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Assessment of the Ecological Habitats of Bacon District, Sorsogon City in the Philippines

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Abstract

The status of ecological habitats in the municipality of Bacon Sorsogon was assessed. Standard sampling techniques were used to generate data that were needed to come up with comprehensive statements regarding the present state of the identified habitats. The line intercept method was used to survey the existing coral reefs. The line quadrat method was used to assess the seagrass/seaweed beds while a line plot method was used to evaluate the community structure of the mangrove habitat. A visual census of fish was employed to asses the diversity and biomass of coral reef fishes. Corals were found to be thriving in the coastal waters of the barangays of Osiao, San Juan, Caricaran, Paguriran and Pagol. The status of the coral reefs in these areas ranged from 'poor' to 'good' live coral cover. The overall mean percentage live coral cover was 40.28% in the whole sampling area indicating that live coral cover conditions were fair. The degrading of live coral conditions can be attributed to both anthropogenic and natural causes. Thirty six species of coral reef fishes were identified in the coral reef stations with varying biomass estimates varying from 2.8 to 7.7 kg per 250 m transect line. Nine species of seagrasses and four species of seaweeds were identified and they were observed to be thriving extensively in the sampling areas. The species *Syringodium isoetifolium* appeared to be the dominant species of seagrass as far as biomass is concerned. This was followed by *Thalassia hemprichii* with *Halophila minor* having the least biomass. Among the seaweeds, the species *Halimeda cylindracea* appeared to contribute most to the biomass. Ten species of mangrove species were identified alongside with another three associated species. *Avicennia marina* was present in all the sampling sites for mangrove assessment. The cutting of mangrove trees was observed in most of the sampling stations, especially at Sta Lucia. The level of perturbation is estimated as level three. The different ecological habitats evaluated were important life support systems for the existing fishery in the area, especially for the gleaning of macro-invertebrates.

Key words: coral reef, ecological habitat, mangrove, seagrass bed, Sorsogon

Introduction

Albay Gulf's south-eastern sector is bordered by the 32.48 km coastline of the Bacon district of the City of Sorsogon. Unlike in neighboring major fishing grounds (Lagonoy Gulf to the north and Sorsogon Bay to the west), gulf-wide scientific inquiries to determine the status of coastal habitats are scant. This is despite the presence of strong ecotourism (Misibis resort in Sto. Domingo, a chain of resorts in Bacon, Embarcadero in Legazpi and many others) and major industries (such as the geothermal power plant of BacMan and the mining in Rapu-rapu and Batan) that from time to time create concerns about their alleged contribution to marine water contamination. In the case of Bacon, the absence of district-wide information about the status of its coral reefs, seagrass, seaweeds and mangroves is a serious concern, in as much as the City is embarking on developmental projects off its coast. Specifically, the mariculture zone project and the decade-old marine sanctuary, in addition to the chain of resorts and the power harnessing and mining industries are special concerns in the development of the district's coastal zone. The sustainability of these projects will surely be affected when the immediate coastal area is degraded. The ecological frontline that would right-away absorb negative impacts are the coral reefs, seagrass and seaweed beds and mangroves. The degrading beyond the capacity to recuperate of these

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resources would soon be followed by cascading impacts to marine biodiversity and eventually to people directly dependent on the bounty of the sea. For this reason periodic monitoring and assessment of the status of the coastal habitats is being encouraged. This can serve as an early warning system which can be used by the local government unit in development planning.

In the 1990s, some NGOs (e.g. Tambuyog Development Center in 1997) and the then Bacon LGU conducted spot monitoring of the status of the ecological habitats of certain sectors for the establishment of a marine protected area. The Coastal Core (2008) through its project on participatory community profiling and development planning for selected barangays of Bacon District, captured concerns involving fisheries' productivity and sustainability. In 2007, experts were hired to evaluate the status of the ecological habitats of Sogod Bay for the establishment of a mariculture project. Spot accounts of coral reef systems are carried out but there is no district-wide assessment of coastal habitats.

This study is a component of the Rapid Resource and Social Assessment of Bacon District. It views the entire coastal habitat of the area as an integrated system which interacts with the entire Albay Gulf system and the immediate nearby marine ecosystem. With the intention of providing a comprehensive description of the status of the existing coastal habitats of the district, the study was laid out to achieve the following general objectives:

1. Determine the percentage live coral cover of the benthic lifeforms
2. Identify different seagrass-seaweeds species
3. Determine the cover of seagrass-seaweeds
4. Identify different mangrove tree species
5. Estimate levels of human perturbation in the mangrove forests
6. Propose measures and interventions that would enhance the ecological functionality of the coastal habitats.

In comparison to other areas in Bicol, Bacon District has good potential for fisheries development and management due to various natural advantages. Firstly, there are marine ecological habitats in the area which are considered to be life support systems for marine species. Secondly, the coves of the town can be used as sites for marine aquaculture. Thirdly, the existence of a marine sanctuary where fishing activities are regulated and fourthly, a human community that is receptive to the ideas of coastal resource management. There is a need to evaluate and assess the existing coastal habitats in the town because the results can be used to further strengthen existing policies and guidelines so that the fishery in the area can be sustained and be enjoyed by future generations of Bacongons and by Bicolanos in general.

1. Methodology

Prior to the sampling proper a quick evaluation of the locations of the habitats was undertaken by interviewing the fishers of the area, who are used to exploiting the resources. After locating the ecological habitats, stations were established to represent the habitats. For coral reef assessment five stations were established. These were used as the stations for reef fish assessment employing the conventional visual census of fish. For seagrass/seaweeds assessment three stations were established. For mangrove forest assessment ten stations were established. The assessment of these three coastal habitats was undertaken with the fisher-cooperators who were also part of the community partners assembled by the city government

To provide a descriptive statement on the condition of the coral reefs of the municipality, the line intercept method was used but with modification. The modification undertaken was to take underwater photographs of the fiberglass measuring tape laid on top of the coral reefs. Repeated photography was done until the entire fifty-meter measuring tape was photographed. The information on benthic lifeforms was transferred to the computer so that it could be further categorized by lifeform and intercepts could be calculated. A standard guide for identifying lifeforms was used to discretely segregate the photographed benthic lifeform samples (English *et al.*, 1994). Appendix presents the different benthic lifeforms that served as a guide to the identification.

To determine the percentage cover and number of occurrences of every lifeform the formula

Percentage cover = Total length of category/ length of transect x 100%

was used.

The percentages of live corals were added together so that a statement of the conditions of the corals could be made. Table 1 presents the basis for determining live coral cover conditions.

Table 1. Coral cover condition

Live Coral (%)	Condition
0-24.99	Poor
25-49.99	Fair
50-74.99	Good
75-100	Exellent

The line quadrat method was used to assess the seagrass/seaweeds community that was found to be thriving in the coastal area. A 100-m transect line was laid perpendicular to the shoreline starting from the deeper portion of the sea towards the shallower area. A .5 X.5 m quadrat was laid on opposite sides of the transect line at intervals of 10 m starting from 0 m up to 100 m. The quadrat has 25 subquadrats which were used to estimate frequency.

The species of seagrass and seaweeds inside the quadrat were identified taxonomically and likewise the cover and frequency were also estimated. Afterwards they were harvested to estimate biomass. The technique of estimating cover followed the standard set forth by Saito and Atobe (1970). Table 2 presents the classes of cover.

Table 2. Classes of dominance used to record cover

Classes	Amount of Substratum Covered	Substratum Covered (%)	Mid-point (%)
5	1/2 to all	50-100	75
4	1/4 to 1/2	25-50	37.5
3	1/8 to 1/4	12.5-25	18.75
2	1/16 to 1/8	6.25-12.5	9.38
1	Less than 1/16	<6.25	3.13
0	absent	0	0

The coverage of identified species in the quadrat was estimated using the formula

$$C= \sum (Mi \times fi)/ \sum f$$

where: Mi = mid point percentage of class i
f = frequency (number of sectors with the same class of dominance)

The above ground parts of the seagrass and seaweeds were separated from the roots and sorted by species. Using a digital top loading balance the weight of every species was calculated. In this way, the biomass was determined. The data on biomass and cover were used to come up with a description of the seagrass community in the area.

A modified line plot method was used to survey the community of mangroves that were found to exist in the southeastern part of the coastal municipality. A 100 m transect line was laid perpendicular to the shoreline towards the hinterland of the mangrove forest. Plots with a dimension of 10 x 10 m were established along the transect line and were distanced ten meters apart. The tree species were identified taxonomically and were counted. Likewise the existence of saplings and seedlings was also noted. Only the relative dominance was calculated to further describe forest structure.

The data generated from the three coastal habitats were analyzed statistically and were used to come up with a general statement about habitat status. These coastal habitats are known for their interdependence and are best known for their role as a life-support system for many marine flora and fauna. The extent of human perturbation was approximated to help inform the various stakeholders of their effects on the critical coastal habitats.

2. Results and Discussion

1) Corals

A total of five stations were surveyed for the presence of coral reefs in the municipality (Table 3). These were Santa Lucia, San Juan, Paguriran, Osiao and Pagol. Different percentages of live coral cover were revealed at each station. Furthermore, live coral cover conditions ranged from poor to good. Santa Lucia had a 15.7% live coral condition which is rated as poor. Paguriran and Pagol have live coral cover conditions of 36.64% and 37.44% respectively. They were both rated as fair. San Juan and Osiao have live coral cover conditions of 59.94% and 51.72%, which is considered good. There are reasons for the different coral cover conditions in the surveyed sites.

Table 3. Status of corals reefs of Bacon District

Stations	Live Coral (%)	Condition
Sta Lucia	15.70%	poor
Paguriran	36.64%	fair
Pagol	37.44%	fair
Osiao	51.72%	good
San Juan	59.94%	good

In the case of Santa Lucia, a large river empties into the cove that was adjacent to the surveyed site. This brings sediments into the coral reef area and cover the polyps of the corals. Such an event can cause the death of corals. It was also observed that the mangrove areas that would impede fast sedimentation were declining. Likewise seagrasses that can serve as buffers to sediments were patchy in the area. Anthropogenic activities within the corals were also observed in the surveyed sites and might have contributed to the decline in live coral cover condition. Fishes such as those belonging to the family Scaridae were present in the area and these fishes are known for feeding on coral polyps (Figure 1).

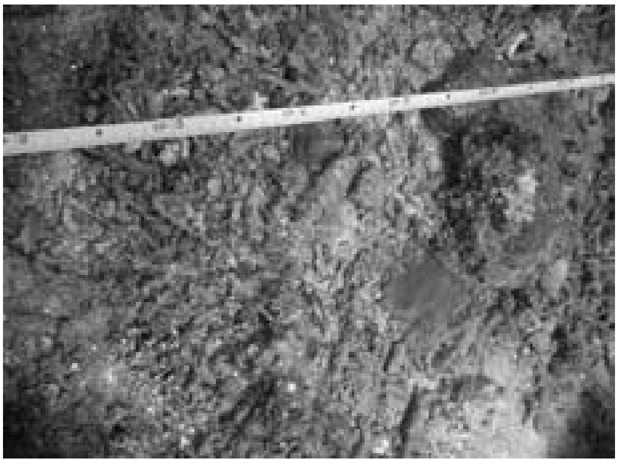

Fig. 1 Rubbles and silt: common signs of disturbances off Sta Lucia-Pagol-Paguriran coral reef system

In Paguriran the bottom topography did not encourage intensive colonization by corals. The reef flat was mostly composed of unstable sand rather than rock. Corals prefer to anchor themselves on rocks or other corals, but not on other substrates. Also anthropogenic activities were taking place in the area. The ecotone in between the seagrass and corals of Pagol have installed fish corral indicating an uptrend in fishing activities. Some parts of the fish corrals were already on the edge of the reef slope. These fishing devices can indirectly contribute to the decline in live coral cover conditions since in the construction of the device some coral colonies have to be sacrificed. There were also other anthropogenic activities in the area which contribute to the decline of live coral cover conditions.

The sampling site in San Juan showed the highest live coral cover for having been declared a sanctuary (Figure 2). Fishing activities were prohibited in the area and the location of the reef would not facilitate intensive fishing activities since it was located two kilometers from the shoreline. Also the fishers near the area avoided it because supposedly “paranormal forces” were present and were guarding the area. Cultural beliefs unexpectedly contributed to resource management. Although a scientific basis for these “paranormal forces” is unclear, it should be considered as a factor influencing fishing intensity, thus in management. This sanctuary should be extended to the adjacent seagrass-seaweed beds for there too, there are macro-invertebrate resources that are in need of protection. However before implementing the expansion of the sanctuary there is a need first to determine the total fishing area of the town so that only 10-15% of it is used as a sanctuary.

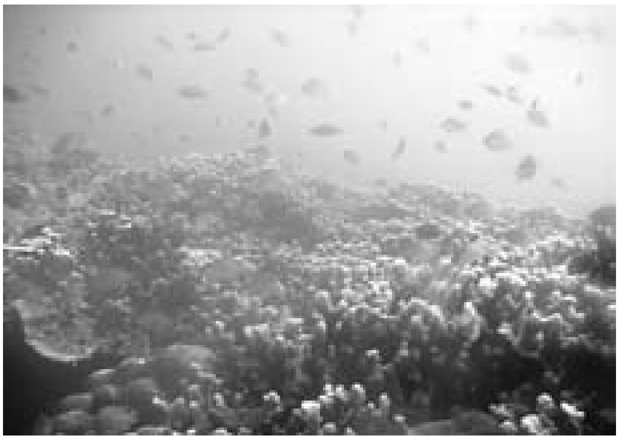

Fig. 2 Corals and fishes inside San Juan marine sanctuary

For Osiao, coral cover is inherently in good condition (52% live cover), considering the geographical and oceanographic endowment it shares with that of the nearby San Juan reef system (Figure 3). However it is alarming to see intact corals be tabulated and basket corals be smothered by thick sediments. The water in this sector is laden with silt which has recently settled into the extensive coral formations, as a result of the recent upland erosion from toppled mountain ridges bordering the coastal zone from Osiao to Sta. Nino of the Bacon District.

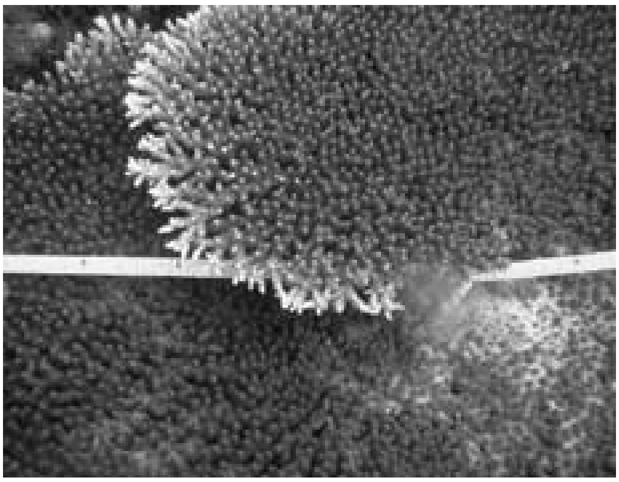

Fig. 3 Silt-smothered table corals of Osiao

The same stations were also used to assess diversity and make preliminary estimates of the biomass of coral reef fishes. Table 4 shows the results for the Sogod Bay stations. A total of 36 species were encountered.

The Pangpang station of Barangay Buenavist harbors the largest number of coral reef fish species (21) followed by the one in Caricaran (17). Manangatanga had the least number of species (13). Biomass estimates (in terms of kilograms) were also computed using the length estimates obtained during the underwater surveys. The biomass of coral reefs is conventionally used to indicate potential fish yield. In fact in this country the importance of coral reef systems in providing nearshore catch is considerable, reaching 2-5 mt/km^2/year (Marten and Polovina. 1982). The biggest biomass, 7.75 kg, estimated from Pangpang would translate to around 310 kg/km^2. This is quite small as compared to the 13.09 mt/km^2 estimated from Pilar (Soliman *et al*. 2000).

2) Seagrass and Seaweeds

Seagrass/seaweed communities were also found in the area (Figure 4). They were found thriving in the

Table 4. Biomass estimates of coral reef fishes in kilograms (50 m = 250 m^2)

	Coral reef fish species encountered	Stations within Sogod Bay		
		Caricaran	Sta. Lucia Manangatanga	Buenvista Pangpang
1	*Abudefduf sexfasciatus*		0.13	
2	*Amblyglyphidodon leucogaster*	0.89	0.04	0.83
3	*Amblygobius decussatus*		0.1	
4	*Amphiprion melanopus*			0.20
5	*Chaetodon flavocoronatus*			0.15
6	*Chaetodon meyeri*	0.05		
7	*Cheilodipterus* sp.		0.06	
8	*Cheiloprion labiatus*	0.34	0.29	
9	*Coris gaimard*	0.04		0.11
10	*Chromis analis*		0.31	
11	*Chromis caudalis*		0.29	
12	*Chrysiptera oxycephala*			0.04
13	*Chrysiptera* sp.		0.43	0.23
14	*Ctenochaetus striatus*		0.17	0.41
15	*Fistularia petimba*			0.08
16	*Gomphosus varius*	0.14		
17	*Halichoeres biocellatus*		0.06	0.07
18	*Halichoeres chrysus*			
19	*Halichoeres hortulanus*	0.14		
20	*Halichoeres melanurus*	0.03	0.56	
21	*Halichoeres* sp.	0.38		0.68
22	*Labroides dimdiatus*	0.05		
23	*Meiacanthus grammistes*		0.01	
24	*Monocantus scopas*			0.20
25	*Parapercis cylindrica*	0.20	0.05	
26	*Platax pinnatus*	0.00		0.07
27	*Pomacentrus branchialis*	0.14		1.00
28	*Pomacentrus burroughi*	0.00		0.20
29	*Pomacentrus chrysurus*	0.19		
30	*Pomacentrus moluccensis*	0.04		1.66
31	*Pomacentus nagasakiensis*			1.09
32	*Pseudanthias bartleetorum*			0.27
33	*Scolopsis bimaculatus*			0.01
34	*Siganus vulpinus*			0.11
35	*Stegastes lividus*	0.3	0.33	0.16
36	*Zanclus cornutus*	2.92		0.19
	Total	**5.84**	**2.83**	**7.75**

intertidal zone fronting the many beach resorts proliferating nearby. Although perturbed by human activities the seagrass appeared to be resilient to such a threat to their existence. A total of nine species of seagrass were taxonomically identified, of which five belonged to the family *Potamogetonaceae* and four belonged to *Hydrocharitaceae*. In Caricaran the species *Syringodium isoetifolium* had the highest cover estimated at 13.49%. *Cymodocea rotundata* had the least cover estimated at 2.55%. Seaweeds were also found. One belonged to the division Phaeophyta and three belonged to the division Chlorophyta. As far as biomass is concerned again *Syringodium isoetifolium* contributed the most. Among the seaweeds the *Halimeda cylindracea* provided the highest contribution to biomass (Table 5).

Fig. 4 Common seagrasses of Bacon District

Table 5. Cover and biomass of Sg/Sw in Caricaran

Species	Cover (%)	Biomass (gm/m^2)
Cymodocea rotundata	2.55	18.36
Halodule uninervis	7.67	57.00
Syringodium isoetifolium	13.49	52.36
Thalassia hemprichii	2.41	47.63
Halimeda tuna	0.14	20.00
Halimeda taenicola	2.80	2.36
Sargasum sp.	0.56	

In the San Juan/Del Rosario area the species *Syringodium isoetifolium* showed the highest cover estimated at 24%. Likewise it also contributed the highest biomass. Halimeda cylindracea gave the least cover and the only seaweeds found within the sampling station. Halophila ovalis provided the smallest contribution to the biomass. In Caricaran south *Cymodocea rotundata* contributed most to biomass but the species with the highest cover in this station was *Halodule pinifolia*. Overall the seagrass community is dominated by *Syringodium isoetifolium*. The computed values of cover and biomass strongly support the dominance of this species.

There is no harvesting of seagrass/seaweeds in the area. Perturbation comes from the lifting of anchors of boats as they leave for other places which would uproot the seagrass. However, these incidents which are not frequently occurring may not totally destroy the entire seagrass bed. The fact that seagrasses have modified stems that allow faster recolonization means that the disturbed areas will be colonized again in due time. Natural forces seemed to contribute more to the disturbance of seagrass beds in the area. When northeast monsoons occur, wind driven waves pound the area which uproots manyof the species. Seagrass recovery happens in summer when southwest monsoon winds start to occur in the area.

No commercially important invertebrates exist in the seagrass beds in the area. This would imply that such species have been harvested quite extensively in the past and that their present population may not allow immediate recovery. However applying proven resource management practices will allow for the recovery of target species. Species like *Holothuria scabra*, *Tripneustes gratilla*, *Actinopyga miliaris* and many others are still present but were already difficult to find and a great deal of effort has to be invested to harvest them.

4) Mangroves

Table 6 lists the ten sampling stations for mangrove assessment. These are from Sawanga, located at the extreme eastern coastal edge of the district, down as far as Banao, Salvacion area which is within Sogod Bay. This stretch of coastal zone contains the bulk in mangrove communities of the district.

Table 6. Sampling Stations for mangrove assessment

Station Code	Site	Coordinates	
		N	E
1	Sawanga (Buhawi)	13° 04.532'	124° 08.370'
2	Sawanga	approximately the same	
3	Bon-ot	13° 03.654'	124° 06.502'
4	Tagud-tud, Gatbo	13° 00.885'	124° 05.791'
5	Tagalwoy, Gatbo	13° 00.585'	124° 05.790'
6	Old Bato	13° 00.582'	124° 05.525'
7	New Bato	13° 00.117'	124° 05.093'
8	Sta. Lucia	13° 00.221'	124° 04.865'
9	Salvacion	13° 00.574'	124° 04.328'
10	Banao, Salvacion	13° 01.032'	124° 04.196'

A total of ten species of mangrove trees were found thriving in the sampling stations surveyed (Table 7). There were four species of the family Rhizoporaceae, two each from Avicenniaceae and Soneratiaceae and one each from the families Myrsinaceae and Palmae.

Likewise three associated species were also identified. These are the Talisay tree, coconut and another scientifically referred to as *Acanthus ilicifolius*. Most of the mangrove communities are concentrated on the border of Sogod Bay, except for the Sawanga mangrove communities which are an extension of the vast mangrove forest in nearby Prieto Diaz.

Table 7. Mangrove species of Bacon District, Sorsogon City

Family	Species	Local Name
Avicenniaceae	*1. Avicennnia lanata*	Piapi
	2. Avicenia marina	Bungalon
Myrsinaceae	*3. Aegiceras corniculatum*	Saging-saging
Palmae	*4. Nypa fruticans*	Nipa
Rhizophoraceae	*5. Bruguiera gymnorrhiza*	Busain
	6. Ceriops decandra	Malatangal
	7. Rhizophora apiculata	Bakauan-lalaki
	8. Rhizophora mucronata	Bakauan-babae
Sonneratiaceae	*9. Sonneratia alba*	Pagatpat
	10. Sonneratia caseolaris	Pagatpat
Associate Species		
Acanthaceae	*1. Acanthus ilicifolius*	
Combretaceae	*2. Terminalia catappa*	Talisay
Arecaceae	*3. Cocos nucifera*	Niyog

Table 8 shows the relative dominance of mangrove species based on line plots laid per station. It is interesting to note that *Avecinea marina* (locally called bungalon) is consistently present in all 10 stations, dominating in terms of relative dominance in five of them. These are the stations within the interior of Sogod Bay and the one at Buhawi of Barangay Sawanga. Bonot, inner Sawanga and Tagudtud of Bonot are dominated by pagatpat (*Soneratia alba*). Another species of pagatpat (*S. caseolaris*) dominated the mangrove stands in the mangrove community of Tagalwuy, Gatbo. Nipa fruticans was not included in the relative dominance estimation since it is not a tree. Nipa palms occupy a thick landward boundary between the mangrove trees and the immediate terrestrial community.

Table 9 shows the number of trees, saplings and seedlings encountered per station. In terms of trees, the station in Salvacion registered the highest number of trees encountered (3100) followed by Banao (still of Salvacion, 2267 trees) and Tagudtud of Gatb (2,229 trees). Tagalwuy of Gatbo had the least number of trees encountered (only 857). In terms of saplings, and seedlings, Sawanga (Buhawi) registered the highest number of saplings and seedlings (3,971 and 7,657 respectively).

Table 10 shows the approximate standing basal area for the encountered and measured mangrove trees per station. Inner Sawanga, which harbors the bigger stands of S. alba (pagatpat) registered the highest standing basal area (2140.8 m^2/ha). This is followed by the nearby Sawanga station in Buhawi (1647.93 m^2/ha). It is not surprising to see the bigger trees and higher standing basal areas in these Sawanga stations as they are seemingly protected from cutting, in contrast to the mangroves from Gatbo to Salvacion where conversion to fishponds and massive cutting are practiced, leaving spots that are cleared if not under slow secondary growth. Tagudtud Gatbo which ranked third in terms of standing basal area (1045.8 m^2/ha) had the greatest number of stems (24,400), as it is dominated by extensively branching S. alba.

The impact of human pressure was estimated at level three indicating a rather high impact. There are two reasons for this. Firstly, there is strong evidence that the human community near the mangrove forest are cutting trees for many purposes such as firewood, timber and shingles (Figure 5). Secondly, large quantities of garbage were seen in the area and this is detrimental to the mangrove because the litter can obstruct the exchange of gases between the roots of the tress and the adjacent environment. Likewise the garbage can destroy the

Table 8. Relative dominance of mangrove specie across the ten sampling stations

Species	Sampling stations									
	1	2	3	4	5	6	7	8	9	10
A. corniculatum		0.52								0.18
A. lanata						8.05	30.21			
A. marina	**70.80**	4.99	3.71	26.93	30.68	**41.72**	**52.34**	**99.07**	**62.73**	**50.74**
B. gymnorrhiza	0.19						31.22			
C. decandra										0.33
N. fruiticans										
R. apiculata	0.66			8.74	5.91	4.24	6.81	0.32		1.71
R. mucronata	4.16		1.82	0.00	**47.12**			0.20		0.33
S. alba	24.19	**94.49**	**94.47**	**64.33**						
S. caseolaris					**59.72**	**45.99**	8.61	0.41	37.27	46.71

breeding places of fishes that are in the vicinity of the mangrove forest. This problem however can be remedied by the barangay council encouraging the people near the area to initiate mangrove reforestation activities and clean the mangrove of any littering garbage. This is not a gargantuan task and the solution is easy to implement and achieve.

Table 9. Number trees, saplings & seedling

Site	Tree	Sampling	Seedling
1	1,829	3,971	7,657
2	1,657	1,686	886
3	1,150	1,450	1,200
4	2,229	1,971	2,143
5	857	1,800	629
6	1,571	2,029	1,486
7	2,000	1,067	100
8	1,300	950	2,800
9	3,100	300	3,100
10	2,267	1,467	267

Table 10. Standing biomass & stems

Site	STABD BA	Stems
	m^2/ha	no/ha
1	1647.93	19,600
2	2140.81	11,600
3	709.35	4,600
4	1045.82	24,400
5	871.96	11,000
6	565.46	15,800
7	973.37	9,600
8	398.83	7,600
9	702.55	6,600
10	729.18	10,400
Total	9785.26	121,200
Average	978.53	12,120

Fig. 5 Rampant mangrove cutting

Conclusion and Recommendations

Given these findings, the following points are worth stressing for their significance regarding recent development and management initiatives for the Bacon District:

1. Sogod Bay is in a stressed condition, due to long periods of perturbation. Its seemingly stable state belies the state of the three integrated coastal habitats, the coral reefs, seagrass-seaweeds and mangroves, all in the advanced stages of degradation.

The corals within Sogod Bay although present and generally poor to fair in condition (15.70-37.44% live cover). Reef fishes are diverse (36 distinct species) but relatively poor in terms of biomass estimates. Sta Lucia and Pagol revealed remnants of large-scale destructive fishing and strong siltation. Certain sectors of Pagol still have promising coral assemblages inhabited by numerous coral reef fishes. The Paguriran reef system is in a bad state, as evidenced by high dead coral cover and the continued impact of fishing (i.e., fish coral encroachment to reef slope, boat anchorage and possibly ecotourism). Around the northern mouth of Sogod Bay, good coral assemblages was encountered while documenting coral reef fishes, but were not assessed. This is a deeper reef system extending towards *Manangatanga*.

The bay also maintains vast seagrass and seaweed beds. Various species of macroinvertebrates are harvested here through gleaning, especially during inclement weather conditions. Mangroves are thriving extensively along the coasts of Sogod Bay. Ten species were identified. The cutting of trees in the interior of the seemingly thick mangrove community is rampant. Human perturbation is estimated to be at level three.

2. The San Juan corals are in a good state, justifying the continued management and protection of the area as a marine sanctuary.
3. Osiao corals are in almost the same condition as in SJ but traces of heavy siltation are evident due to the recent soil erosion caused by massive landslides in the early months of 2009. The continued heavy silt loading threatens the assemblage of good corals assemblage in this sector, dominated by amazing table and basket corals, extending to Santo Nino.

Given these points, the following steps are hereby recommended:

1. Regular monitoring of coastal habitats especially given that the mariculture project is in place in Sogod Bay, which will potentially cause further disturbance as soon as it begins to operate commercially.
2. Monitoring of mangrove cutting and the carrying-out mangrove rehabilitation projects in barren and ideal plantation sites and also at spots in the interior of the mangrove forest cleared by illegal cutting.
3. Expansion of the marine sanctuary to cover not only the coral reef system but the nearby seagrass and seaweed beds too. Also, the regular monitoring and installation of permanent transects for this purpose is strongly suggested. There is a need to implement the revised management system for the sanctuary moving it from being LGU-centered to community-based.
4. Check and management of waste disposal from coastal communities.

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Appendix Life form categories and codes

CATEGORIES	DESCRIPTION	CODE	NOTES/REMARKS
Hard Coral:			
Dead Coral		DC	Recently dead, white to dirty white
Dead Coral w/ Algae		DCA	Standing but no longer white
Acropora	Branching	ACB	At least 2° branching e.g. *Acropora palmata*, *A. formosa*
	Encrusting	ACE	Usually the base-plate of immature *Acropora* forms, e.g. *A. palifera and A. cuneata*
	Submassive	ACS	Robust with knobs of wedge-like form e.g. *A. palifera*
	Digitate	ACD	No 2° branching, includes *A. humilis, digitifera & gemmifera*
	Tabulate	ACT	Horizontal flattened plates e.g. *A. hyacinthus*
Non-Acropora	Branching	CB	At least 2° branching e.g. *Seriatopora hystrix*
	Encrusting	CE	Major portion attached to substratum as a laminar plate e.g. *Porites vaughani, Montipora undata*
	Foliose	CF	Coral attached at one or more points, leaf-like appearance e.g. *Merulina*
	Massive	CM	Solid boulder or mound e.g. *Platygyra daedalea*
	Submassive	CS	Tends to form small columns, knobs or wedges e.g. *Porites lichen, Psammocora digitata*
	Mushroom	CMR	Solitary, free-living corals of the *Fungia*
	Millepora	CME	Fire coral
	Heliopora	CHL	Blue
Other Fauna:			
Soft Coral		SC	Soft bodied coral
Sponges		SP	
Zoanthids		ZO	Examples are *Platythoa, Protopalythoa*
Others		OT	Ascidians, anemones, gorgoniants, giant clams, etc.
Algae	Algal Assemblage	AA	Consists of more than one species
	Coraline Algae	CA	
	Halimeda	HA	
	Macroalgae	MA	Weedy/fleshy browns, reds, etc.
	Turf Algae	TA	Lush filamentous algae, often found inside damselfish territories
Abiotic	Sand	S	
	Rubble	R	Unconsolidated coral fragments
	Silt	SI	
	Water	WA	Fissures deeper than 50 cm
	Rock	RCK	
Other		DDD	Missing data