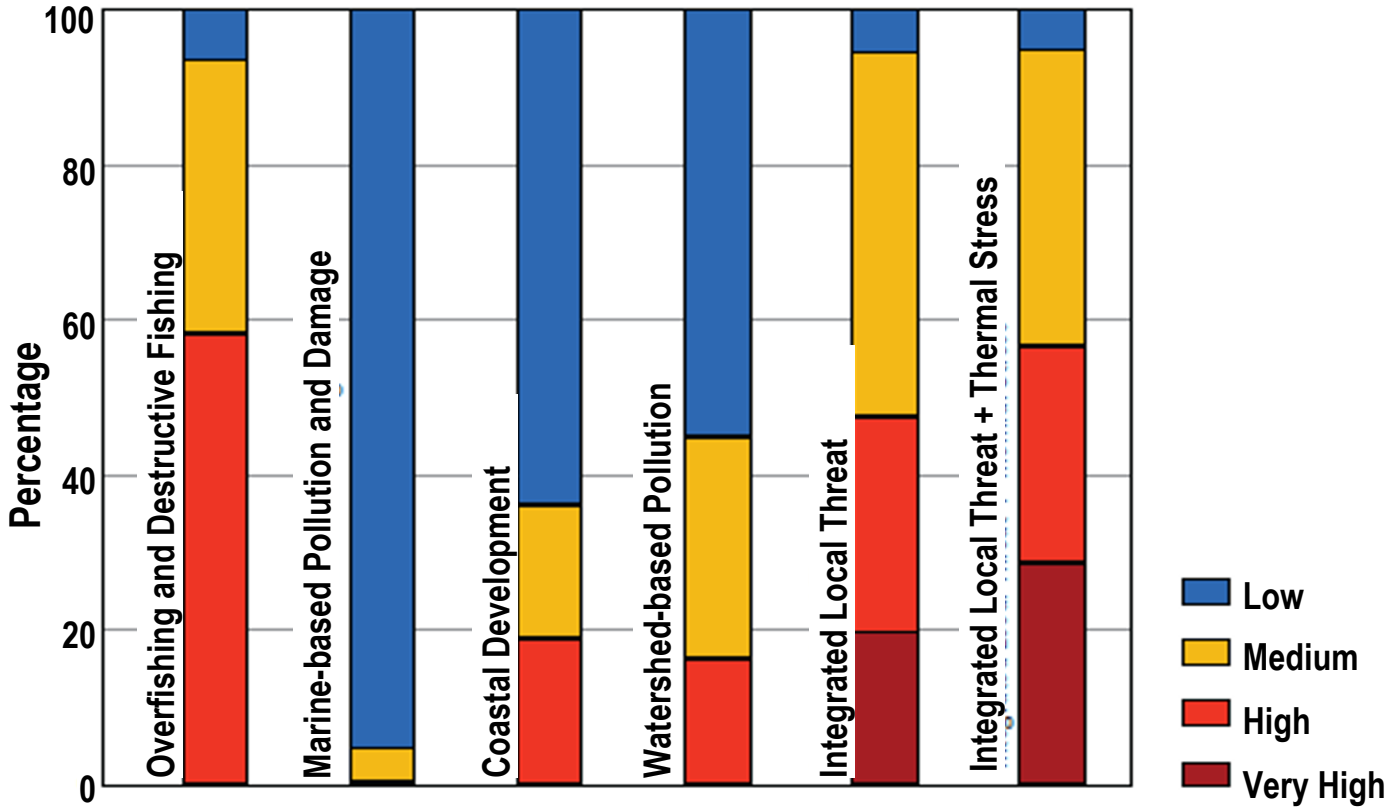
Low Medium High Very High

Burke et al 2011 Reefs at Risk Revisited



Burke et al 2011 Reefs at Risk Revisited

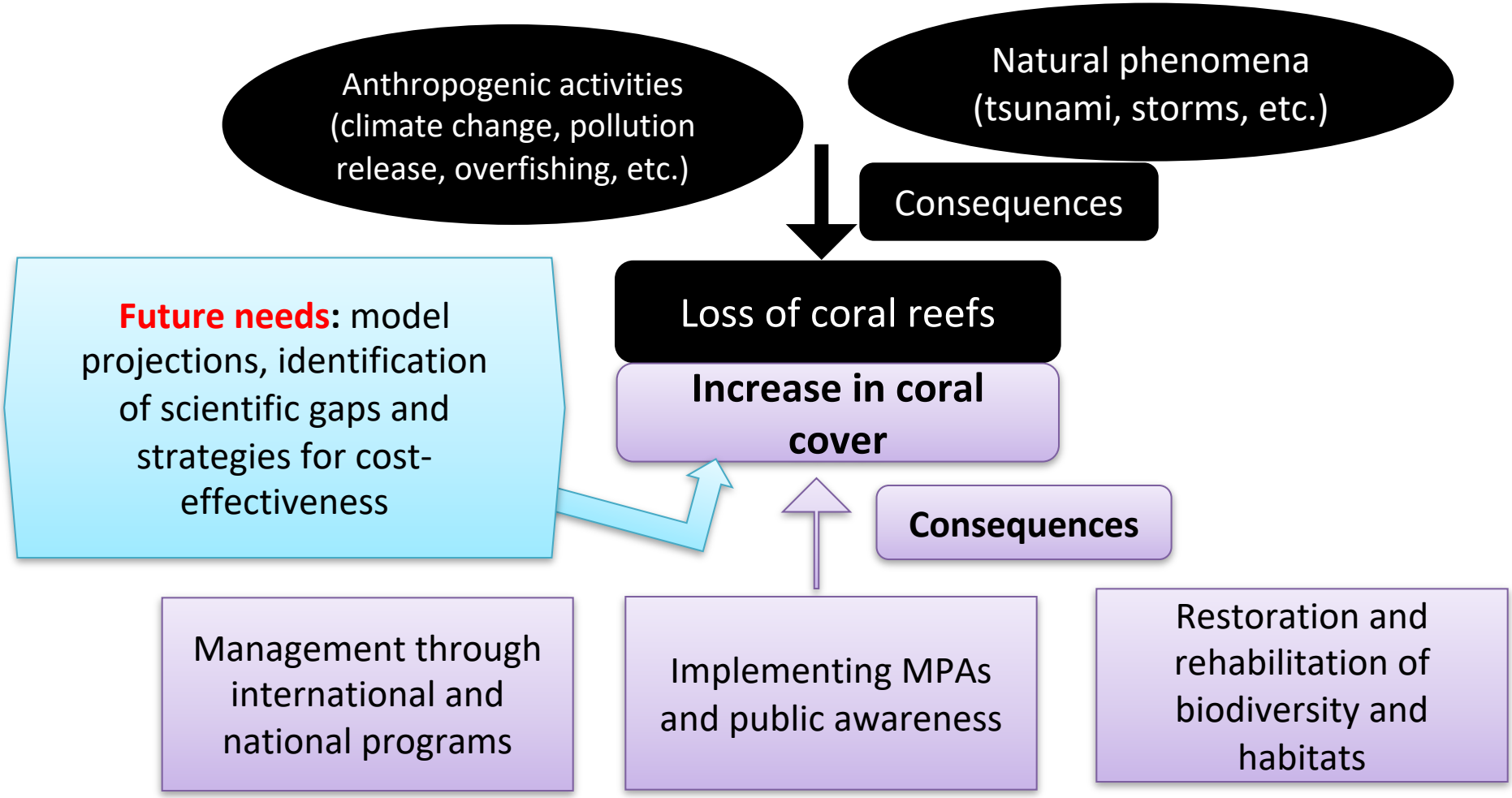
Reefs at Risk in Southeast Asia



Burke et al 2011 Reefs at Risk Revisited

How we can increase the coral cover

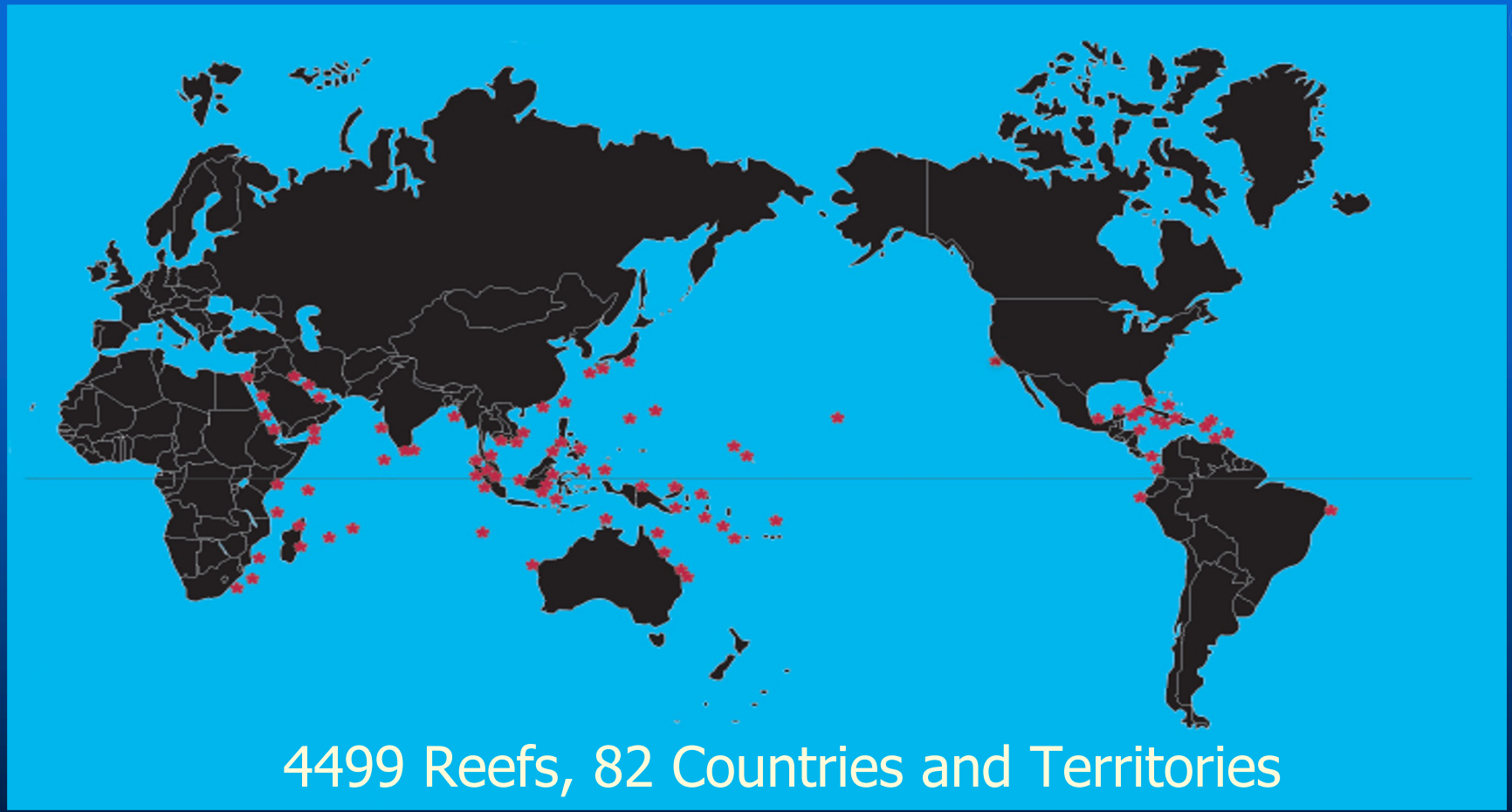
MONITORING & RESTORATION



Chavanich and Viyakarn (2016) The Cnidaria, Past, Present and Future

Monitoring methods for coral reef health – **Reef Check**

Scale &
Fast Execution


4499 Reefs, 82 Countries and Territories

Indicator Organisms

- Measure human impacts – *food, curio trade, aquarium sales*
- Ease of identification – *easily identified by non-scientists*
- Demand for organisms – *desirability, high demand*
- Broad distribution – *widely distributed*
- Ecological importance – *role in ecosystem eg. sea urchins*
- Can we fix it? – *If indicator changes, can we get it back? Will management be possible?*


Photo by D. Wescott


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Photo by D. Wescott


Photo by D. Wescott


Photo by D. Wescott

Measurables

- Measure important living and non-living reef components (% cover) with respect to human impacts

- Corals living and recently killed, sponges and algae as indicators of an imbalance between herbivores and nutrients.


Photo by J.A. Alvarez


Photo by J. Hill


Photo by R. Torres

Who are the people involved?

Everybody!

- Villagers/fisherfolk
- Tourist divers and academics & Students
- Local dive clubs
- Government agency staff
- NGO's conservation groups
- Other stakeholders

RC Turks and Caicos Islands


RC Saipan


RC St. Lucia


RC China

RC Indonesia

The Basic Reef Check Substrate Categories

Code	Category
HC	**HARD CORAL** (*includes blue coral, fire coral and organ pipe coral)*
SC	**SOFT CORAL** *(includes zoanthids)*
NIA	**NUTRIENT INDICATOR ALGAE** *(includes seaweed that proliferates with high nutrient input)*
OT	**OTHER** *(includes other living or non-living substrata, such as, hydroids, anemones, gorgonians and ascidians)*
SP	**SPONGE**
RC	**ROCK** *(includes any surface that coral could settle onto Including rock covered with turf algae, bivalves, coralline algae and dead coral)*
RKC	**RECENTLY KILLED CORAL** *(includes coral that has died in the last year. Such coral will still have a white or partially white skeleton and may be slightly overgrown with algae)*
RB	**RUBBLE** *(includes dead coral of 0.5 to 15 cm diameter)*
SI	**SILT**
SD	**SAND** *(includes pieces less than 0.5 cm in diameter)*

Which inverts do we count?

- Banded coral shrimp (*Stenopus hispidus*)
- Diadema urchin (*Diadema* sp. and *Echinothrix* spp.)
- Pencil urchin (*Heterocentrotus mammilatus*)
- Collector urchin (*Tripneustes* sp.)
- Sea cucumbers (Holothuridae)
  - Prickly Redfish, Prickly Greenfish, Pinkfish
- Crown-of-thorns starfish (*Acanthaster planci*)
- Giant clam (*Tridacna* sp.) (size to be estimated in orders of 10cm)
- Triton (trumpet) shell *(Charonia tritonis)*
- Lobster (Palinuridae)

Which Fish Do We Count?

- Grouper *(all species - count all individuals that are larger than 30 cm and sized to the nearest 10 cm*
- Barramundi cod
- Snapper (all species)
- Sweetlips (all species)
- Butterflyfish (all species)
- Humphead wrasse (off the transect records also)
- Parrotfish *(all species over 20 cm)*
- Bumphead parrotfish (off the transect records also)
- Moray Eel

Current situation of coral reefs in the region – Green fins

Green Fins, a public-private initiative of the United Nations Environment Programme and Reef-World, provides the only internationally recognised **code of conduct** used to reduce the environmental impact of the diving and snorkelling industry.

Green Fins Code of Conduct

UNEP

Reef-World.org

"To protect and conserve coral reefs by establishing and implementing environmentally friendly guidelines to promote a sustainable diving and snorkelling industry."

As a Green Fins Member You Are Expected To:

1. Adopt Green Fins mission statement
2. Display the adopted Green Fins agreement for the public to see
3. Adhere to the 'Green Fins' Friendly Diving and Snorkelling Guidelines and act as a responsible role model for guests
4. Participate in regular underwater cleanups at dive operator selected sites
5. Participate in the development and implementation of a mooring buoy program and actively use moorings, drift or hand place anchors for boats
6. Prohibit the sales of corals and other marine life at the dive operation
7. Participate in regular coral reef monitoring and report coral reef monitoring data to a regional coral reef database
8. Provide adequate garbage facilities on board facility's vessel and deal with responsibly
9. Operate under a 'minimum discharge' policy
10. Abide by all local, regional, national and international environmental laws, regulations and customs
11. Provide guests with an explanation of Green Fins 'Friendly Diving and Snorkelling Guidelines' in pre dive briefings
12. Provide training, briefing or literature for employees and guests regarding good environmental practices for snorkelling, diving, boating, marine wildlife interaction and other marine recreational activities
13. Provide staff and guests with public awareness and environmental materials (ID books, pamphlets etc)
14. Provide guests with information on local Marine Protected Areas, environmental rules and regulations
15. Promote a strict 'No Touch' policy for all reef diving and snorkelling

Adapted from The Coral Reef Alliance (CORAL)

www.greenfins.net

Supported by Rufford, Mangroves for the Future

Environmental Standards for Diving and Snorkelling

GREEN FINS

No stepping on Coral

No stirring the sediment

No touching or chasing marine life

No feeding fish

No littering

Don't buy souvenir of coral and marine life

Do not support shark finning

No spear fishing

Do not anchor on coral reefs

Do not collect dead or alive marine life

No gloves

Wear life jacket when snorkelling

Use mooring buoys

Report environmental violations

Join in conservation projects

www.greenfins.net

UNEP

Reef-World.org

Threat category	Total DC assessment score	Description
Green	0-27	DC has made a significant effort to mitigate environmental threats, and poses no serious environmental threat according to the Green Fins assessment guidelines.
Yellow	28-204	DC has made some effort to mitigate environmental threats, but there is still significant potential for improvement.
Red	205-330	DC has made no effort to mitigate environmental threats, or has one or more practises which pose substantial threat.

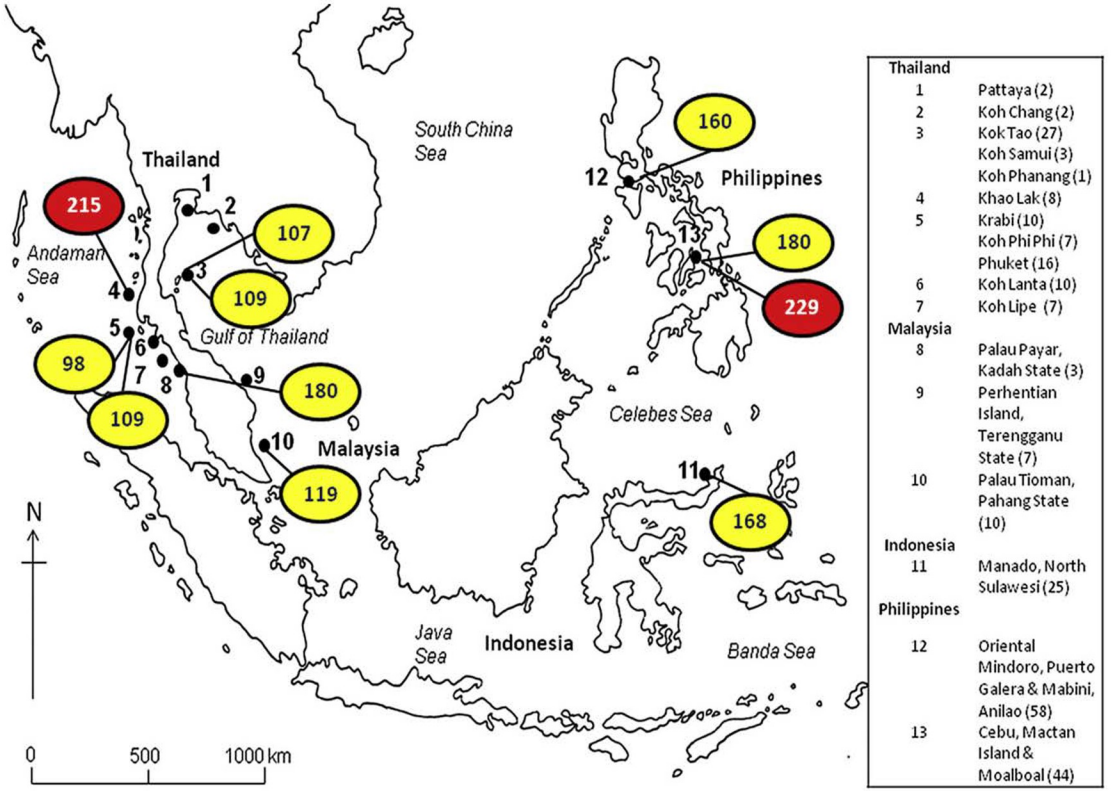
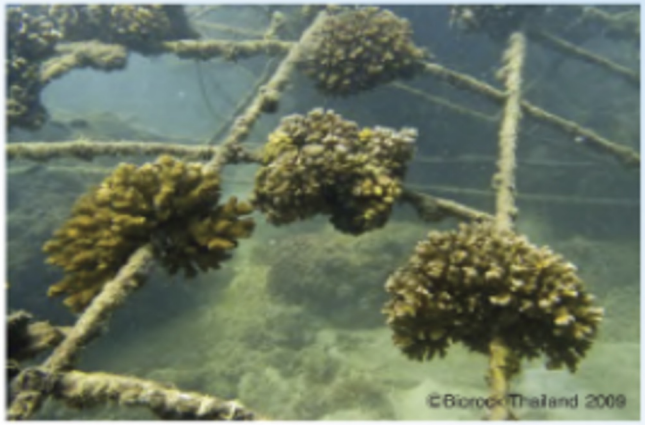


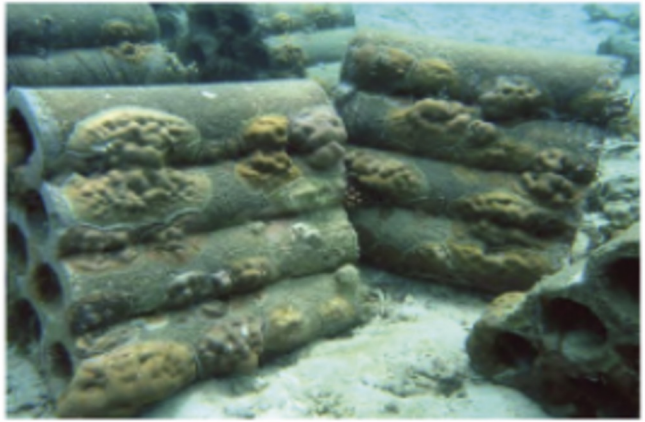
Fig. 1. Map of South East Asia showing Green Fins participating countries, Thailand, Malaysia, Indonesia and the Philippines and the locations of resorts where dive centres have been recruited as Green Fins members (numbers in brackets refer to the number of dive centres recruited in each resort). Values in the circles represent mean dive centre scores from the initial assessments which occurred between 2008 and 2012 (Thailand: dates 2008 $n = 127$, Philippines: 2011–2012 $n = 190$, Malaysia: 2009 $n = 150$, Indonesia: 2009 $n = 168$). Mean dive centre scores between 28 and 204 = yellow threat, and between 205 and 330 = red threat. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

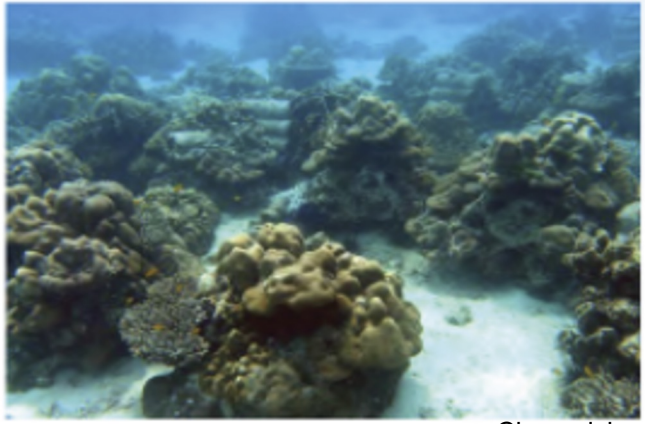
Hunt et al 2013

Coral Restoration Techniques in the Western Pacific Region

Physical restoration



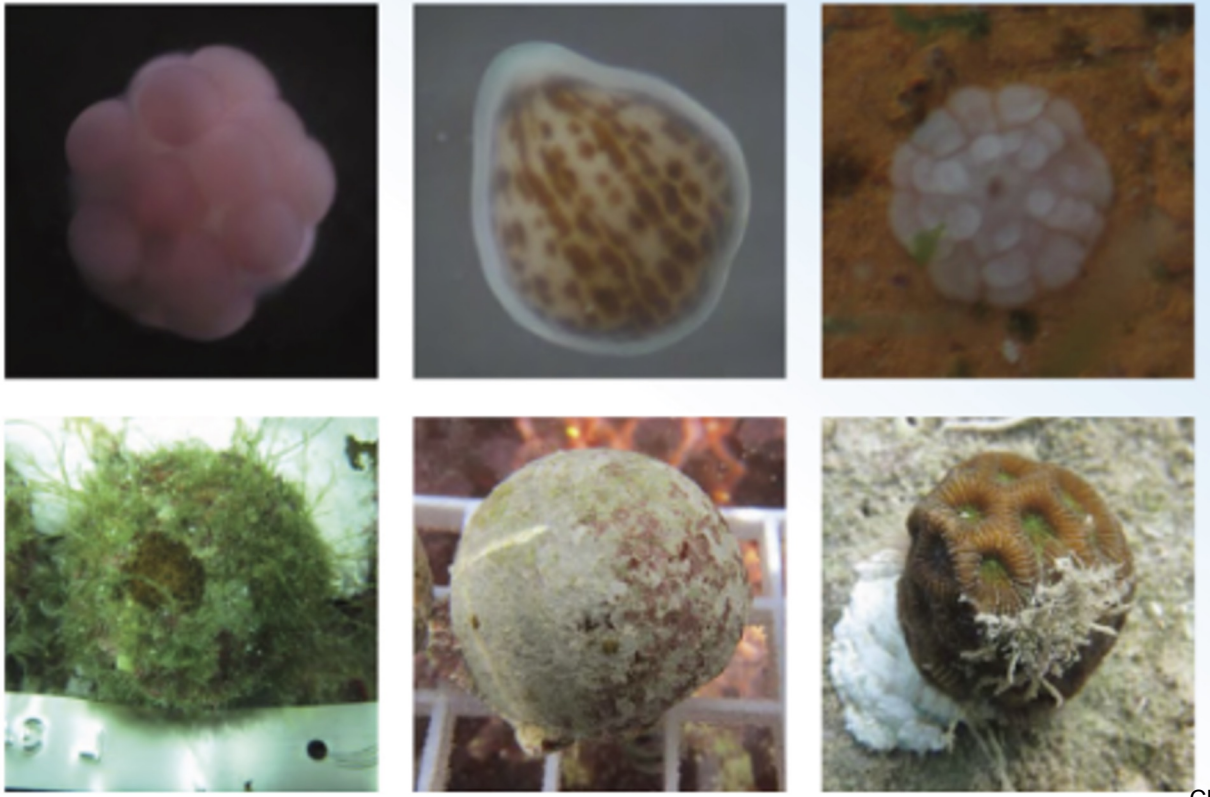




Chavanich et al (2014) IOC/WESTPAC

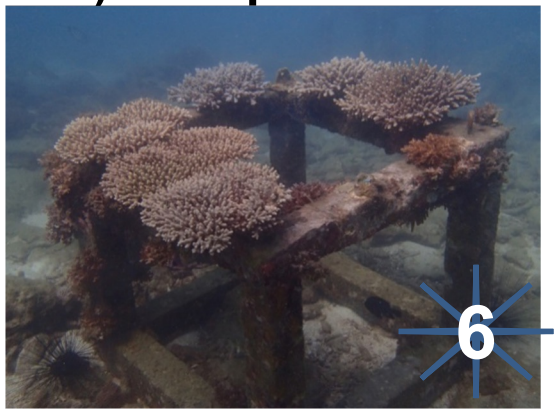
Biological restoration

Sexual propagation

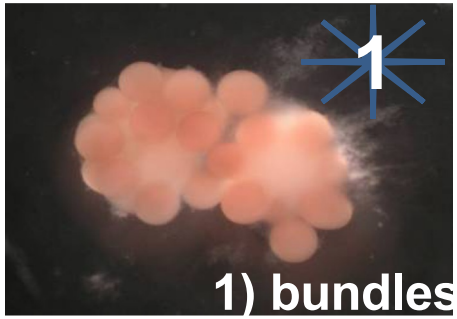


Chavanich et al (2014) IOC/WESTPAC

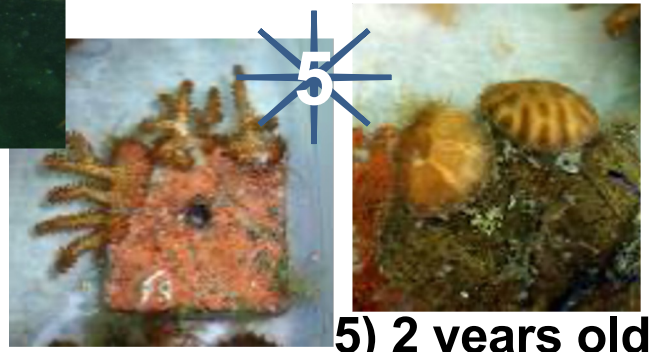
6) transplantation



2) fertilization



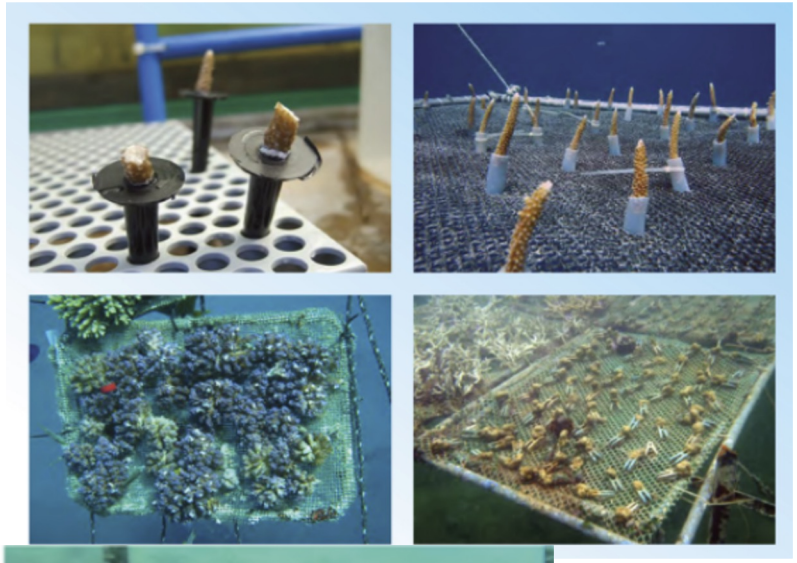
3) coral hatchery



5) 2 years old

4) 1 year old

Asexual propagation



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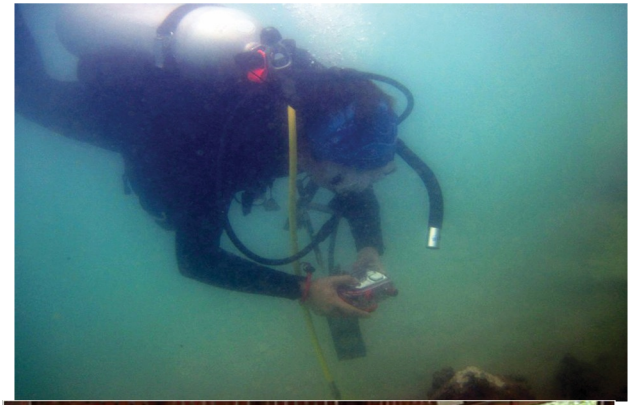
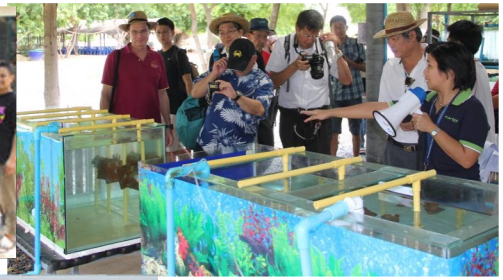
Marine Biodiversity and Ecosystems

Coral Reef Conservation & Restoration



Trainings and studies on the impact of sediment on coral reefs



Field study on coral reef restoration techniques

Thank You

Langkawi's fluorescent corals

Photo by Zulfigar Yasin