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SPECIES COMPOSITION OF SEAGRASSES IN SELECTED BARANGAYS OF VICTORIA, NORTHERN SAMAR

Juveneil J. Tenedero
Ma. Leovilla Destura Santos
University of Eastern Philippines-Catarman

Cynic J. Tenedero,LPT,MAEd
Technological University of the Philippines-Manila

ABSTRACT Very Limited studies have been conducted on species composition of seagrasses in the coastal waters of Northern Samar. This study was conducted to determine the species composition and percent cover of seagrasses in the coastal waters of the selected barangays of the Municipality of Victoria, Northern Samar such as Barangays Erenas, Lazaro, and Libertad. To achieve the objectives, descriptive research design was used to identify and classify the different kinds of seagrasses that are present in the study areas. A line-plot method, was used to cover as many species as possible on each site. Sampling was done in the littoral and sub-littoral zones during low tide at day time. Results revealed that six seagrass species were identified in the selected coastal barangays belonging to two (2) families and five (5) genera. The species are Cymodocea rotundata, Cymodocea serrulata, Halodule pinifolia, Halophila ovalis, Syringodium ioetifolium, and Thalassia hemprichii. The highest total number of species (5) was found in Barangay Erenas and San Lazaro while the least number of species (3) was collected in Barangay Libertad. Shannon Weiner Diversity Index revealed that the seagrasses of Victoria Northern Samar are diverse. The environmental parameters are within the tolerance range, but lower salinity did not favor the growth of the other seagrass species.

Keywords: species, seagrasses, coastal barangay, Victoria, Northern Samar

INTRODUCTION

Dynamic of Seagrasses

Productivity of seagrasses can be controlled by physiological processes, as well as various biotic and abiotic factors that influence plant metabolism. Light, temperature, and inorganic nutrients affect biochemical processes of organisms, and are considered as major factors controlling seagrass growth. Minimum light requirements for seagrass growth vary among species due to unique physiological and morphological adaptations of each species, and within species due to photo-acclimation to local light regimes. Seagrasses can enhance light harvesting efficiencies through photo-acclimation during low light conditions, and thus plants growing near their depth limit may have higher photosynthetic efficiencies. Annual temperatures, which are highly predictable in aquatic systems, play an important role in controlling site-specific seasonal seagrass growth. Furthermore, both thermal adaptation and thermal tolerance contribute greatly to seagrass global distributions. The optimal growth temperature for temperate species range between 11.5 °C and 26 °C, whereas the optimal growth temperature for tropical/subtropical species is between 23 °C and 32 °C. However, productivity in persistent seagrasses is likely controlled by nutrient availability, including both water column and sediment nutrients. It has been demonstrated that seagrasses can assimilate nutrients through both leaf and root tissues, often with equal uptake contributions from water column and sediment nutrients. Seagrasses use $HCO3-$ inefficiently as a carbon source, thus photosynthesis is not always saturated with respect to DIC at natural seawater concentrations leading to carbon limitation for seagrass growth. Our understanding of growth dynamics in seagrasses, as it relates to main environmental factors such as light, temperature, and nutrient availability, is critical for effective conservation and management of seagrass habitats (Fortes,1986).

Biology of Seagrasses

Seagrass are angiosperms that have become adapted to life in the marine environment. They inhabit shallow coastal waters throughout the world, except at polar latitudes. Evolutionary studies using DNA sequences have revealed that the present seagrass diversity arose from at least three separate lineages (Waycott and Les, 1996).

Seagrass are flowering plants, which are adapted to saline habitat. Except for species of Halophyla, which have oval of elliptical leaves, the test of seagrass has long, thin strap like leaves and monophodial growth form. The plant arises from creeping underground stems or rhizomes, they attached to all types of substrates, occurring most extensive on soft one (Short et al., 2001). Seagrass beds are among the most extensive shallow marine coastal habitats worldwide. Their ecosystem services include sustaining diverse faunal communities, supporting fisheries, providing coastal protection through stabilization of sediments, cycling of nutrients and carbon sequestration. In the Caribbean, seagrasses are associated with marine/brackish protected bays and estuaries or reef systems (reef lagoons between the coastlines and the coral reefs). In reef systems, seagrass communities fulfil the above-mentioned services, and additionally provide important ecological linkages with the adjacent coral reefs and/or mangroves. Seagrass communities support the existence of coral reefs through the export of organic materials and provide grazing grounds and/or nurseries for coral reef fishes and other reef fauna. In addition, associated calcareous macro-algae and epiphytes on seagrass leaves are major providers of calcium carbonate sediments (Coles, et al. 1987).

All species of rhizomatous, clonal plant with their leaves and roots produced via rhizome extension and have evolved mechanisms to reproduce in the marine environment (den Hartog, 1970; Waycott and Les, 1996).

Seagrass have been ranked as one of the most valuable ecosystems in the biosphere, due to the important ecosystem services they provide. Seagrass beds are rated the 3rd most valuable ecosystem globally (on a per hectare basis), only preceded by estuaries and wetlands. Costanza et al., (1997) have estimated the economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$16-54 trillion (1012) per year, with an average of US$33 trillion per year. Hence, the ecological systems and the natural capital stocks are critical in environmental life.

Factors controlling seagrass distribution and conditions are of increasing interest to the scientific community due to their ecological and economic value (Duarte, 1999). An extensive body of literature exists on seagrasses and factors influencing their growth, depth limit, and distribution. A number of general parameters have been set as critical to whether seagrass will occur along any stretch of coastline. These include physical parameters that regulate the physiological activity of seagrass (temperature, salinity, waves, currents, depth, substrate and day length), natural phenomena that limit the photosynthetic activity of the plants (light, nutrients, epiphytes and diseases) and anthropogenic inputs that inhibit the access to available plant resources (Kuo and den Hartog, 2001).

A number of general parameters are critical to whether seagrass will occur along any stretch of coastline. This includes physical parameters that regulate the physiological activity of seagrasses (temperature, salinity, waves, currents, depth, substrate), natural phenomena that limit the photosynthetic activity of the plants and anthropogenic inputs that inhibit that access to available plant resources (nutrient and sediment loading). Various combinations of these parameters will permit, encourage or eliminate seagrass from a specific location (Amesbury and Francis, 1988).

Abal and Dennison (1996) concluded that the distribution and growth of seagrasses is regulated by a variety of water quality factors such as temperature, salinity, nutrient availability, substratum characteristics, turbidity, and submarine irradiance. Other factors that can determine the suitability of a site for seagrasses should be added to the list. However, different species of seagrasses have different habitat requirements. Livingston, et al., (1998) determine a hierarchy of habitats for three species of seagrass. Salinity, temperature and depth restraints are important habitat variables that control seagrass growth; when such variables are not limiting, light, sediment and nutrient characteristics become important in the determination of the distribution of seagrass in coastal areas (Livingston et al., 1998).

There are 60 described species of seagrasses worldwide, within 12 genera, 4 families and orders. The Indo-Pacific has the largest number of seagrass species worldwide, with vast meadows of mixed species stands. There are 23 species (Short et al. 2001) of seagrasses found throughout the tropical Indo-Pacific (Region IX, in Short and Coles 2001). These include the genera of Cymodocea, Enhalus, Halodule, Halophila, Syringodium, Thalassia, Zostera and Thalassodendron. Seagrasses provide a sheltered, nutrient-rich habitat for a diverse range of flora and fauna.

Understanding the dynamics of seagrass meadows in different regions is needed to establish successful management and conservation strategies. Seagrasses were found at a total of 31 locations in Costa Rica, most from the Pacific coast; 16 of which are reported for the first time. Diversity-wise from a total of seven species for Costa Rica, six species are reported for the Caribbean, and four species for the Pacific (Villarreal, Tussenbroek, and Cortés (2018).

It was given emphasis by Yakub et al., (2013), there are about 12 species of seagrass found in Singapore is dominated by Enhalus acoroides and Halophila ovalis type being the least is the type Halodule pinifolia, Halophilia decipiens and Halophilia minor. The spread of seagrass found ranging from sand to muddy substrate. Research conducted by Nobi et al., (2011) in the waters of the Indian discovered seven species of seagrasses that Halophilia decipiens, Thalassia hemprichii, Cymodocea rotundata, C. serrulata, Halodule pinifolia, Halodule uninervis and Syringodium isoetifolium, dominated by the type C. serrulata, while Vibol et al. (2010), the diversity of species of seagrass found off the coast of Cambodia around 12 types dominated by Halodule uninervis.

Seagrasses in the Philippines

In the study of Calumpong and Menez (1997), there are two types of seagrass meadows in the Philippines that are dependent on specific substrates. Those that thrive primarily on sand-dominated substrate are of the Syringodium- cymodocea, Halodule association; white those that grow primarily on muddy substrate are of the Enhalus- thalassia association.According to Paz Alberto et.al, (2015), Seagrass Diversity in Candelaria and Masinloc in Potipot Island, Candelaria, Zambales, three species of seagrass were found namely: Cymodocea rotundata (smooth ribbon seagrass), Thalasia hemprichii (sickle seagrass) and Syringodium isoetifolium (name noodle segrass). Cymodocea rotundata and Syringodium isoetifolium belong to Family Cymodoceacea while Thalasia hemprichii belongs to Family Hydrocharitaceae. On the other hand, five seagrass species were found in Oyon Bay, Masinloc, Zambales, namely: Cymodocea rotundata, Enhalus acoroides, Halophilla ovalis, Thalasia hemprichii and Syringodium isoetifolium. Enhalus acoroides (tape grass) and Halophilla ovalis (spoon grass) also belong to Family Hydrocharitaceae. Gilbert C. Sigua et al.

Masagca (2008), reported existing mangrove database of the typhoon-prone island province of Catanduanes in Luzon, Philippines with a total of 37 species of mangrove vascular flora (13 species of major mangrove elements, 10 species of minor mangrove elements and 14 associated mangrove species) were identified in the island under study.

Marino (2018) added the identification of the specimens' results revealed nine (9) seagrass species were collected in the five coastal areas of Allen, Northern Samar. The nine species represented one (1) class, class Liliopsida; two (2) families, family Cymodoceae and Hydrocharitacea; and six (6) genera.

Menez, et al., (1983) reported 13 species of seagrasses in the Philippines. It is important to study seagrasses, because it will give more information to the community, fishermen, and researcher in Victoria, Northern Samar and it is much better that we have an idea also to protect or manage the seagrass to what is there importance. This paper determined the species diversity and composition of seagrasses among selected barangay in Victoria, Northern Samar. Specifically, (1) collected, identified, and classify the seagrasses in the coastal waters of selected barangay in Victoria, Northern Samar; (2) determined the species diversity, abundance, and percent cover of the seagrasses in the study areas; and, (3) described the environmental factors that influence the distribution and diversity of seagrasses in the study area.

METHODOLOGY

Research Design

Descriptive research design was used in this study. The four selected coastal barangays namely Colab-og, Libertad, San Lazaro and Erenas served as the sampling sites. Species found within the quadrat was collected, identified and counted. Three 100m transect lines were laid down from the subtidal to the intertidal zone at 25m distance between transects. Then, 1m × 1m quadrats and starting from zero point of the 100m transect line with 10m interval was made. The sampling site was visited one to two hours before low tide occurs. In the collection of samples, the complete plants were removed from the substrate using a knife and then placed them in a cellophane.

Locale of the Study

The study was conducted in the selected barangays in the Municipality of Victoria, Northern Samar, namely: Ponlacion II, Libertad, Colab-og and Erenas. Geographically, Victoria is located between the town of Allen to the north and San Isidro to the south. Victoria consists of 16 barangays and has a total land area of 186.70 square kilometer. Northern Samar is bounded on the north by the San Bernardino Strait, on the east by the Pacific Ocean, on the west by the Samar Sea, and on the south by Western Samar. Its total land area is 3,498 square kilometers.

Identification and Classification of the Specimen

Every representative sample was preserved in an alcohol solution. The specimen was prepared by cleaning it in running water for 10 to 20 minutes to remove the alcohol, dirt and debris that may have attached to it. Taxonomic classification and key to the identification of Calumpong and Menez (1997) and Kuo and den Hartog (2001) was used. Experts was also consulted on the identification and classification.

Measurement of Environmental Parameters

The environmental parameters determined during the collection of seagrasses in every sampling sites were salinity, water temperature, types of substrates, depth, and current. To measure salinity. water samples were collected and brought to the College of Sciences to determine using refractometer. During the reading, the instrument was positioned to face the light and reading was done the eyepiece. through the eyepiece the reading will be done. Water temperature was measured using an ordinary thermometer. The temperature was observed twice per sampling, in the morning and in the afternoon. To read,the thermometer was dipped in the water for 3 to 5 minutes. Types of substrates were identified through ocular observation. The substrate was identified rocky, sandy, or muddy. The depth of the water was measured using a calibrated meter stick. It was measured from the water surface down to the bottom. Current of the water was determined using a styrofoam as a medium. The styrofoam was place at the starting point. The time require for the styrofoam to reach the starting point is (f). Water pH- determined using a pH meter. And there is a following step to get pH.

RESULTS AND DISCUSSION

Based on the identification of the specimens' results revealed six (6) seagrass species were collected in the four coastal areas of Victoria, Northern Samar. The six species represented one (1) class, Liliopsida; two (2) families, family Cymodoceaceae and family Hydrocharitacea; and five (5) genera. Based on the identification of the specimens, results revealed that six seagrass species were collected from the four coastal areas of Victoria, Northern Samar. These six species belonged to one class, Liliopsida, and were classified into two families: **Cymodoceaceae** and **Hydrocharitaceae**, representing five different genera. Among these, the Cymodoceaceae family comprised four species: **Cymodocea** rotundata (Asch), C. serrulata (Asch. Magnus), Halodule pinifolia (Hartog), and Syringodium isoetifolium (Asch). Meanwhile, the Hydrocharitaceae family included two species: Halophila ovalis (Hooker) and Thalassia hemprichii (Hartog).

Cymodocea rotundata (Figure 1) belongs to the division Tracheophyta, class Liliopsida, and order Alismatales, under the family Cymodoceaceae. It is characterized by its distinct rounded leaf tip and narrow leaf blade, measuring approximately 2–4 mm wide. The leaves typically range in length from 7 to 15 cm and contain 9 to 15 longitudinal veins, which contribute to its structural support and nutrient transport. Additionally, the plant exhibits well-developed leaf sheaths, which encase the base of the leaves and provide further protection and structural stability.

Figure 1. Cymodocea rotundata, Asch., (1870)

Cymodocea serrulata (Figure 2) belongs to the division Tracheophyta, class Liliopsida, and order Alismatales, under the family Cymodoceaceae. This species is distinguished by its serrated leaf tips and robust rhizomes. The leaves are about 3–4 mm wide and 2 mm thick, with 13 to 17 prominent longitudinal veins and three dorsal parallel veins, which provide strong structural integrity and nutrient conduction. The sturdy nature of its rhizome supports firm anchorage to the substrate, enabling it to thrive in dynamic coastal environments.

Figure 2. Cymodocea serrulata (R. Br) Asch.& magnus., (1870).

pinifolia (Figure 3) is classified under the division Tracheophyta, class Liliopsida, and order Alismatales, within the family Cymodoceaceae. It is a delicate seagrass species recognized by its rounded leaf tips and small, narrow leaf blades. The species exhibits fewer than 4–8 cross veins, and the overall blade size is diminutive and needle-like. This morphology allows it to adapt efficiently to soft substrates in intertidal zones.

Figure 3. Halodule pinifolia Hartog., (1970).

Halophila ovalis (Figure 5) belongs to the division Tracheophyta, class Liliopsida, and order Alismatales, within the family Hydrocharitaceae. Its leaves are characteristically oval in shape, measuring between 5 to 20 mm in length, and have smooth margins without hairs. The blade contains eight or more cross veins, aiding in nutrient distribution and mechanical support. Its clean, hairless surface and compact form make it well-suited for rapid colonization in shallow, sandy substrates

Figure 5. Halophila ovalis Hooker., (1858)

Syringodium isoetifolium (Figure 6) is under the division Tracheophyta, class Liliopsida, and order Alismatales, from the family Cymodoceaceae. It is easily identified by its cylindrical, spaghetti-like leaves, which taper to a fine point and range from 7 to 30 mm in length. The rounded cross-section of the leaves enhances flexibility and minimizes resistance to water flow, which is beneficial in exposed or turbulent environments.

Figure 6. Syringodium isoetifolium (Asch) Dandy (1939) .

Thalassia hemprichii (Figure 7) belongs to the division Tracheophyta, class Liliopsida, and order Alismatales, under the family Hydrocharitaceae. This robust species is noted for its thick rhizomes, which show distinct scars between shoots, and hooked or curved leaf blades. The leaves, ranging from 10 to 40 cm in length, feature short black bars of tannin cells that may serve as a defense against herbivory. Typically found on shallow reef flats, T. hemprichii plays a critical role in stabilizing sediments and providing habitat for marine fauna.

Figure 7. Thalassia hemprichii, den hartog., (1970)

Table 1. Presence/Absence of Seagrasses in the Four Barangays of Victoria, Northern Samar

Class	Species	Colab-og	Erenas	Libertad	San Lazaro
Liliopsida	Cymodocea rotundata	✓	✓	✓	✓
Cymod-oceaceae	Cymodocea serrulata	✓	✓	✓	✓
	Halodule pinifolia	✓	✓	-	✓
	Syringodium isoetifolium	-	✓	-	✓
Hydrocharita-ceae	Halophila ovalis	-	-	-	-
	Thalassia hemprichii	✓	✓	✓	✓

Legend: (/) Present; (-) Absent

Table 1 shows the species of seagrasses present in the four coastal areas of Victoria Northern Samar. Barangay Erenas and San Lazaro had the highest number of five (5) seagrass species collected. This was followed by Barangay Colab-og with a total of four (4) seagrass species, Barangay Libertad had the lowest total number of three (3) seagrass species collected.

According to Orth et al. (1991), Short and Coles, (2001), the abundance of seagrasses is dependent on the water depth dependence, the highest abundance typically being found at intermediate water depths were levels of exposure and light are moderate. The decline in seagrass abundance from the maximum depth towards greater water depth depends, at least partly, on light attenuation in the water column and is therefore sensitive to changes in water Quality (Duarte, 1991; Krause Jensen et al., 2003).

Table 2. Percent Cover of Seagrass in Victoria, Northern Samar

Species	Barangay			
	Colab-og	Erenas	Libertad	San Lazaro
Cymodocea ro-tundata	15.41	18.52	10.71	10.34
Cymodocea ser-rulata	11.06	12.77	15.36	15.24
Halodule pinifolia	13.04	10.33	–	15.83
Halophila ovalis	–	–	–	10.13
Syringodium isoetifolium	–	11.25	–	–
Thalassia hem-prichii	13.04	12.51	13.7	11.06

The data shows the cover of seagrass species in four (4) coastal barangays of Victoria, Northern Samar.

In Barangay Erenas, the highest cover of species under class Liliopsida: Cymodocea rotundata obtained 18.52%; While Halodule pinifolia had the least cover of 10.33%, In Barangay Colab-og, C. rotundata had the highest cover 15.41% and C.serrulata had the least cover of11.06%. In Barangay Libertad C. serrulata had the highest cover of 15.36% and C.rotundata had the least cover of 10,71%. In Barangay San Lazaro, the highest cover of 15.83% was that of Halophila Ovalis and the least of 10.13% was that of Halodule pinifolia.

Species Diversity

Table 3 presents the distribution of seagrass species and the calculation of the Shannon Wiener Diversity Index (H') for the coastal areas of Victoria, Northern Samar. A total of six seagrass species were identified, with the number of individuals for each species ranging from 1 to 4. The table shows the proportional abundance (pi) of each species, their corresponding natural logarithm (Ln(pi)), and the resulting values for **pi * Ln(pi),** which are used to compute the diversity index.

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Table 3. Distribution of Seagrass Species and Calculation of the Shannon-Wiener Diversity Index (H') in the Coastal Areas of Victoria, Northern Samar

		% decimal	Nat log	X	
Species	Number(p)	pi	Ln(pi)	piLn(pi)	-piLn(pi)
Cymodocea rotundata	4	0.235	-1.448	-0.34	0.34
Cymodocea serrulata	3	0.176	-1.737	-0.306	0.306
Halodule pinifolia	4	0.235	-1.448	-0.34	0.34
Halophila ovalis	1	0.059	-2.83	-0.167	0.167
Syringodium isoetifolium	2	0.118	-2.137	-0.252	0.252
Thalassia hemprichii	3	0.176	-1.737	-0.306	0.306
	17			TOTAL = 1.711	

Shannon Weiner Diversity Index Pi
=Percentage in decimal form
Ln(x) =" natural logarithm". Using calculator
* =multiply

< 1.5 = LOW DIVERSITY
1.5<X<2.5 =MED DIVERSITY
> 2.5 = HIGH DIVERSITY

Environmental Parameters

The environmental parameters which were determined simultaneous with the sampling were pH, temperature, current, depth, salinity, and substrate. The mean average of the parameter is presented in the Table 4.

Table 4. Environmental Parameters

Sampling Areas	Environmental parameters (September to November)					
	pH	Tempera-ture (°C)	Current m/s	Depth cm	Salinity (ppt)	Types of substrate
Colab-og	7.26	30	8.11	9	30	Sandy/ Muddy
Erenas	7.57	30	7.26	18	30	Sandy
San Lazaro	7.34	28	10.12	7	35	Sandy/ Rocky
Libertad	7.47	31	6.18	36	30	Sandy

pH

pH is measure of acidity or alkalinity of a substances and is one of the stable measurements in seawater. Ocean water has an excellent buffering system with the interaction of carbon dioxide and water so that it is generally always at a pH of 7.5 to 8.5. Neutral water is a pH of 7 while acidic substances are less than 7 (down to 1, which is highly acidic) and alkaline substances are more than 7 (up to 14, which is highly alkaline). Anything either highly acid or alkaline would kill marine life but the oceans are very stable with regard to pH. If seawater was out of normal range (7.5-8.5) then something would horribly wrong (Anderson ,2003).

In Barangay Erenas the highest pH was the record of 7.57; and the lowest was in Barangay Colab-og which indicates a normal seawater pH. Barangay Erenas is considered to have a normal pH but it has also the highest pH among the four barangays. The substrate was rocky, sandy, and muddy from the landward to seaward.

Temperature

As to the temperature in the four-study area, Barangay Libertad had the highest temperature value of 31ºC, while in Barangay San Lazaro had the lowest temperature of 28ºC. The optimal growth temperature for temperate species range between 11.5 °C and 26 °C, whereas the optimal growth temperature for tropical/subtropical species is between 23 °C and 32 °C (Fortes, 1986).

The water current is dependent on the weather condition. The weather condition during September to November was rainy season but sunny occurred in September during the actual sampling. The water current in Barangay Colab-og was 8.11 meter per second (m/s); in Barangay Erenas, 7.26m/s; in Barangay Libertad, 10.12m/s; and, in Barangay San Lazaro 6.18m/s.

Depth

The depth of the water in the sampling site was as follows: 9cm, 18cm, 7cm, and 36cm. The depth of the water in the estuary has an effect to the salinity of the area as the area is more deep, salty seawater is denser and stay in the bottom.

Salinity

The Salinity of the estuaries fluctuates directly both from place to place and from time to time. When seawater averaging about 35 ppt salinity mixes with fresh water nearly 0 ppt the mixture has salinity somewhere in between. The fresh water that is mixed has the lower salinity. Changes in salinity could also affect water currents because saltwater is denser than fresh water and sinks (Nasreen,2022).

The differences in salinity during the sampling period could be due to the flow and or heavy rainfall, that a change in salinity of the ocean is affected by seasonal factors, and the salinity of the ocean water.

Substrate

The substrates in the study area are all ideal for the organism under study. Seagrass usually flourish in mixed muddy to sandy and rocky by seaward zone substrate. Substrate are very important habitat because it helps in the growth and survival of all organisms.

CONCLUSION

There were six (6) seagrass species found in the study area; namely: Cymodocea rotundata, Cymodocea serrulata, Halodule pinifolia, Halophila ovalis, Syringodium isoetifolium, Thalassia hemprichii. The same six (6) species of seagrasses were also found in Igang Bay, Guimaras, these species are all found in the eastern sites in the Philippines Alimen and Selorio (2017). Cymodocea rotundata had the highest cover of 18.52% found in Barangay Erenas, While, Halophila ovalis had the least cover (10.13) found in Barangay San Lazaro. The highest percent cover also considered the most abundant species.

Moreover, Shannon Weiner Diversity Index tells that the seagrasses of Victoria Northern Samar are med diverse, because the result are 1.5<X>2.5. If the result is less than <1.5 it is Low diverse, and if the result is Greater than >2.5 it is high diverse. The environmental parameters are within the tolerance range but lower salinity did not favor the growth of the other seagrass species.

It is recommended to follow-up study on the species diversity and composition be conducted to obtain information on the seagrass species in other localities and the environmental parameters be considered for observation in order to relate these to the presence and/or absence of seagrass

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