Webinar

Friday 7 May 2pm (Manila Time)

Growing Reefs Faster Than We're Killing Them

By Scott Countryman of ree.ph

Scott will present the process of mineral accretion using marine renewable energy to grow limestone structures for marine habitats, coastal storm defence and breakwaters. His Nasugbu installation growing artificial reefs will be presented and how this complements offshore energy development. This webinar will highlight how regenerative industries can be aligned with marine renewable energy use. Integrating energy users to support regenerative activities is part of the Marine Aquaculture, Reefs, Renewable Energy, and Ecotourism for Ecosystem Services TA and the wider Action Plan for Healthy Oceans and Sustainable Blue Economies.

If you are unable to attend, a recording of the Webinar will be available at https://events.development.asia/learning-events/growing-reefs-faster-we-re-killing-them

Using Ocean Based Renewable Energy to Regenerate Coral Reefs

Agenda

- **Introduction**
- **Experiences in the Field**
- **Challenges Facing Coral Reefs**
- **Scalable Solutions**
- **Q & A**

Presented by:
Scott Countryman, Executive Director
The Coral Triangle Conservancy
May 7, 2021

Not For Profit Organization

Regeneration

We are philanthropic venture based in the Philippines campaigning to establish networks of ecosystem sized marine protected areas while pioneering new technologies and social programs to end overfishing.

Our programs seek to increase awareness of the importance of coral reefs and then seed and incubate locally managed businesses that create economic incentives for conservation activities.

Lifeboat Project Nasugbu: Networks of NEOLI MPAs

Regeneration

Conservation success increases dramatically when MPAs have five key features.

A study of 87 marine protected areas worldwide has found that conservation success - as indicated by fish biomass - improves exponentially when an MPA has five key features. Those recurring characteristics are:

- **No fishing** allowed;
- Well-**Enforced**;
- More than 10 years **Old**;
- Relatively **Large** in area (larger than 100 km2); and
- **Isolated** from fished areas by habitat boundaries, such as deep water or sand.

30% by 2030!

Forbes

Protecting 5% More Of The Ocean Can Increase Fisheries Yield By 20% According To New Research

Ariella Simke Contributor

Science

SCIENCE HEALTH FUTURITY CULTURE ENVIRONMENT

FISHING SAPS THE OCEAN'S POWER TO CAPTURE CARBON

NOVEMBER 19TH, 2020

POSTED BY HARRISON TASOFF-UC SANTA BARB

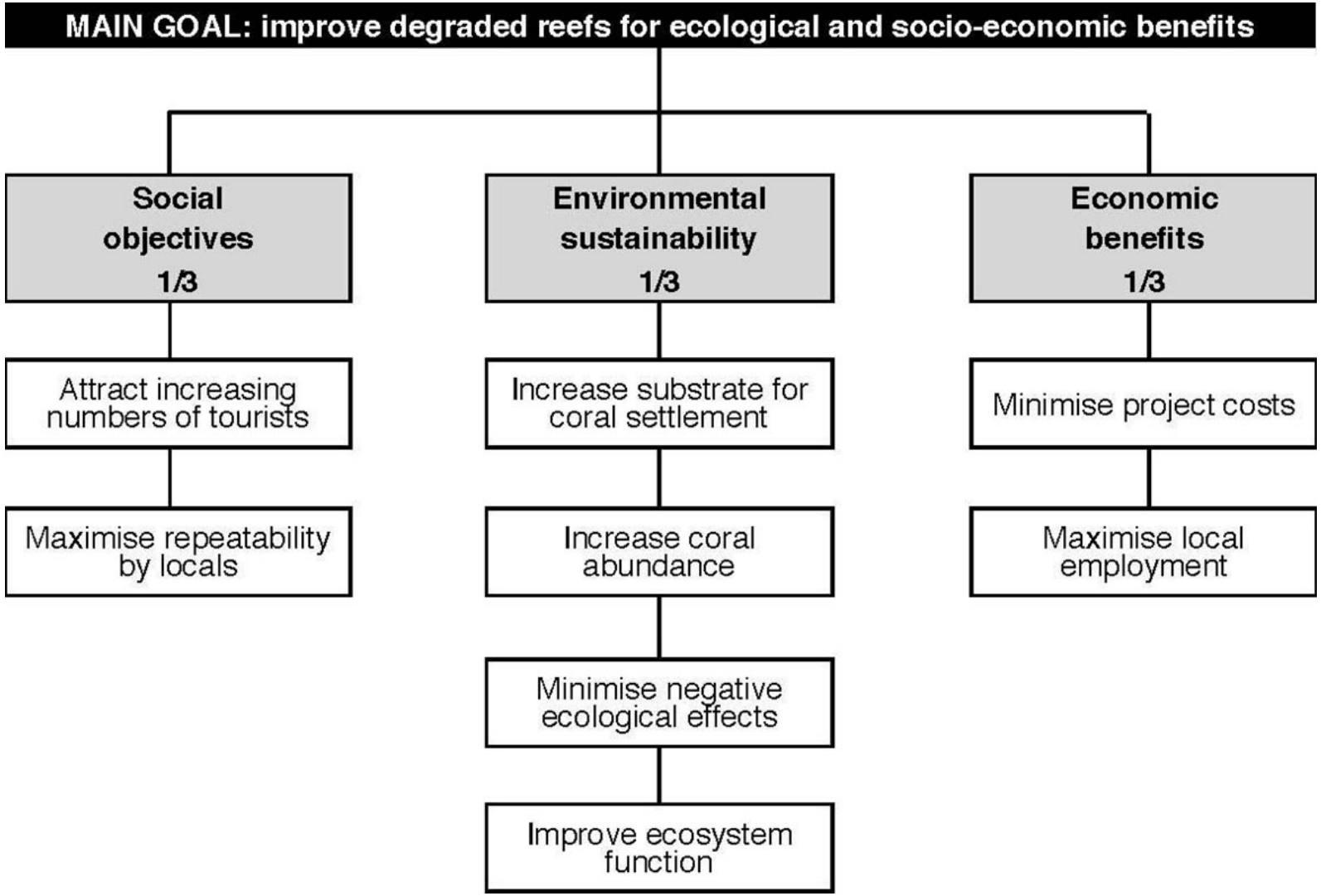
(Credit: Getty Images)

Fishing reduces carbon sequestration in the ocean, researchers report.

SHARE THIS

Lifeboat Project Nasugbu: Rehabilitating Coral Reefs

Regeneration

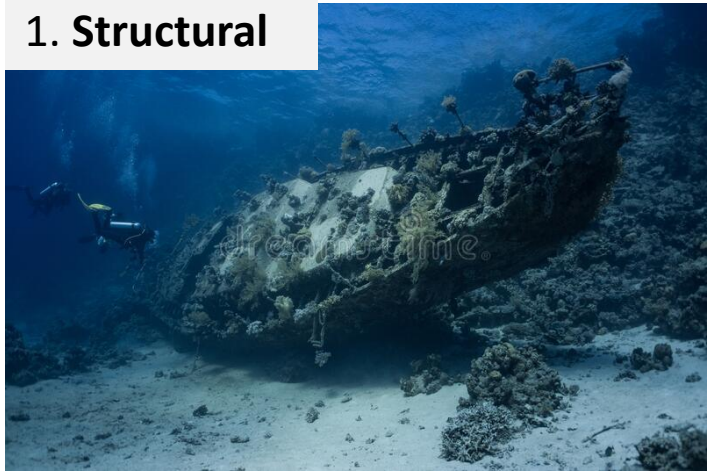


Methods Of Coral Restoration

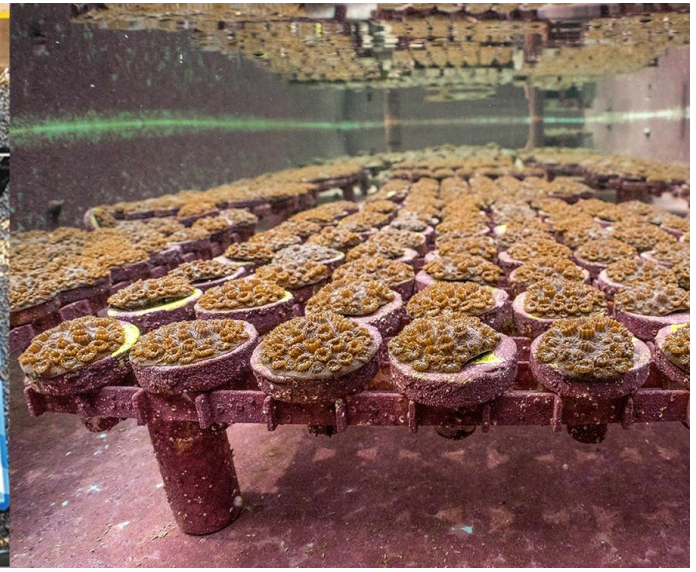
Regeneration

(1) Increase substrate available for coral growth, (2) increase the amount of coral coverage or, (3) alter growing conditions

1. **Structural**



2. **Biological**

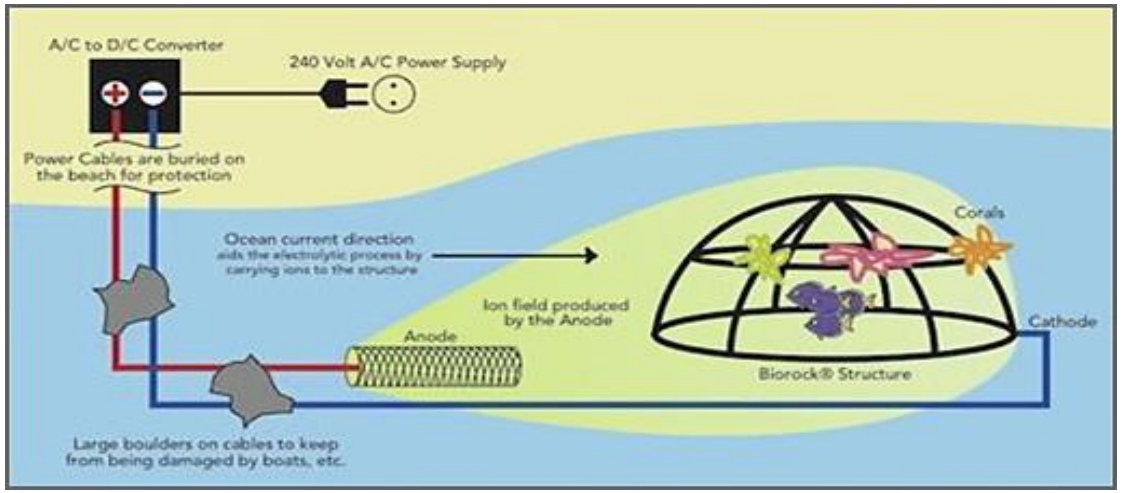


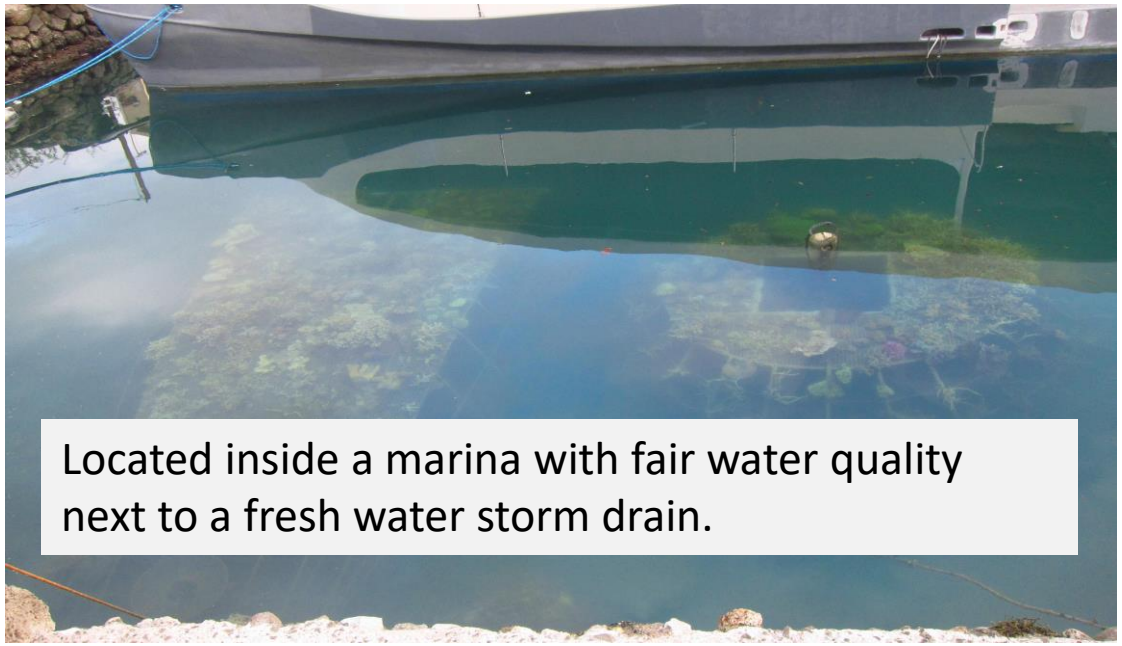
Methods Of Coral Restoration

Energy Regeneration

3. Physical

10sqm surface area/2.5 meter diameter domes built in less than 30 min for around US$16/each in materials and labor.





Located inside a marina with fair water quality next to a fresh water storm drain.

2013 Biorock Pilot (9 Months)

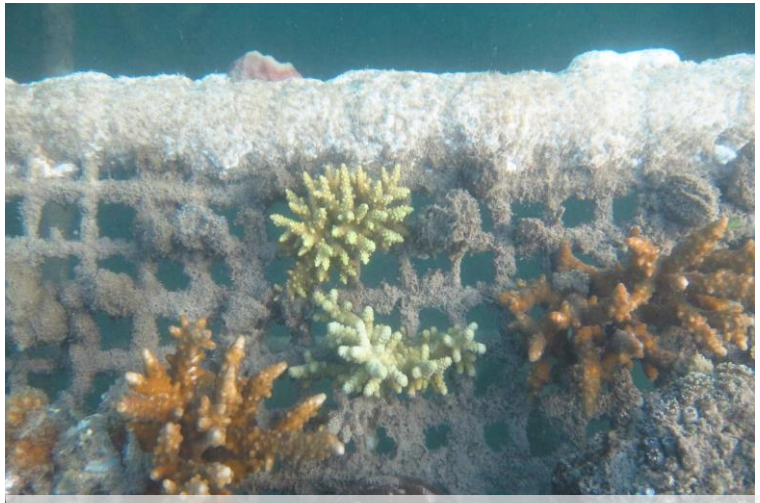
Regeneration

9kw Solar/72kwh Battery (@150 unit capacity)

50w-80w per structure/<10 Meters distance

600%+ growth rates and hyper branching

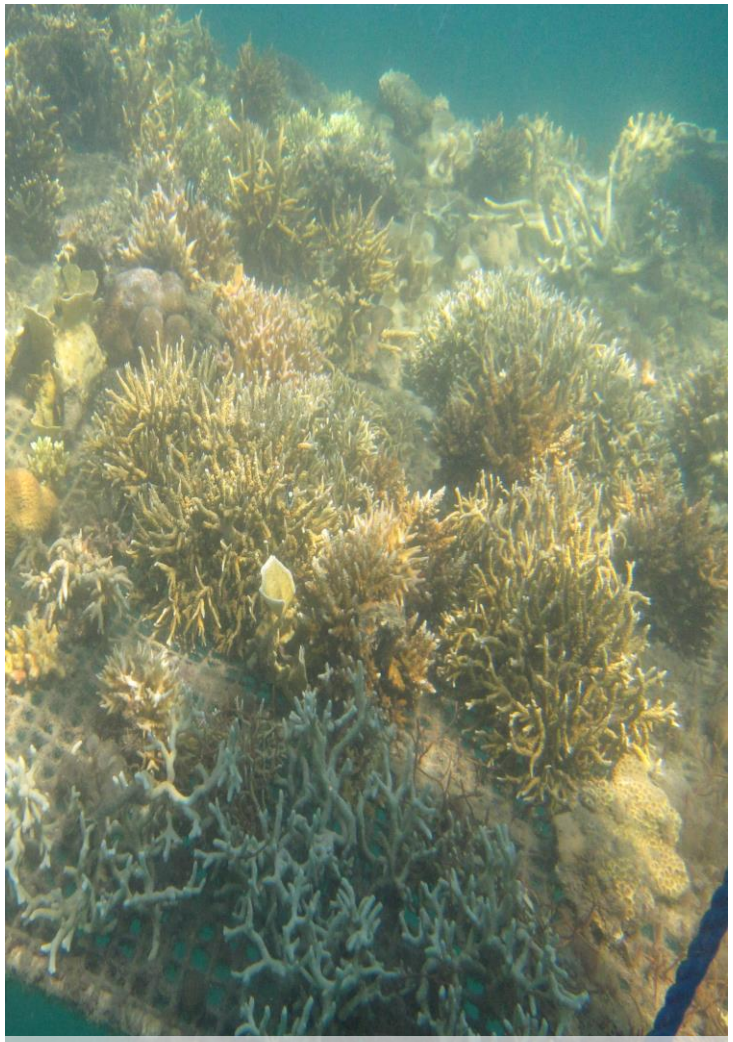
Wide variety of local corals grown



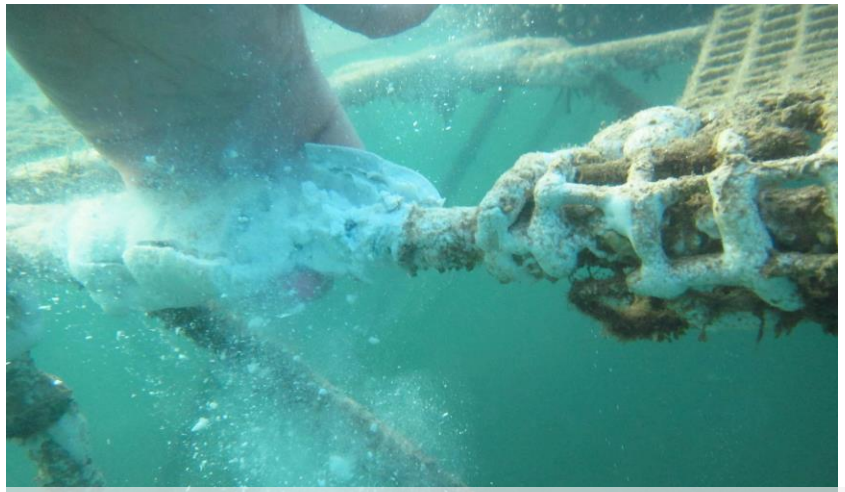
Recruitment of new corals observed

Biorock Observations

Regeneration



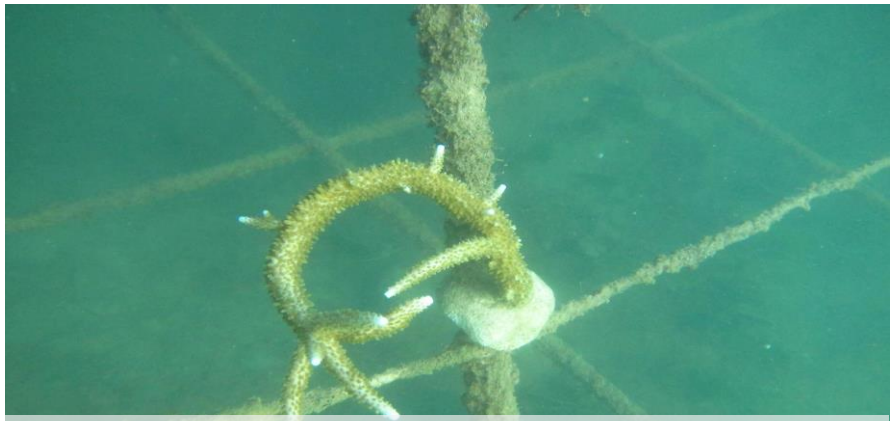
Rapid Overcrowding



Goldilocks power settings 24/7

Corrosion and coral mortality if no power.

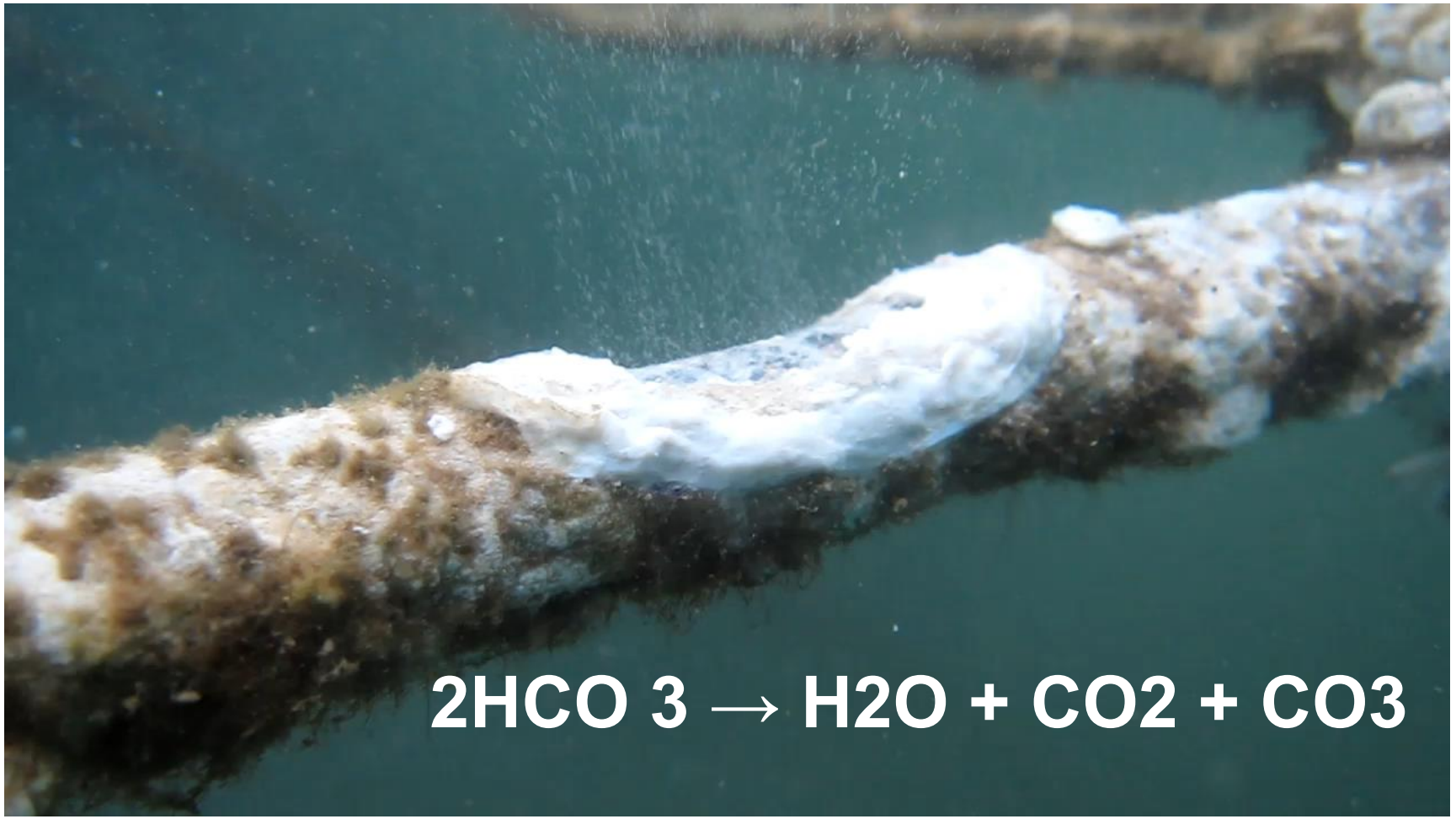
Top heavy due to accelerated growth



Homogenous DNA

Hydrogen Bubbles Streaming from Electrolysis

Could we channel the hydrogen bubbles to collect and store ?

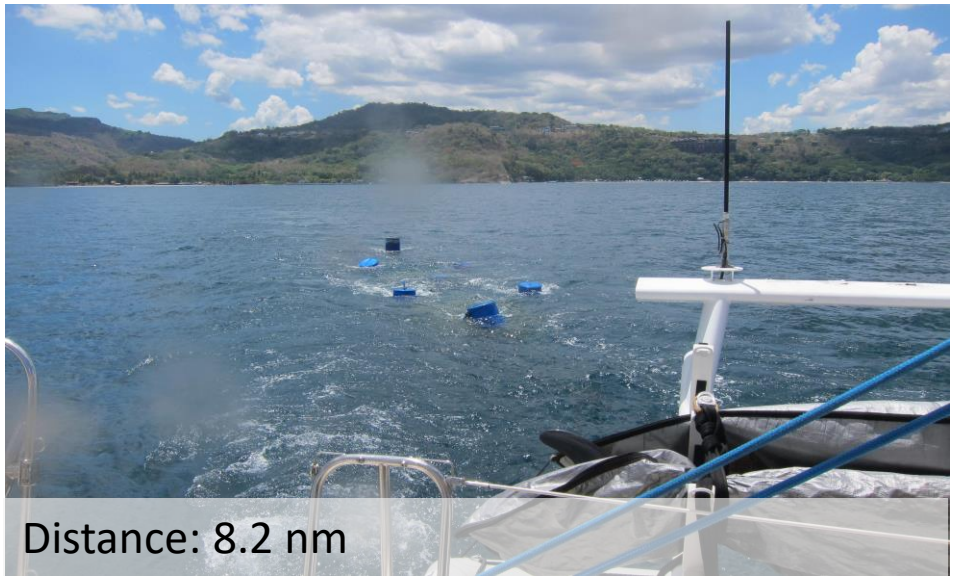


Solution: Nursery Hub and Movable Reefs
To achieve ‘Highway Parity’

Regeneration

1knt-1.5knts in calm seas

@20% loss of coral in route.



Distance: 8.2 nm

Fish swam along entire way!

Basic Reeph Forms

Domes

- Universal applications
- Most natural looking
- Good verticality
- Good wave tolerance

Wedges

- More durable (12mm-16mm)
- Excellent wave tolerance

Tables

- Easiest to construct/lowest cost
- Good in protected waters in fragment nurseries

Lifeboat Project Nasugbu: Habitat Mapping (69kms)

Regeneration

	Area (sq meters)	Shoreline Distance (m)	Snorkel	Manta	SCU
Bucanita	166,874	2,456	x	x	
Dorado	140,976	1,370	x	x	
Arkaya	118,802	1,350	x	x	
Balibago	108,070	1,376	x	x	
N. Etayo	156, 389	2,012	x	x	
S. Etayo	257, 108	1,793	x	x	
Baybay	82,827	1,306	x	x	
Subli	160,961	1,622	x	x	
Santelmo	281,032	2,193	x	x	
Pico de Loro Cove	338,861	2,870	x	x	
Papaya	1,316,779	6,633	x	x	
Layag Layag	671,721	3,236	x	x	
Kayraang Cove	834,274	5,791	x	x	
Calayo	2,220,296	6,951	x	x	
Loralie/Long Beach	2,333,416	7,225	x	x	
Pt Fuego	931,424	3,144	x	x	
	9,706,313	51,328			

Hamilo Coast Marine Sanctuary with Buffer Zone

No Take Area:

South West: 14°11'16.00"N, 120°34'40.00"E
South East: 14°11'16.00"N, 120°35'13.00"E
North West: 14°13'46.00"N, 120°34'40.00"E
North East: 14°13'46.00"N, 120°35'16.00"E

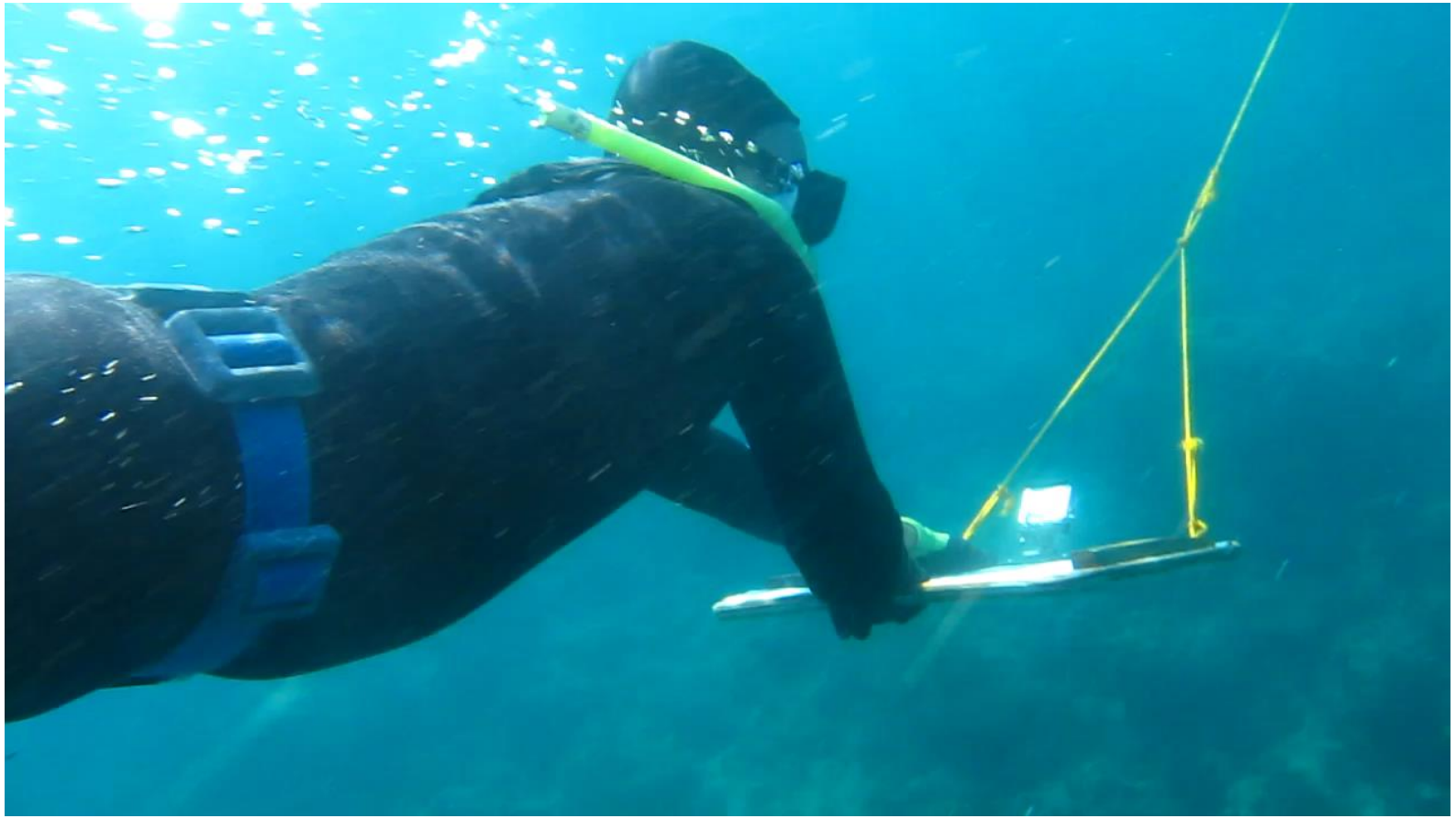
Buffer Zone:

South West: 14°10'56.00"N, 120°34'7.00"E
South East: 14°10'56.00"N, 120°35'13.00"E
North West: 14°14'13.00"N, 120°34'7.0"E
North East: 14°14'13.00"N, 120°35'15.00"E

Coral Reef Triage

Lifeboat Project Nasugbu: Location, Location, Location!

Regeneration

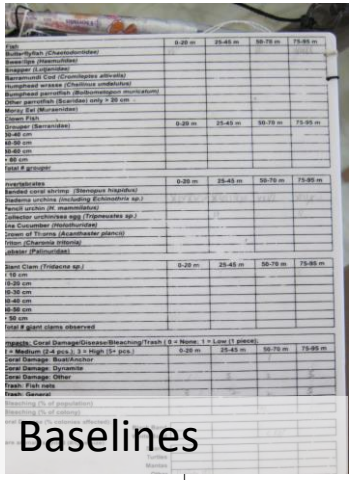


Lifeboat Project Nasugbu: Site Selection

Regeneration

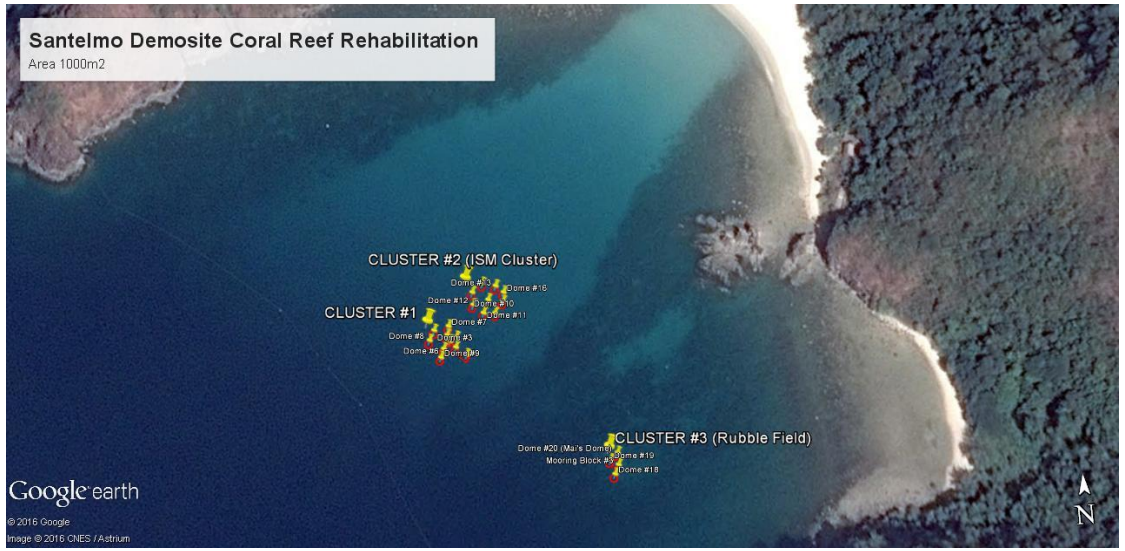
Collecting ‘Orphans’

Reefcheck



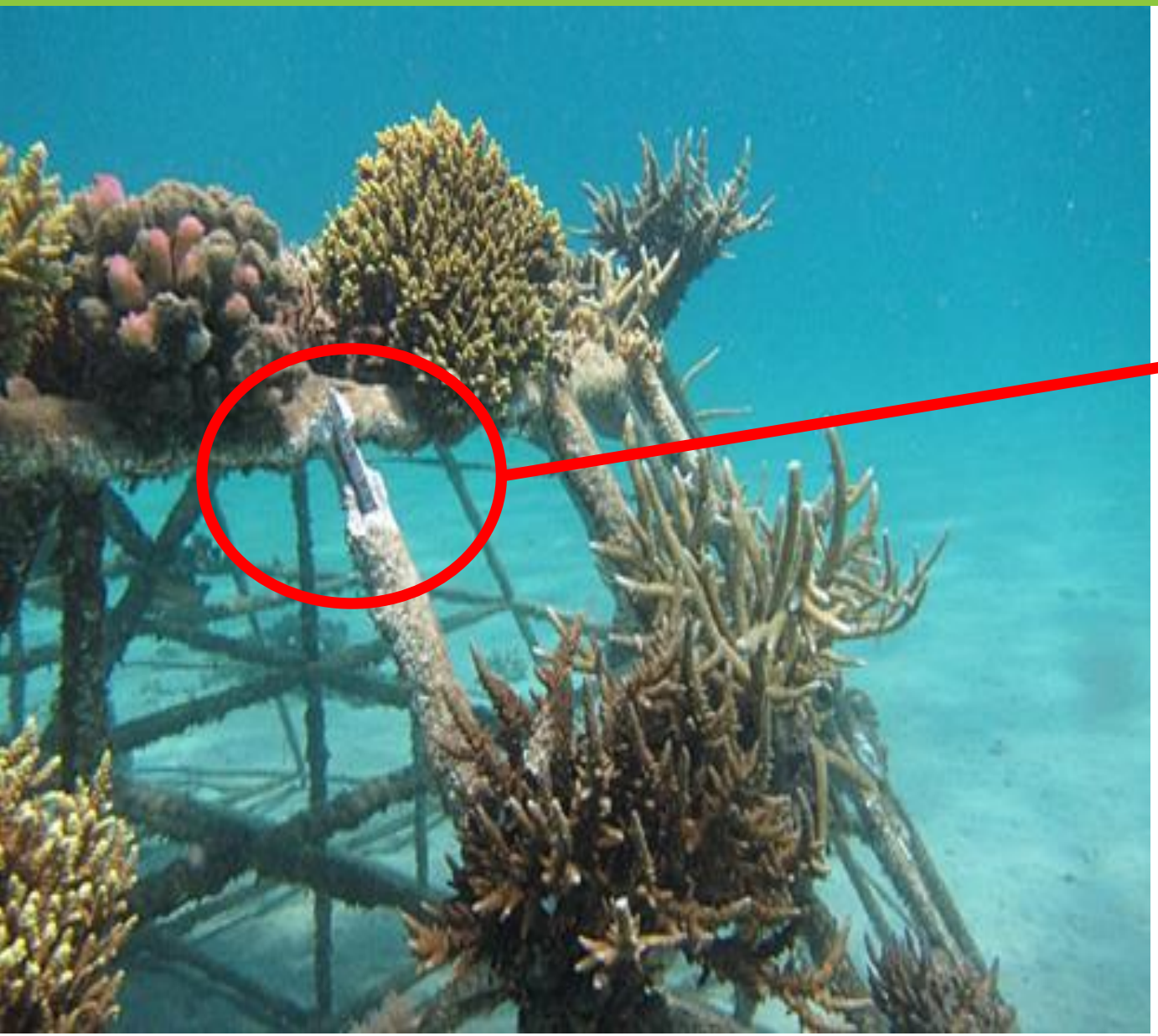
Baselines

Weekly Maintenance



Calcium Carbonate as Substrate and Protection for Metal

Regeneration

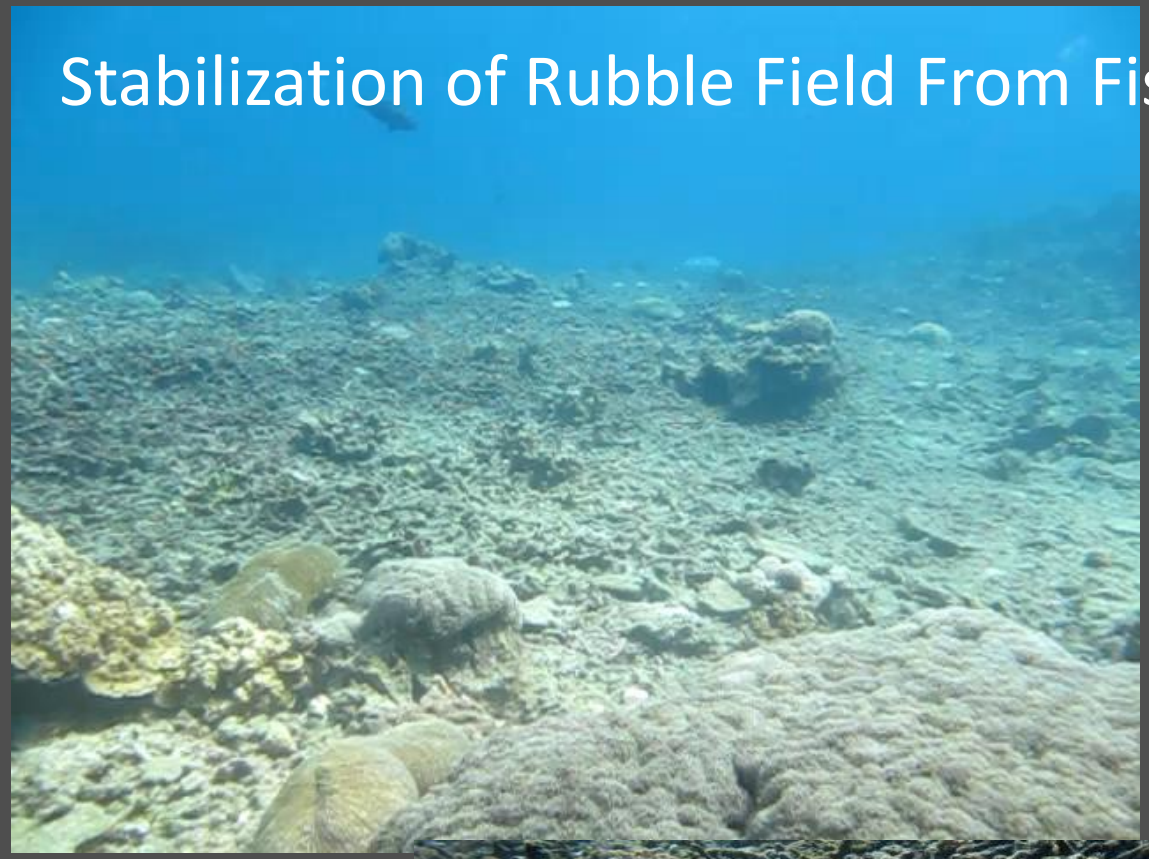


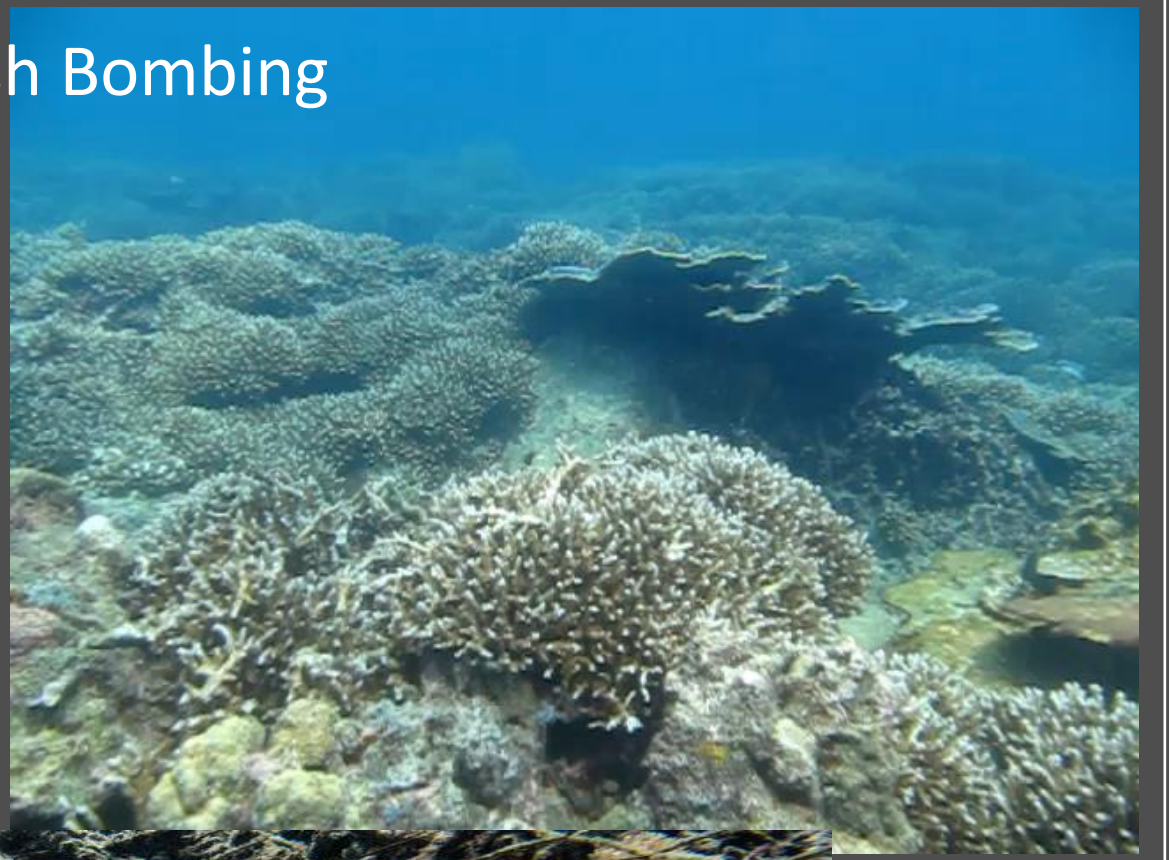
Use of Mesh for Growing New Reefs

Energy

Regeneration

Stabilization of Rubble Field From Fish Bombing





Networks of Sensors: To Stop Fish Bombing

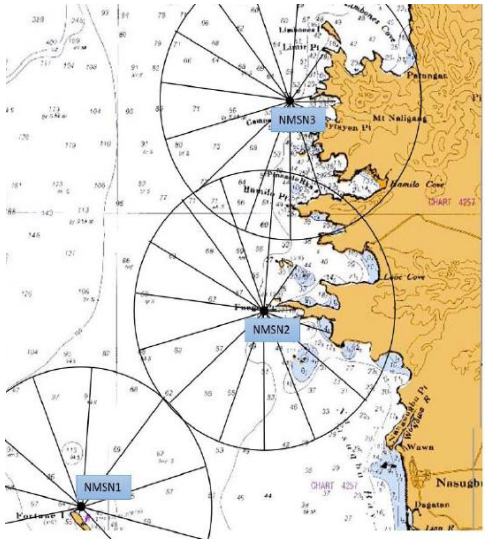
Regeneration

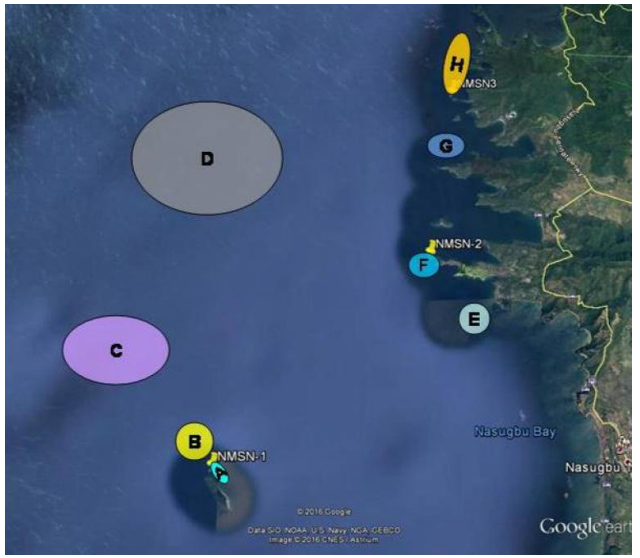
Table 2. Blast data recovered from the detectors (overlapping blasts excluded)

Loc / Month	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
NMS N-1	368	1,655	2,134	801	1,559	1,486	1,099	1,378	1,241	1,134
NMS N-2	138	239	238	13	6	7	3	4	2	6
NMS N-3	15	59	317	38	51	59	68	81	83	31
Total:	521	1,953	2,689	852	1,616	1,552	1,170	1,463	1,326	1,171

Loc / Month	Jan-17	Feb-17	Mar-17	Totals
NMS N-1	301	393	149	13,698
NMS N-2	0	1	1	658
NMS N-3	9	13	9	833
Total:	310	407	159	15,189

Note : June 2016 was adjusted using data from this deployment to the figures shown.

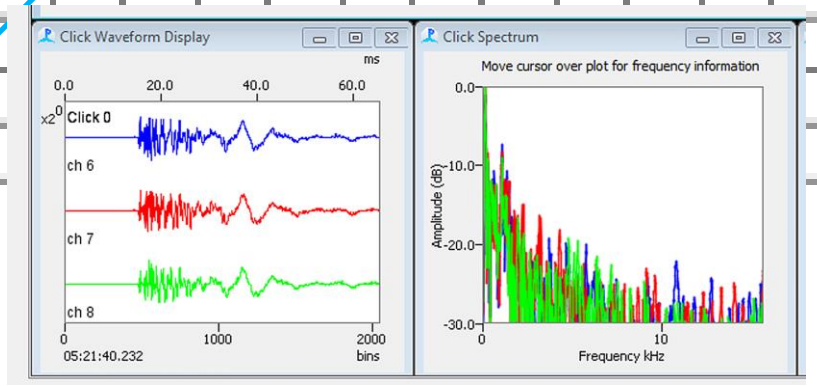




Bomb Waveform

Regeneration

- MGuard visual display: 3 hydrophones



Solutions: Technology Enabled DIY Enforcement

Regeneration

Solutions: FishPals Smartphone App for Fishermen

Regeneration

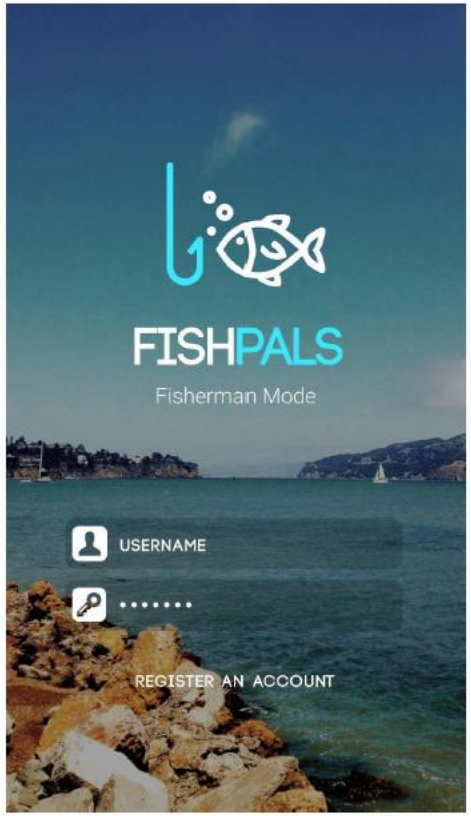
Market: Near Real Time Oline Fish Auction

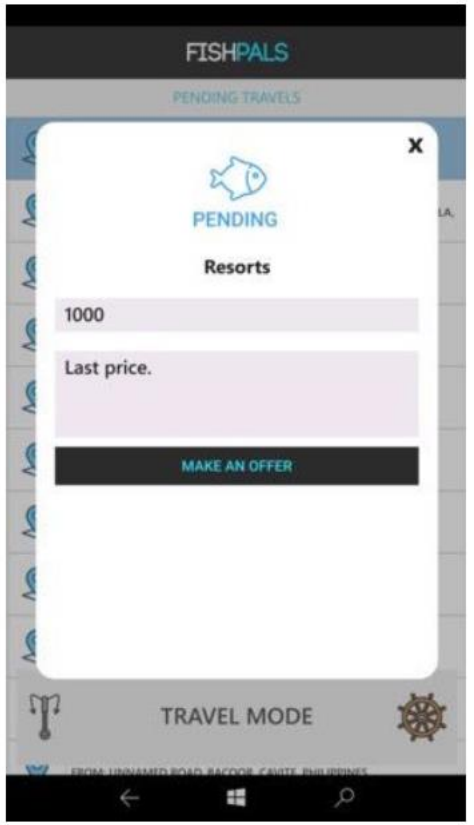
Water Taxi: Alternative employment when not fishing

Bounty: Reward paid for tips that result in arrests of illegal fishing boats

Fisheries Data: GPS data of catch location and time

Emergency Services: Weather updates and SOS service





Solutions: Containerized Operations for Scalability

Regeneration

Marine Lab

Command and Control Center

Community Outreach HQ

Staff housing

. . .all in a single unit running off-grid on renewable energy.

Summary of 5 Year Nasugbu Lifeboat Project

Regeneration

The Killer Assumptions of Climate Change

- Coral Bleaching (and its ugly twin acidification) are accelerating and 'Its happening faster than we expected'. The world is not reducing GHG emissions and while world leaders discuss plans the fossil fuel tap is still on and coral reefs are still bleaching.

IUU Fishing Remains Rampant

- Underfunded and understaffed many government offices lack the resources, or political will, to take effective action against both small scale and commercial fishers. Fish bombs, cyanide, poor anchoring practices, and other forms of destructive fishing are a constraint stress on coral reefs.

Increasing Land Based Pollution and Erosion from Unchecked Coastal Development

- Single use plastic production us up every year and will continue to pollute rivers and waterways that empty into the sea with a mess of other additional household and industrial wastes.

Lack of Funding

- Most of the time dependent on private donations and volunteers to cover expenses
- Local and National government provided very little support and often transaction costs and overcoming LGU bureaucracy were the biggest obstacles

- Urgent Action on Climate Change Needed More Than Ever
- Rapid Loss of Biodiversity and Extinction Level Event for Coral Pending

Its not too late!

- NEOLI MPAs in 30% by 2023
- We can measure and end fish bombing within a year
- We can rapidly grow climate change resistant coral
- Marine EVs are the future now to decarbonize marine transport

. . .and the more we learn about it, the worse it gets.

Regeneration

Bioplastics NEWS

STIC ~ CHEMICAL RECYCLING NEWS PER TOPIC ~ SUBSCRIPTION ~ CONTACT ~

BIODEGRADATION & COMPOSTING

These Corals Choose to Eat Plastic Over Food

BY AXEL BARRETT
August 1, 2019

Tiny plastic particles may also be a vehicle for microbes that sicken or even kill corals, a new study finds.

SCIENTISTS HAVE FOR the first time shown that some wild corals are feeding on tiny shreds of plastic trash. Worse, the animals seem to prefer those 'microplastics' over their natural food—even when the plastic is carrying bacteria that can kill them.

The new study, published in Proceedings of the Royal Society B: Biological Sciences, focused on a temperate species of coral collected off Rhode Island, one that builds small clusters no larger than a human fist.

Plastic debris can devastate coral reefs. Credit: Kathryn Berry

ECOLOGY · 25 JANUARY 2018

Plastic trash is sickening the world's coral reefs

Exposure to plastic junk makes fragile reefs highly susceptible to disease.

Plastic waste in the ocean makes reef-building corals highly vulnerable to several potentially fatal diseases.

Joleah Lamb at Cornell University in Ithaca, New York, and her colleagues surveyed 159 reefs in the Asia-Pacific region for signs of disease and plastic pollution, and discovered a dramatic correlation: the likelihood of disease on a coral free of plastic waste was only 4%, but jumped to 89% on a coral blighted by plastic.

MICROPLASTICS

Paint: The Big Source of Ocean Microplastics You Didn't Know About

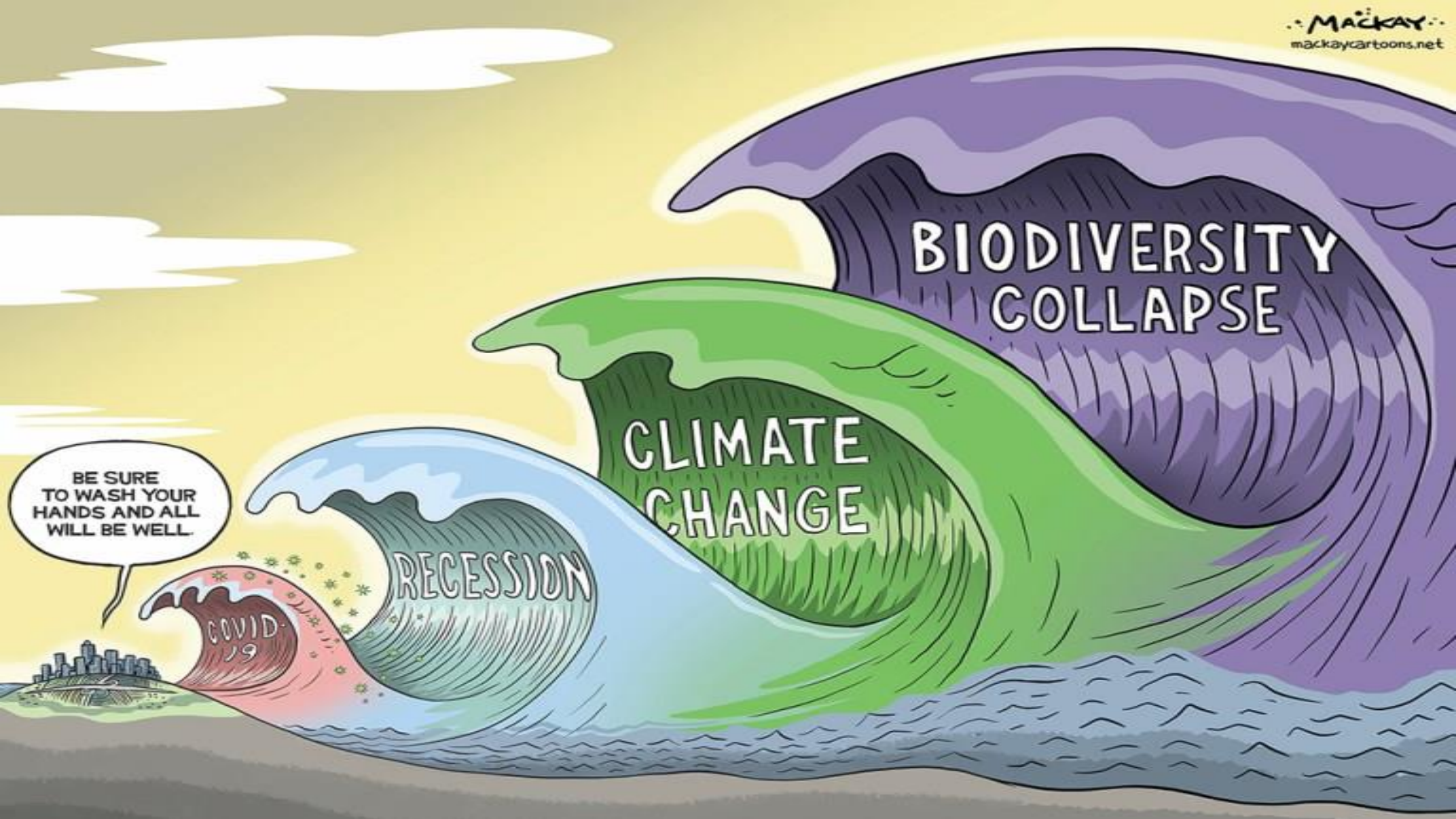
By World Economic Forum | Sep. 08, 2020 10:37AM EST

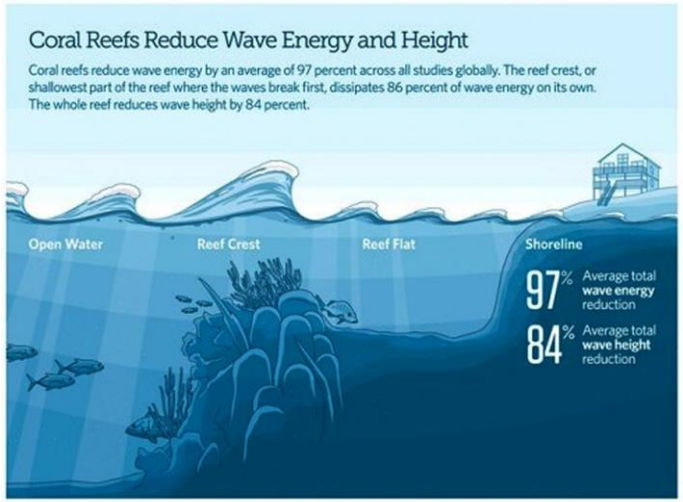
OCEANS

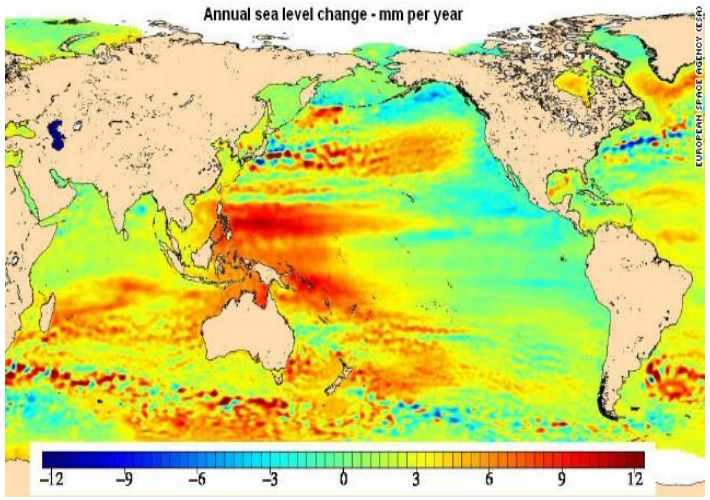
There has been very little focus on the fact that unless paint residuals are collected during surface preparation and the maintenance process, they will largely end up in the ocean as microplastics. DisobeyArt / Getty Images

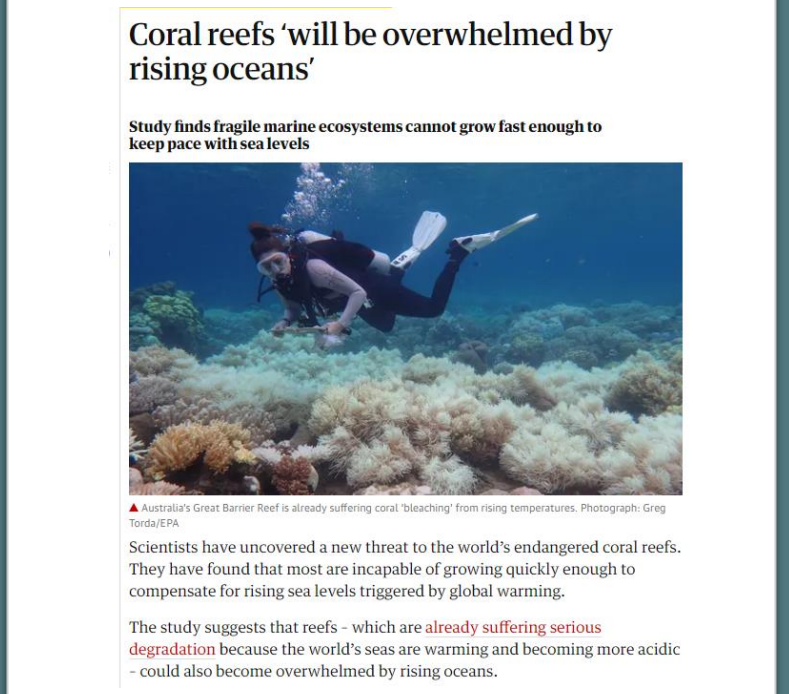
By Declan McAdams and Tore Angelskår

Until recently, microplastics that enter the ocean from paint have not received a lot of attention. There has been very little focus on the fact that unless paint residuals are collected during surface preparation and the maintenance process, they will largely end up in the ocean as microplastics.


MACKAY
mackaycartoons.net
BIODIVERSITY COLLAPSE
CLIMATE CHANGE
RECESSION
COVID-19
BE SURE TO WASH YOUR HANDS AND ALL WILL BE WELL.







Coral reefs 'will be overwhelmed by rising oceans'

Study finds fragile marine ecosystems cannot grow fast enough to keep pace with sea levels

▲ Australia's Great Barrier Reef is already suffering coral 'bleaching' from rising temperatures. Photograph: Greg Torda/EPA

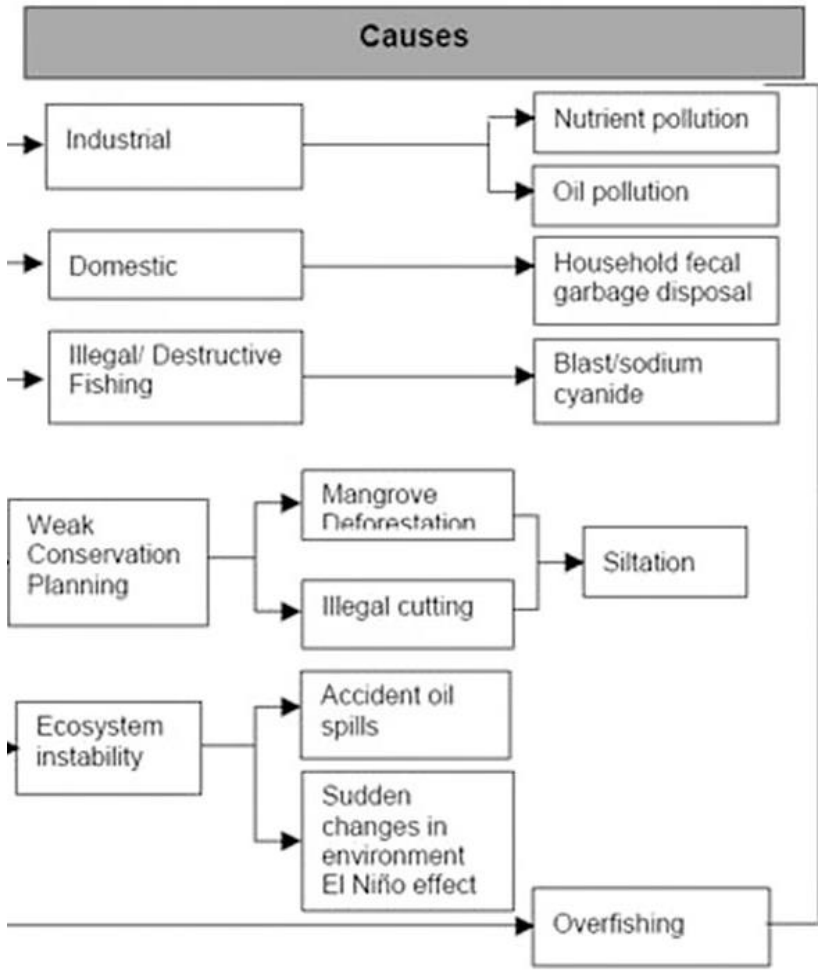
Scientists have uncovered a new threat to the world's endangered coral reefs. They have found that most are incapable of growing quickly enough to compensate for rising sea levels triggered by global warming.

The study suggests that reefs - which are already suffering serious degradation because the world's seas are warming and becoming more acidic - could also become overwhelmed by rising oceans.

Can we really grow coral reefs faster than we are killing them?

Answer: Yes!

Problems Remain: Population Density and Climate Change



Marine species increasingly can't live at equator due to global heating

Study suggests it is already too warm in tropics for some species to survive

▲ Fish at Wetar island in Indonesia. Scientists say the fall in marine diversity around the equator could have profound consequences that are hard to predict. Photograph: agefotostock/Alamy

Global heating has made the ocean around the equator less rich in wildlife, with conditions likely already too hot for some species to survive, according to a new study.

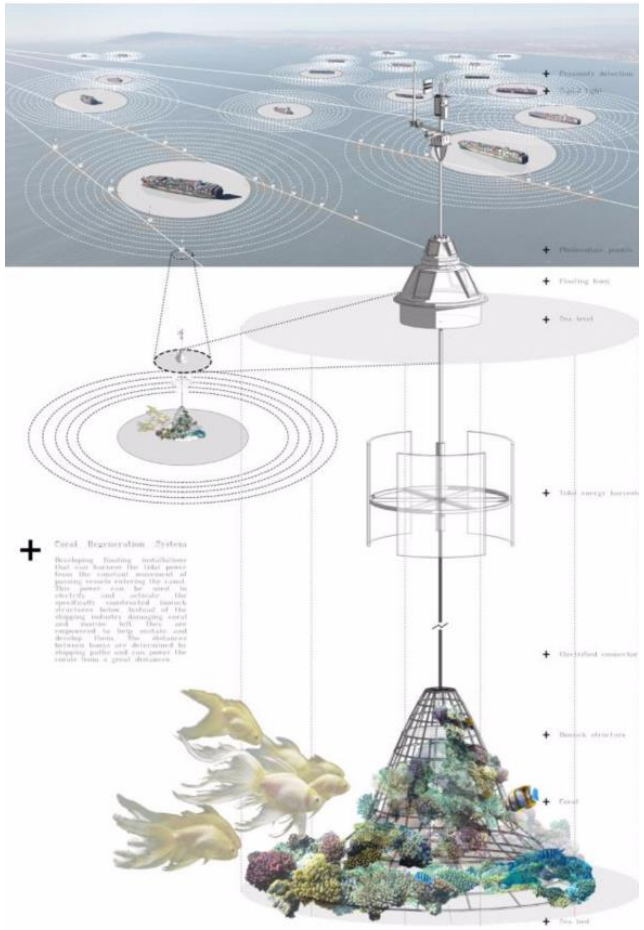
Analysis of the changing locations of almost 50,000 marine species between 1955 and 2015 found a predicted impact of global heating - species moving away from the equator - can now be observed at a global scale.

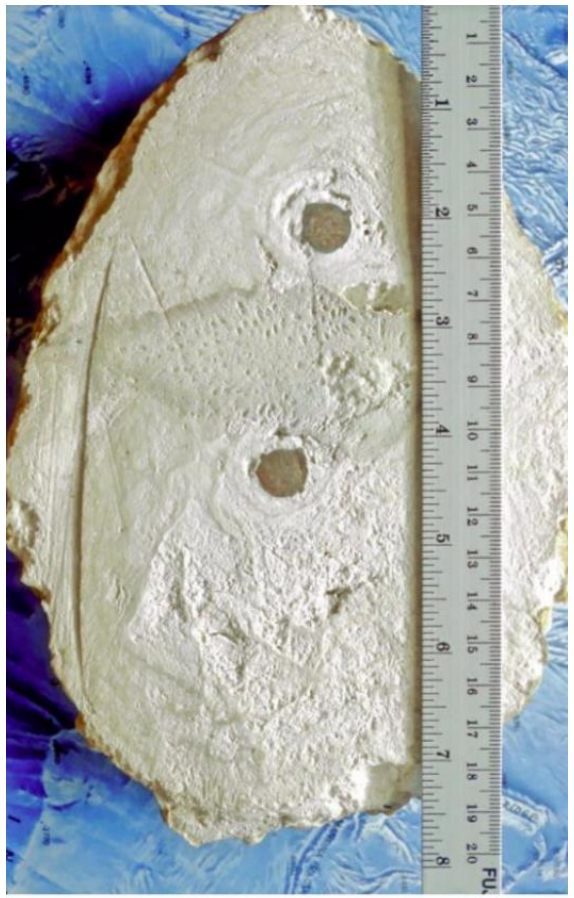
It said further global heating, which is now unavoidable, would cut the richness of species in the ocean in tropical regions even further.

Scientists said the consequences of the shift could be profound and would be challenging to predict.

Proven on offshore gas platforms over 40 years ago

Regeneration





Mineral accretion sample from Maldives which was grown electrolytically during **only five years.**

Biorock Electric Reefs Grow Back Severely Eroded Beaches in Months

by tsarkisian | Oct 11, 2017 | 2 Comments

Journal of *Marine Science and Engineering* — MDPI

Biorock Electric Reefs Grow Back Severely Eroded Beaches in Months

Thomas J. F. Goreau [1,2] and Paulus Prong [2,3]
[1] Global Coral Reef Alliance, 37 Pleasant Street, Cambridge, MA 02139, USA
[2] Biorock Indonesia, Bali 80361, Indonesia
[3] Pulau Gangga Dive Resort, Sulawesi 95253, Indonesia

Abstract

Severely eroded beaches on low lying islands in Indonesia were grown back in a few months—believed to be a record—using an innovative method of shore protection, Biorock electric reef technology. Biorock shore protection reefs are growing limestone structures that get stronger with age and repair themselves, are cheaper than concrete or rock sea walls and breakwaters, and are much more effective at shore protection and beach growth. Biorock reefs are permeable, porous, growing, self-repairing structures of any size or shape, which dissipate wave energy by internal refraction, diffraction, and frictional dissipation. They do not cause reflection of waves like hard sea walls and breakwaters, which erodes the sand in front of, and then underneath, such structures, until they collapse. Biorock reefs stimulate settlement, growth, survival, and resistance to the environmental stress of all forms of marine life, restoring coral reefs, sea grasses, biological sand production, and fisheries habitat. Biorock reefs can grow back eroded beaches and islands faster than the rate of sea level rise, and are the most cost-effective method of shore protection and adaptation to global sea level rise for low lying islands and coasts.

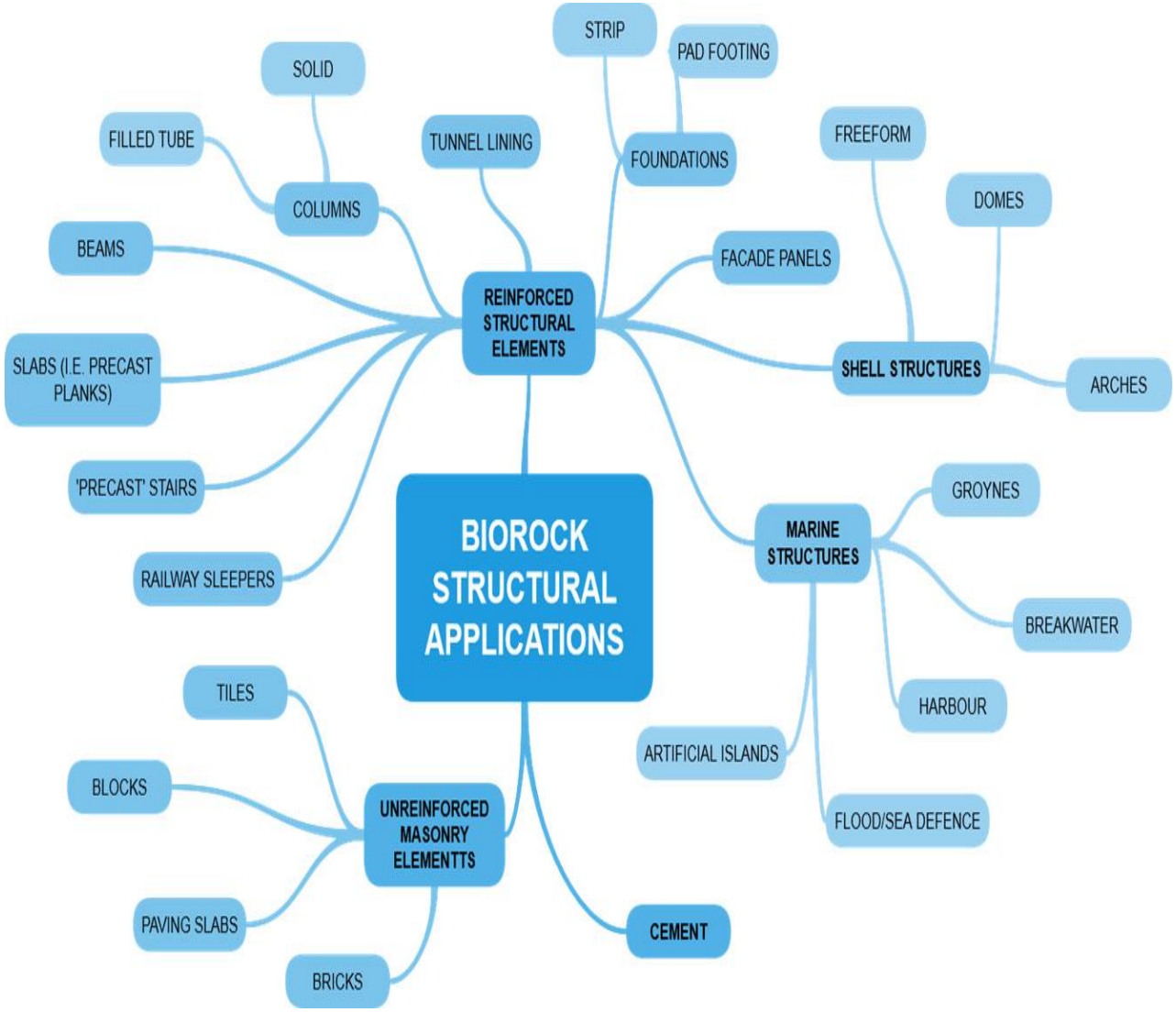
Gili Eco Trust in Indonesia documented a 100% survival rate after the most recent bleaching event compared to 60% mortality on control reefs.

‘Intercrop’ Commercial Reeph Products Within Areas Undergoing Restoration

Regeneration

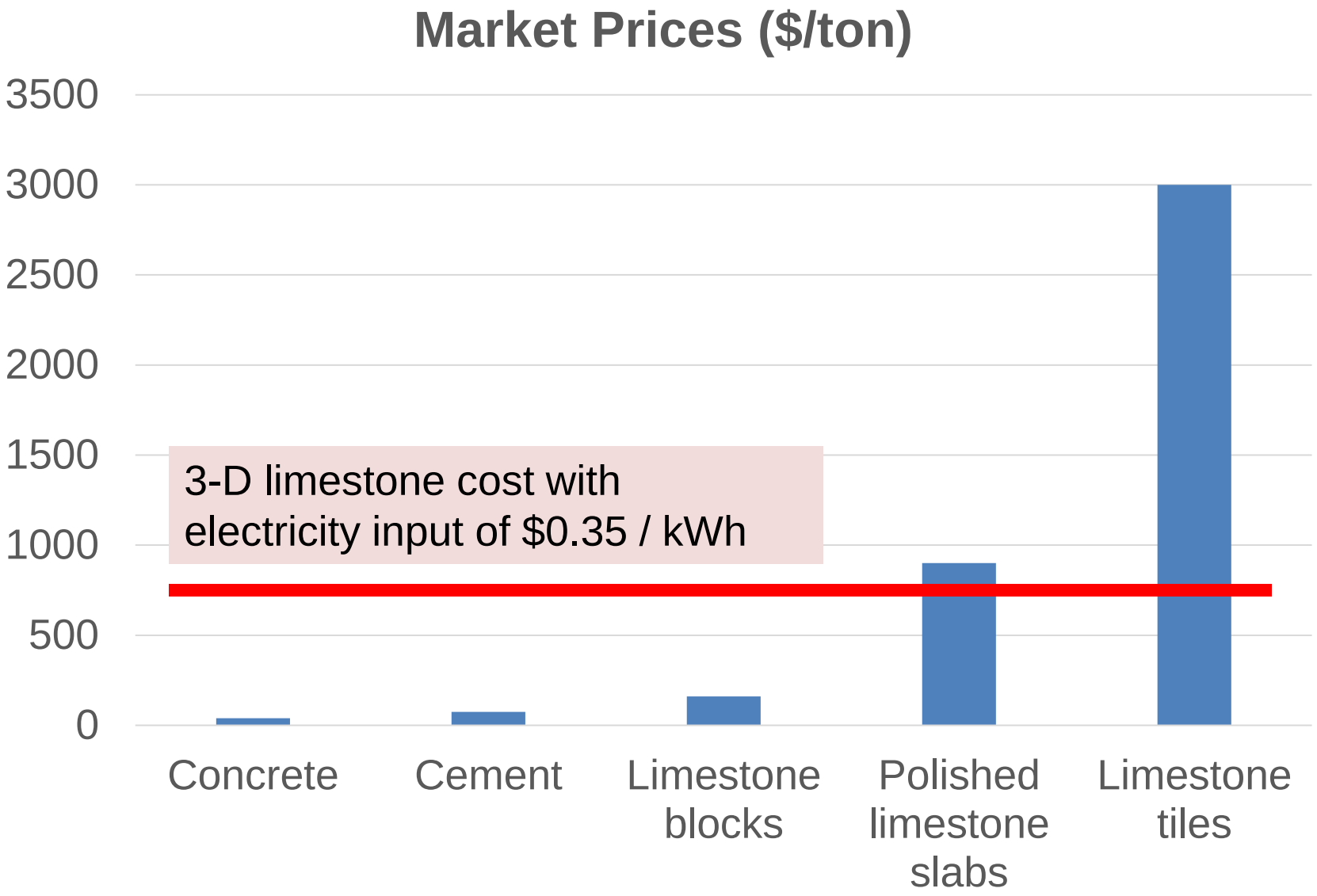
Prefabricated Limestone Products Grown in Seawater

. . . and capture segments of the $682B/year cement industry.



Sustainable Limestone Building Materials

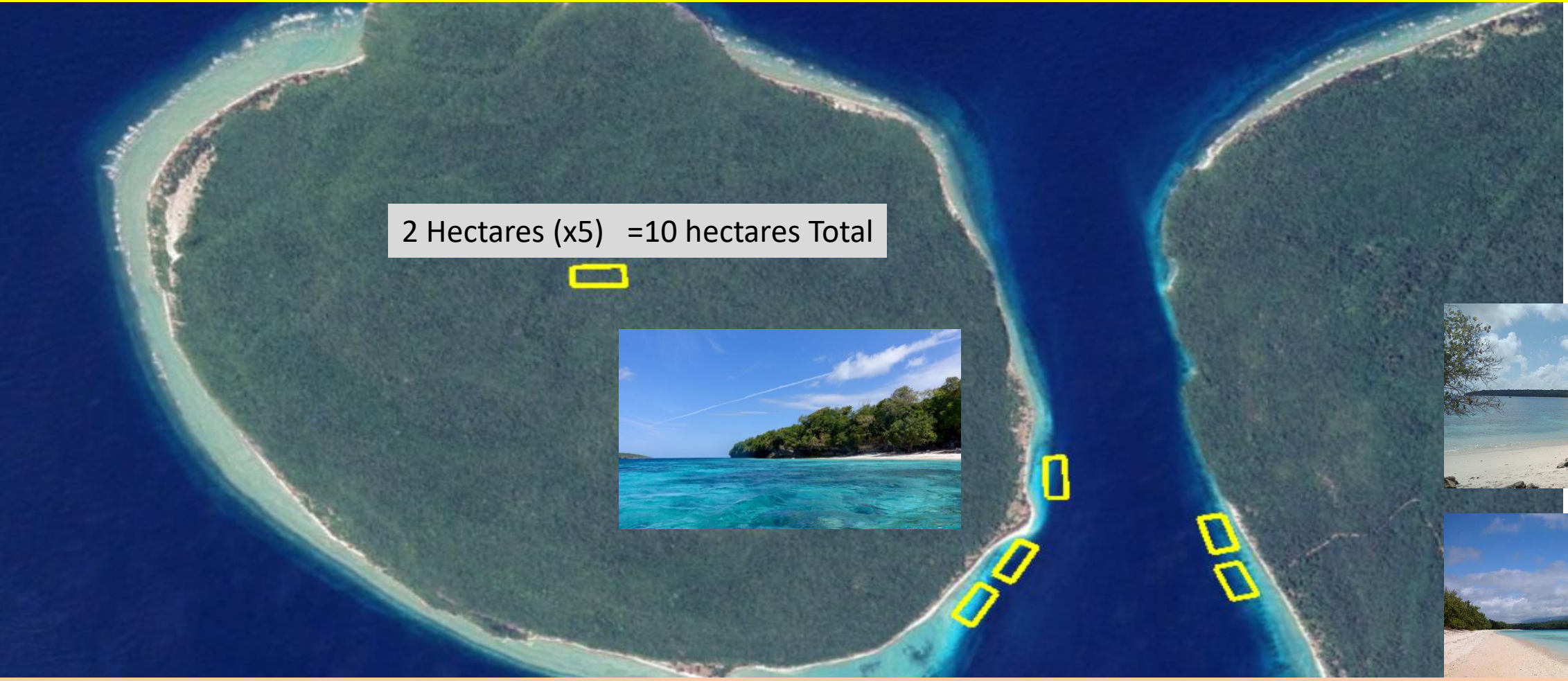
Regeneration



Data Courtesy of Dan Millison

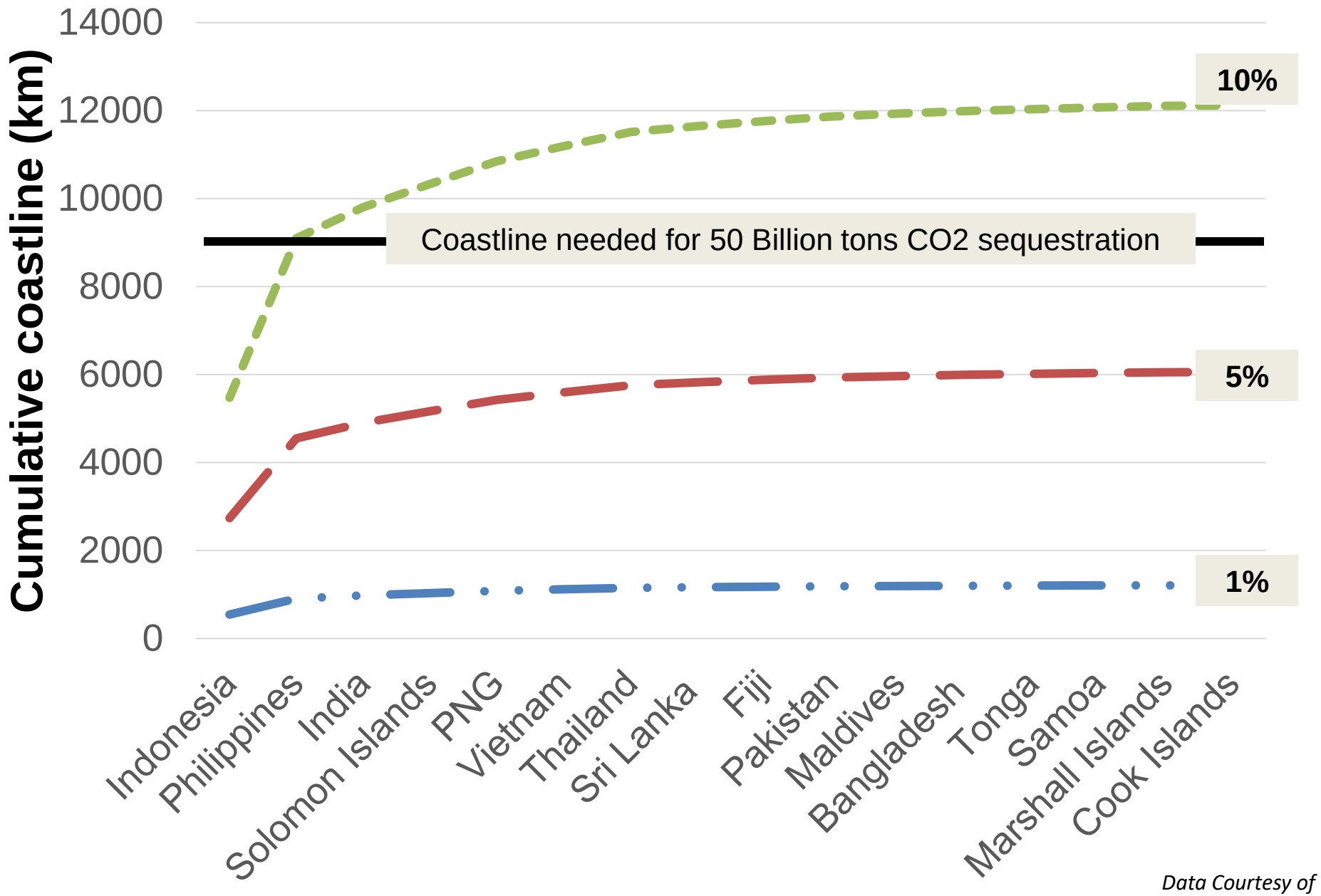
Sample Power/Rev. Calculations for 2km Coral Reef Permaculture Project (10 hectares of Coral Reeph Nursery)

Yellow Nurseries with Benthic Domes (Total 1,000 domes) to consume 50kwh or 1,200kwh/day for a total of 438Mwh/year. (Example $43.8K/year in electricity cost at $0.10/kwh.)



Estimated revenue per year for cultured fish products (at direct to consumer retail prices) = @$1m/year.

Scalability



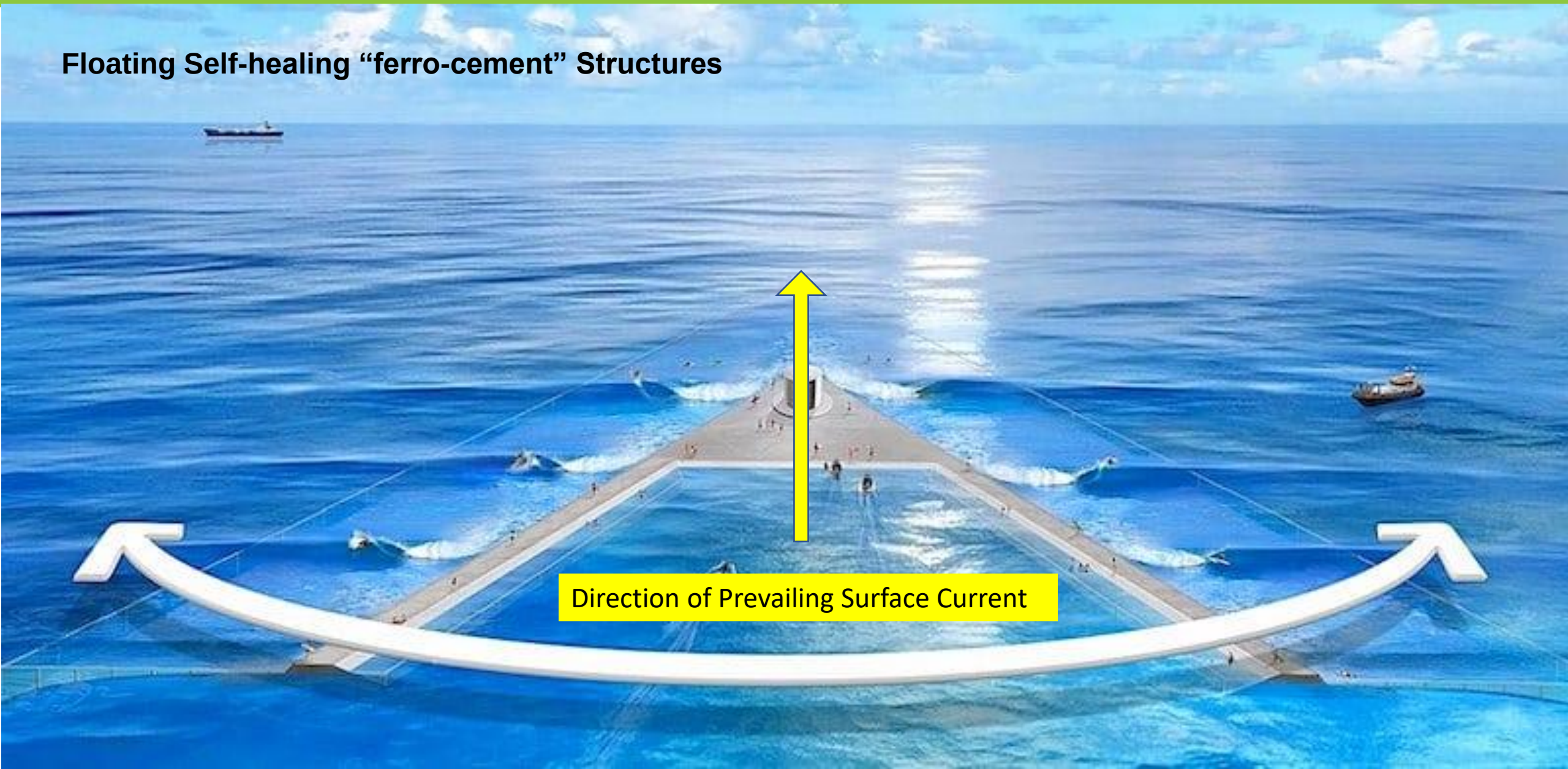
Data Courtesy of Dan Millison

Suspended Midwater Reephs

Regeneration

Breakwater unit costs vs. length in Asia-Pacific

Regeneration



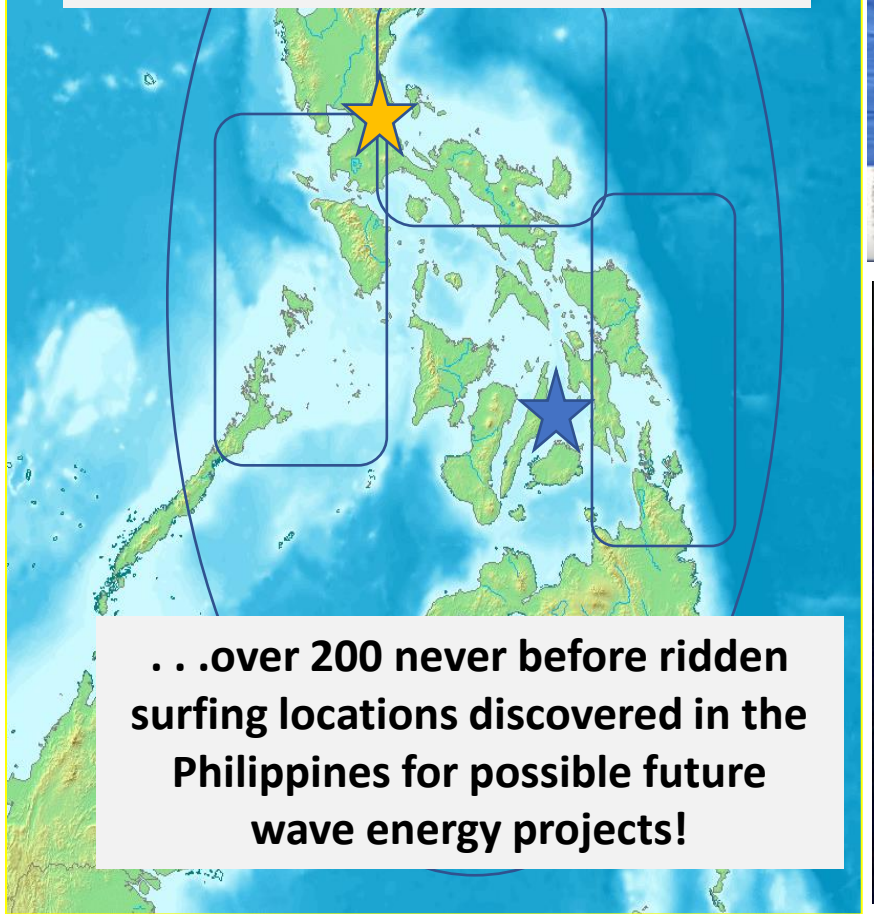
Solutions: Carbon Negative Eco Tourism

THE TYPHOON'S TAIL

"The tropical low-pressure system is predicted to intensify into a typhoon." Skipper, Scott Countryman was delivering the possible welcome speech as we boarded his impressive vessel named King of Sports. What normally happens with these typhoons off the Philippines, is they tend to fizzle out and move toward us, not producing much swell. But this one looks perfect. It's supposed to get a lot stronger, moved out to sea-and sit here." His finger jabbed a spot on his nautical map 500 miles east of the Philippines, the world's second-largest archipelago. His finger dance on the map in circles, mimicking the brewing storm and crinkling the paper in the violent display of what was about to occur. We were on one of 7107 (mainly undiscovered) islands that make up the Philippines - and we were about to join the dots in largely uncharted waters.

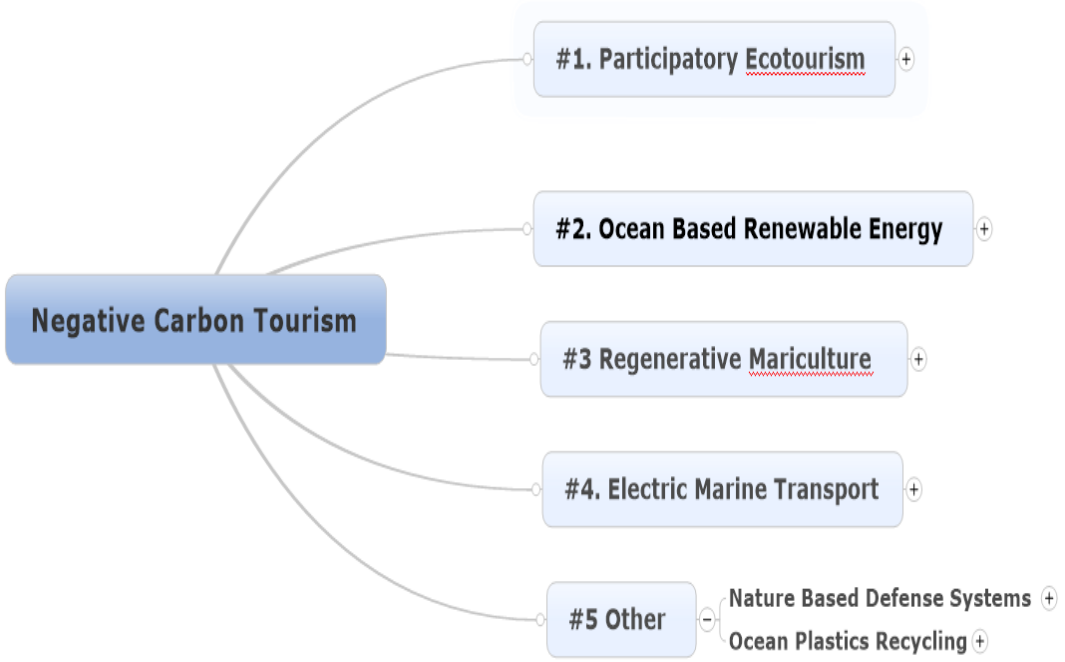
2003-2004 landed 14 feature articles and 4 covers of surf magazines.

Wave Energy to Surf Tourism Revenue ($10B/year Globally)



. . .over 200 never before ridden surfing locations discovered in the Philippines for possible future wave energy projects!

Solutions: Negative Carbon EcoTourism



Europeans to fly less even after Covid-19, EU bank finds

Airlines were already under pressure because of their carbon footprint (Photo: Khairil Zhafri)

By ESZTER ZALAN

BRUSSELS, 12. JAN, 07:05

A majority of citizens from the 27 EU countries intend to fly less to help fight climate change even after Covid-19 related restrictions are lifted, according to a survey of the European Investment Bank (EIB) published on Monday (11 January).

Solutions: ‘Norway Seed Banks Atolls’ for Coral DNA

Regeneration

‘Life support’ measures could buy Great Barrier Reef another two decades, study finds

Australian scientists say shading reef and controlling coral-eating starfish can only be effective if strong action is taken to reduce emissions

▲ Australian study shows there is a way to buy the Great Barrier Reef ecosystem some time if the technologies develop as hoped. Photograph: Lucas Jackson/Reuters

Shading corals and deploying more heat-resistant species across the Great Barrier Reef on an as-yet untested scale could buy the world heritage site another two decades, according to a study led by Australian government scientists.

Summary of Use Cases for Ocean Based RE

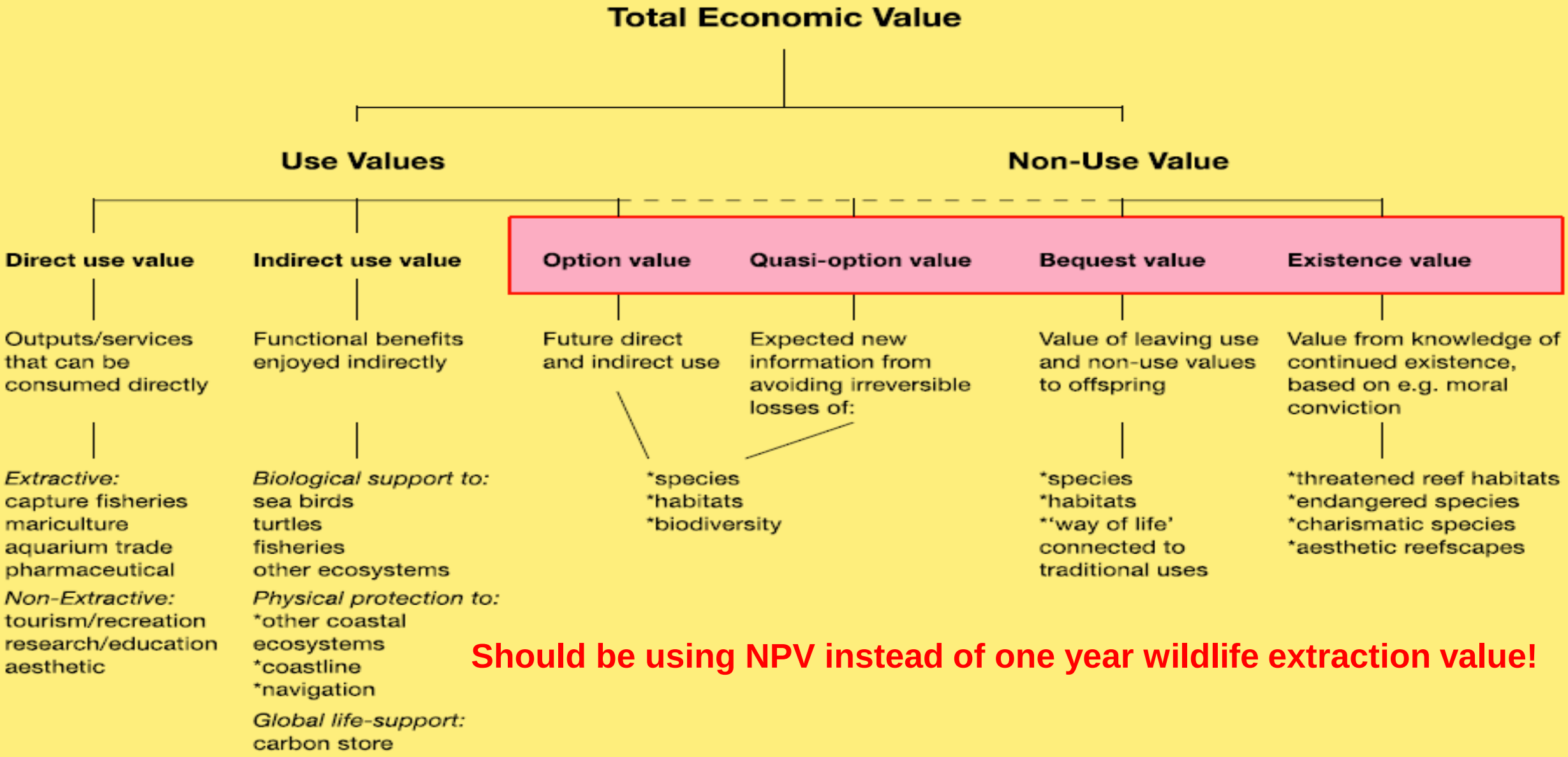
- *Power Supply for electric mineral accretion* ***to regenerate coral reefs***
- *Electricity to* ***grow limestone commercial products***
- ***Charging stations for small electric vessels.***
- *Ocean energy production with submarine cable* ***to shore to stabilize solar minigrids*** *for small island communities.*
- ***Desalination*** *for island communities.*
- ***Power for data gathering sensors*** *and monitors.*
- ***Charging station for underwater ROVs*** *.*
- *Energy to power* ***thermocline redefine*** *to move cold oxygen rich water from the dark and deep to supply aquaculture or rehabilitate a shallow lagoon impacted by rising temperatures from climate change*
- *Small scale* ***Hydrogen Production***
- ***Pumping water for gravity batteries***

Backup Slides

- Coral Related Climate Change
- Ocean Energy Production
- RE for Marine Transport/Electric Boats
- Food and Multitrophic Aquaculture
- Regenerative Commercial Activity
- Integrated MPA Management

Lifeboat Project Nasugbu: Valuation of Coral Reefs

Regeneration



Should be using NPV instead of one year wildlife extraction value!