FBS-Environment and Community Research and Development Services (FBS-ECReDS)

Block 2, Lot 23, Luis Jacob St., Casili Hills Subdivision,
Brgy. Casili, Mandaue City 6014, Cebu, Philippines

May 18, 2022

MARION RAAGAS
Sagip Coron Palawan
Coron, Palawan, Philippines

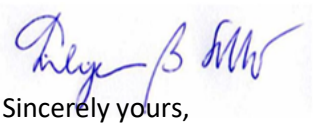
Subject: Biophysical Assessment of the Damage to Marine Habitats due to the Coron Bay Reclamation Project, Coron, Palawan, Philippines Report

Dear Mr. Raagas,

Greetings!

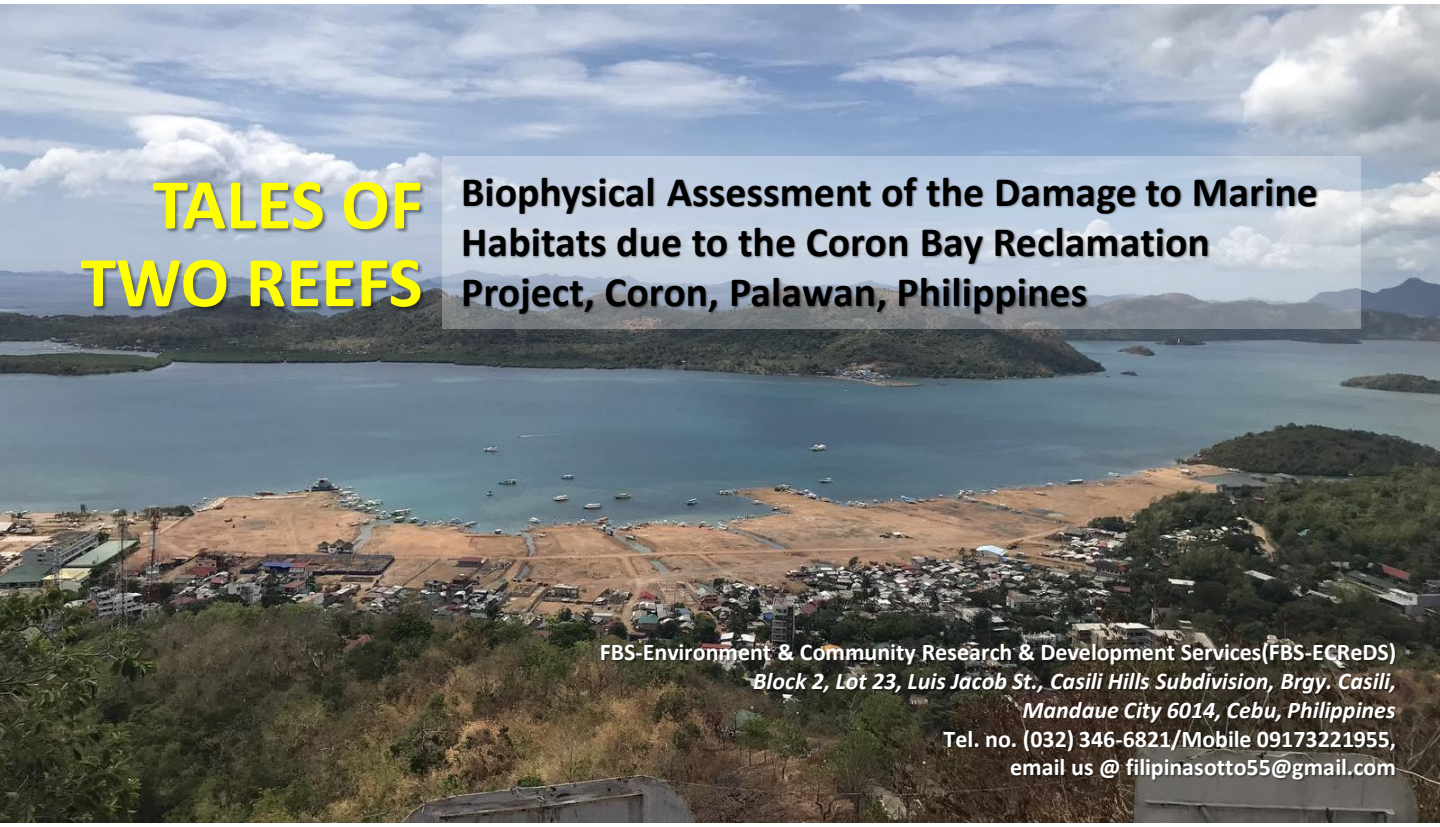
Submitting herewith the results of the study we conducted in Coron, Palawan commissioned by your office. We also presented results of this Marine Ecosystem Study conducted on April 26 to 30, 2022 at the Coron Inter-Agency Task Force Meeting attended by representatives from DENR, PRA, DOT, AFP and Sagip Coron at the President's Room, Manila Polo Club Makati last May 18, 2022.

Hoping that all is in order. Thank you for the opportunity to work with your group. God bless.



Sincerely yours,
FILIPINA B. SOTTO, Ph.D.
Consultant, FBS-ECReDS

Cc: Joy Magno
Bob Magallanes
Sarge Sarmiento
Nymia Raagas



TALES OF TWO REEFS

Biophysical Assessment of the Damage to Marine Habitats due to the Coron Bay Reclamation Project, Coron, Palawan, Philippines

FBS-Environment & Community Research & Development Services(FBS-ECReDS)
Block 2, Lot 23, Luis Jacob St., Casili Hills Subdivision, Brgy. Casili,
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Tel. no. (032) 346-6821/Mobile 09173221955,
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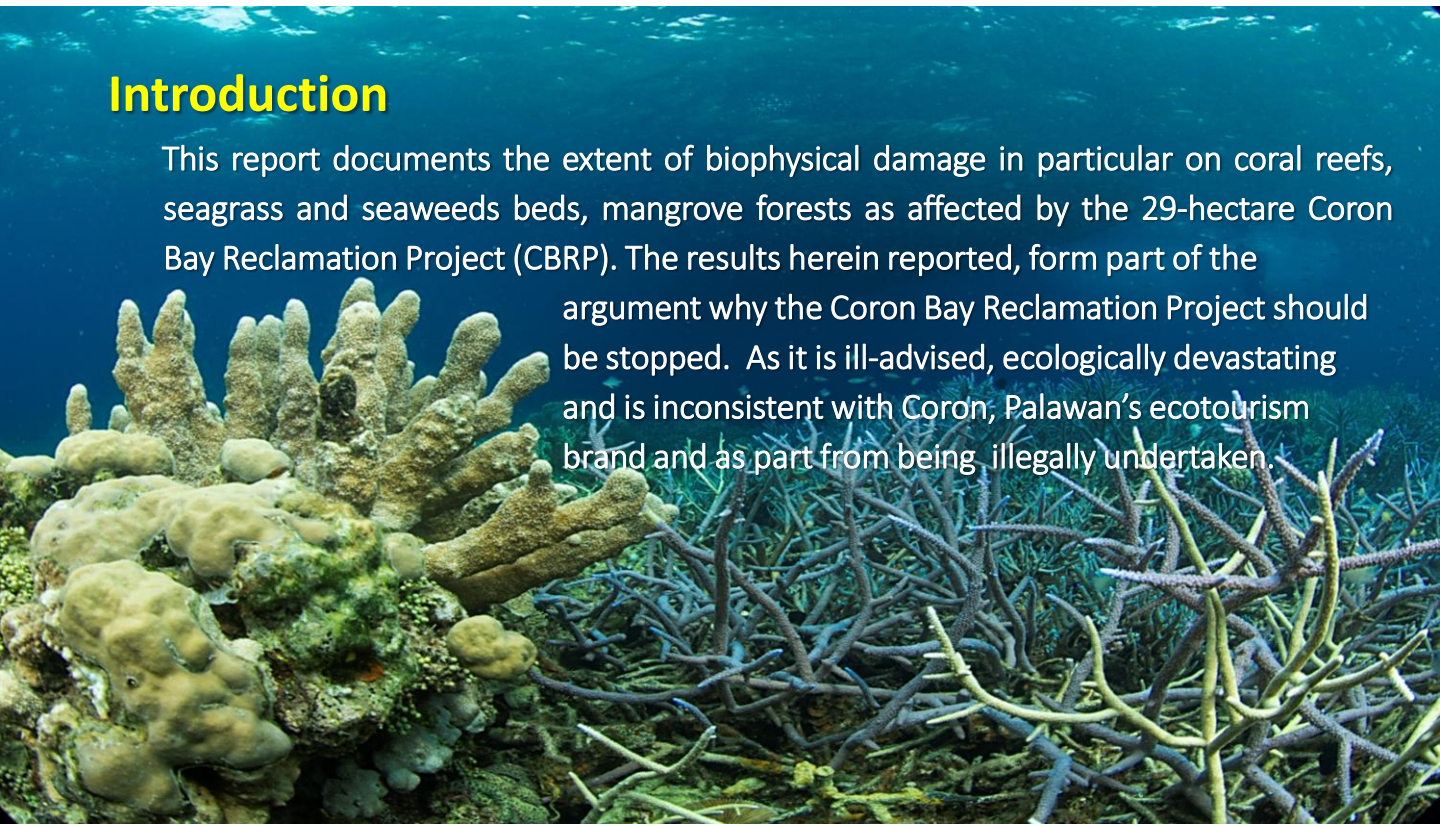


Introduction

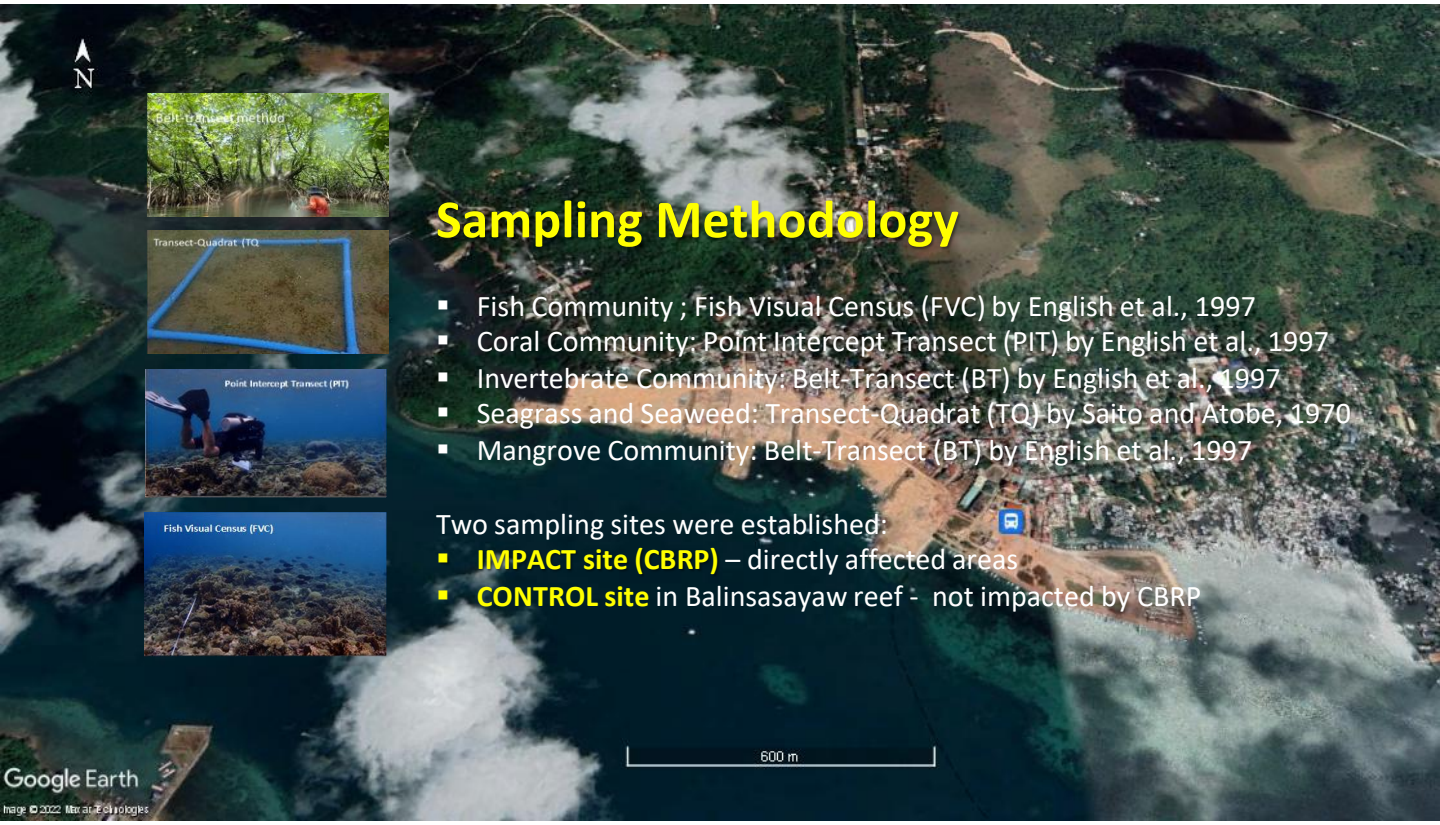
This report documents the extent of biophysical damage in particular on coral reefs, seagrass and seaweeds beds, mangrove forests as affected by the 29-hectare Coron Bay Reclamation Project (CBRP). The results herein reported, form part of the argument why the Coron Bay Reclamation Project should be stopped. As it is ill-advised, ecologically devastating and is inconsistent with Coron, Palawan's ecotourism brand and as part from being illegally undertaken.

Objectives

The study conducted a biological and physical marine resources assessment on the area affected by the Coron Bay Reclamation Project (CBRP). Particularly, the following were assessed:

2.1. Mangrove species composition, density, frequency, dominance & relative abundance;
2.2. Seagrass and seaweed community (species composition, frequency & density);
2.3. Macro-invertebrates community (species composition, frequency & density);
2.4. Coral community (species composition & live coral cover);
2.5. Fish community (species diversity, density & biomass and); and
2.6. Fisheries potential (catch per unit effort).

*This type of analysis provides better index regarding the **importance, function, services and valuation** of the remaining coastal habitats in its current state*



Sampling Methodology

- Fish Community ; Fish Visual Census (FVC) by English et al., 1997
- Coral Community: Point Intercept Transect (PIT) by English et al., 1997
- Invertebrate Community: Belt-Transect (BT) by English et al., 1997
- Seagrass and Seaweed: Transect-Quadrat (TQ) by Saito and Atobe, 1970
- Mangrove Community: Belt-Transect (BT) by English et al., 1997

Two sampling sites were established:

- **IMPACT site (CBRP)** – directly affected areas
- **CONTROL site** in Balinsasayaw reef - not impacted by CBRP


N
Poblacion,
Coron
IMPACT SITE
(Coron Bay
Reclamation Project)
Siete Pecados Marine Protected Area
CONTROL SITE
(Balinsasayaw Reef)
2 km


Mangrove Community Structure Study

Mangrove Species Composition of Impact Site (7 species)

Rhizophora apiculata
"Bakhaw lalaki"

Rhizophora mucronata
"Bakhaw babae"

Rhizophora stylosa
"Bakhaw bato"

- **0.81 VERY LOW Diversity**
- **0.42 MODERATE Evenness**

Avicennia marina
"Miapi"

Sonneratia alba
"Pagatpat"

Lumnitzera littorea
"Culasi"

Xylocarpus granatum
"Tabigi"

Images are taken from Field Guide To Philippine Mangroves by J. H. Primavera

Mangrove Species Composition of Control Site (12 species)

Aegiceras floridum
"Tinduk-tindukan"

Avicennia marina
"Miapi"

Bruguiera gymnorrhiza
"Pototan"

Excoecaria agallocha
"Buta-buta"

Lumnitzera littorea
"Culasi"

Pemphis acidula
"Bantigi"

Rhizophora apiculata
"Bakhaw lalaki"

Rhizophora mucronata
"Bakhaw babae"

Rhizophora stylosa
"Bakhaw bato"

Scyphiphora hydrophyllacea
"Nilad"

Sonneratia alba
"Pagatpat"

Xylocarpus granatum
"Tabigi"

1.26 VERY LOW Diversity 0.51 HIGH Evenness

Images are taken from Field Guide To Philippine Mangroves by J. H. Primavera

Mangrove Importance Value

The Mangrove Importance Value underscores the most important species that contribute to the whole mangrove community structure in the Impact Site in Coron, Palawan.

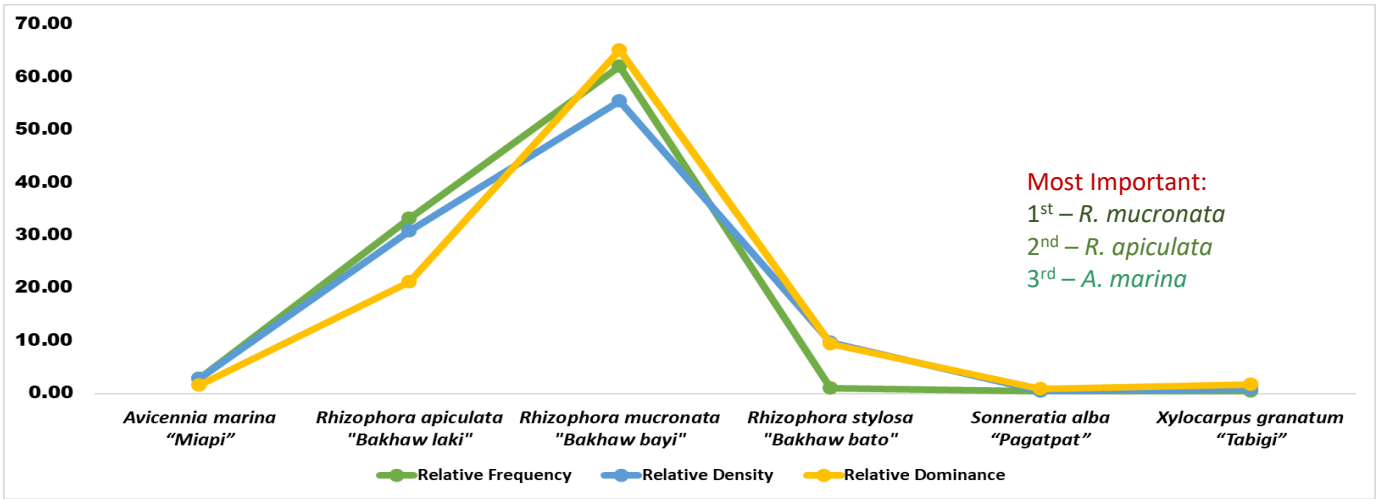


Figure 9. Relative frequency, density, and dominance of mangrove species in Impact Site

Mean Tree Density = **6, 716 trees/ha.** Mean Tree Basal Area = **33.57 sq. m**

Mangrove Importance Value

The Mangrove Importance Value underscores the most important species that contribute to the whole mangrove community structure in the Control Site in Coron, Palawan.

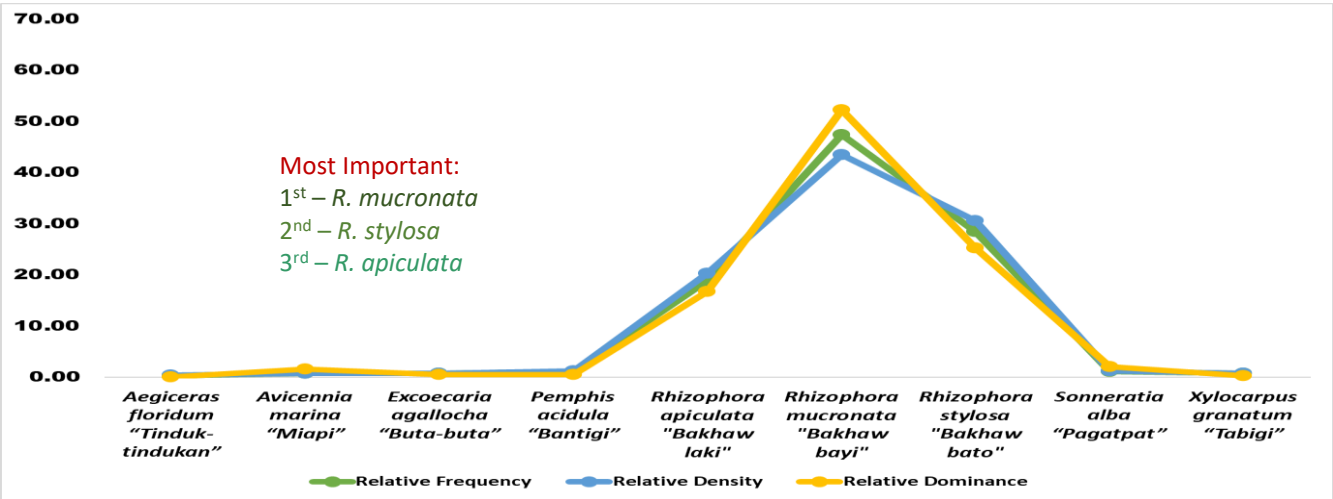
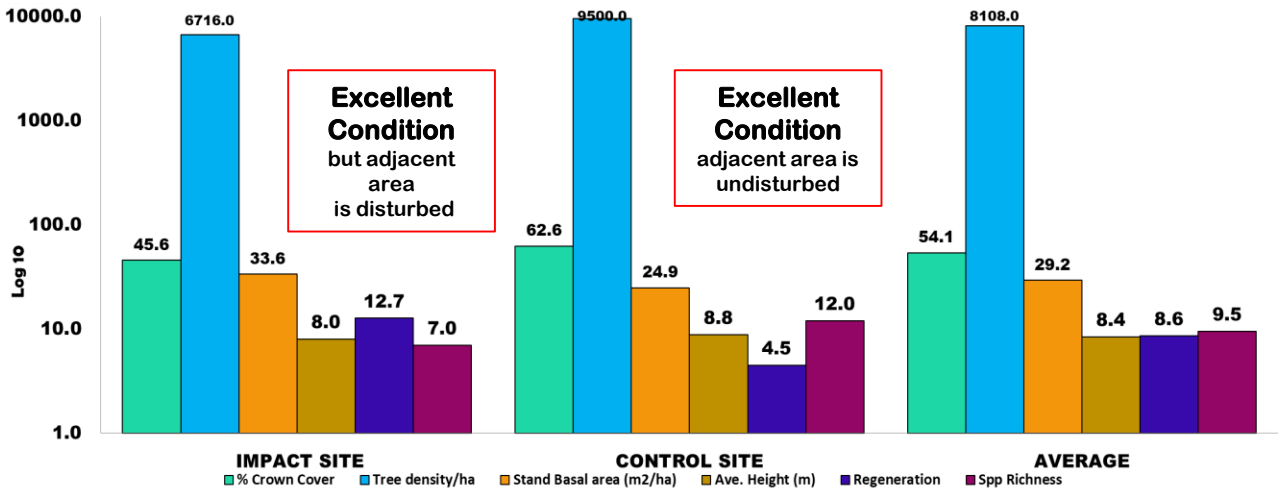


Figure 10. Relative frequency, density, and dominance of mangrove species in Control Site

Mean Tree Density = **9, 500 trees/ha.** Mean Tree Basal Area = **24.91 sq. m**

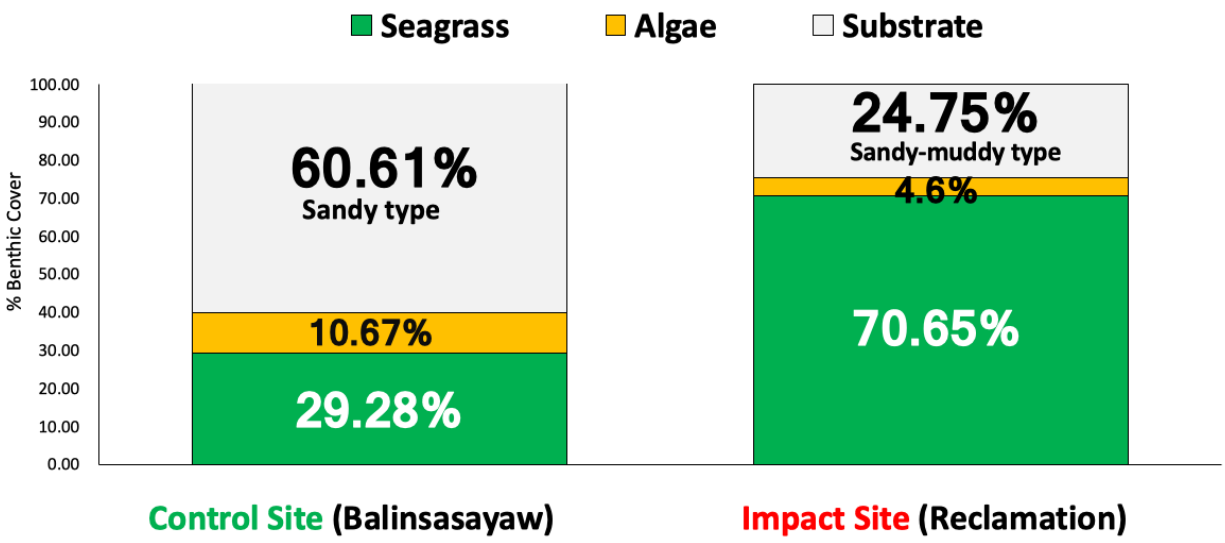
Mangrove Community Structure

The mangrove community structure illustrates the health status of mangroves in impact & control sites.



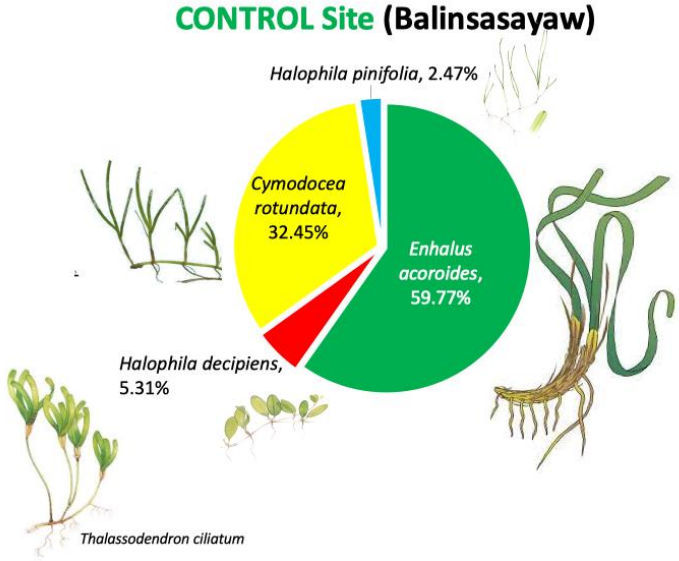
Mangroves in both impact and control sites have no major difference, only in terms of species diversity. This tells us that mangroves in Coron are generally mature and in stable state except in the impact site currently under threatened from dying-off due to restricted water circulation.

Seagrass, Algae and Substrate Type Cover at the Seagrass Habitats



Seagrass Species Richness

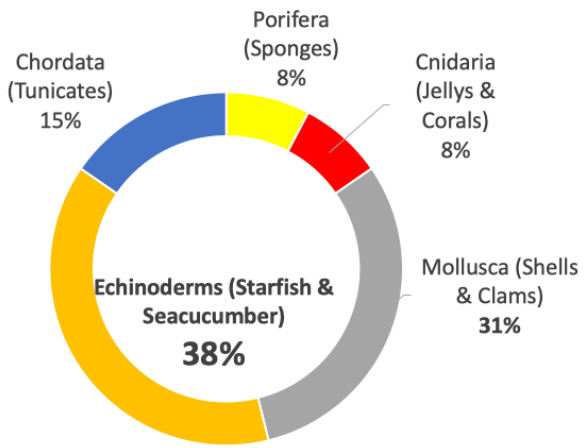
CONTROL Site (Balinsasayaw)



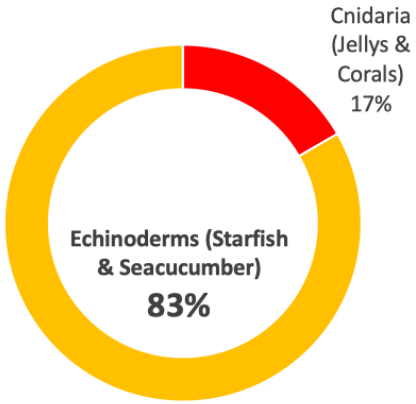
IMPACT Site (Reclamation)

Macro-invertebrate Occurrence at the Seagrass Habitats

CONTROL Site (Balinsasayaw)



IMPACT Site (Reclamation)



Tales of Two Reefs

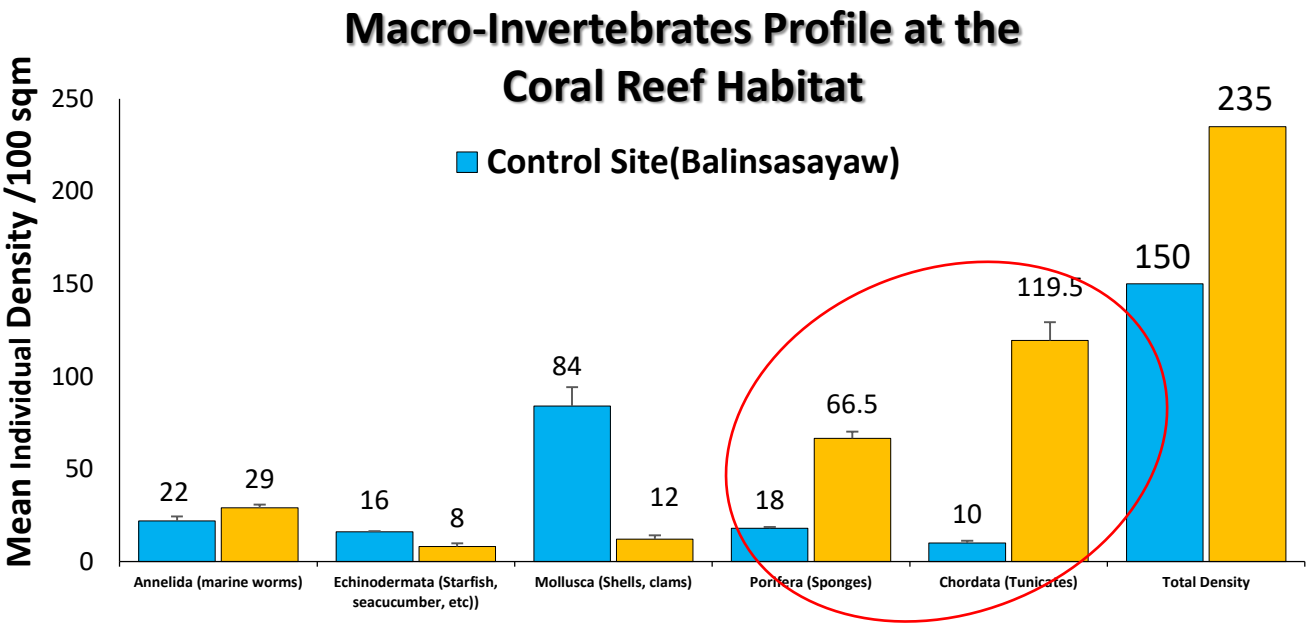
IMPACT SITE
(In front of Reclamation Area)

CONTROL SITE
(4km away from Reclamation Area)

Seagrass/seaweed habitats in the impact site are inundated with silt and mud, which reduces productivity, as compared to the control site with sandy substrate with presence of diverse flora and fauna.

Seagrass/Seaweed Zone


Macro-Invertebrate Community
Sea Star, Sea Cucumber, Shells, Clams, Sponges
Activate Windows
Go to Settings to activate Windows.



Macro-invertebrates in the impact site (orange bar) and control site (blue bar) share similar fauna families. The main difference is the dominance of sponges and tunicates in the impact site which are group of invertebrates that usually thrive in a nutrient-rich environment.


Fish and Coral Communities

FISH SPECIES RICHNESS

How many kinds of fish found in the area

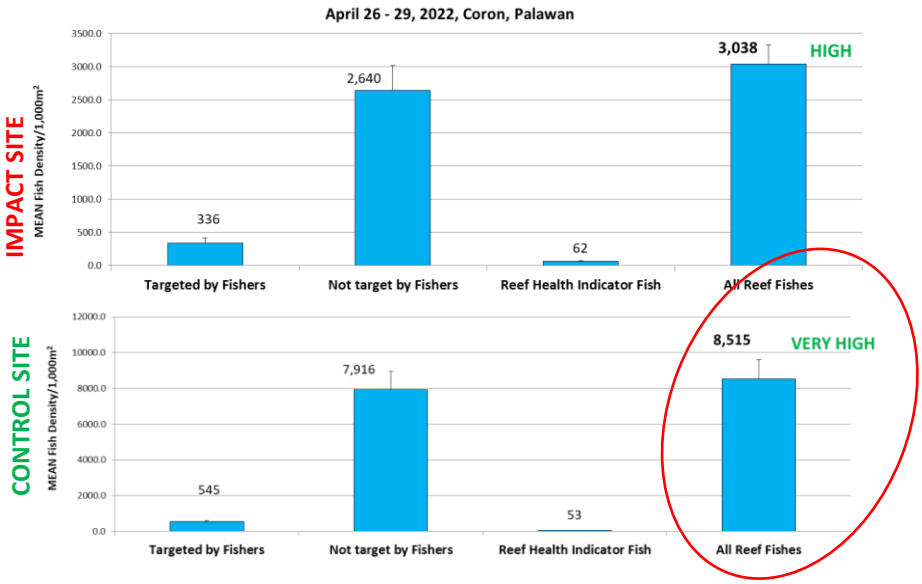
Species richness in the impact site is under POOR condition. Disturbance due to presence of silt and mud negatively affected the area particularly corals causing other reef-dependent species to out-migrate, seeking elsewhere reef to refuge.

The control site registered MODERATE condition as the reef is undisturbed and protected by among locals.

SPECIES RICHNESS INDEX:	Very Poor	Poor	Moderate	High	Very High
	0 - 26 spp	27 - 47 spp	48 - 75 spp	76 - 100 spp	> 100 spp

Fish Condition Index based on the works of Hilomen et al., 2000

FISH DENSITY
Amount of fish found in the area



Fish density registered VERY HIGH in the control site with more target species with commercial value compared to the impact area.

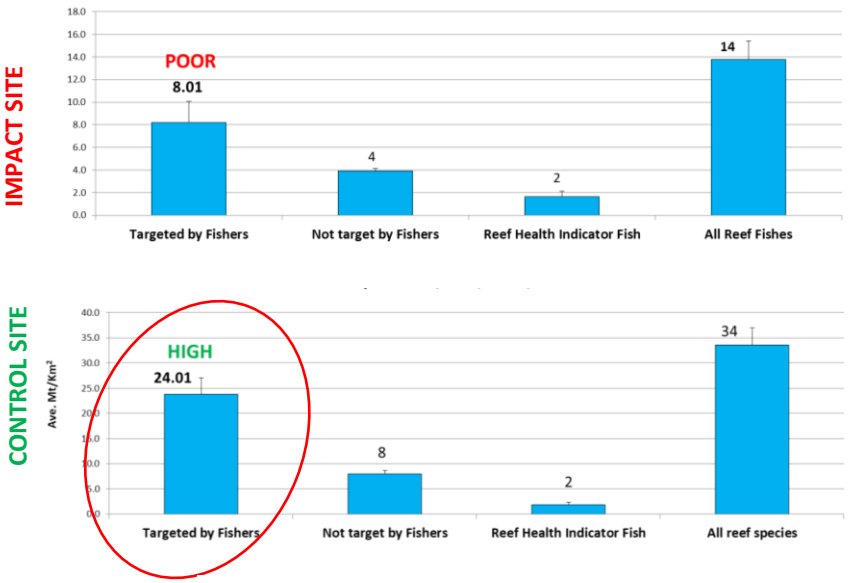
FISH DENSITY INDEX:	Very Poor	Poor	Moderate	High	Very High
	0 – 201	202 - 676	677 – 2,267	2,268 – 7,592	> 7,592

Fish Condition Index based on the works of Hilomen et al., 2000

FISH BIOMASS

How much potential fish weight if the area is harvested within the area

April 26 - 29, 2022, Coron, Palawan



Fish biomass is a primary driver of coral reef ecosystem services and has high sensitivity to human disturbances such as fishing and high-impact coastal developments.

Fish biomass in the impact area registered POOR condition with a low number of commercial species counted, as compared to the control site under HIGH condition with triple the number of targeted by fishers species over that of the impact area. This shows that an undisturbed reef equate to higher fish productivity that importantly maintains the reef structure and processes within the coral reefs.

FISH BIOMASS INDEX: (Target species only)	Very Poor	Poor	Medium	High	Very High
	< 5.0	6 - 10	11 - 20	21 - 41	> 41

Fish Condition Index based on the works of Hilomen et al., 2000

Tales of Two Reefs

IMPACT SITE
(In front of Reclamation Area)

3.7 Kg or 1.2 Kg/Hr. CPUE

CONTROL SITE
(4km away from Reclamation Area)

Total 10.3 Kg or 3.4 Kg/Hr. CPUE

Fisheries Potential (Catch per Unit Effort) through Test Fishing

LIVE CORAL COVER

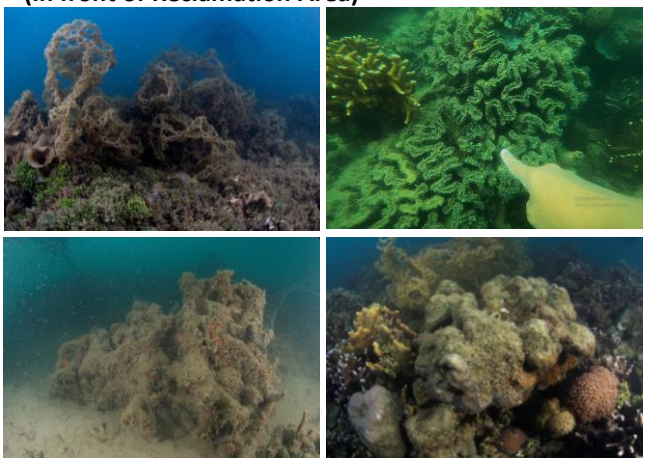
Live coral cover represents the health status as well as the productivity of a reef. Live coral cover in both reefs registered under GOOD condition. However, the dead corals with algae (DCA) and sand silt accounted more in the impact site which shows deterioration and the inundation of sediments. The high percentages of sponges and macro algae are also signs associated to sedimentation, brought about more highly-nutrient rich waters which these animals prefer.

POOR = 0-25%; FAIR = 26-50%; GOOD = 51-75%; EXCELLENT = 76-100%.
Coral condition based on hard coral cover (Gomez et al., 1994)

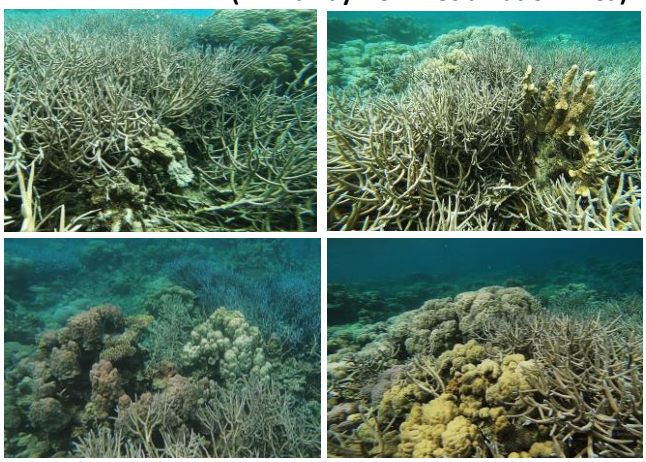
Fish Condition Index based on the works of Hilomen et al., 2000

Tales of Two Reefs

IMPACT SITE
(In front of Reclamation Area)



CONTROL SITE
(4km away from Reclamation Area)



Coral Reef Zones

Coral–Algal Phase Shift?

McManus and Polsenberg, 2004

Do we need to be concern with Coral-algal phase shift? Yes we do, because this is a situation wherein algal communities overgrow a coral reef (as shown above) and affects productivity. Reclamation soil have brought in minerals and other nutrients that allows algae to flourish than corals. Looking at the test fishing conducted as proof, reefs with lower productivity produces lower harvest (impact site 3.7kg fish) as compared to the control site with higher fish yield (10.3 kg fish)

CONCLUSIONS

- The municipality of Coron has an estimated marine water area of **360,310 hectares** (=3,603.1km^2), stretching from Brgy. Bintuan to Brgy. San Jose that includes the ff.

  - Mangrove area **25,938.78 ha (7.20%)**
  - Coral reefs **15238.10 ha (4.23%),**
  - Seagrass/seaweeds& **4941.14 ha (1.37%)**
  - The hard coral cover of Coron ranges from **poor** to **good** condition (Licuanan *et al.*2017).

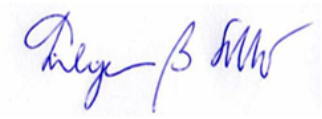
CONCLUSIONS

Mangrove Communities

.

- Overall the current mangrove conditions In both **Impact** and **Control** sites based on the parameters measured ***showed no marked differences except*** *in the number of species*. A study by Buitre *et al.,* (2019) concluded that based on landscape metrics, the mangroves of Coron showed stability, confirming that the mangrove areas in this municipality are still in **good conditions**.

- While the mangroves are still in good conditions, the Coron mangroves, still suffered from mangrove area loss due to some development such as the 40-hectare Coron Bay Reclamation Project. The CBRP has already reclaimed 19 hectares, affecting about 6 hectares of mangroves in the 2nd phase reclamation. This is not only a **violation of the existing DAO 15-90, SEP Law & ECAN**.



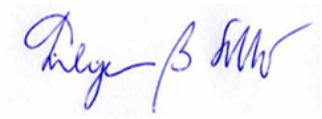
CONCLUSIONS

Seagrass/Seaweed Communities

- **Impact site (Reclamation)** were observed to have **higher sandy-muddy substrate** & **leaf blades of seagrasses** were covered by fine sediments and having has less seagrass species count (**1 species**). Invertebrates were dominated by sponges and tunicates which are thriving in waters with nutrient-rich particles.

- **Control Site (Balinsasayaw)** has **sandy substrate & cleaner leaf blades**, with **4 species of seagrass** and diverse invertebrates species.

- Impact area's productivity was affected by the reclamation in terms of the number of species (fish and invertebrates) it supported as well as the lower potential fish yield which was conducted in coral-seagrass zones.



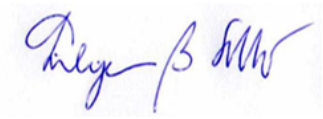
CONCLUSIONS

Macro-invertebrates

- **Impact site** has a **Low Evenness Index** but higher species count, thus having a dominant group of **sponges** & **tunicates** which favors silty environment with nutrient-rich particles due to their filter feeding lifestyle.

- **Control site** on the other hand, has lower species dominance but higher on species diversity evenness (**equality in diversity**).

- **Sponges and tunicates** may be thriving now but if the source of the nutrient-rich particles which they feed on will not be mitigated (reclaimed area not fortified with seawall where sediments leach out), then sediments will continue and **may increase the degree of silt which can also clog their system and die-out**.



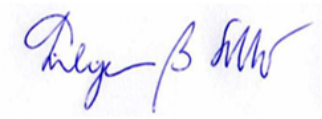
CONCLUSIONS

Fish Community and Fisheries Potential

- **Impact Site has POOR fish diversity, HIGH fish density , POOR fish biomass** and having **2.7 kg after 3 hours of fishing** or **0.9kg/hr CPUE.**

- **Control site has MODERATE fish diversity, VERY HIGH fish density , HIGH fish biomass** and having **10.3 kg after 3 hours** or **3.4kg/hr CPUE.**

- Reefs Impacted by reclamation have shown **decline in productivity**, in terms of diversity, density and biomass and this was clearly demonstrated in the test fishing activity which shows **lower fisheries potential** as compared to the control site.



CONCLUSIONS

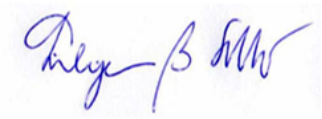
Coral Community

- **Impact Site** has **live coral cover** at **50.8%** (Good), **dead corals with algae** or DCA at **27%**, **Silt and sand** at **10%** and **sponges** at **6.3%** high.

- **Control site** has **live coral cover** at **66.3%** (Good), **dead corals with algae** or DCA at **19%**, **Silt and sand** at **2%** and **sponges** at **0.2%** high.

- Corals in front of the **impact site** are **slowly dying due to continuous sedimentation** and threatened by **algal infestation** brought about by eutrophication (high nutrient load) from the soil nutrients dumped into the sea.

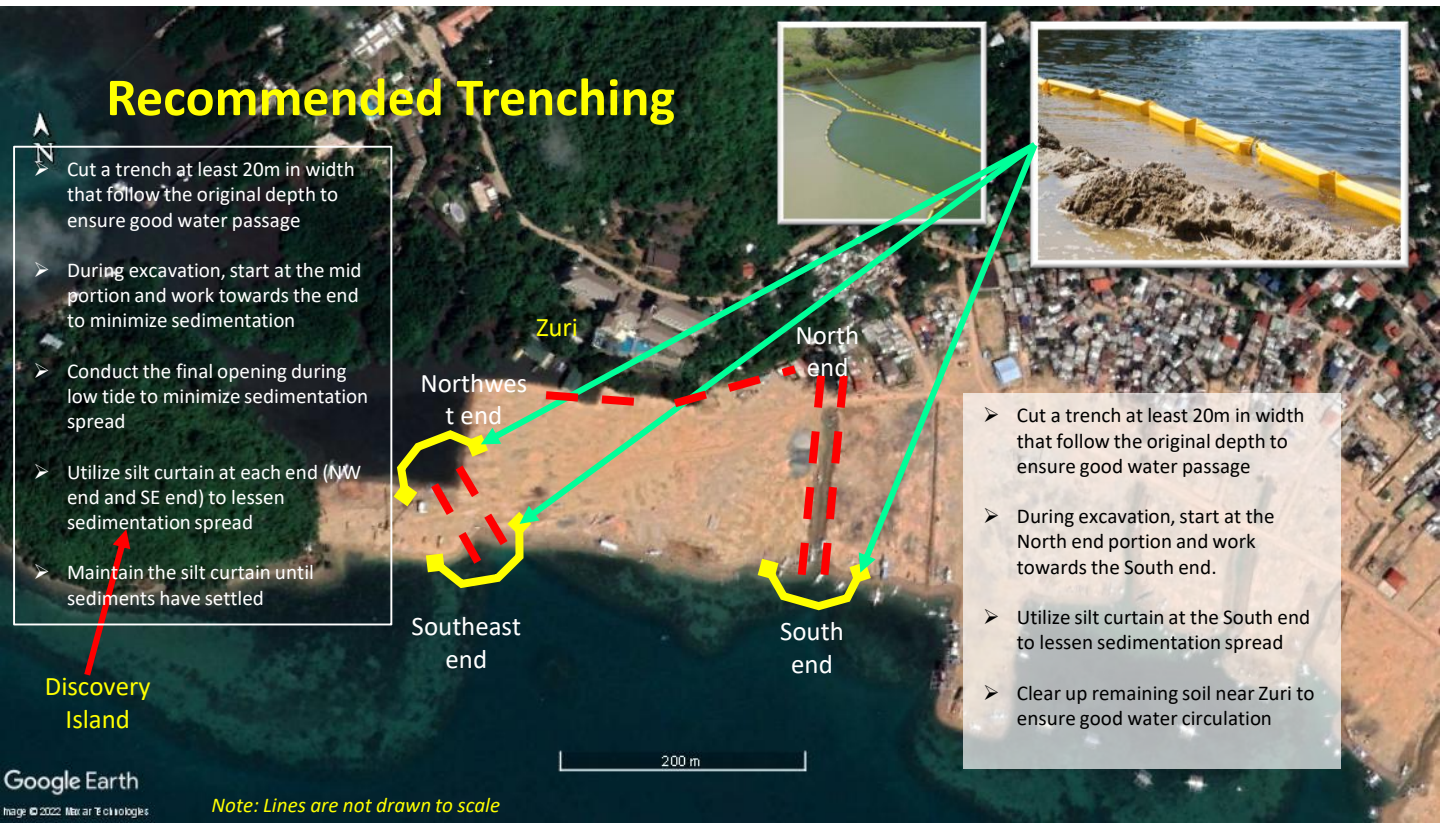
- Thriving filter-feeding sponges and tunicates dominating the invertebrates community have shown domination due to their lifestyle preferring nutrient-rich particles. However, as the saying goes, "**too much of anything is dangerous**". This could also lead to eventual death by clogging.



RECOMMENDATIONS

- The over 29-hectares of **mangrove-seagrass-coral reef area** is now reclaimed and gone forever. To prevent further permanent destruction of habitats at the nearby areas, it is STRONGLY RECOMMENDED to stop the reclamation expansion and start the rehabilitation.

- Create a trench near Discovery Island, as well as deepen the existing trench near Zuri (see next slide as reference) to ensure good water circulation and prevent mangroves from dying off.



Note: Lines are not drawn to scale

RESOURCE VALUATION

CORON BAY RECLAMATION PROJECT

Proponent:
Provincial Government of Palawan

EnP Karen P. Gatus
May 18, 2022

ECONOMIC VALUE

PHIL. CORAL REEFS ANNUAL ECONOMIC BENEFITS

US$ 1-1.4 Billion

Table 10. Potential annual economic net benefits

Resource Use (Direct and Indirect)	Philippines[a] ($ million)	Philippines-South China Sea Basin ($ million)
Fisheries	620.0	11.3
Tourism	108.0	2.3
Carbon Sequestration		8.4
Coastal Protection	326.0	23.2
Biodiversity	10.0	7.0
Research		0.7
Total Net Annual Benefits	1,064.0	52.7
Net Present Value[b]	9,063.0	449.1
Reef Area (km^2)	27,000.0	4,640.9

[a]Burke et al, 2002

[b]Stream of annual benefits over 20 years at 10% discount rate

References:
Samonte-Tan, G. and Armadillo, M. C. 2004. Economic Valuation of Philippine Coral Reefs in the South China Sea Biogeographic Region. National Coral Reef Review Series No. 3. UNEP.

White, A.T., Vogt, H.P. and Arin, T. 2000. Philippines coral reefs under threat: The economic losses caused by reef destruction. Marine Pollution Bulletin 40: 598–605.

ECONOMIC VALUE

REEF-SITE SPECIFIC

VALUATION OF CORAL REEFS AND THE SOCIO-ECONOMIC CONTEXT

Appendix 5. Total economic value (PhP million)

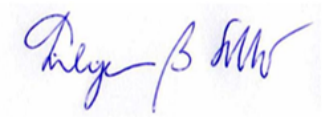
Location of Reef	Fisheries	Tourism	Research	Net Market Value[a]	Carbon Sequestration	Coastal Protection	Biodiversity	Non-market Value[b]	Total Economic Value[c]
1. Lingayen Gulf	12.7	0.0	18.0	30.7	9.5	26.3	7.9	43.6	74.4
2. North Luzon-Babuyan Islands-Batanes Islands	2.7	20.8	10.3	33.8	2.0	5.6	1.7	9.4	43.2
3. South Luzon-Marinduque-Eastern Mindoro-	30.6	57.0	0.0	87.5	22.7	63.1	18.9	104.7	192.2
4. Northwestern Palawan	206.6	47.4	0.0	254.0	153.4	426.1	127.8	707.3	961.2
5. Kalayaan Island Group, Palawan	366.2	0.4	10.0	376.6	271.9	755.2	226.6	1,253.7	1,630.3
Total	**618.8**	**125.6**	**38.3**	**782.7**	**459.5**	**1,276.3**	**382.9**	**2,118.6**	**2,901.2**

[a]Net market value from fisheries, tourism and research.

[b]Non-market value including carbon sequestration and shoreline protection and option value

[c]Net market value plus non-market value

Reference:
ECONOMIC VALUATION OF PHILIPPINE CORAL REEFS IN THE SOUTH CHINA SEA BIOGEOGRAPHIC REGION (UNEP 2004)



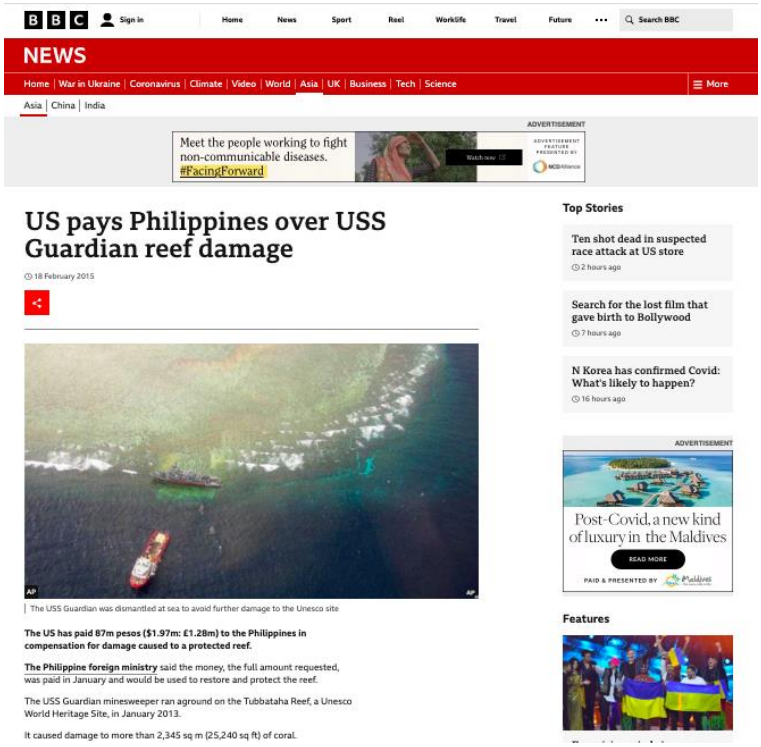
ECONOMIC VALUE

Table 6. Estimated total monetary value using the median, minimum, and maximum monetary value per annum for each marine biome (US$, 2007 prices)

Marine ecosystem	Median	Minimum	Maximum
Coral reefs	515.54	95.664	5,535.717
Seagrass	2.617	2.559	4.114
Mangroves	3.007	0.074	219.472
Continental shelf*	493.990	483.043	776.483
Total for coral reefs, mangroves and seagrass	520.163	98.298	5,759.302
Total	1,014.153	581.341	6,535.785

Note: Estimates may not add up due to rounding off of values per hectare. Median, minimum and maximum values for each coastal ecosystem obtained from De Groot et al. (2012).

Reference:
TY - JOURAU - AZANZA, RHODORAAU - ALIÑO, PORFIRIOAU - CABRAL, RENIELAU - MEÑEZ, MARIE ANTONETTEAU - PERNIA, ERNESTOAU - MENDOZA, RONALDAU - SIRIBAN, CHARLESPY - 2017/07/01SP - 1EP - 26T1 - VALUING AND MANAGING THE PHILIPPINES' MARINE RESOURCES TOWARD A PROSPEROUS OCEAN-BASED BLUE ECONOMYVL - 18JO - PUBLIC POLICYER -



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US pays Philippines over USS Guardian reef damage

18 February 2015

The USS Guardian was dismantled at sea to avoid further damage to the Unesco site

The US has paid 87m pesos ($1.97m: £1.28m) to the Philippines in compensation for damage caused to a protected reef.

The Philippine foreign ministry said the money, the full amount requested, was paid in January and would be used to restore and protect the reef.

The USS Guardian minesweeper ran aground on the Tubbataha Reef, a Unesco World Heritage Site, in January 2013.

It caused damage to more than 2,345 sq m (25,240 sq ft) of coral.

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CASE STUDY

- USS Guardian Minesweeper ran aground on the Tubbataha Reef, a **UNESCO World Heritage Site** in January 2013
- caused damage to more than 2,345 square meter of coral.
- US has paid **PhP87 million pesos ($1.97m: £1.28m)** to the Philippines in compensation for damage caused to a protected reef

Reef Damage value: **US$840 (PhP 37,100) per square meter**

THE CASE OF CORON RECLAMATION

- Entire Province of Palawan is a **UNESCO BIOSPHERE RESERVE**
- Province of Palawan is known as the Philippine's "**Last Ecological Frontier**"
- Coron Island Natural Biotic Area - in the tentative list to qualify for inclusion in the **WORLD HERITAGE LIST**
- Ancestral Domain (R04-CADC-134).
- National Reserve Proclamation # 219
- Tourist Zone and Marine Reserve Proclamation # 1801
- Mangrove Swamp Forest Reserve Proclamation # 2152
- Priority Protected Areas NIPAS Act 1992


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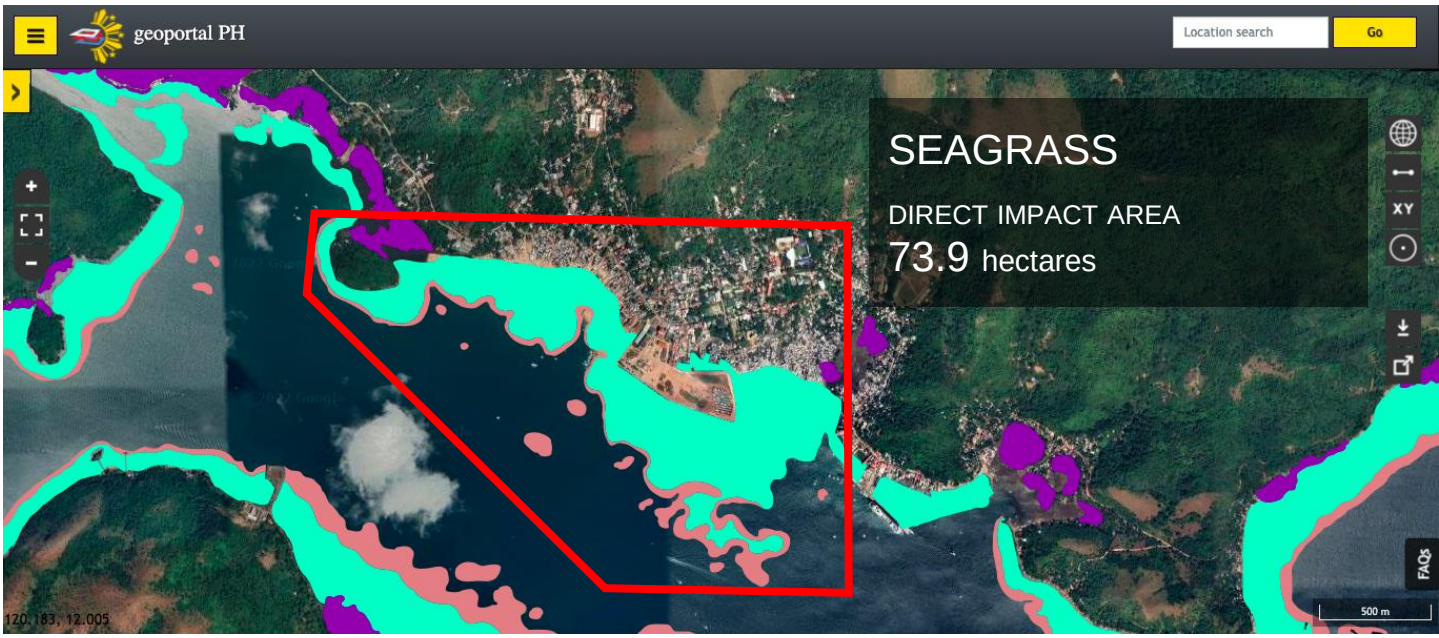
51 HECTARE
RECLAMATION PROJECT
• CORON WATERFRONT DEVELOPMENT PROJECT
• Proponent: Provincial Government of Palawan
• Covering barangays of Poblacion, 2, 3 and 5
https://www.pea.gov.ph/corporate-profile/programs-and-projects/reclamation2021\
XY
FAQs
500 m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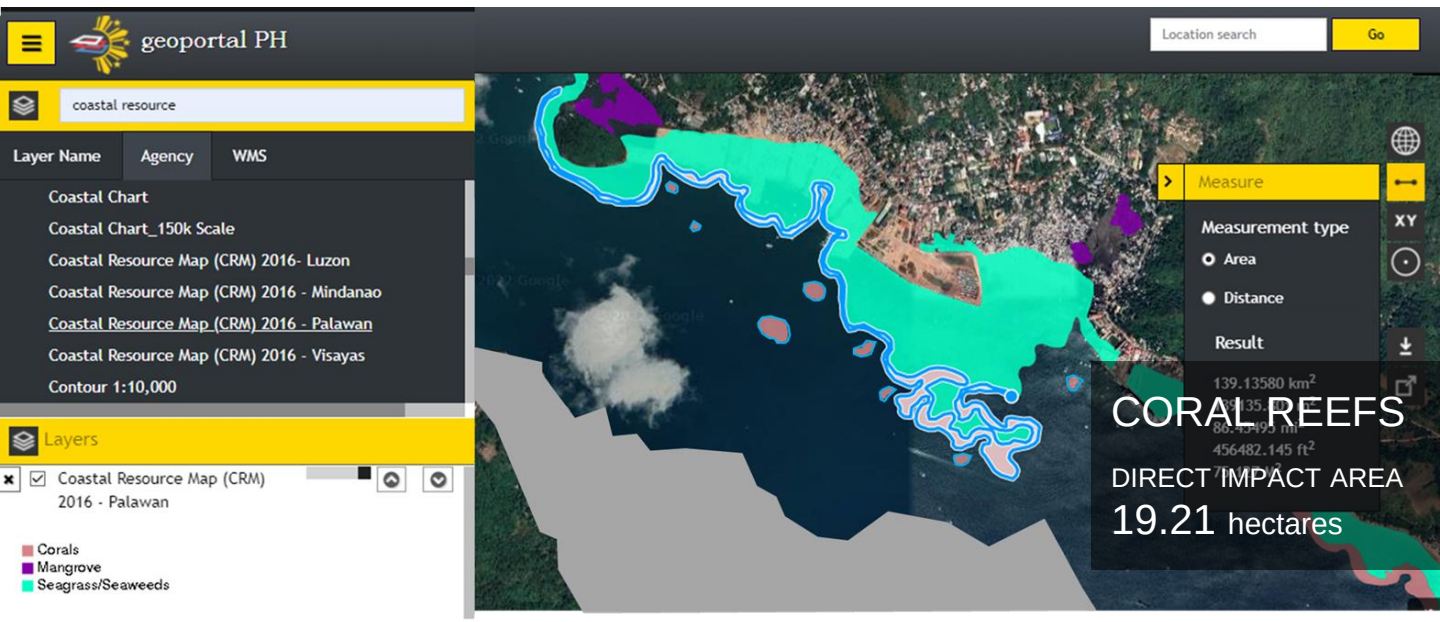
SEAGRASS
DIRECT IMPACT AREA
73.9 hectares
XY
FAQs
120.183, 12.005
500 m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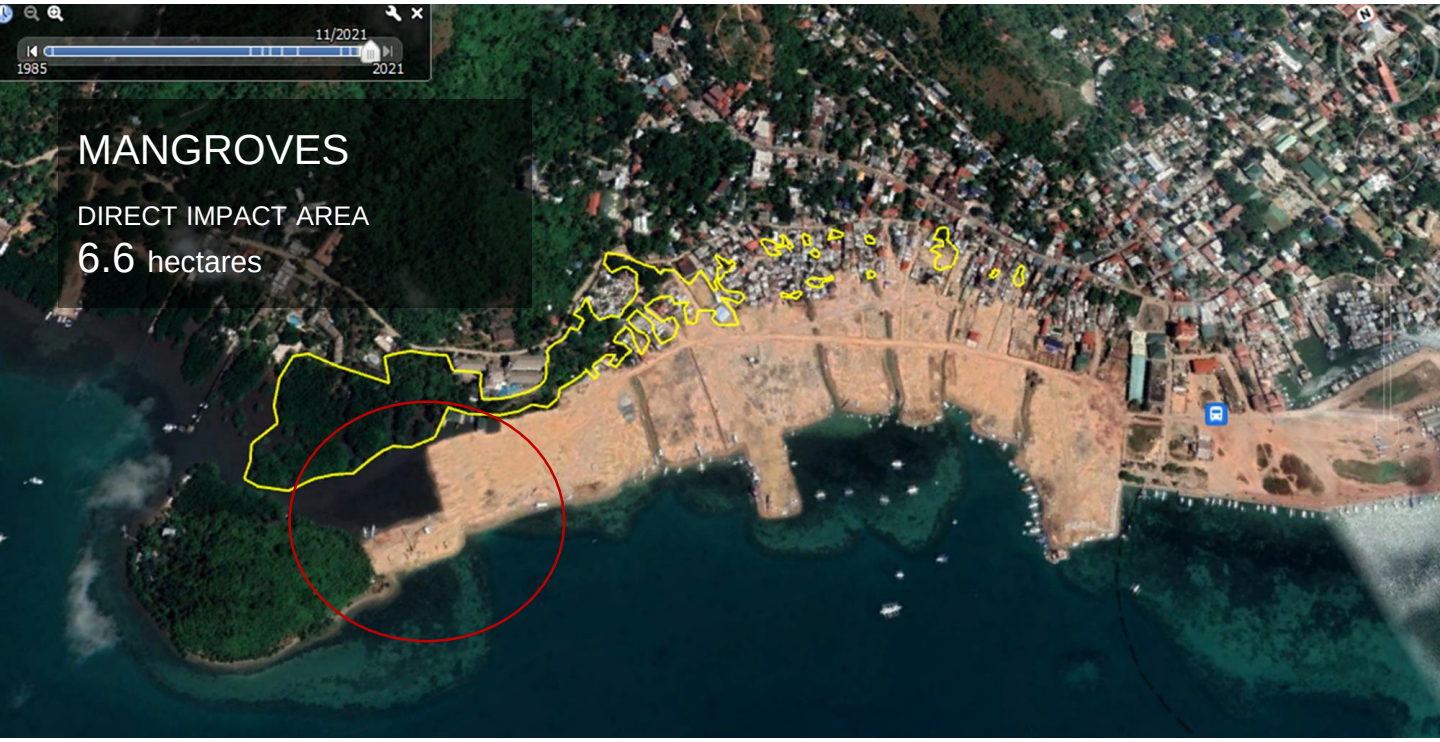
coastal resource
Layer Name
Agency
WMS
Coastal Chart
Coastal Chart_150k Scale
Coastal Resource Map (CRM) 2016- Luzon
Coastal Resource Map (CRM) 2016 - Mindanao
Coastal Resource Map (CRM) 2016 - Palawan
Coastal Resource Map (CRM) 2016 - Visayas
Contour 1:10,000
Layers
Coastal Resource Map (CRM) 2016 - Palawan
Corals
Mangrove
Seagrass/Seaweeds
Measure
Measurement type
Area
Distance
Result
139.13580 km²
456482.145 ft²
CORAL REEFS
DIRECT IMPACT AREA
19.21 hectares


12/2019


11/2021
1985
2021
MANGROVES
DIRECT IMPACT AREA
6.6 hectares

RESOURCE VALUATION (DAMAGE)

DAMAGE TO CORAL REEFS (19.21 has.)

- **US$ 6,799,994**[a]

DAMAGE TO MANGROVES (6.6 has.)

- **US$ 1,279,357**[b]

DAMAGE TO SEAGRASS (73.9 has.)

- **US$ 2,136,966**[b]

TOTAL DAMAGE TO COASTAL RESOURCES

US$ 10,216,317

(Opportunity Loss)

[a] pegged at US$ 676/m^2 computed using Groot et al 2012 Ecosystem Values System; Damage value for USS Guardian Minesweeper was at US$ 840/m^2
[b] computed using Groot et al 2012 Ecosystem Values System


Together we can make
a difference,
One Tree, One Reef
at a Time.
Thank you for your time.

Annex:

Table 3. Summary of monetary value for services per biome of global costal ecosystems (in US$/ha/year, 2007 price levels)

Ecosystem services	Coral reefs	Coastal systems	Coastal wetlands
Provisioning services	55,724	2,396	2,998
Food	677	2,384	1,111
Water			1,217
Raw materials	21,528	12	358
Genetic resources	33,048		10
Medicinal resources			301
Ornamental resources	472		
Regulating services	171,478	25,847	171,515
Climate regulation	1,188	479	65
Disturbance moderation	16,991		5,351
Waste treatment	85		162,125
Erosion prevention	153,214	25,368	3,929
Nutrient cycling			45
Habitat services	16,210	375	17,138
Nursery service		194	10,648
Genetic diversity	16,210	180	6,490
Cultural services	108,837	300	2,193
Aesthetic information	11,390		
Recreation	96,302	256	2,193
Inspiration			
Spiritual experience		21	
Cognitive development	1,145	22	
Total economic value	352,249	28,917	193,845

Source: De Groot et al. (2012).

ANNEX: