



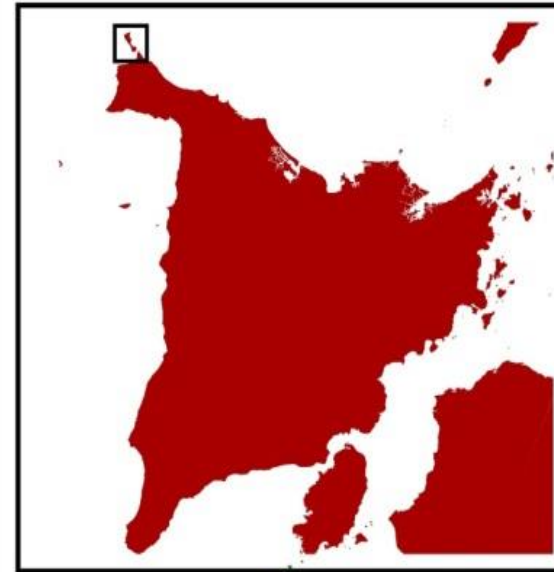
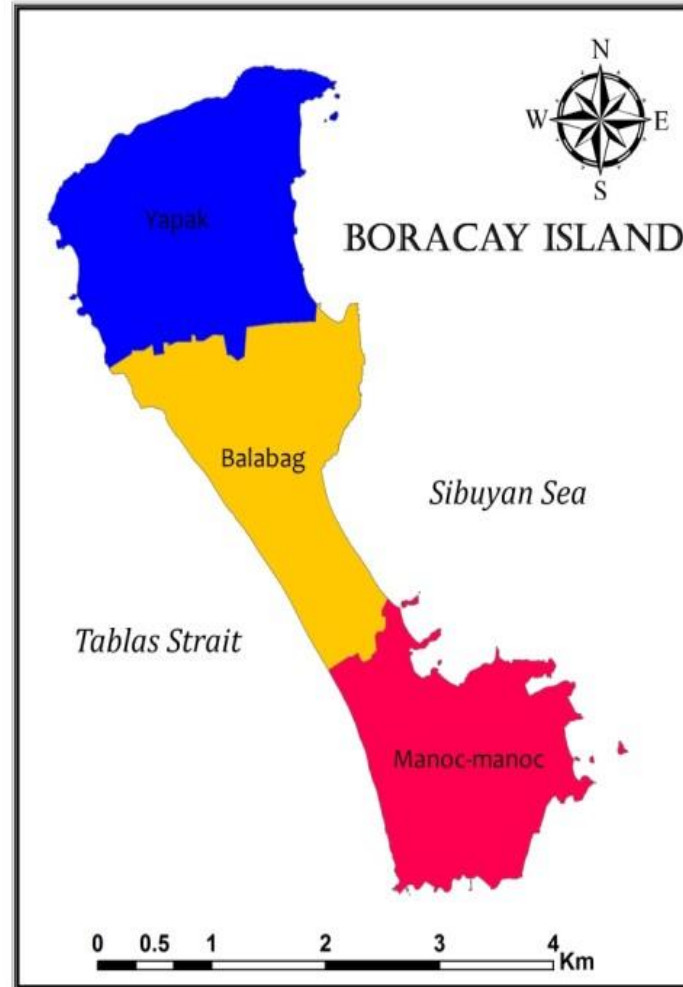
Coastal habitat degradation/ Decreasing coral cover in Boracay

Maria Lourdes San Diego-McGlone

Marine Science Institute, University of the Philippines

Diliman Quezon City

Boracay Island



Total area = 1,006 ha
Municipality of Malay
Province of Aklan

Travel + Leisure Magazine dubbed it the World's best island in 2012

BORACAY MAPS

BEACHES • NIGHTLIFE • RESTAURANTS • HOTELS



- Tourism in the island flourished in the 1970s when there were still no electricity and tourist facilities available
- It became more popular in the 1980s to backpackers and foreign visitors who stayed in small structures made of light materials

Boracay in the 1980s



Photo from Natalie Cawaling, 1980

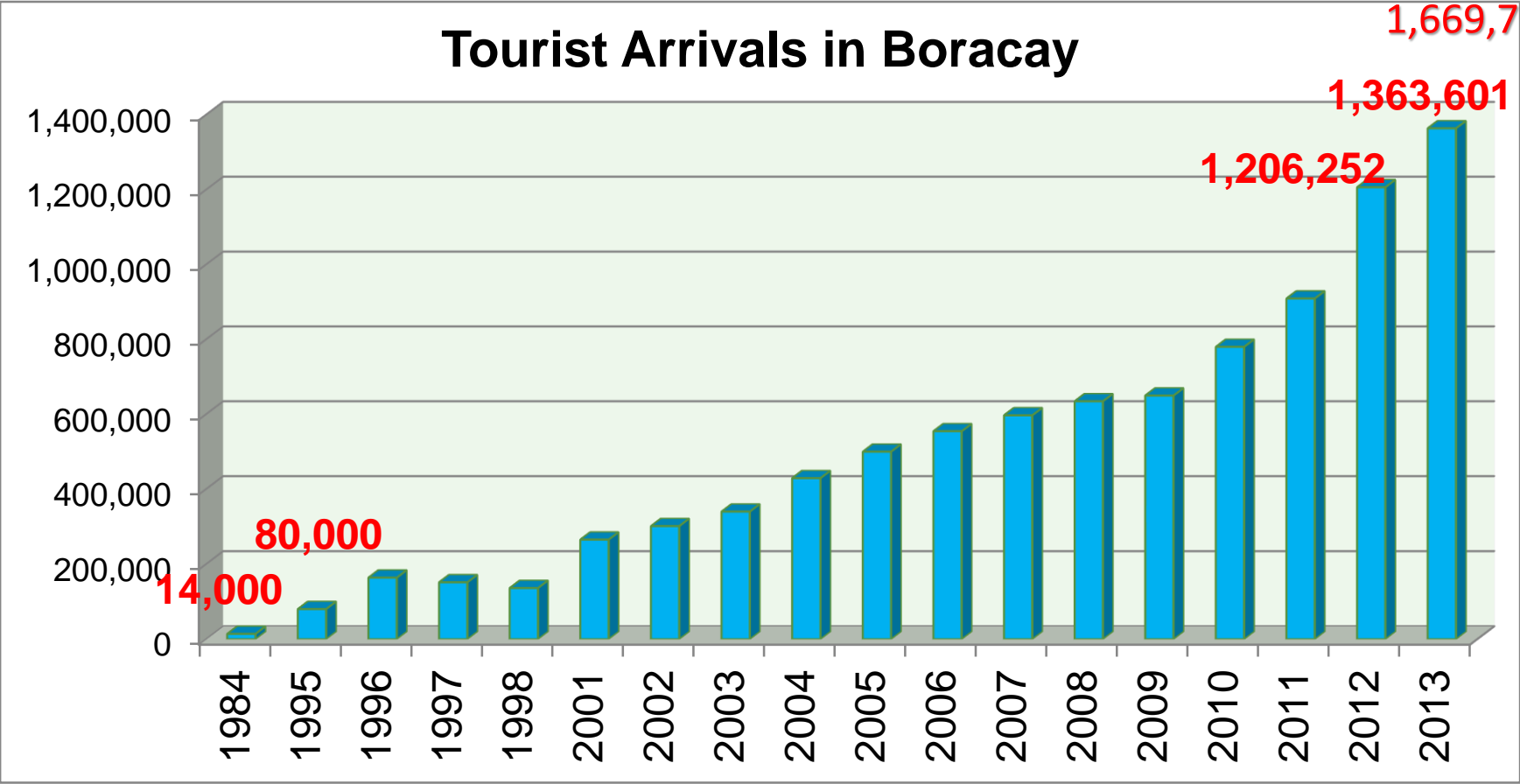


Photo by Virginia Bera, May 1983



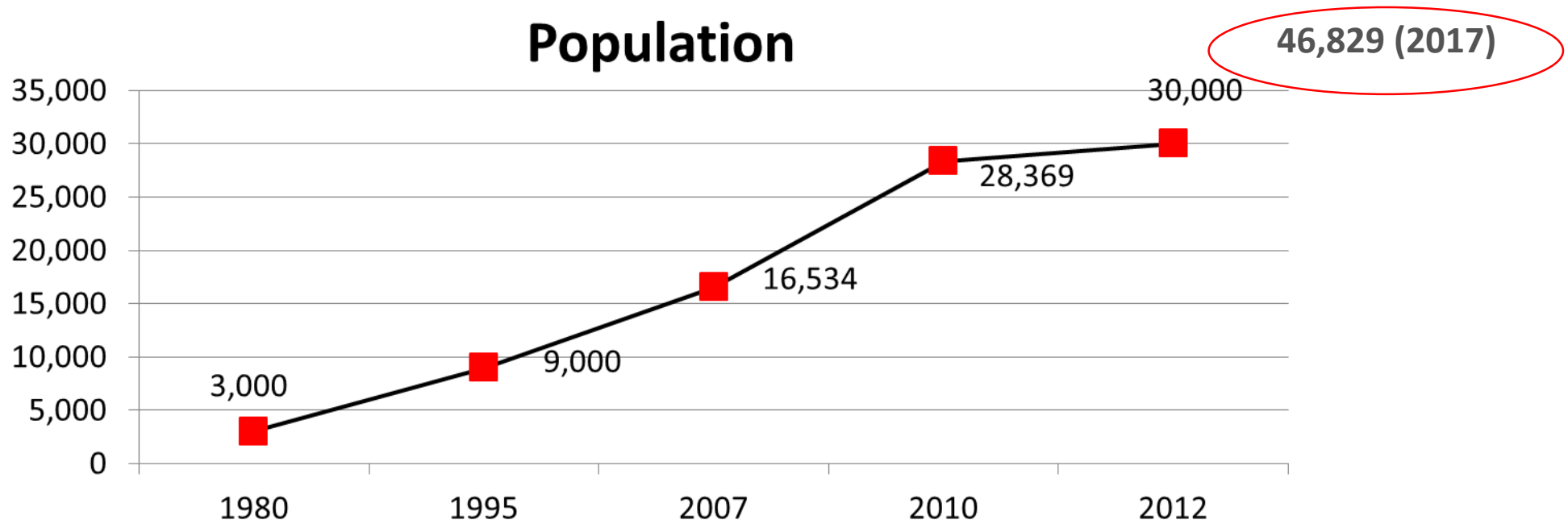
Photo by Virginia Bera, May 1983

(Source: Rowan, 2011)



Tourist Arrivals from 1984 to 2013 (Source: Philippine Information Agency and Department of Tourism)

Population






Population in Boracay Island from 1980 to 2012 (Note: 2012 is the unofficial figure released by the local government of Malay)



Primary issues in Boracay Island

- Offshoot of unsustainable tourism, aggravated by impacts of climate variability and global warming

- Issues (inter-dependent)
 - Coastal erosion
 - Improper coastal infrastructure development
 - High rate of population increase
 - Water quality degradation
 - Green tides
 - Loss of coastal habitats
 - Lack of knowledge to address the issue






Boracay Island

How CECAM helps address the issues

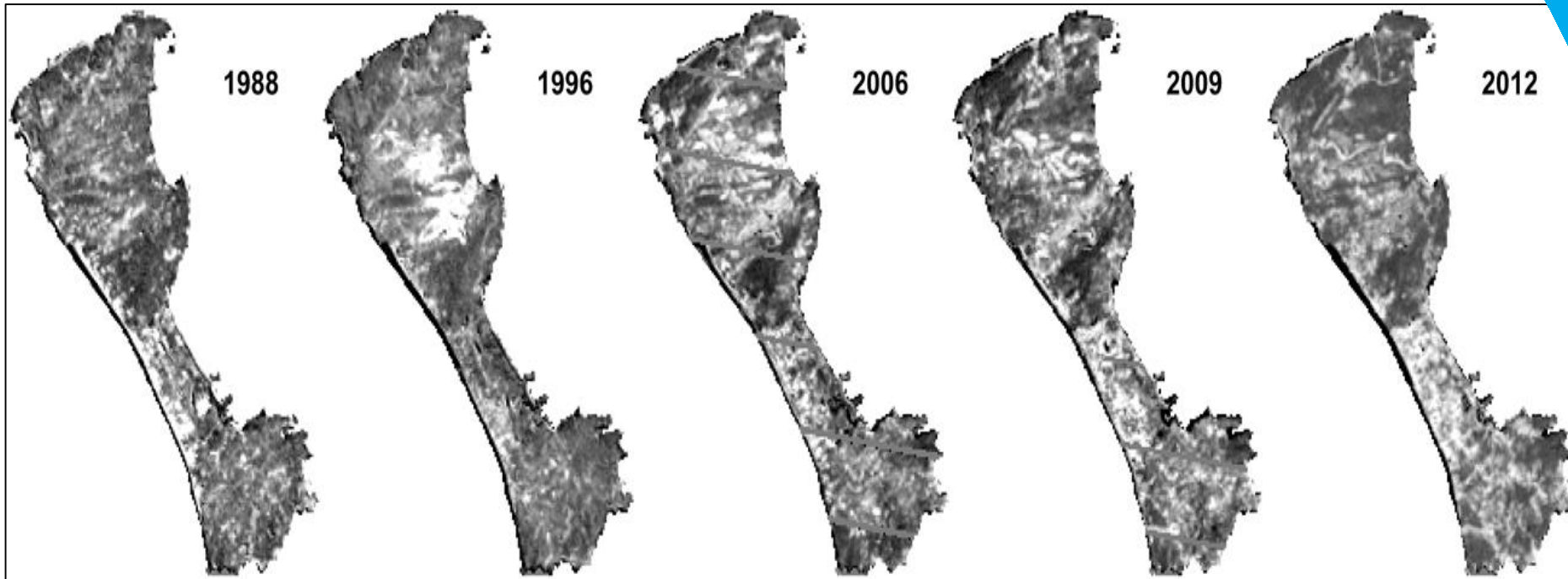
- Land and Benthic Cover Mapping
- GIS Analysis
- Water Quality Surveys
- Modeling of waves and coastal erosion
- CCTV Monitoring and IDSS
- Reef and Socio-Economic Survey
- Workshops and Training
- Partnerships



As the top tourism destination in the Philippines, Boracay Island is world-renowned for its four-kilometer beach with powdery white sands. In the last three decades, there has been a rapid increase in population, hand-in-hand with a strong development pressure. This results in declining forest cover, degradation of water quality and demise of coastal marine habitats. CECAM assesses the current condition of the island, aimed at improving it. It also promotes sustainable development through informed decisions. Partnerships have been established with the local government and various non-government organizations.

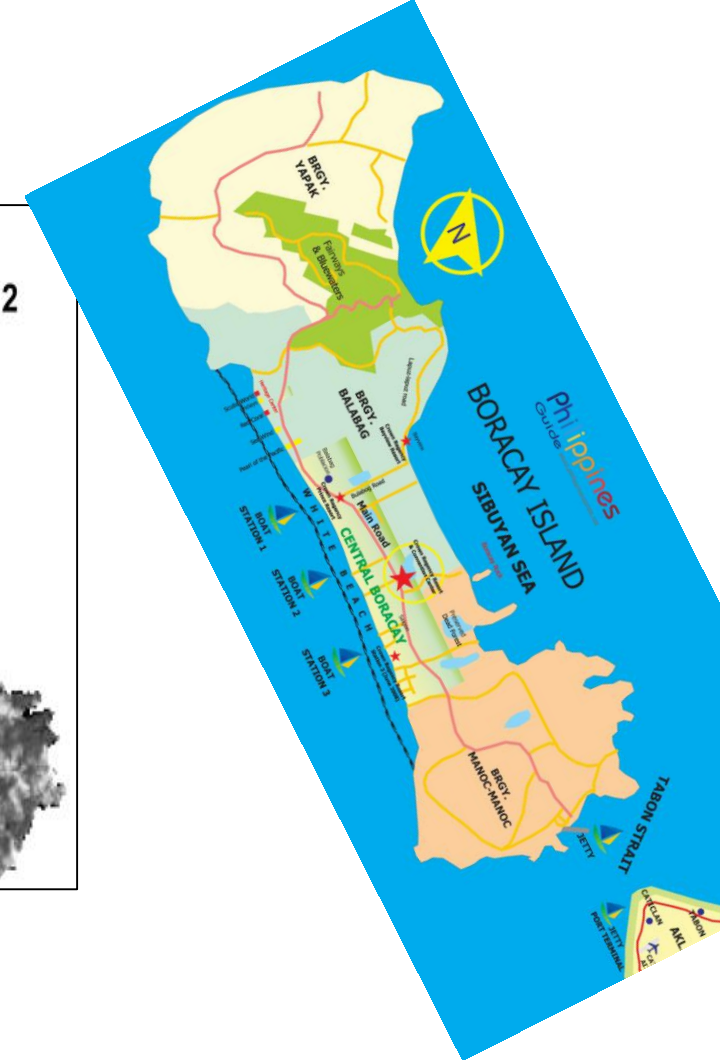
Contact Information:
 Municipal Environmental and Natural Resources Office,
 Malay, Aklan
 Mobile: 09999951631; Email: malay_lgu@yahoo.com

Findings: Built-up land areas

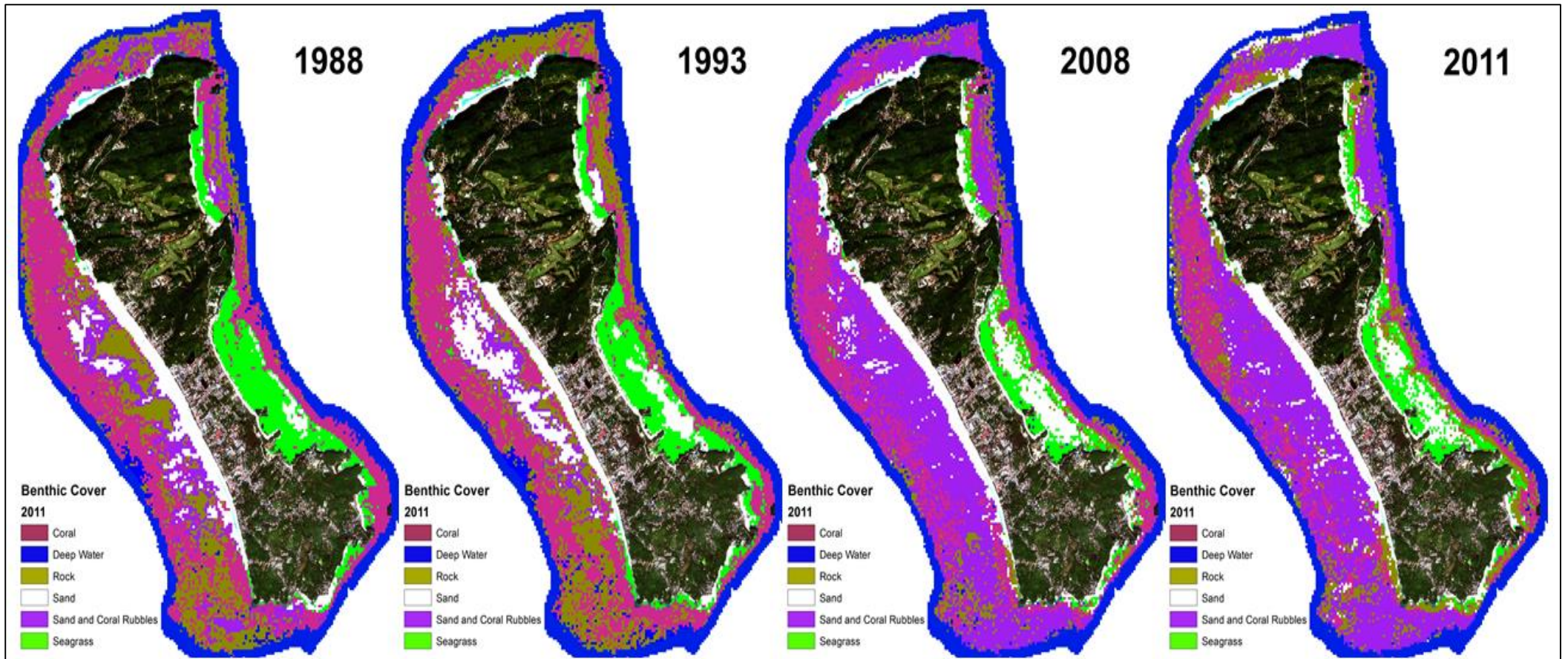


Built-up land area cover change (Boracay 1988-2012)

1. Significant built-up areas on the island occurred in 1988-2012 (lighter tones indicate built-up and bare areas).
2. Built-up cover in Barangay Balabag (White Beach) continuously increases since 1988.
3. The sudden peak in the total built-up area in 1996 mostly took place in Barangay Yapak where the Boracay Fairways and Bluewater, a resort with an 18-hole golf course is located.

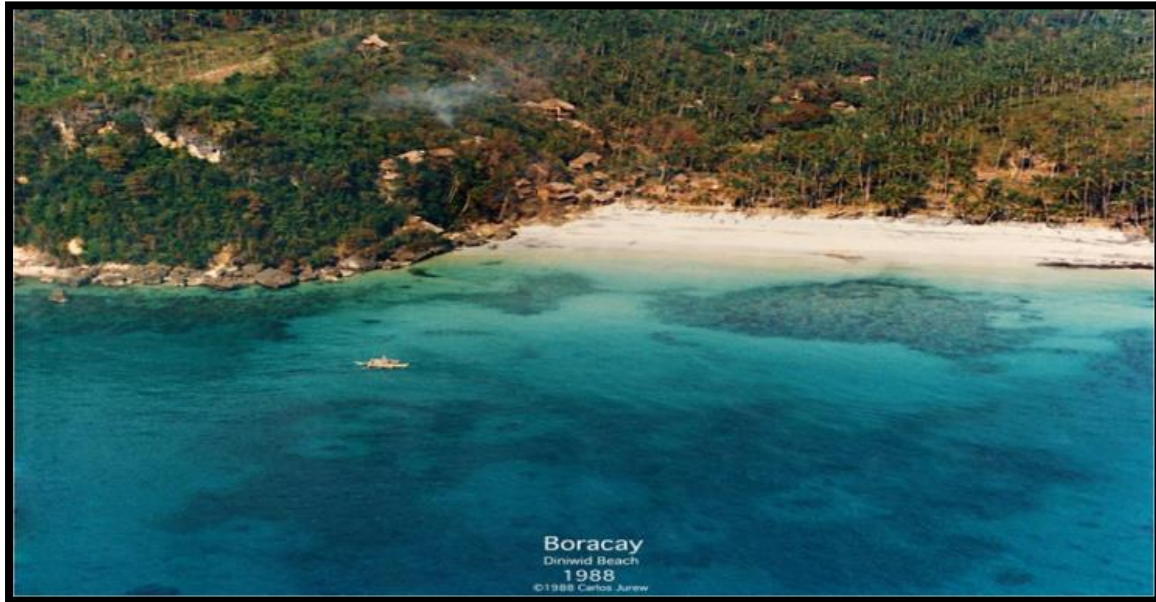


Findings: Benthic cover (coral, seagrass, rock, sand)



Benthic Cover using different satellites

1. Coral cover decreased by 70% from 1988 to 2011 (23 years).
2. Most significant decrease occurred in 2008-2011 when tourist arrivals increased by 38.4%.
3. A dramatic increase in sand & coral rubbles occurred in SW Boracay in 2003-2006 when tourist arrivals increased.



Diniwid Beach, 1988 © Carlos Jurew

Corals have disappeared

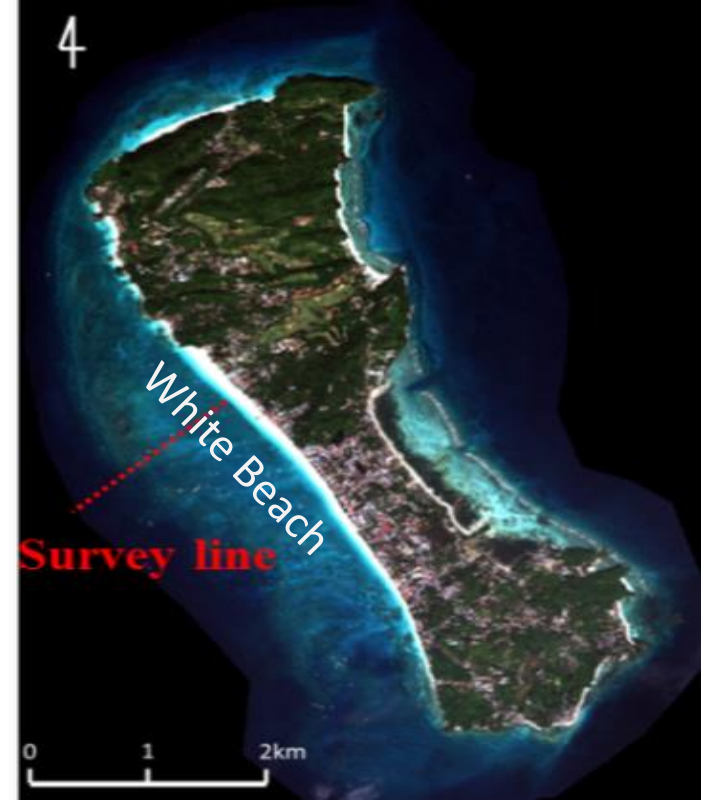


Diniwid Beach, 2007 © Carlos Jurew

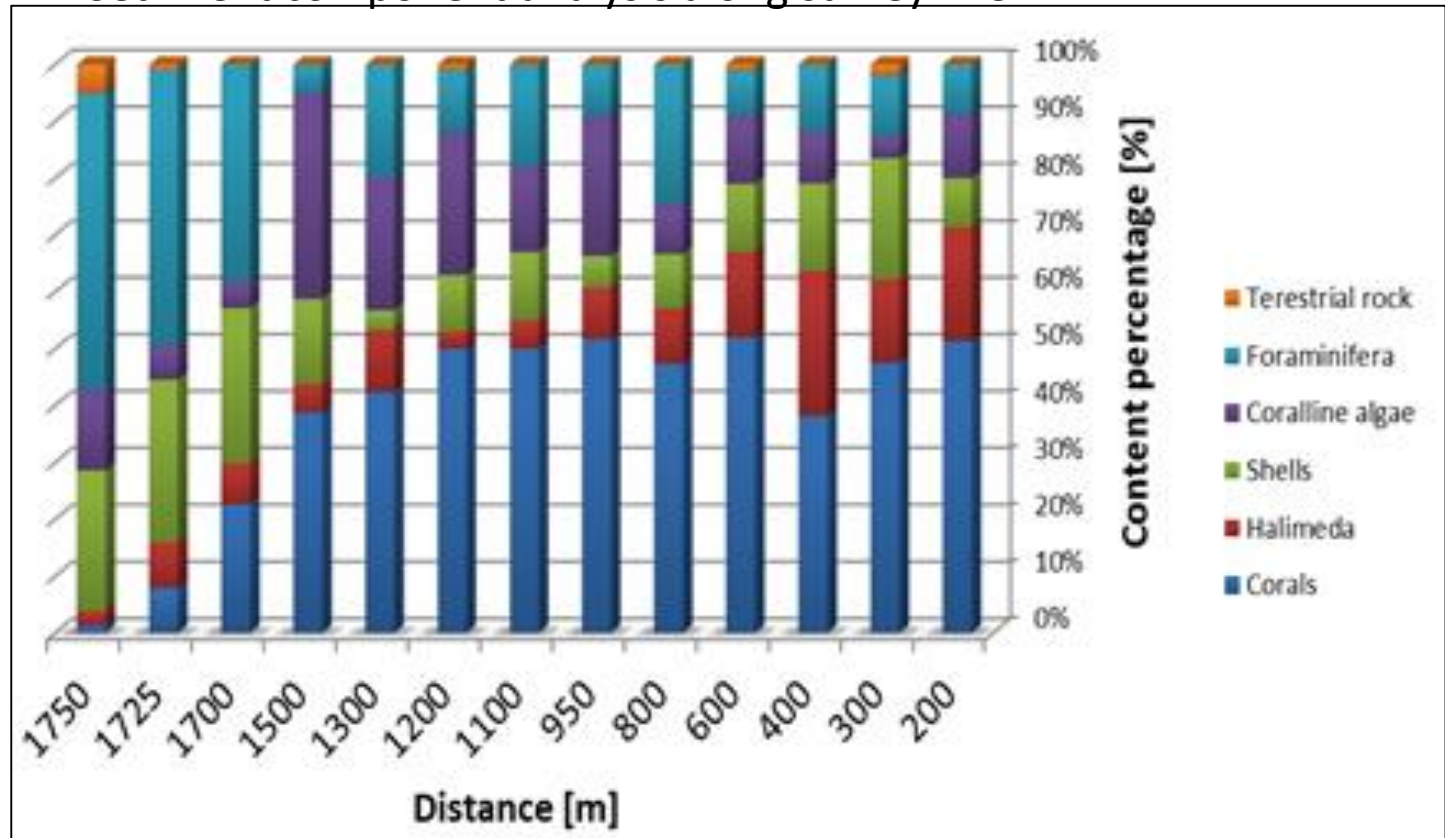
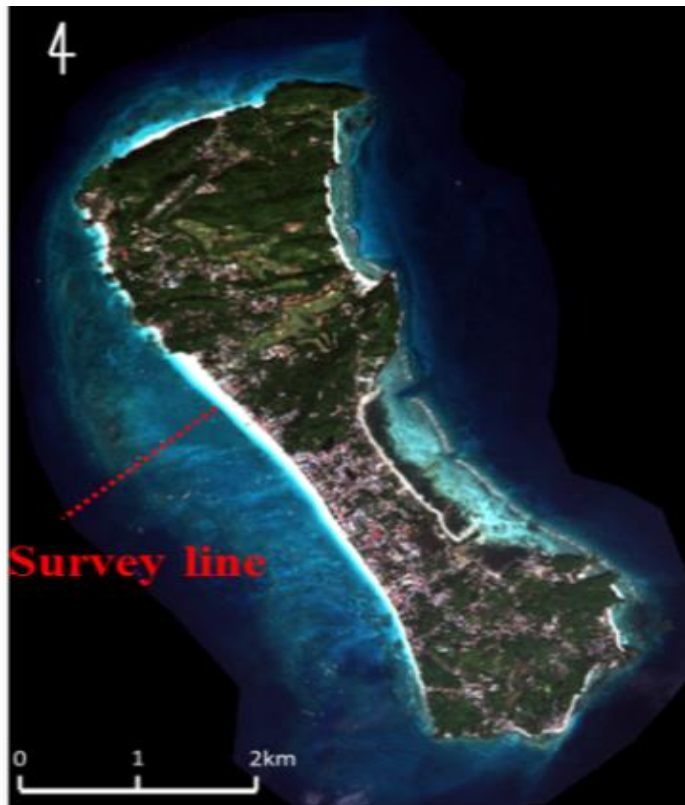
Coral reef ecosystem serves an important role in
White Beach's formation and maintenance

How?

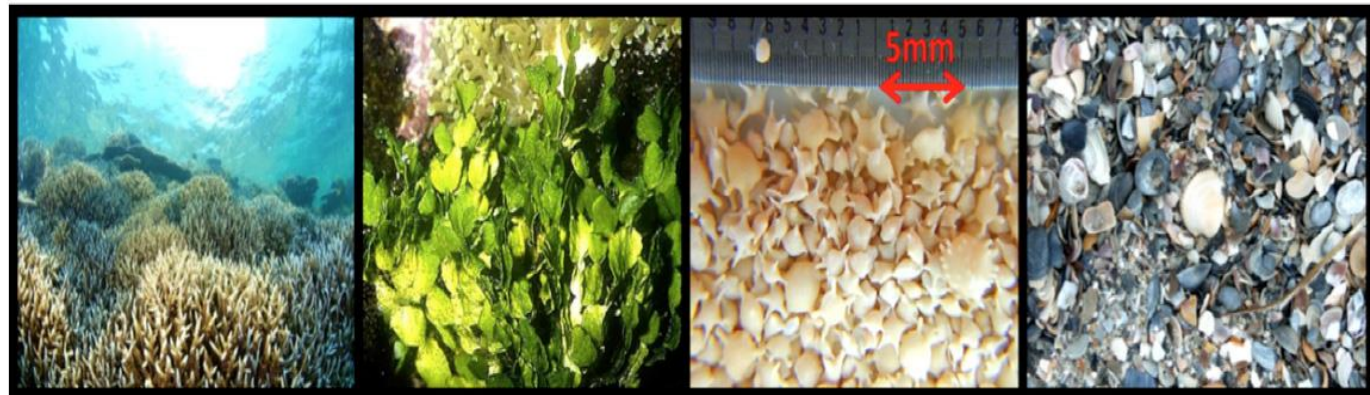
- supply source of sand
- wave damping



Sediment component analysis along survey line



Boracay's powdery sand is produced mainly by foramineferans and the calcium carbonate impregnated green seaweeds *Halimeda* spp. (Fortes M.D., Fortes E.G., David L.T., 2009)



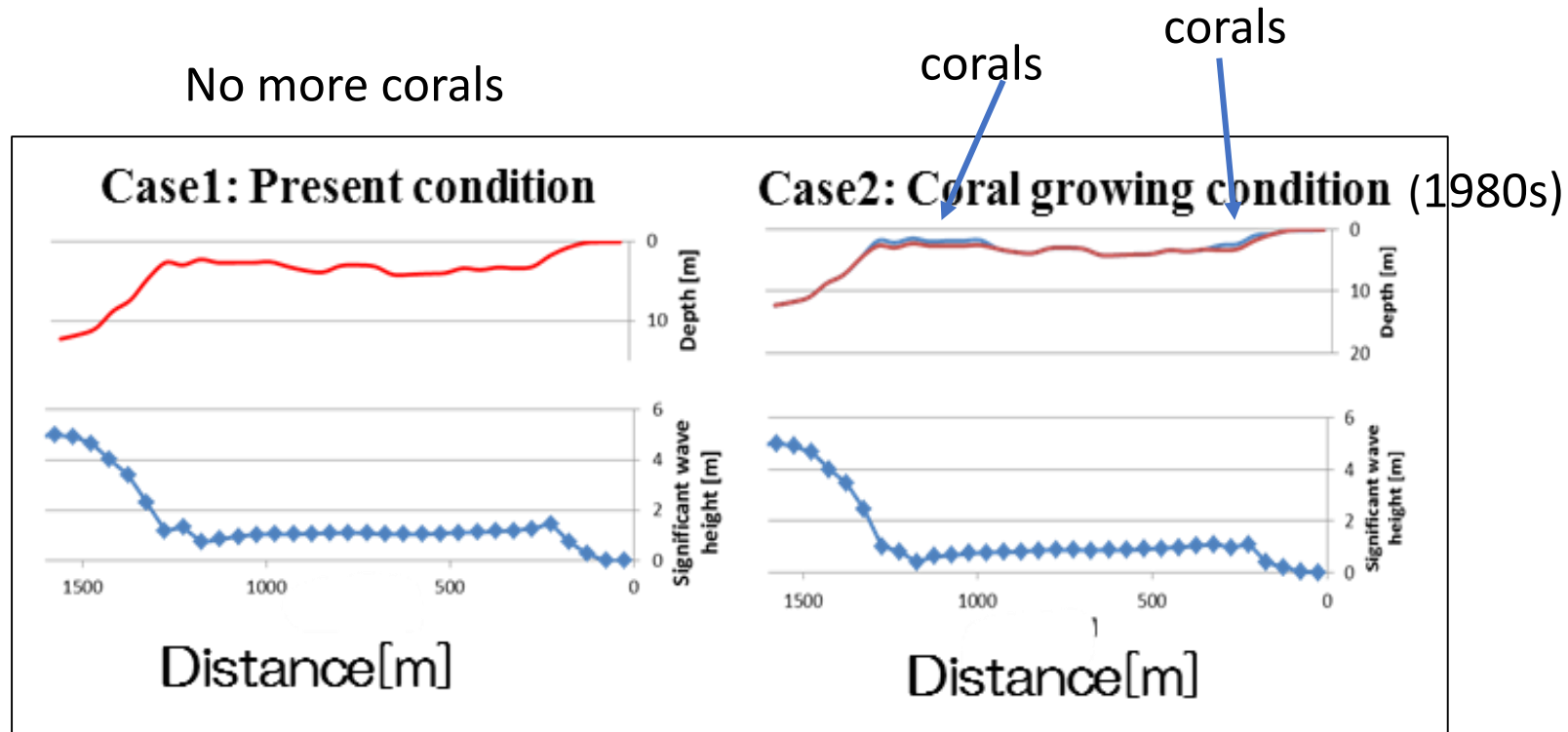
corals

Halimeda

foraminiferans

shells

Wave Damping refers to wave dissipating function of corals



During rough conditions (wave height >5m), run-up distance is smaller by more than 8m with corals -> corals induce wave breaking and dissipate wave energy at reef edge

Findings: **Erosion** of White Beach

Deterioration of the reef ecosystem in front of the beach leads to erosion due to reduction of reef's functions

1. As natural breakwater, damping wave;
2. Supplier of beach sediments

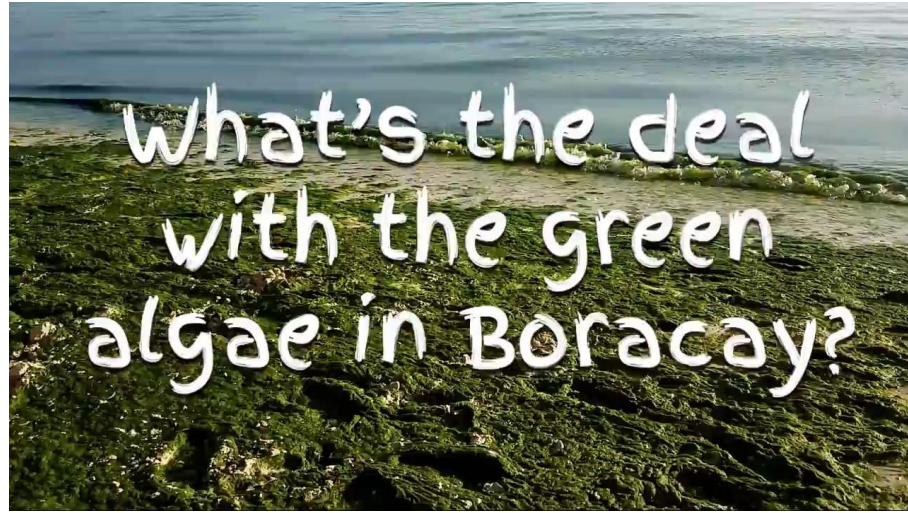
Causes of deterioration

1. Water quality degradation
2. Direct impacts by marine leisure activities (anchoring, diving/ snorkeling, etc.)

Secondary cause: Improper construction of sea walls, restaurant/hotels on the backshore



Findings: 'Green tides' (now occurring in most months of the year)



POSTER at Caticlan Airport

GREEN ALGAE

> WHAT ARE GREEN ALGAE?

Green algae are group of algae with a bright green pigment that is being produced in its cells. There are about 7,000 kinds of green algae that can be found in both saltwater and freshwater. Some are free-floating and small enough to be seen by the naked eye, while some form large masses and grow on rocks.

> IS IT SOMETHING NEW?

Every year, the water in some areas in Boracay appears green during the months of February to May due to the seasonal bloom of green algae. This phenomenon had been observed by local residents even before Boracay Island was discovered as a prime vacation destination, flocked by tourists and crowded with developments. Stories of island-grown local residents can attest to the historical recurrence of this algal bloom:

"Living in Boracay since birth made me witness this presence of algae every summer. There is nothing to be alarmed seeing these algae on the shore, its even thicker way back then." Lucrecia Gelito-Sullano, 92 y.o. a native of Boracay

"I used to play with these algae when I was a kid – rolling them like a mat or making them into "algae balls" and threw it to other kids. Sometimes, we swim underneath these floating algae and chase fishes hiding underneath it." Harvey Gelito, 45 y.o. a native of Boracay

"I and my friends used to play with these algae by gathering handful of it. We wash them using laundry soap, then hang them to dry under the sun. The one who gets the whitest is the winner." Mila Yap-Sumdad, 69 y.o. a native of Boracay

IS THE ALGAL BLOOM SOMETHING TO BE SCARED OF?

NO. There is nothing to be scared of with the green algal bloom. Scientifically green algal bloom is linked to the high nutrient load of the water. Usually with calm and warm waters, coupled with intense light during summer, these green algae consume excess nutrients from the water and process it for their growth and reproduction, thus, this equates to their proliferation. In fact, the presence of these algae is nature's way of balancing the problem of high nutrient content in the water. According to Prof. Mark Fran of Philippine Society of Cell Biology, "these algae have ecological functions and one of them is by serving as shelter for some juvenile fishes thus, removing it all will result to ecosystem imbalance."

What makes the sand of Boracay powdery, and soft to the feet when we step on it, is its organic component, the CORALLINE ALGAE.

However, the mat of algae washed ashore was believed by the local folks to be source of the island's white sand. As this belief had long been in the minds of some locals, well then we have to respect ethnical differences.

ALL INFORMATION ABOVE IS PROVIDED BY BORACAY FOUNDATION, INC.

RECORDED BY TORALDO DEL ROSARIO


A friendly reminder from:

PHILIPPINE TOURISM FIRST

Department of Tourism Region VI - Boracay Sub-Office
 6700 M. J. Delos Angeles Blvd., Boracay Island, Malay, Aklan, Philippines 11
 Tel. No. (+63 20) 586 3300
 E-mail: domboracay@gmail.com

Department of Tourism Region VI - Main Office
 6800 M. J. Delos Angeles Blvd., Boracay Island, Malay, Aklan, Philippines 11
 Tel. No. (+63 33) 337 8411 / 509 3500
 Telex: (+63 33) 335 0241
 E-mail: deptour@mtcc.com / deptour@yahoo.com
 Website: www.visitboracay.com

Boracay Foundation, Inc.
 2nd Flr. Villa Bldg., Manroad, Bantud, Manocmanoc
 Boracay Island, Malay, Aklan, Philippines
 Tel. No. (+63 36) 288 3971
 Telex: (+63 36) 288 0209
 Email: boracayfoundation@yahoo.com



> IS IT SOMETHING NEW?

Every year, the water in some areas in Boracay appears green during the months of February to May due to the seasonal bloom of green algae. This phenomenon had been observed by local residents even before Boracay Island was discovered as a prime vacation destination, flocked by tourists and crowded with developments. Stories of island-grown local residents can attest to the historical recurrence of this algal bloom:

"Living in Boracay since birth made me witness this presence of algae every summer. There is nothing to be alarmed seeing these algae on the shore, its even thicker way back then." Lucrecia Gelito-Sullano, 92 y.o. a native of Boracay

"I used to play with these algae when I was a kid – rolling them like a mat or making them into "algae balls" and threw it to other kids. Sometimes, we swim underneath these floating algae and chase fishes hiding underneath it." Harvey Gelito, 45 y.o. a native of Boracay

"I and my friends used to play with these algae by gathering handful of it. We wash them using laundry soap, then hang them to dry under the sun. The one who gets the whitest is the winner." Mila Yap-Sumdad, 69 y.o. a native of Boracay

IS THE ALGAL BLOOM SOMETHING TO BE SCARED OF?


NO. There is nothing to be scared of with the green algal bloom. Scientifically green algal bloom is linked to the high nutrient load of the water. Usually with calm and warm waters, coupled with intense light during summer, these green algae consume excess nutrients from the water and process it for their growth and reproduction, thus, this equates to their proliferation. In fact, the presence of these algae is nature's way of balancing the problem of high nutrient content in the water. According to Prof. Mark Fran of Philippine Society of Cell Biology, "these algae have ecological functions and one of them is by serving as shelter for some juvenile fishes thus, removing it all will result to ecosystem imbalance."

What makes the sand of Boracay powdery, and soft to the feet when we step on it, is its organic component, the CORALLINE ALGAE.

However, the mat of algae washed ashore was believed by the local folks to be source of the island's white sand. As this belief had long been in the minds of some locals, well then we have to respect ethnical differences.

ALL INFORMATION ABOVE IS PROVIDED BY BORACAY FOUNDATION, INC.

Mafaneda is an EXAMPLE OF CORALLINE ALGAE



Boracay: Why abnormal 'green tides' occur



HEALTHY REEF

Normally contains the 'bloom'-causing algal populations but these are in check; the 2 causal algal species in Boracay & in many other countries in the world are shown below:



Ulva lactuca



U. reticulata

MDFORTES

Typhoons
Overfishing
Anchor damage

Dynamite fishing
Poison fishing
Trampling, etc.
(in combination)



DEGRADED REEF

Less algal grazers & competitors, more space to attach to. So, rapid, more growth of the algae; those attached to small pebbles float or carried by swimmers, boats, & reach the beach (in combination)

With less N & P nutrients in water, with high temperature, stronger wave action (more aeration, mixing effect); (in combination)

With excess nutrients (N & P) (from where?); plus high temperature, weaker wave action, high tidal exposure (in combination)



"Normal bloom", the algae soon decay, drift away, gone

NO excess N & P;
NO temperature (good for algae);
LOW tidal exposure;

Good water mixing or aeration from greater wave action
(in combination)



Massive "abnormal bloom" as in April 2009 & December 2012

...tied up strongly with excess nutrients (N & P) & high temperature



Boracay: Bulabog Beach

One of main outfall in Bulabog



A pipe in Boracay spewing raw sewage into the sea of Boracay Island. Picture by nomadichands.com



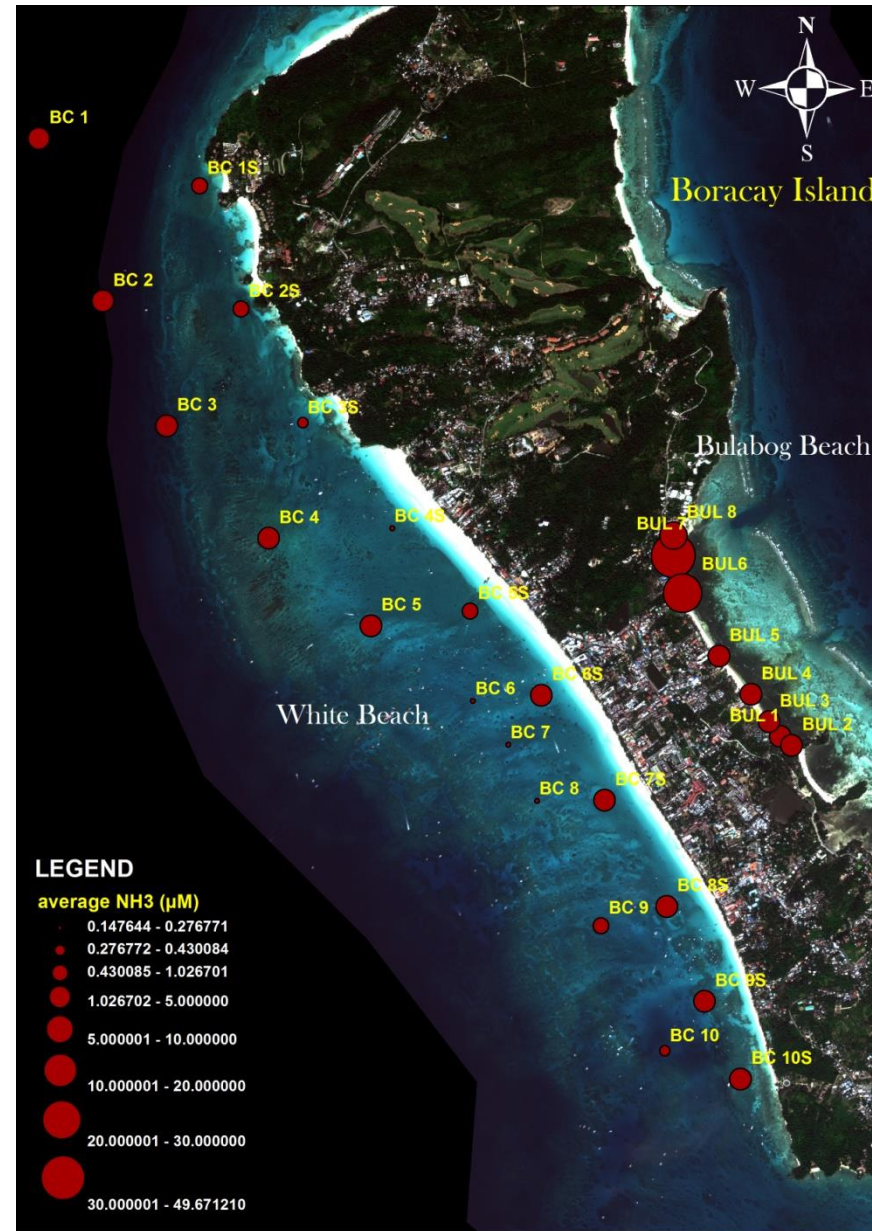
Lowest concentration

BC4S → $0.15 \mu\text{M}$

Highest concentration

Bul7 → $49.67 \mu\text{M}$

ASEAN criteria: $\text{NH}_3 = 5 \mu\text{M}$



15-17 Dec 2012

Chlorophyll-a

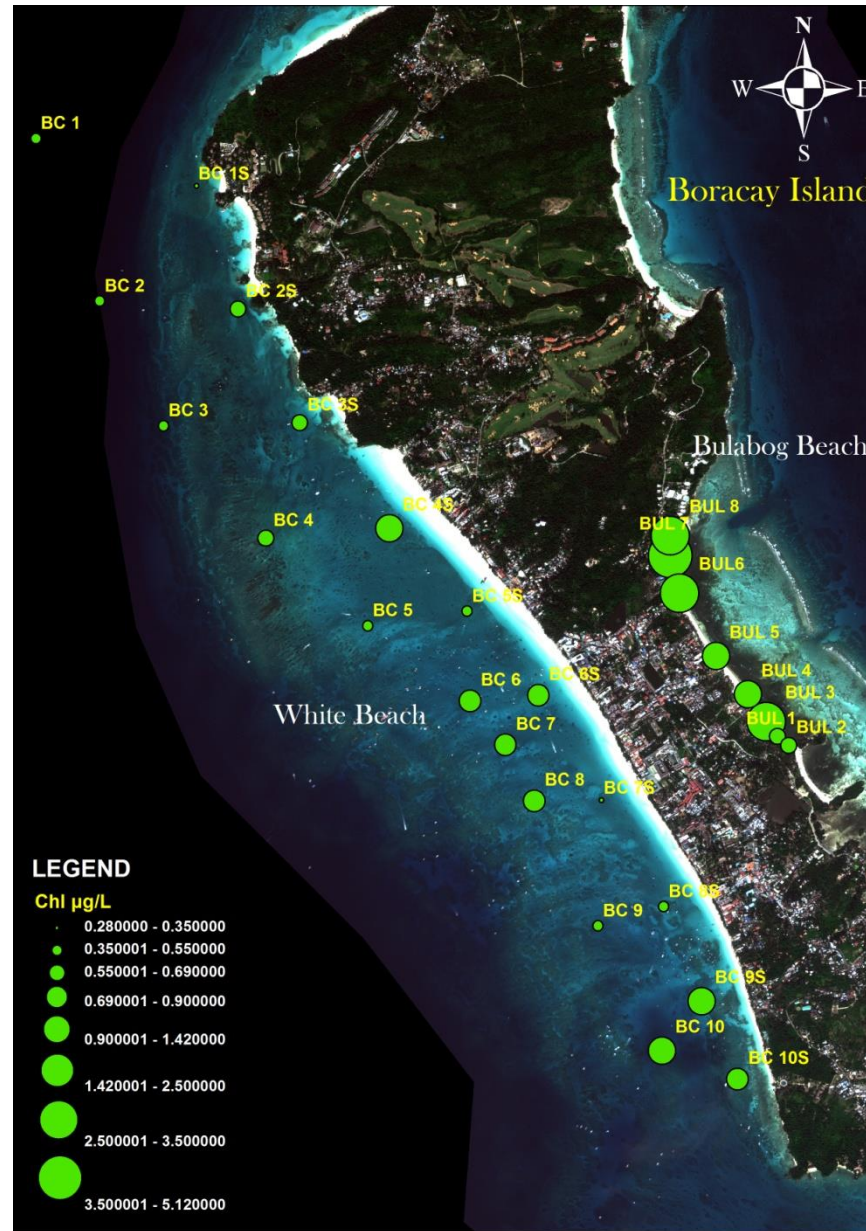
Lowest concentration

BC1S → 0.35 µg/L

Highest concentration

Bul7 → 5.12 µg/L

ASEAN criteria: Chl = 10µg/L



15-17 Dec 2012

TSS

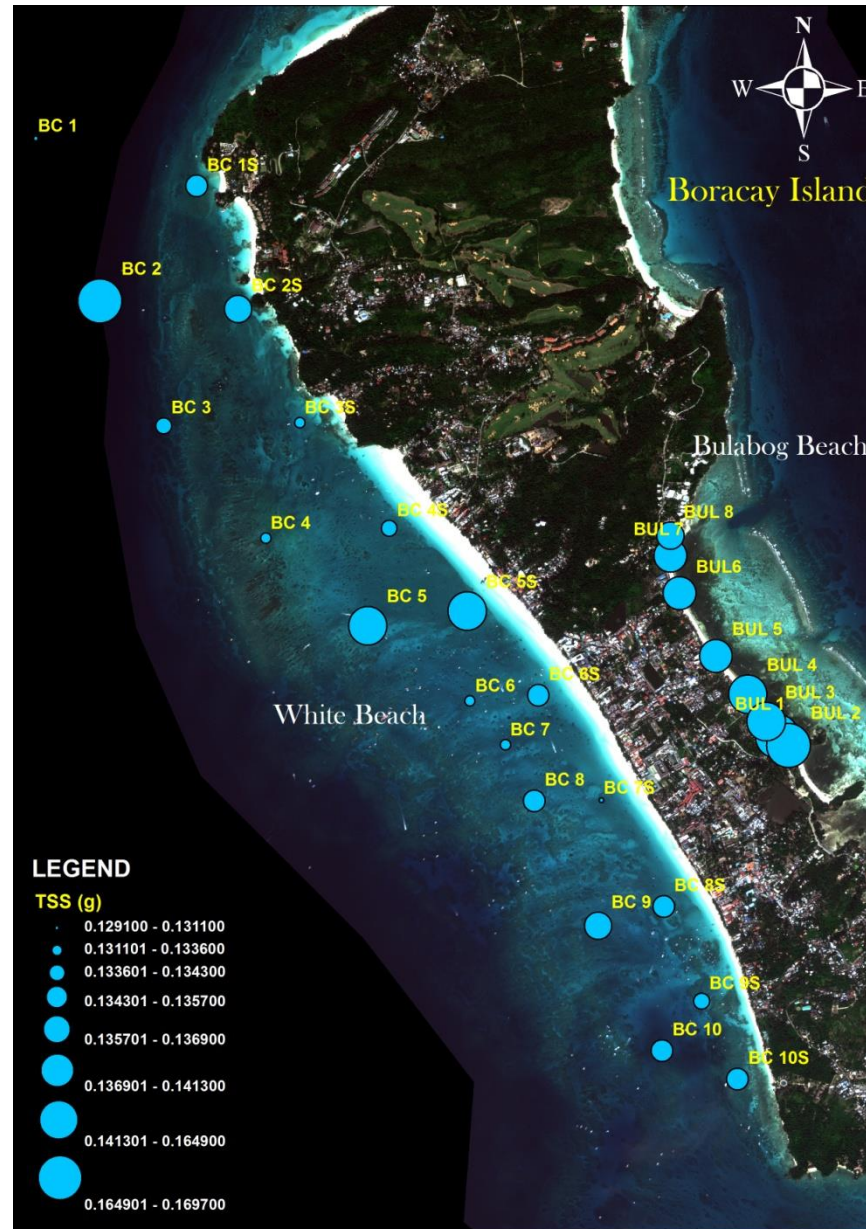
Lowest concentration

BC1 → 0.129 g/L

Highest concentration

Bul1 → 0.166 g/L

ASEAN criteria: TSS = 50 mg/L

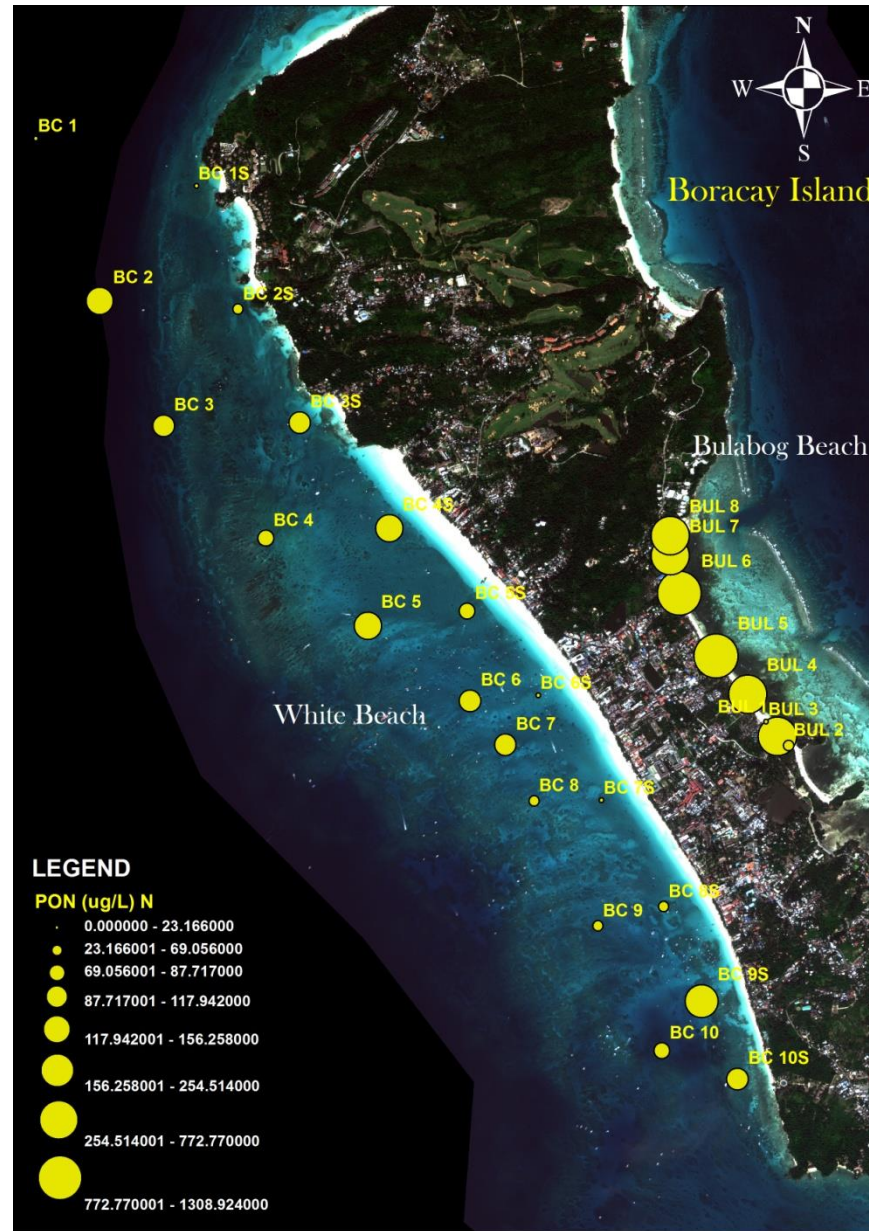


15-17 Dec 2012

PON

Lowest concentration
BC1S & Bul3 → 0 ug/L

Highest concentration
Bul7 → 1308.92 ug/L



15-17 Dec 2012

POC

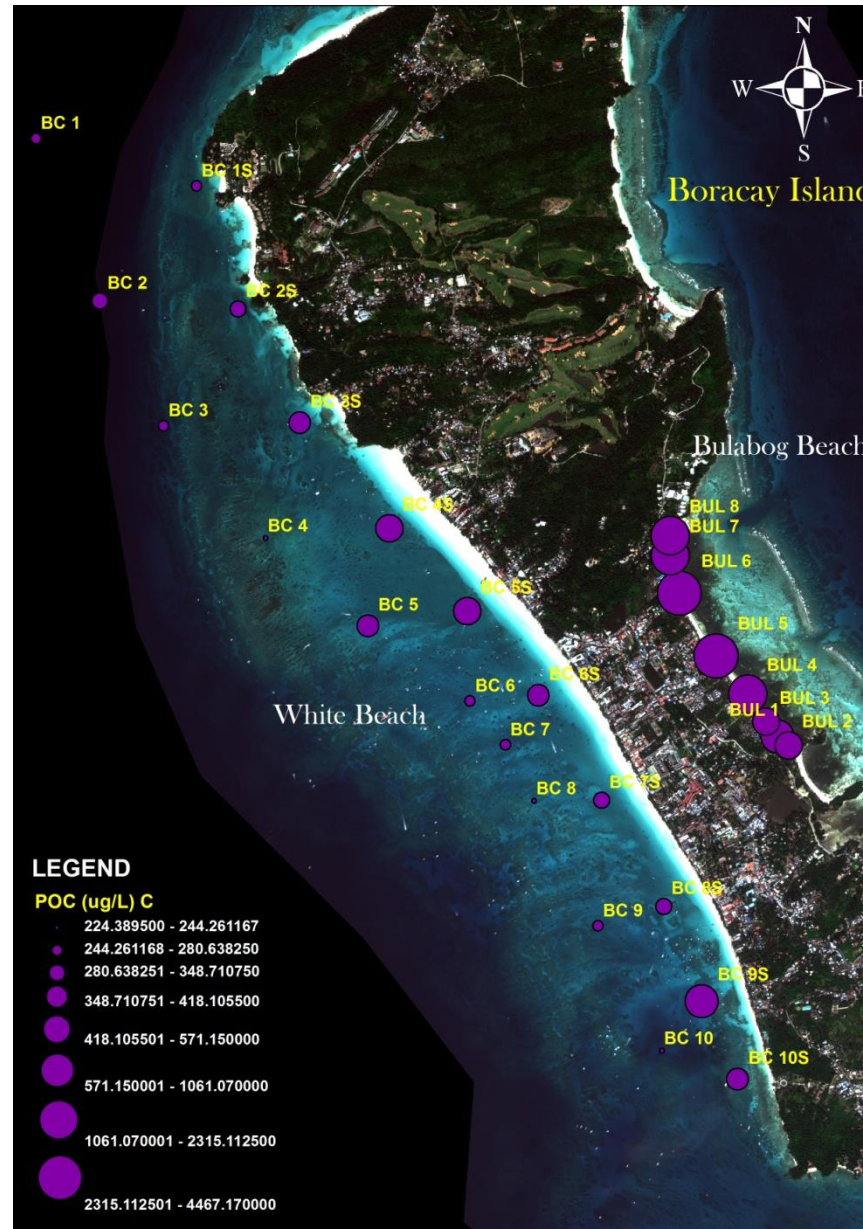
Lowest concentration

BC8 → 224.39 ug/L

Highest concentration

Bul7 → 4467.17 ug/L

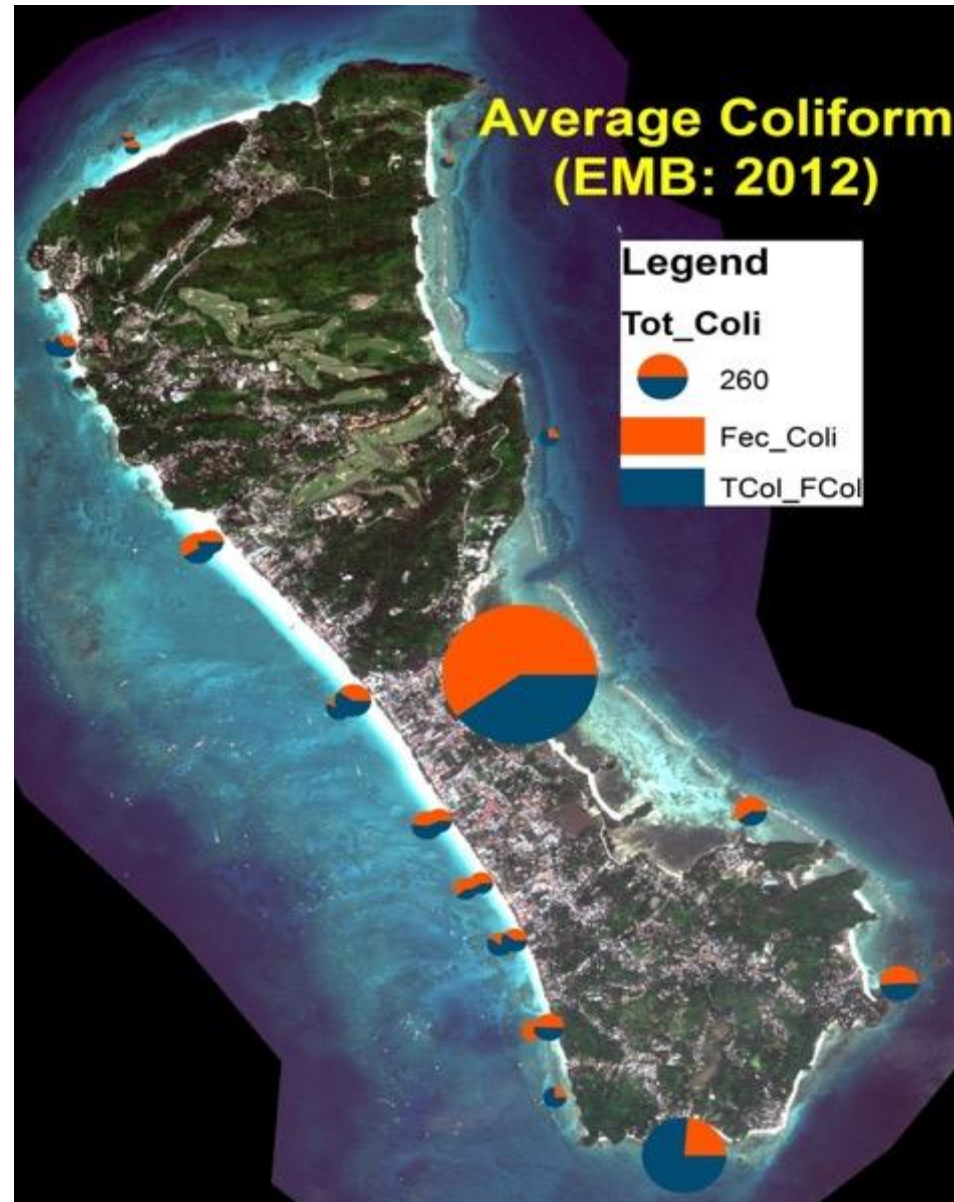
C/N near sewage pipes: 3-4



15-17 Dec 2012

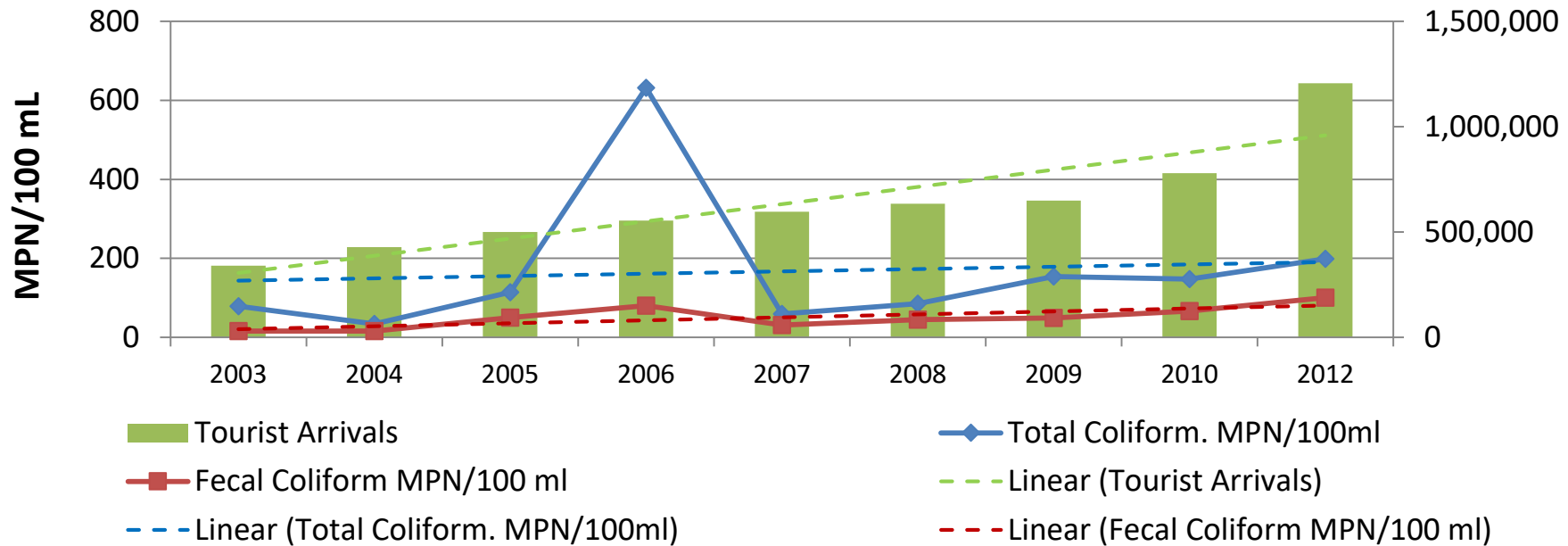
Findings: Fecal coliform (*E. coli*) counts

Higher during calmer waters in White Beach; Consistently high all year round in Bulabog.

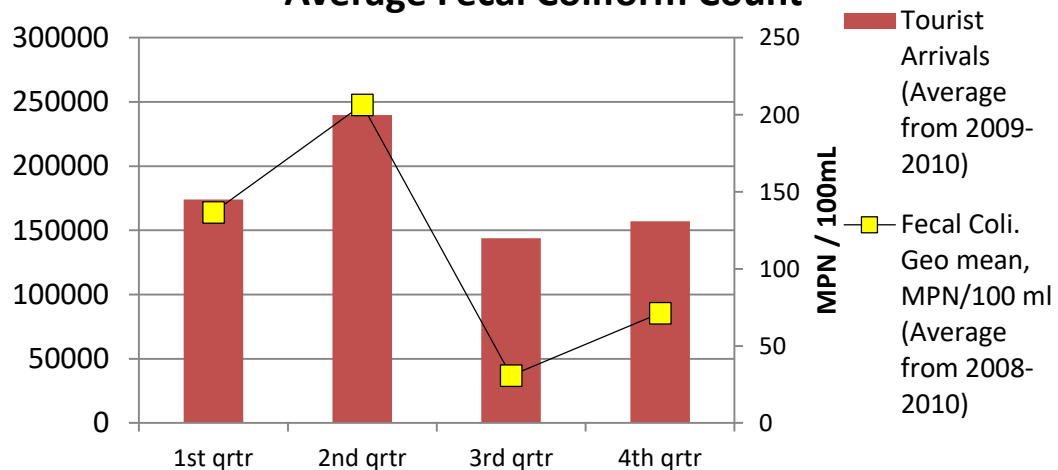


- Villa del Oro beach area → 2.00 MPN/100ml
- Highest concentration Bulabog Pier → 445.00 MPN/100ml
- Allowable limit (Class SB) is 200 MPN/100ml

Coliform Count VS Tourist Arrivals (2003-2012)



Quarterly Tourist Arrivals and Quarterly Average Fecal Coliform Count



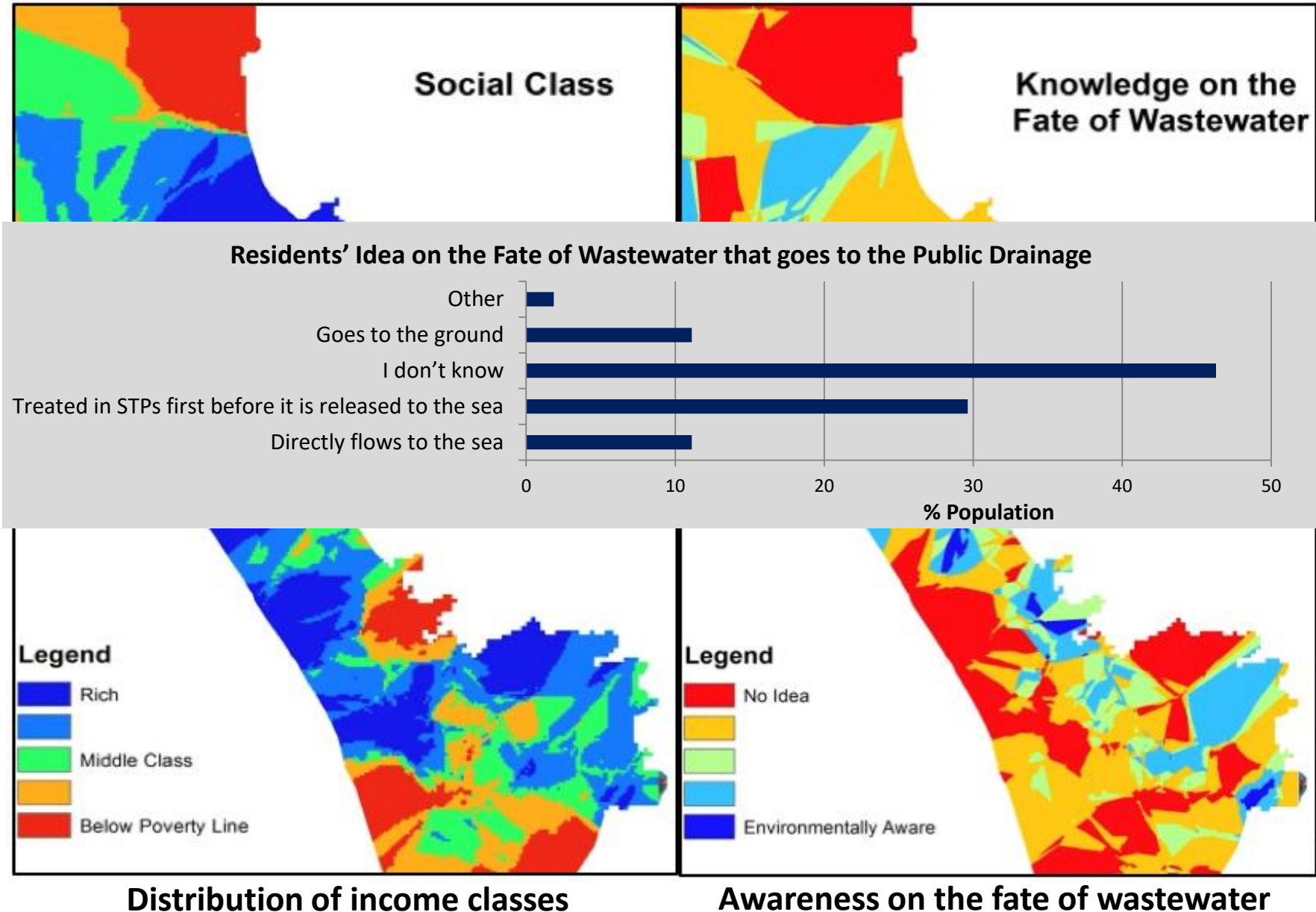
2003 to 2012 average total coli and fecal coli counts exhibit an increasing trend as the number of tourist arrivals increase during the same period.

Findings: Awareness on the fate & effects of waste water

1. 14% of the households, w/o septic tanks; waste water from their houses goes direct to the ground.

2. Most of the residents w/o septage system do not know where the wastewater from public drainage/canals ends up.

3. Most of the residents living in the western side of barangay Balabag (White Beach side) have no idea on the fate & effects of wastewater discharged into public storm drainage



SUMMARY

- Relatively poor water quality observed in eastern side of island where marine outfalls located and in sitios where dense informal settlements present. High nutrient levels and fecal coliform found in sites adjacent to areas with dense buildings.
- Rapid urban growth in island brought significant change in both its vegetation and coral cover. Due to huge demand for buildable areas, parts of the beaches, forest zone and even areas with steep slopes occupied and developed.
- Social status of population and lack of awareness on environment are important factors in degradation of island's environment. Residents do not have a clear idea where their wastewater go after direct discharge onto the ground. Lack of knowledge on effects of wastewater to seawater and groundwater jeopardized quality of said water bodies.
- Strong correlation between number of tourists visiting the island and water quality of the beaches exists. Better wastewater management is required in order to accommodate large influx of tourists.

WAY FORWARD

- A collective vision for a more sustainable tourism development in the island.

Thank You for listening!

