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Assessment of Seagrass and Macrobenthic Algae in Pujada Bay, Mati, Davao Oriental

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Abstract

The Status of the existing seagrass and algae meadows of Pujada Bay, Mati, Davao Oriental was assessed from September 2001 to August 2002. The structure of seagrass and algae communities was determined using the Transect-Quadrat Method. A total of g species of seagrass was identified in the study area: These were *Cymodocea rotundata, Cymodocee senulata, Enhatus acoroides, Haludule pinifolia, Haludole unineniis, Halophila minor, Halophila ovalis, Syringodium isoetifolium and Thalassia hemprichii.* Taitaidaga station had the highest percent cover (41%) of seagrass dominantly covered with species of H. *ovalis* (11%) and H. *minor* (8%) while Manguihay station had the lowest percent cover (24%) of T. *hernprichii* (12%) and C. rotundata (5%). In terms of its density (shoots/m^2), it is noted that Lawigan had the highest density (1,720 shoots/m^2) of S. isoetifolium (438 shoots/m^2) and T. hemprichii (431 shoot/m^2) while Manguihay (955 shoots/m^2) had again the lowest density of seagrass species where T. hemprichii (524 shoot/m^2) and H. ovalis (169 shoot/m^2) dominated the site. Fifty-seven species of algae were identified. These consist of Chlorophyta (green algae) having 25 species under 9 families: Rhodophyta (Red algae) with 16 species under 6 families and Phaeophyta (Brown algae) with 13 species under 4 families. The highest percent frequency (41 %) of macrobenthic algae is noted in Taitaidaga station while Manguihay (69%) the lowest. Lawigan had the highest percent cover (11%) and Manguihay (5%) had the least cover. It is dominantly covered with green algae (43%) followed by red algae (35%) and brown algae (27%).

Keywords: seagrasses, macrobenthic algae

Introduction

Pujada Bay is located on the Southeastern most part of Mindanao. It forms the southeastern stretch of the long coastline of Davao Oriental in the eastern Pacific.

The Bay is an important fishing ground for the coastal barangay of Mati as well as the neighboring communities in the area. Seventy-five percent of the coastal population depends on the bounty of the Bay for food and livelihood (DA-Fisheries). This high reliance on marine resources poses a serious threat and pressures to marine ecosystems especially the seagrass and algal meadows in the Bay.

Seagrass and algal meadows form thick assemblages performing dynamic spectrum of physical and biological functions in marine environment. They serve as nursery grounds, shelter and food sources for many species of marine organisms; and human source of food and income, living space and recreation area, and stabilize and protect the coastlines.

Considering the value of these resources and the socio-economic pressures. An effective approach to conservation and management practices should be done. Improvement and restoration of environmental quality should be a major policy concern.

In spite of its declaration as protected seascape, the management of Pujada Bay has not really gone far; some baseline information needed for this effort are absent.

This study would add to the scanty and meager information of seagrass and algae in Mindanao specifically the Southeastern Coast of Mindanao (facing Pacific Ocean). This baseline information would help in formulating policy guidelines for the sustainable marine resources management in Pujada Bay and in pointing out denuded areas for rehabilitation purposes.

Objectives

A. General Objectives:

1. To identify the species composition, distribution and relative abundance of seagrass and algae in Pujada Bay;
2. To determine the standing stock and temporal variability of commercially important seagrass and algal species

B. Specific Objectives:

1. To determine the extent of seagrass and algal meadows along Pujada Bay
2. To determine the growth rate of different seagrass species for future rehabilitation, if necessary and;
3. To identify sites for possible culture of commercial algae

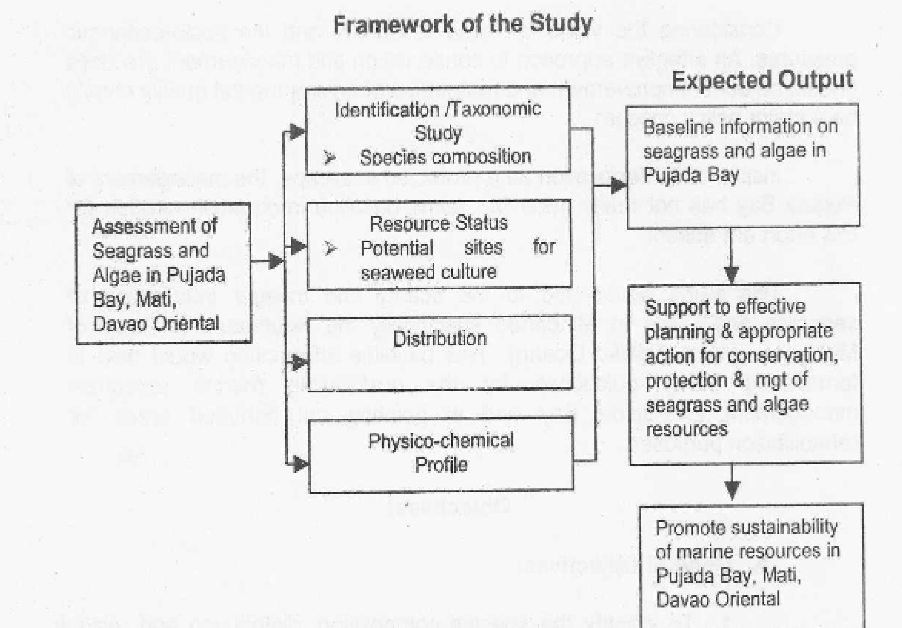

Figure 1. Project Framework

Methodology

1. Study Area

Three sampling stations within Pujada Bay were established from September 2001 to August 2002 (Figure 2). Two stations were established at the opposite sides of the mouth of Pujada Bay and 1 station at the inner part of the Bay. These stations were:

1. Lawigan (GPS: N 06^{0}47’56” N and 126^{0}19’34” E)
2. Taitaidaga (GPS: N 06^{0}52’60” and 126^{0}11 ‘23” E)
3. Manguihay (GPS N 06^{0}53’2” and 126^{0}16’35” E)

Other sites were also investigated. Samples were collected to come up with a profile of seagrass and macrobenthic algae in Pujada Bay and its neighboring shores. The other stations were located at the outer part of Pujada Bay: These stations are:

Dacab, Mamali (GPS: 06^{0}52’31”N and 126^{0}11’OI”E)
Macarnbol (GPS: 06^{0}57’38”N and 126^{0}13’14”E)
Juanivan Island. Taganilao (GPS: 06^{0}49’57”N and 1260 16’26” E)
Pujada Island (GPS: 06^{0}52’31”N and 126^{0}11’01”E)

Bobon (GPS: $06^{0}50'01''$N and $126^{0}16'28''$E)
Sandigan, Dahican (GPS: $06^{0}54'31''$N and $126^{0}17'25''$E)

2. Field Sampling

Monthly sampling of seagrass and macrobenthic algae was done on the established stations. In other sites, random field sampling was conducted to take preliminary notes of the profile of seagrass and algal meadows in the Bay. Skin diving (snorkeling) and scuba diving were employed in the assessment especially in the deeper areas and high tide.

3. Seagrass

The line Transect Quadrat Method was used in the study (English et al., 1997). Two 100m transects were established perpendicular to the shoreline. A 0.25 square meter quadrat was deployed to the transect at 10m interval. Shoot frequency, cover and count of seagrass was done and recorded per species level. Identification of seagrass was based on the taxonomic key of Fortes (1993); Calumpong and Menez (1997).

Physico-chemicai parameters for seagrass and algal meadows like temperature, salinity, depth, transparency and substrate type were measured and noted during the field sampling:

Two genera namely; Thalassia hemprichii and Enhalus acoroides were selected for productivity test because of their morphological structure which are bigger and wider sheath and easy to locate due to much occurrence among species. Primary productivity of selected seagrass was determined by using the stabbing techniques modified by Tomasko and Lapointe (1990). At the other sites, random sampling with the use of 3 replicates of quadrats were done to have some notes on the profile of its seagrass resources.

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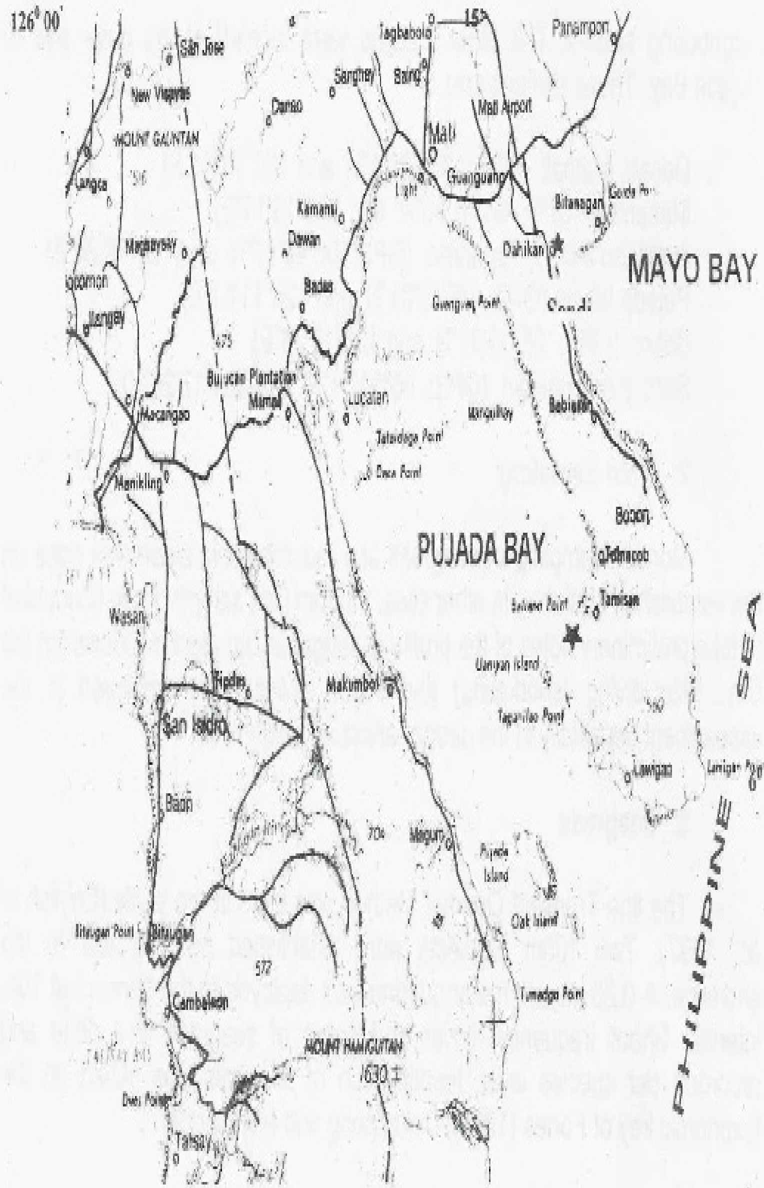

Figure 2. Map of the study area

4. Algae

Transect-Quadrat Method was used in seaweed frequency and cover of the species (Saito and Atobe 1970). Two 100m transect belt perpendicular to the shoreline was established in each station. A 0.25 square meter quadrat was laid to the transect with an interval of 10m from each quadrat. For every quadrat, thalli of seaweeds count, percent algal cover and substrate type was recorded Menez (1997). Collection of macrobenthic algae was done for herbaria purposes. Consultation with seaweeds taxonomy experts will be done for species identification and verification.

Collection of macrobenthic algae was done in other collecting sites to note the seaweed resources of Pujada Bay and neighboring shores.

Results and Discussion

Seagrasses

Resources and Distribution

A total of 9 species of seagrass were accounted in this study under 2 families of Hydrocharitaceae and Potamogetonaceae. These were Cymodocea rotundata, Cymodocea serrulata, Enhalus acoroides, Halodule pinifolia, Halodule uninervis, Halophila minor, Halophila ovalis, Syringodium isoetifolium and Thalassia hemprichii (Table 1; Appendix 1).

The sites in Pujada Bay are generally mixed as in most seagrass meadows in the Philippines. The seagrass species that form these mixed meadows comprises the smallest (*Halophila minor*) to the largest *(Enhalus acoroides*) (Vermaat et. al., 1995). The distribution pattern of seagrass communities varies on how inclined the environmental factors/gradients are (Fortes, 1993). Its zonation pattem represent different growth forms and seagrass association such as *Syringodium-Cymodocea—HaloduIe*. The occurrence and distribution of the 9 seagrass species in Pujada Bay varies. Seven of these species have wide distribution and high occurrence in all sites. They were observed the whole duration of the sampling months. These species include *Thalassia hemprichii*, *Halophila ovalis, Halophila minor, Cymodocea rotundata, Syringodium isoetifolium, Halodule uninervis, and Halodule pinifolia*. Species of limited distribution includes *Enhalus acoroides and Cymodocea serrulata*, which are both absent in Manguihay.

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Table 1. Species composition and abundance of seagrass species in Pujada Bay

Percent Cover (%) Species Composition	LAW	MAN	TTD	Total	Mean	SD	SE
Cymodocea rotundata	4.85	528	6.22	16.35	5.45	0.70	0.40
Cymodocea serrulata	1.33	0.00	0.79	2.12	0.71	0.67	0.39
Enhalus acoroides	0.75	0.00	0.61	1.36	0.45	0.40	0.23
Halodule pinifolia	2.26	0.95	5.18	8.39	2.80	2.16	1.25
Halodule uninervis	0.75	0.01	2.17	2.93	0.98	1.10	0.64
Halophila minor	0.46	1.87	7.78	10.11	3.37	3.88	2.24
Halophila ovalis	1.77	2.79	11.82	16.37	5.46	5.53	3.19
Syringodium isoetifolium	6.75	1.45	0.51	8.71	2.90	3.37	1.94
Thalassia hemprichii	20.45	12.70	6.34	39.49	13.16	7.06	4.08
Total	39.36	24.45	40.59	105.82	35.27	8.99	5.19
Density (Shoots/m2) Species Composition	**LAW**	**MAN**	**TTD**	**Total**	**Mean**	**SD**	**SE**
Cymodocea rotundata	252	169	317	738	246	74	43
Cymodocea serrulata	26	0	13	39	13	13	8
Enhalus acoroides	47	1	4	52	17	26	15
Halodule pinifolia	401	36	209	647	216	183	105
Halodule uninervis	33	0	75	108	36	37	22
Halophila minor	34	63	118	215	72	43	25
Halophila ovalis	58	120	46	223	74	40	23
Syringodium isoetifolium	438	42	40	520	173	229	132
Thalassia hemprichii	431	524	283	1238	413	121	70
Total	1720	955	1074	3780	1260	411	237

Legend: LAW- Lawigan;MAN- Manguihay; TTD- Taitaidaga

Figure 3 shows the percent cover (%) and density (shoots/m2) in 3 sites of Pujada Bay. Taitaidaga station had the highest percent cover (41%) of seagrass dominantly covered with species of H. ovalis (12%) and H. minor (8%). It is followed by Lawigan (40%) dominantly covered with *T. hemprichii* (20%) and *S. isoetifolium* (7%). Manguihay station had the lowest percent cover (24%) where *T. hemprichii* (12%) and C. rotundata (5%) abound the area.

In terms of its. density (shoots/m^2), it is noted that Lawigan had the highest density (1, 720 shoots/m^2) of *S. isoetifolium* (438 shoots/m^2) and *T. hemprichii* (431 shoot/m^2). This is followed by Taitaidaga (1 ,074 shoots/m^2) of *C. rotundata* (317 shoot/m^2) and *T. hemprichii* (283 shoot/m^2). Manguihay (955 shoots/m^2) had again the lowest density of seagrass species where *T. hemprichii* (524 shoot/m^2) and *C. rotundata* (169 shoot/m^2) dominated the site. Density of the other sites were also done with 1 field sampling at random (Appendix). It ranges from 90-120 shoot/m2 where *C. rotundata, S. isoetifolium and H. minor* are commonly distributed in the sites.

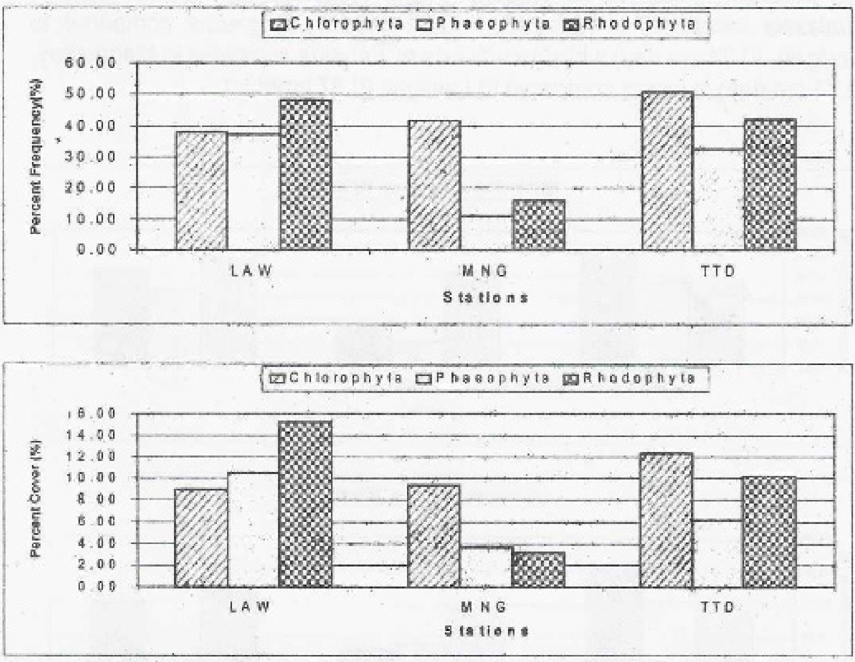

Figure 3. Percent Frequency and Cover of macrobenthic algae in three stations

The differences in the occurrence and abundance among species in 3 monitored sites and other neighboring coastal areas may be attributed to species substrate adaptations, growth forms, associated fauna (grazers) and human factors (gleaners). For example, Lawigan station has the highest numbers of gleaners. Established transect markers were always displaced compared to other stations in Manguihay and Taitaidaga. Another factor is the location of the sites; the Manguihay station which was located in the inner part of the bay had lesser seagrass cover and density than the 2 stations located at the outer part of the Bay. The other sites have narrow intertidal flats and exposed openly to direct strong wave action (Sandigan and Bobon areas).

Growth Rate of Seagrass (*Enhalus acoroides and Thalassia hemprichji*)

It was observed that the growth rate of the MIO seagrass species in two different areas varies (Figure 4 and Appendix 2). Growth rate of *Thalassia hemprichii* in Manguihay (0.39 cm/day) is greater compared to Lawigan, (0.34 cm day) while growth rate .0f Enhalus acoroides in Manguihay, (0.71 cm/day) is lesser compared to Lawigan (0.87 cm/day).

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The results might be due to the following reasons. First is latitudinal difference (Rollon and Fortes, 1990). Lawigan is situated facing the Pacific side wherein water movement and wave pressure is greater compared to Manguihay, which is situated in the inner part of Pujada bay. Second is physical disturbance and pollution, Lawigan is more populated than Manguihay, moreover, a small creek is present in Lawigan in which the influx of freshwater and other man-made pollution probably affects the growth rate of seagrasses. Third is nutrient absorption, wherein growth rate of the seagrasses depends on the nutrients limitation in certain areas (Fortes, 1995).

Macrobenthic Algae

Resources and Distribution

A total of 57 species of macrobenthic algae were identified in Pujada Bay. Occurrence and distribution are listed in Appendix 3.

Division Chlorophyta (Green algae) had the greatest number of individual species (25) under 9 families. Most of the species were found in Lawigan (25). This was followed by Taitaidaga (23) and Manguihay (20). Seven species are widely distributed in the 3 stations dominated by family *Dasycfadoceae and Valoniaceae* such as genera of *Bornetella, Neomeris, Dictyosphaeria* and Valonia respectively.

Division Rhodophyta (Red Algae) ranks second among the most identified species (18). Lawigan and Taitaidaga have the highest rank (18 species) followed by Manguihay (15 species). These are dominated by family *Corallinaceae, Galaxauraceae and Gracillariaceae*. This composed the genera of *Amphiroa, Galaxaura and Gracilaria*.

Division Phaeophyta (Brown algae) had lesser-identified species (14) under 2 dominant families of *Sargassaceae and Dictyotaceae*. It was observed that Lawigan (14) have the highest rank, Taitaidaga (11) and Manguihay (9). The most common species of brown algae found in all sites are Padina minor, Padina australis, *Dictyota dichotoma, Dictyota* linearis and Sargassum *polycystum*.

Abundance of Macrobenthic Algae (Percent Frequency and Percent Cover)

The highest percent frequency (125%) of macrobenthic algae is noted in Taitaidaga station. This site is followed by Lawigan (123%) and Manguihay (68%).

The group of green algae in the sites had the highest percent frequency (43%) and cover (10%). This is dominantly represented by families of *Dasycladoceae, Valoniaceae, Caulerpaceae and Halimedaceae*. Red algae with percent frequency (106%) and a cover (29%) also dominates the sites and commonly found in Lawigan and Taitaidaga. These are represented by *Amansia glomerata* (5%), *Mastophora rosea* (2%) and *Actinotrichia fragilis* (4%). The brown algae had the least frequency (27%) and cover (7%). Species of Padina minor (7%), Padina australis (5%) and *Dictyota dichotoma* (2%) are the most common nowadays.

Table 2. Algal groupings, Percent frequency and cover in Pujada Bay

Percent Frequency(%)							
	LAW	MNG	TTD	Total	Mean	SD	SE
Chlorophyta	38.20	41.56	50.90	130.66	43.55	6.58	3.80
Phaeophyta	37.42	10.88	32.49	80.79	26.93	14.12	8.15
Rhodophyta	48.16	16.21	42.00	106.37	35.46	16.95	9.79
Total	123.78	68.65	125.39	**317.82**	**105.94**	**37.65**	**21.74**
Mean	**41.26**	**22.88**	**41.80**				
SD	**5.99**	**16.39**	**9.21**				
Percent Cover (%)							
	LAW	MNG	TTD	Total	Mean	SD	SE
Chlorophyta	9.00	9.33	12.38	30.71	10.24	1.86	1.08
Phaeophyta	10.50	3.62	6.21	20.33	6.78	3.47	2.01
Rhodophyta	15.19	3.19	10.26	28.64	9.55	6.03	3.48
Total	**34.69**	**16.14**	**28.85**	**79.68**	**26.57**	**11.36**	**6.57**
Mean	**11.56**	**5.38**	**9.62**				
SD	**3.23**	**3.43**	**3.13**				

Legend: LAW- Lawigan;MAN- Manguihay; TTD- Taitaidaga

Conclusion/Recommendations

The Eastern Coast and the outer part of Pujada Bay (Lawigan, facing Pacific Ocean) is more species rich than the inner part of the Bay. More detailed studies should be conducted on seagrass and algae along the neighboring waters to come up with the real status of seagrasses in Pujada Bay and neighboring coastal areas facing Pacific Ocean.

Linkages and establishment of network the LGU's, NGO's and the academe should be strengthened to promote high level of awareness on value of seagrass and algae resources.

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