

## SPECIES DIVERSITY OF SEAGRASSES IN CAMOTES ISLANDS, CENTRAL PHILIPPINES

Serapion N. Tanduyan, Berenice T. Andriano and Ricardo B. Gonzaga

Cebu Technological University, San Francisco, Cebu, Philippines  
Email: [sntanduyan@yahoo.com](mailto:sntanduyan@yahoo.com)/ fax no. 0324970318

### ABSTRACT

Seagrasses of Camotes Islands were studied to determine its species diversity. A transect-quadrat method was used where 3 transects were laid in each station taking into account its species in the four municipalities of Camotes Islands which are San Francisco, Poro, Tudela and Pilar. Results show that there were 11 species of seagrasses found in the four municipalities of Camotes Islands which are *Halophila decipiens*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis*, *Halophila minor*, *Halophila ovalis*, *Halophila ovata*, *Enhalus acoroides* and *Syringodium isoetifolium*. *Halophila decipiens* and *Thalassia hemprichii* are the distinct species of seagrass found in the municipalities of Poro and San Francisco, respectively while there are 9 species that are common in all the municipalities that include: *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis*, *Halophila minor*, *Halophila ovalis*, *Halophila ovata*, *Enhalus acoroides* and *Syringodium isoetifolium*.

Keywords: Seagrass, Species Diversity, Camotes Islands, Transect-quadrat method

### INTRODUCTION

Seagrass is one diverse ecosystem where it supports diverse flora and fauna in marine waters. It is the only group of flowering plants or angiosperms that inhabit the coastal and marine environment of the temperate and tropical region. (Phang, 2000). Of the three marine ecosystems in coastal areas, it occupied the mid part of it.

It serves as the feeding, breeding and nursery grounds of marine organisms of commercial importance. They are highly productive and contribute greatly in supplying oxygen in the seas as well as sequestrations of carbon. Their presence has been abused by humans due to lack of knowledge and information regarding this ecosystem. Siltation and over harvesting of associated flora and fauna in seagrass beds resulted to its destruction. The gleaners mercilessly pull out the plant in searching for bivalves destructing not only the plant but also its habitat.

In Camotes Islands it serves as the breeding ground for several species of fish especially siganids. Human activities have affected so much in its present status



that is why its status and condition should be assessed in order to draw out plans for conservation and sustainability.

Seagrass as marine angiosperms, one of the features of seagrasses is their ability to reproduce underwater and studies on its reproduction and phenology are important so as to know the population dynamics (Walker et al.2001). Seagrasses are highly specialized marine flowering plants adapted near shore. They are not monophyletic group of plants but is a functional grouping referring to marine flowering plants living entirely submerged and sharing numerous convergent morphological and physiological characteristics.

Seagrasses are very important component of the coastal ecosystem because of their part in trophic and nursery importance for fishes and larger vertebrates. They are directly consumed in the form of leaves and indirectly consumed in the form of detritus and epiphytes by animal species including crabs, prawns, shells and fishes (Edgar et. al 2001).

Decomposition of seagrass is one feature in the seagrass beds. They are usually caused by the physical and chemical breakdown of dead organisms evolving other organisms notably bacteria, fungi and animals. In most marine-angiosperm-based ecosystems, only a small amount of the leaf production is consumed in the plant in situ by echinoderms, crustaceans, and fishes and in the tropics, turtles and dugongs most consumption of the leaves occurs through the action of crustaceans, gastropods and microorganism in the letter (Walker et al.2010)

Den Hartog (1997) mentioned the functions of seagrass beds. One is that it stabilizes the bottom. Due to gregarious growth and dense root systems all perennial seagrasses stabilize to some degree and even the tiny halophellids are able to produce such effect.

As food resource seagrasses are digested by very restricted members of organisms like sea urchins, and is restricted to some fishes like Scaridae, Acathuridae, turtles and Sirenia while geese and ducks graze on beds which become exposed during low tide. Some insects (larvae) and Talitridae (Amphipoda) ate seagrasses when they are washed ashore and begin to decompose. They serve as nurseries and shelter to many organisms.

Kikuchi and Peres (1977) mentioned seagrasses bed significance to associated flora and fauna since it takes a dense submerged vegetation and it increases the available surface for epiphytic algae and associated fauna. The dense

vegetation softens the water movement by currents and waves and offers calm underwater space within it. Depending on hydrodynamic conditions, suspended silt and other colloidal substances form sediments in the seagrasses bed.

By photosynthetic activity seagrasses produce and consume CO<sub>2</sub> dissolved in the water during daytime. High O<sub>2</sub> concentration in seagrass bed can support high densities of various animal forms. Excessive illumination in the daytime is diminished by the leaf canopy, protecting the bottom from isolation and permitting a shaded microenvironment to develop at the base of the vegetation.

Seagrass beds serve as feeding, breeding and nursery grounds for a host of marine organisms, especially fishery species of commercial importance (Phang 2000). In Southeast Asia seagrass is used in many ways: as packing material, paper, children's toys, and compost for fertilizer, folder and materials for baskets and mats (Fortes 1995).

Seagrasses are highly productive and contribute greatly to oxygenation of the seas as well as carbon sequestration, leading to reduction in the effects of global warming (Phang 2000).

Many important fishery species start their lives in seagrass beds and migrate to other marine ecosystems. Seagrass beds together with coral reef supply more than one-fifth of the fish catch in East Asia (McManus 1988). The amount of fish found in seagrass beds is five times that in muddy and sandy habitats.

Because of their shallow sublittoral and some extent intertidal existence, seagrass systems are subject to stresses imposed by man's ever growing use of the coastal zones. Our continued multiplicity of demands upon estuarine and coastal environments as producers of food, avenues for transportation, and receptacles of wastes, living space and sources of recreational or aesthetic pleasure makes it imperative that we understand the function of these near-shore ecosystems.

Dried eel grass leaves have been used by man as fuel, packing and upholstering material, insulation, fodder, and fertilizer (Thayer et al. 1987). Seagrass habitats in the Gulf of Mexico have declined precipitously during the past 50 years (Neckles, 1994). Most habitat losses can be attributed to effects of coastal population growth and accompanying municipal, industrial and agricultural development. Neckles (1994) further stated that restoration and preservation of this important habitat depends foremost on improving scientific understanding of the complex causal relationships between anthropogenic stress and seagrass

ecosystem persistence and on developing scientifically based management programs for seagrass conservation.

*Thalassia hemprichii* and *Enhalus acoroides* were dominant and constant species in South Sulawesi, Indonesia. *Halodule uninervis* and *Cymodocea rotundata* occurred as pioneering species occupying the mangal areas near the beach and exposed sites to the reef edge.

*Enhalus*, *Thalassia*, *Halophila*, *Halodule*, *Cymodocea*, *Syringodium* and *Thalassodendron* are basically tropical genera although several of the above genera have some species which extend into subtropical or warm temperate trees (Zieman 1996). *Halodule* was found in the intertidal pools at Hinadkabon Bay, Surigao del Norte (Alino et al. 2002, 184 p.) There were 10 species of seagrass found in Sarangani Province and General Santos City (de Jesus 2001); 6 species found in Olango Island distributed in to 5 barangays (Poo, Talima, Tungasan, Sabug and San Vicente) (Sotto et al. 2001 p.40). Short et. al (2001) cited that there were 15 species of seagrasses distributed in the Philippines. Seagrass as a natural resource has been greatly neglected globally and especially in Malaysia (Phang 1990). In Southeast Asia the lack of research interest has been based mainly the absence of extensive beds and expertise (Fortes 1995). Only in the recent years with the devastation of seagrass beds due to pollution, followed by loss of fishery species have increased efforts in seagrass research. In general the biodiversity of flora and fauna in seagrass ecosystems is high. The seagrass trap nutrients flowing in from the estuaries and offer protection to a myriad of organisms ranging from microscopic diatoms to the large dugongs. The food webs that abound in the ecosystem are numerous and offer great potential for research (Phang 2000). At North Bais Bay, Negros Oriental growth rates and primary production *Enhalus acoroides* (L.F.) Royle was studied by Estacion and Fortes, 1987. Growth rates significantly increased with decrease in the percent of time the seagrass beds were exposed to air and sun in daytime.

## MATERIALS AND METHOD

A transect -quadrat method was used where three transects were laid in each station taking into account its species and the physico- chemical parameters in the four municipalities of Camotes Islands which are San Francisco composed of 10 coastal barangays, Poro (10), Tudela (5) and Pilar, Cebu (10). This adopted the book of English et. al (1997) and Short et al.(2001).





Figs. 2-3. The 1x 1 m quadrat laid in the shallow water areas where seagrasses are found

Figs. 4-5. Laying of quadrat in the deeper areas

## RESULTS AND DISCUSSION

### *Seagrasses in Camotes Islands*

Based on the assessment of seagrasses in Camotes Islands this consists of eleven (11) species belonging to two Families namely: Potamogetonaceae and Hydrocharitaceae.

#### *A. Potamogetonaceae*

##### 1. *Cymodocea rotundata* Ehrenberg & Hemprich ex Ascherson

*San Francisco, Cebu* = Consuelo, Himensulan, Unidos, Santiago, Union, San Isidro, Sta. Cruz, Esperanza, South Pob., and North Poblacion.

*Poro* = Western Poblacion, Libertad, Teguis, Mercedes, Esperanza, Sta. Rosa and Daan Paz.

*Tudela* = Calmante, Mc. Arthur, Villahermosa, Puertobello

*Pilar* = Upper Poblacion, Lower Poblacion, San Juan, Moabog, Kawit, Esperanza, Dapdap and Imelda

##### 2. *Cymodocea serrulata* (R. Brown) Ascherson & Magnus

#### *Distribution:*

*San Francisco, Cebu* = Consuelo, Himensula, Unidos, Santiago, Union, San Isidro, Sta. Cruz, Esperanza, South Pob., and North Poblacion.

- Poros = Western Poblacion, Eastern Poblacion, Libertad, Teguis, Mercedes, Esperanza, Sta. Rosa and Daan Paz.
- Tudela = Calmante, Mc. Arthur, Villahermosa, Puertobello
- Pilar = Upper Poblacion, Lower Poblacion, San Juan, Moabog, Kawit, Esperanza, Dapdap and Imelda

### 3. *Halodule pinifolia* (Miki) den Hartog

Distribution:

San Francisco, Cebu = Consuelo, Heminsulan, Unidos, Santiago, Union, Sta.Cruz, Esperanza, Southern Poblacion, Northern Poblacion

Poros = Western Poblacion, Eastern Poblacion, Mabini, Libertad, Tiguis, Mercedes, Cagcagan, Sta.Rosa and Daan Paz

Tudela = General, Calmante, Mc.Arthur, Villahermosa, and Puertobello

Pilar = Upper Poblacion, Lower Poblacion, San Juan, Villahermosa, Moabog, Kawit, Lanao, Esperanza and Imelda

### 4. *Halodule uninervis* (Forsskal) Ascherson

Distribution:

San Francisco, Cebu = Heminsulan, Esperanza, Southern Poblacion and Northern Poblacion

Poros = Tiguis, Esperanza and Daan Paz

Tudela = Villahermosa, Puertobello

Pilar = Upper Poblacion, Lower Poblacion, Villahermosa, Moabog, Lanao, Esperanza, Dapdap and Imelda

### 5. *Syngodium isoetifolium* (Ascherson) Dandy

Distribution:

San Francisco, Cebu = Consuelo, Heminsulan, Unidos, Santiago, San Isidro, Sta. Cruz, Esperanza, Southern Poblacion and No. Pob.

Poros = Tiguis, Mercedes and Esperanza

Tudela = Calmante and Villahermosa

Pilar = Lower Poblacion, Moabog and Kawit



Fig. 6. *Cymodocea rotundata*



Fig.7. *Cymodocea serrulata* (R. Brown) Ascherson & Magnus



Fig. 8. *Halodule pinifolia* (Miki) den Hartog



Fig. 9. *Halodule uninervis* (Forsskal) Ascherson



Fig. 10. *Syringodium isoetifolium* (Ascherson) Dandy

B. Family Hydrocharitaceae

6. *Enhalus acoroides* (L.F.) Royle

Distribution:

San Francisco, Cebu = Heminsulan, Unidos, Santiago, San Isidro, Sta.Cruz,  
Esperanza, Southern Poblacion and Northern Poblacion

Poros = Western Poblacion, Mabini, Libertad, Tiguis,  
Mercedes, Esperanza, Daan Paz

Tudela = Calmante, Mc.Arthur, Villahermosa and Puertobello

Pilar = Upper Poblacion, Lower Poblacion, San Juan,  
Villahermosa, Moabog, Kawit, Lanao, Esperanza,  
Dapdap and Imelda

7. *Halophila decipiens* Ostenfield

Distribution:

San Francisco = none

Poros = Western Poblacion, Eastern Poblacion, Mabini, Libertad and  
Esperanza

Tudela = none

Pilar = Upper Poblacion, San Juan, Lanao, Esperanza, Dapdap  
and Imelda

8. *Halophila minor* (Zollinger) den Hartog

Distribution:



---

San Francisco	= Consuelo, Heminsulan, Union, Sta.Cruz and Southern Poblacion
Pororo	= Western Poblacion, Esperanza and Daan Paz
Tudela	= Calmante
Pilar	= San Juan and Villahermosa

9. *Halophila ovalis* (R. Brown) Hooker f.

Distribution:

San Francisco	= Unidos, Santiago, Union, San Isidro, Sta.Cruz, Esperanza, Southern Poblacion and Northern Poblacion
Pororo	= Western Poblacion, Eastern Poblacion, Tiguis, Mercedes, Esperanza, Sta. Rosa and Daan Paz
Tudela	= Calmante, Mc.Arthur, Villahermosa and Puertobello
Pilar	= Upper Poblacion, Lower Poblacion, Villahermosa. Moabog, Kawit, Esperanza, Dapdap and Imelda

10. *Halophila ovata* Gaudin

Distribution:

San Francisco	= Union, Esperanza
Pororo	= Eastern Poblacion, Mabini, Mercedes, Esperanza, Cagcagan and Sta.Rosa
Pilar	= Lower Poblacion, San Juan, Villahermosa and Moabog

11. *Thalassia hemprichii* (Ehrenberg) Ascherson

Distribution:

San Francisco	= Southern Poblacion and Northern Poblacion
Pororo	= Daan Paz
Tudela	= none
Pilar	= none



Fig. 11. *Enhalus acoroides* (L.F.) Royle



Fig. 12. *Halophila decipiens* Ostenfield



Fig. 13. *Halophila minor* (Zollinger) de Hartog



Fig. 14. *Halophila ovalis* (R. Brown) Hooker f.



Fig. 15. *Halophila ovata* Gaudin



Fig. 16. *Thalassia hemprichii* (Ehrenberg) Ascherson

Table 1a. Species of Seagrass belonging to the Different Families

Species	San Francisco	Poro	Tudela	Pilar
1. <i>H. pinifolia</i>	√	√	√	√
2. <i>C. serrulata</i>	√	√	√	√
3. <i>C. rotundata</i>	√	√	√	√
4. <i>H. minor</i>	√	√	√	√
5. <i>S. isoetifolium</i>	√	√	√	√
6. <i>H. ovales</i>	√	√	√	√
7. <i>E. acoroides</i>	√	√	√	√
8. <i>H. ovate</i>	√	√	√	√
9. <i>H. uninervis</i>	√	√	√	√
10. <i>H. decipiens</i>	<b>X</b>	√	<b>X</b>	√
11. <i>T. hemprichii</i>	√	√	<b>X</b>	<b>x</b>

Table 1b. Distribution of Seagrasses in the four municipalities of Camotes Islands

Family Potamogetonaceae	Family Hydrocharitaceae
1. <i>Cymodocea serrulata</i> (R. Brown) Ascherson & Magnus	1. <i>Enhalus acoroides</i> (L.F.) Royle
2. <i>Cymodocea rotundata</i> Ehrenberg & Hemprich ex Ascherson	2. <i>Halophila decipiens</i> Ostenfield
3. <i>Halodule pinifolia</i> (Miki) den Hartog	3. <i>Halophila minor</i> (Zollinger) den Hartog
4. <i>Halodule uninervis</i> (Forsskal) Ascherson	4. <i>Halophila ovalis</i> (R. Brown) Hooker f.
5. <i>Syringodium isoetifolium</i> (Ascherson) Dandy	5. <i>Halophila ovata</i> Gaudin
	6. <i>Thalassia hemprichii</i> (Ehrenberg) Ascherson

Table 2. Physico- Chemical Parameters of the Seagrass Beds of the Different Municipalities of Camotes Islands

Physico- Chemical Parameters	San Francisco	Poro	Tudela	Pilar
Temperature	24 – 30 <sup>0</sup> C	24 – 30 <sup>0</sup> C	27 – 28 <sup>0</sup> C	28 <sup>0</sup> C
Salinity	26 – 40 ppt	30 – 33 ppt	31 – 34 ppt	35 – 38 ppt
Water depth	0.1 – 5.8 m	0.3 meter	0.3 meter	5 meters
pH	6.7 – 8.7	.55 – 7.93	7.48 – 8.15	7.38 – 8.2

Seagrasses of Camotes Islands belonged to two families, Potamogetonaceae and Hydrocharitaceae (Table1a). Five species of seagrasses belong to Potamogetonaceae and six species belong to Hydrocharitaceae. There are 11 species of seagrasses found in Camotes Islands (Table1b). Ten species are found in the municipality of San Francisco, 11 species in Poro; 9 species in Tudela and 10 species in Pilar.

There are nine species of seagrasses that are common in the four municipalities of Camotes Islands (*Cymodocea serrulata*, *Cymodocea rotundata*, *Halodule pinifolia*, *Halodule uninervis*, *Syringodium isoetifolium*, *Enhalus acoroides*, *Halophila minor*, *Halophila ovalis* and, *Halophila ovata*) and *Halophila decipiens* are distinct in Poro and Pilar and *Thalassia hemprichii* are distinct in San Francisco and Poro, Cebu. Poro has the most of the seagrasses (11) species; San Francisco (10) species; Pilar (10) species and the lowest is Tudela (9) species. Poro has the highest number of species on the account that being the largest island it is also

situated between the two islands of Camotes (Pacijan and Ponson) where it is protected from typhoons and other calamities.

As reflected in table 1 it shows that there are 11 species of seagrasses found in Camotes Islands. This means that out of 15 species of seagrasses in the Philippines as cited by Short et al (2001) Camotes Islands is highly diverse in terms of seagrasses which is 73.33%. Camotes Island being found off Northeastern Cebu is a strategic place for growth of seagrasses since it is bounded by Cebu on the South; Leyte on the North and Bohol Island on the East. It is protected by these islands and found to be less disturbed in terms of natural calamities. Being surrounded by Camotes Sea this contributes to the proliferation of seagrasses and other marine flora and fauna. The only species of seagrasses that are not found in Camotes Islands as provided by Short et al (2001) are *Halophila spinosa*, *Ruppia maritima*, *Thalassodendron ciliatum* and *Halophila beccarii*.

In Malaysia, Phang (2000) collected 15 species of seagrasses which is 36% greater than the collected species in Camotes Island. In Indo - Pacific Region particularly in Persian Gulf is having only 4 species (*Halodule uninervis*, *Halophila ovales*, *Halophila stipulacea* and *Syringodium isoetifolium*) and Camotes Islands has 7 species more than Persian Gulf. In the Red Sea, East Africa and India having 13 species respectively, Camotes Islands is 2 species less of seagrasses compared to the two big bodies of water.

Two families (Table 1) of seagrasses are found in Camotes Islands which are Family Potamogetonaceae and Hydrocharitaceae.). Five species belong to Potamogetonaceae and 6 species belong to Hydrocharitaceae.

As to the physico-chemical parameters of the Islands all the municipalities have normal range of temperature where they can be tolerated for the growth of seagrass. The salinity is also within the normal range where the waters are mostly marine. The pH is still favorable except in Barangay Calmante, Tudela which is beyond normal pH (9.8). The water depth of each municipality is usually shallow where penetration of sunlight is possible for the photosynthetic process of the plant. Substrates are rocky, sandy and muddy throughout the islands where these are all favorable for the sea grass to anchor and live on.

## CONCLUSION

1. There are 11 species of seagrasses that belong to 2 families (*Potamogetonaceae* and *Hydrocharitaceae*) found in the four municipalities of Camotes Islands.
2. All the 11 species of seagrasses are completely found in the municipality of Poro seconded by San Francisco and Pilar, and then the lowest is Tudela which is 9.
3. The salinity ranges from 20-42 ppt; temperature from 24-32°C; water depth 0.1 to 5.8 m and pH from 4.3-9.8.

## REFERENCES

- Calumpong H.P. and E.G. Menez 1997. Field Guide to the Common Mangroves, Seagrasses and Algae of the Philippines. Bookmark Inc. ,Makati City Philippines. 197 p.
- Colin, C.L. Arnesson. 1995. Tropical Pacific Invertebrates. A field guide to the marine invertebrates occurring on tropical pacific coral reefs, seagrass beds and mangrove. Coral Reef Press, California USA. 226 pp.
- Dawes, CJ 1998. Marine Botany. John Wiley and Sons Inc. New York. 406p.
- Edgar, G.J. Hiroshi M and R.J. Ortho, Fish, crabs, shrimps and other large mobile epebenthos: measurement methods for their biomass and abundance in seagrass pp.255 in Estacion J.S. and M.D. Fortes. 1998. Growth Rates and Primary Production of *Enhalus acoroides* (L.f.) Royle from Lag-it, North Bais Bay, The Philippines in Aquatic Botany 29 (1998) 347-356, Elsevier Science Publishers, Amsterdam pp. 347 to 356.
- English S.C. Wilkinson and V. Baker. 1997. Survey Manual for Tropical Marine Resources (2<sup>nd</sup> ed.) Australian institute of Marine Science, Australia 296 pp.
- Menez, E.G., R.C. Phillips and H.P. Calumpong. 1983. Seagrass from the Philippines. Smithsonian Institution Press, Washington D.C. 40p.
- Phang S.M. 1999. Seagrass of Malaysia (Botanical Monograph University of Malaya), Malaysia 60 p.
- Phillips R.C. and E.G. Menez. 1998. Seagrass (Smithsonian contributions to the marine sciences) Smithsonian Institution Press, Washington D.C. 104p.
- Short F.T., M.R.Coles and C.S. Short 2001, Seagrass Global Assessment Phoenin Book Co. USA 387pp.
- Trono, Jr. G.C. Field Guide and Atlas of the Seaweeds Resources of the Philippine Bookmarks, Inc. 1997, 306p.

Walker, D.I., B. Olesen and R.C. Philips in pp.59 "Reproduction and Phenology in Seagrasses"

Walker, D.I., G. Pergent and S. Fazi "Seagrass Decomposition pp, 314 in Global Seagrass Research Methods