COMMODITY R&D REVIEW
OF ON-GOING AND COMPLETED
R&D PROJECTS
November 24-26, 2004

A. BASIC INFORMATION

1. Program title: Seaweed R&D
   Project title: Cultural Practices and Management of Selected Seaweeds in La Union

Study title: Stock Assessment of Commercially Important Seaweeds in La union

2. Researcher: Lantion, E. B., Galvez, G. N.

3. Implementing Agency/ Station: DMMMSU
   A. lead agency: DMMMSU-NLUC-FRTI
   B. Cooperating agency
   C. Project Site: La Union

4. Funding Agency: DMMMSU

5. Duration
   a. Date Started: January 2002
   b. Date Ended: December 2003

6. Financial Report for CY 2002
   1. Total Approved Budget: P 150.00
   2. Actual Released Budget: P 150.00
   3. Actual Expenditures: P 119, 800

7. BUDGETARY REQUIREMENT FOR CY 2003
   Personal Services
   Maintenance and Operating Expenses
   Equipment/Capital Outlay
   Total

B. TECHNICAL REPORT

I. ABSTRACT

This study was conducted to determine the seasonality and abundance and assess the natural stocks of commercially important different seaweeds in La Union. Seaweeds specimens were gathered using transect and quadrant method along intertidal zones of selected seaweed communities of Luna, Balaoan, Bacnotan, San Fernando City, Sto. Tomas and Rosario La Union from February 2002 to January 2003.

Results indicated that there were 46 species of seaweeds along the coastal areas of La Union comprising three classes, 19 families, 13 order and genera. There were 21 species that belong to class Chlorophyta, 12 to Phaeophyta and 13 to Rhodophyta. Similarity indices of more than 50% suggest that these coasts belong to one geographical area.

Distribution of species by distance from shore suggested variability. Similarity indices were generally below 50% except for 30-35m and 85-90m.

Species found throughout the sampling sites was observed to be populated more by Sargassum spp.

II. RATIONALE

The utilization of marine algae as items of food and as raw materials for industries highlights the economic importance and potential of these fishery resources. The increasing contribution of the present industry to the foreign trade of the Philippines during the past fifteen years as well as utilization of a number of species as a food in any areas in the country have emphasized the need to develop the large but untapped potentials of these resources. Seaweed farming and gathering of natural stocks has also become a productive alternative or additional source of livelihood among the coastal populations who are not benefited by industrial developments.

According to Trono (1987), one of the basic problem which prevent the rapid development of the seaweed industry in the Philippines and in other developing countries in the tropics is the lack of information on the industries of economically important seaweeds.

The nature and physiography of the Philippines, La Union in particular, allows a more and positive outlook in as far as the available areas for the diversification of the base of the seaweed industry.

Basic studies should always form necessary components of any research and development program. Thus, a large portion of the program activities shall focus on the gathering baseline data on the resources. This shall consist of inventory and stock assessment works, knowing the taxonomy and evaluation of commercially important seaweeds. Information on the data derived from this priority area shall provide baseline information essential to the development and diversification of the resource base of the seaweed industry in the province; hence, this study was designed.

III. OBJECTIVE:

1. To determine the seasonality and abundance of commercially important seaweeds of La Union; and
2. To inventory and assess the natural stocks of the different seaweeds in coastal areas of La Union.

IV. RESEARCH HIGHLIGHT

Review of Literature

The macroscopic forming algae constitute the group commonly known as "seaweeds". Being outo-tropic organisms, they need sunlight in order to live. They do not grow at depths greater than several hundred feet where light cannot penetrate (Ganzon Fortes, 1987). Many kinds of seaweeds are found all over the world. There are certain species of red, green and brown marine algae, and they grow.

Thurman (1975) described those three divisions of macroscopic algae as:

Chlorophyta or green algae, the predominant form of algae found in freshwater environments, not well represented in the ocean. Most species are intertidal, or those that would be found in shallow water or bays. Although they range in color, because of the pigment chlorophyll, from yellow green to a very dark green, most are somewhat grass green in color. They grow to moderate size, seldom exceeding a foot in the large dimension. Forms range that of finely branched filaments to flat thin sheets. The various species of genus Ulva (sea lettuce), a thin membranous sheet two cell layers, thick may be found widely scattered throughout cold water areas, while genus Codium (sponge weed) is dichotomously branched form that is more commonly found in warm waters and can be in excess of six (6m) in length.

Phaeophyta (Brown algae), the group that contains the large numbers of the marine plant community, and they are found attached to the bottom throughout much of the littoral and inner sub-littoral zones. The dominant pigment in the brown algae is fucoxanthin, and the color may range from a very light brown to black. The brown algae occur primarily temperate and cold-water areas. Sizes ranges from small black encrusting patch of *Ralfsia,* found in the upper and middle intertidal zones where it is exposed to an extensive threats of desiccation and may become crisp and dry in the sun without dying, to the *Pelagophycus* (bull kelp) which may grow attached to small holdfast in water depths in excess of 30 m. a genus of brown algae, *sargassum,* may be found either attached to the bottom nearshore waters in a belt between the subtropics or floating freely at the ocean's surface. The floating variety found in the Sargasso Sea southeast of Bermuda is buoyed up by its small grape-sized air bladders.

Rhodophyta or Red algae, is the most abundant and widespread of the marine macroscopic algae. Over 400 species are found attached from the very highest intertidal levels to the outer edge of the inner sub-littoral zone. They are very rare in fresh water. The red algae range in size from just visible to the naked eye to lengths up to 3 m. *Rhodophyta* are found in warm and cold water areas, with the warm water varieties being relatively small. The characteristics pigment of the red algae is phycoerrythrin. The color of the red algae, depending on where one finds it in the intertidal or inner sub-littoral

zones, will varies considerable. In the upper well-lighted areas it may green to black or purplish in color, and as you pass into the deeper water zones where the light concentrations become less, the color changes through a brown to a pinklish red. Some red algae is found to depths of 185 m where its red pigment is still capable of absorbing blue green wavelengths of light that manage to penetrate to three depths.

In terms of tropical marine waters around the Philippine islands, seaweeds are among the most diverse in the world. Indeed, Menez, (1987) and Moe et al. (1987)), as cited by Laroya and Dias (2001) catalogue 209 genera and 917 species of marine seaweeds in our waters.

As cited by Trono et al. (1984) the Philippines has more than 390 species of seaweeds with known economic value, but only few species are known. In southern Philippines, *Eucheuma* is the most extensively farmed, providing livelihood to thousands of seaweed farmers. Production of other economical value species such as *Sargassumi* and *Gracilaria* depends largely on natural stocks.

Eucheuma, one the various species of the Philippines seaweeds has aroused commercial interest in the world market because it is a source of an important phycocolloid known as carageenan. Coastal areas of Albay were surveyed and test plots of *Eucheuma alvarezil* were laced (Manzano, and Trono, as cited by Laroya and Diaz, 2001).

Silva et al. (1987), as cited by Laroya and Diaz (2001) found that some 864 species of marine macrobenthic algae including several species of Cyanophyta occurred in the Philippines. The *Rhodophyta* consists of 507 species with 39 families, 7 orders and 212 species of Chlorophyta belonging to 11 families and 7 orders.

According to the records of the 1993 Fisheries Profile of the Fisheries and Aquatic Resources, the Autonomous Region in Muslim Mindanao (ARMM) has a remarkable production of seaweed, which contributes at least 70% share into the Philippine National Grade Carageenan and produces an average of 273,395 metric tons per year. Zamboanga, Jolo, Tawi-Tawi, North and South Palawan, Cebu and Bohol were the country's major source of seaweeds. Al Tillan (1993) reported that, over 70% of the nations hectares planted to seaweeds are located in Tawi-Tawi where 80% of the total volumes of seaweeds come from. Meanwhile, Western Mindanao accounts for more than 90% of the total seaweeds export of the country.

According to Trono (1984), there are 20 commercially important seaweeds found in the Lingayen Gulf. Natural stocks of seaweeds are harvested along portion of the shores and shallow areas in Bolinao, Anda and Alaminos in Pangasinan and in Sto. Tomas and San Fernando La Union. About 30 small – and large-scale gatherers reside in each village (Barangay). Commercial gatherers harvest seaweeds only during the peak season, aboard motorized boats (banca). Like the contract buyer the large-scale gatherers sells the seaweed in bulk to middlemen at distribution centers such as the Alaminos landing area. The produce is then transported by land to the market in Dagupan, San Fernando and other towns. In contrast to this, small-scale gatherers collect year-round in areas near their residence and sell directly to their neighbors or to contract buyers who pick up the harvest on site.

Gathering by hand in the intertidal zone during low tide is the usual practice. However, for other sub-tidal species, diving with the use of the air compressor hose

system is necessary. An alternative method involves dragging a wooden, rarely gear across the substrate.

According to Diaz and Laroya (2001) there are 33 species and 3 Divisions of seaweeds in four selected areas of La Union. These divisions are Phaeophyta with 2 orders, four families and 10 species. Rhodophyta with 8 orders, 6 families and 11 species and Chlorophyta with 3 families and 12 genera.

According to traditional gatherers who use to collect *banca*-load of seaweeds, a day's harvest has now been reducing to two cans or at most five sacks. A case in points is the intense and unregulated harvesting of *Eucheuma* for carageenan production, which almost completely depleted the stock a dacade ago. Present stocks have hardly recovered (Trono 1984).

Introduction and successful application of culture techniques of seaweeds was initiated by Dr. Maxwell Doty and Mr. Vicente Alvarez in cooperation with BFAR and University of Hawaii in 1969 which led to the wide utilization of Philippine *Eucheuma* as raw materials for the manufacture of carageenan in the world market. In 1972, Tawi-Tawi, Jolo and Zamboanga fishemen started the first *Eucheuma* commercial farms in the country (Maxwell 1977).

This need has been enhanced by the recognition of the fact that the traditional fishery resources are fast depleting due to intense and increasing pressure from the resource users (Calumpong and Menez 1992).

Today there is growing awareness in macrobenthic algae in the Philippines because of the success of culture on some of the commercially important seaweeds such as *Eucheuma, Garcilaria* and *Caulerpa.* Because of their export potentials, Trono et al (2000) conducted growth studies on the cultivars of *Eucheuma* and *Kappaphycus* as a method of strain selection to establish production performance of the said seaweed species.

1. METHODOLOGY

A. Study Site

This study was conducted in selected coastal areas of La Union, where potential algal communities are located. Established study areas in La Union were; Balaoan, Bacnotan, Luna, San Fernando City, Sto. Tomas and Rosario.

Areas I is located in Cariskis, Luna; Area II in Paraoir, Balaoan; Area III in Quirino-Cabarsican, Bacnotan; Area IV in Carlatan, San Fernando City; Area V in Damortis, Sto. Tomas; and Area VI in Rabon, Rosario.

General description of the study areas:

Site	Substrate	Natural Stocks (Dominant)	Activities of Local Inhabitants
Area I	Sandy, Rocky Corraline	Sragassum species, Gracilaria, Padina Caulerpa species Hypnea	Fishing, gathering of seaweeds and other Marine resources
Area II	Sandy, Rocky Corraline Sandy-muddy	Sargassum species, H. Cuneiformis Padina species Caulerpa species	Fishing, gathering of seaweeds and other Marine resources
Area III	Sandy, Rocky Corraline	Sargassum species, Gracilaria, Padina Caulerpa species	Fishing, gathering of seaweeds and other Marine resources
Area IV	Sandy, Rocky Corraline	Sargassum species, Gracilaria, Padina Caulerpa species	Fishing, gathering of seaweeds and other Marine resources
Area V	Sandy, Rocky Corraline	Sargassum species, Garcilaria, Padina	Fishing, gathering of seaweeds and other Marine resources
Area VI	Sandy, Mauddy Rocky	Sargassum species, Gracilaria, Padina Caulerpa species	Fishing, gathering of seaweeds and other Marine resources

B. Materials

Materials necessary in seaweed collection are; plastic bags, net bags, knife for scrapping, labeling materials such as pencils and pentel pens, record slate, facemasks, rafts (rubberized tires), transect lines and 50cm x 50cm quadrat.

Materials used in preserving seaweed for species identification are 300ml clear bottles with plastic covers, 2 liter graduated cylinder, formalin solutions, labeling materials, masking tapes.

Dried samples were placed in coupon bond in pressed form.

C. Sampling procedures

Quarter sampling was conducted at selected sampling stations per study area using the Transect-Quadrant Method (Saito and Atobe, 1970). The transect line was calibrated at 5 meters interval, laid perpendicular to the coastline extending seaward. Twenty quadrats were sampled along the 100m transect line at each station.

D. Gathering of Quantitative Data on the Communities

D.1. Species Composition

Seaweed were calssified and identified at species bed by using the Field Guide and Atlas of the Seaweed Resources of the Philippines (Trono, 1999), Seaweed Identification by Fortes (1991) and authenticated pictures of seaweeds samples of Prado (2002). Validation and identification of seaweed were conducted by seaweeds experts of National Museum.

D.2. Biomass Determination

Biomass determination is an important measure of abundance. Seaweed biomass is usually expressed as units of weight per area (or volume) of habitat.

E. Data Analysis

Descriptive statistics including mean, rank was used to interpret and analyze the data and species composition and description of seaweed collected from the study areas.

Similarity index of species were obtained using the Jaccards Coefficients (CCj) (PCAMRD, 1991) as cited by Laroya & Diaz (2000) and Prado (2002), as follows.

$$CCj = \frac{c}{a+b-c} \times 100$$

Where:

a= no. of species in local of a
b= no. of species in local b
c= total no. of species common in both locality

Similarity indices are useful in determining how similar are the seaweed communities in terms of species present (Fortes, 1999 and Prado, 2002).

RESULTS:

Table 1. Identified Seaweed Species and their Composition

Class Chlorophyta		**Sampling Areas**					
		I	**II**	**III**	**IV**	**V**	**VI**
Order	**Family**						
Bryopsidales	**Caulerpaceae**						
	• *Caulerpa peltata*	/	/				
	• *Caulerpa racemosa*		/	/	/		
	• *Caulerpa serrulata*		/	/	/		
	• *Caulerpa sertularruioides*		/	/	/	/	
	• *Caulerpa lentilifira*			/			/
	• *Caulerpa taxipolia*					/	
	Halimedaceae						
	• *Halimeda cylindracea*				/		
	• *Halimeda incrassata*		/				
	• *Halimeda macroloba*	/	/		/		
	• *Halimeda macrophysa*					/	/
	• *Halimeda tuna*	/		/	/		
	• *Halimeda velasquezii*	/	/	/	/	/	/
	Udoteaceae						
	• *Udotea orientalis*		/	/	/	/	
Cladophorales	**Cladophoceae**						
	• *Chaetomopha crassa*		/	/	/		
Dasycladales	**Dasycladaceae**						
	• ***Cymopolia van-bosseae***	/		/	/	/	
	• *Neomeris van-bosseae*	/	/		/	/	
	Polyphysaceae						
	• *Acetabularia dentata*			/	/		/
	• *Acetabularia major*		/				
Siphonocladales	**Siphonocladaceae**						
	• *Boergesenia forbesii*	/	/	/	/		
	Valoniaceae						
	• *Valonia aegagropila*	/	/	/	/		
Ulvales	**Ulvaceae**						
	• *Enteromorpha intestinalis*	/				/	

Class Chlorophyta		**Sampling Areas**					
		I	**II**	**III**	**IV**	**V**	**VI**
Order	**Family**						
Fucales	**Sargassaceae**						
	• *Sargassum crassifolium*	/	/	/	/	/	/
	• *Sargassum cristaefolium*	/	/	/	/		
	• *Sargassum oligocystum*	/	/	/	/	/	/
	• *Sargassum polycystum*	/	/	/	/	/	/
	• *Sargassum ilicifolium*	/	/				
	• *Turbinaria ornata*		/				
Dictyotales	**Dictyotaceae**						
	• *Dictyota cervicornis*	/	/	/	/	/	/
	• *Dictyota dichotoma*	/	/	/	/		
	• *Padina autralis*	/	/	/		/	/
	• *Padina japonica*	/	/	/	/	/	/
	Cystseiraceae						
	• *Hormophysa cuneiformis*	/	/	/	/		/
Scytosiphonales	**Scytosiphonaceae**						
	• *Hydroclathrus clathratus*	/	/	/		/	/
Class Rhodophyta							
Order	**Family**						
Corallinales	**Corallinaceae**						
	• *Amphiroa foliaceae*	/	/	/			
	• *Amphiroa fragilissima*				/	/	
	• *Masthopora rosea*	/	/	/	/		
Bonnemaisoniales	**Galaxauraceae**						
	• *Galaxaura oblongata*	/	/	/	/	/	/
	• *Galaxaura fasciculate*	/	/	/			
Cryptonemialeas	**Cryptonemiaceae**						
	• *Halymenia durvillaei*	/					
Gelidiales	**Gelidieceae**						
	• *Gelidiella acerosa*	/	/	/	/		
Gigartinales	**Gracilariaceae**						
	• *Ceratodictyon spongiosum*	/	/	/	/		
	• *Gracilaria arcuata*	/	/	/	/		
	• *Gracilaria eucheumoides*	/	/	/	/		
	• *Gracilaria coronopifolia*	/	/	/		/	/
	• *Gracilaria salicornia*		/		/		/
	Hypneceae						
	• *Hypnea pannosa*	/	/		/		/
Total number of species identified		30	36	31	31	18	15

Legend:

Indicate the presence of seaweed species in the sampling areas.

All seaweed identified which were collected from February 2002 to January 2003 are listed in Table 1. It was noted among the study areas that Balaoan represented the most number of species, 36 or 78.26% followed by Bacnotan, and San Fernando City with 31 or 67.39%, Luna had 30 or 65.22% species identified while Rosario had 15 or 32.61% and Sto. Tomas had 18 or 39.13% (Fig.2)

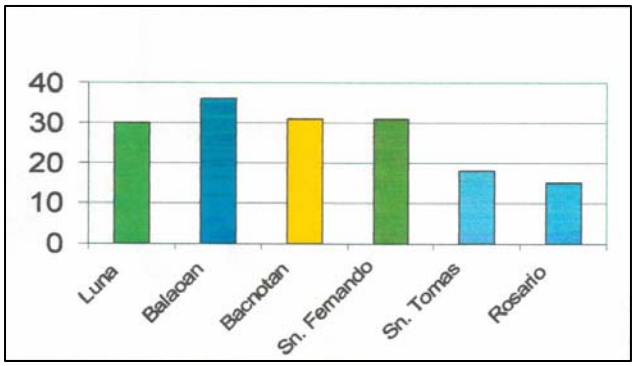

Figure 2. Species composition by sampling stations

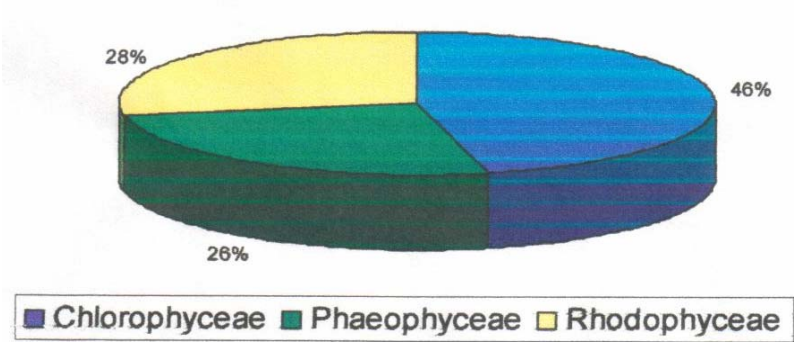

Figure 3. Species composition by class

It was noted further that class Chlorophyceae represented the most abundant with 21 species (46%) while class Rhodophyceae and class Phaeophyceae represented 13 (28%) and 12 (26%) species respectively (Fig. 3).

Seaweed species noted for its economic importance were six species of Caulerpa, 1 species of Gelidiella, 4 Gracilaria, and 5 Sargassum species. These species were harvested from the natural stocks by coastal dwellers as food with medicinal value while other species were utilized as fertilizers and feed ingredients for livestosks (Ganzon-Fortes 1991, Prado, 2002).

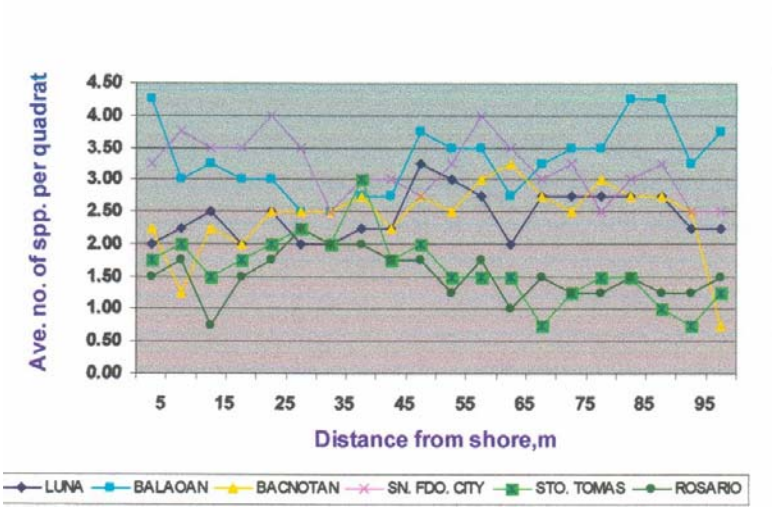

Fig. 4 Number of species by distance in all areas

Meanwhile, in San Fernando, higher number of species was found within the 10-60 m distance strata. Species occurrence ranged from 2.5 o 4 corresponding to a mean of 3.18.

In Santo Tomas, the presence of species ranged from 0.75 to 2.25 corresponding to a mean of 1.63. High number of species was also found at 30-40m distances from shore.

In Rosario, higher number of species was also found from 30-40m distances from shore. Species occurrence ranged from 0.75 to 2.25 corresponding to a mean of 1.53.

Generally, results suggest that starting from shore, biodiversity increases (table 4) to some distance seaward, being highest at 40-65m in all areas, and tend to decrease to some extent until the breakwater where wave action is strong and usually affect the habitat including organisms in particular. In such area, a robust plant species with strong holdfast and root system can survive. More delicate species of seaweed tend not to be favorable to such type of ecosystem far from the shore.

Table 2a. Relative distribution of Species at Luna, La Union

Species	Density	%	Rank
Sargassum polycystum	330.888	32.087	1
Sargassum crassifolium	221.575	21.489	2
Hormohysa cuneiformis	159.363	15.454	3
Sargassum cristaefolium	159.075	15.426	4
Padina japonica	30.638	2.971	5
Hypnea pannosa	18.825	1.826	6
Galaxaura oblongata	17.563	1.703	7
Dictyota cervicomis	13.288	1.289	8
Hydroclathrus clathratus	12.475	1.210	9
Masthopora rosea	11.375	1.103	10
Gracilaria coronopifolia	7.788	0.755	11
Gelidiella acerosa	7.163	0.695	12
Amphiroa foliaceae	6.025	0.584	13
Ceratodictyon spongiosum	5.525	0.536	14
Gracilaria eucheumoides	5.125	0.497	15
Enteromorpha intestinalis	4.625	0.449	16
Sargassum oligocystum	3.750	0.364	17
Padina australis	3.488	0.330	18
Boergesenia forbesii	3.275	0.318	19
Galaxaura fasciculate	2.113	0.205	20
Gracilaria arcuata	3.188	0.309	21
Dictyota dichotoma	1.713	0.166	22
Halimeda velasquezii	0.750	0.073	23
Cymopolia vanbosseae	0.725	0.070	24
Neomeris vanbosseae	0.300	0.029	25
Caulerpa peltata	0.190	0.018	26
Halimeda macroloba	0.163	0.016	27
Halimeda tuna	0.150	0.015	28
Valonia aegagropila	0.50	0.005	29
Halymenia durvillaei	0.038	0.004	30
Total	**1031.209**		

Of the species found in Luna, (table 2a) *S. polycystum* rank first in terms of 330.89 per. 25m^2 surface area. This followed by *S. crassifolium*, *H. cuneiformis, S. cristaefolium* and *P. japonica* in descending order. These have densities of 221.58, 159.36, 159.08, and 30.63 per. 25 m^2 surface area respectively. The least species was *H. durvillaei* (ranked 30th).

TABLE 2b. Relative distribution of Species at Balaoan, La Union

Species	Density	%	Rank
Sargassum cristaefolium	139.088	22.028	
Sargassum polycystum	122.863	19.458	1
Hormohysa cuneiformis	113.763	18.017	2
Sargassum crassifolium	59.713	9.457	3
Padina australis	37.650	5.963	4
Sargassum oligocystum	30.025	4.755	5
Padina japonica	21.863	3.463	6
Galaxaura oblongata	19.000	3.009	7
Gracilaria coronopifolia	12.950	2.051	8
Hypnea pannosa	12.350	1.956	9
Hydroclathrus clathratus	11.850	1.877	10
Gelidiella acerosa	7.900	1.251	12
Galaxaura fasciculate	7.813	1.237	13
Caulerpa racemosa	6.303	0.998	14
Masthopora rosea	5.913	0.936	15
Caulerpa serrulata	4.363	0.691	16
Gracilaria arcuata	3.563	0.564	17
Dictyota cervicomis	2.938	0.465	18
Sargassum ilicifolium	1.963	0.311	19
Amphiroa foliaceae	1.750	0.277	20
Helimeda velasquezii	1.150	0.182	21
Valonia aegagropila	0.99	0.156	22
Halimeda macroloba	0.925	0.146	23
Caulerpa peltata	0.725	0.115	24
Gracilaria eucheumoides	0.625	0.099	25
Dictyota dichotoma	0.550	0.087	26
Boergesenia forbessi	0.450	0.071	27
Ceratodictyon spongiosum	0.425	0.067	28
Chaetomorpha crassa	0.388	0.061	29
Halimeda incrassata	0.338	0.037	30
Turbinaria ornate	0.313	0.049	31
Neomeris vanbosseae	0.300	0.048	32
Acetabularia major	0.200	0.032	33.5
Gracilaria saliconia	0.200	0.032	33.5
Caulerpa sertularioides	0.113	0.018	35
Udotea orientalis	0.100	0.016	36
Total	**631.411**		

In Balaoan, of the 36 species recorded, (table 2b) *S. cristaefolium* had the highest density of 139.09 per .25 m^2 of surface area. This was followed by *S. polycystum,* (122.86) *H.cuneiformis,* (113.76), *S. crassifolium* (59.71), and *P.australis* (37.65) respectively. The least wa *U. orientalis* (0.10).

TABLE 2c. Relative distribution of Species at Bacnotan, La Union

Species	Density	%	Rank
Sargassum polycystum	349.01	45.41	1
Sargassum crassifolium	165.34	21.51	2
Sragassum cristaefolium	88.05	11.46	3
Sargassum oligocystum	56.48	7.35	4
Hormophysa cuneiformis	55.20	7.18	5
Padina australis	11.40	1.48	6
Galaxaura oblongata	9.65	1.26	7
Caulerpa racemosa	5.73	0.75	8
Caulerpa serrulata	3.78	0.49	9
Padina japonica	3.46	0.45	10
Masthopora rosea	3.45	0.45	11
Amphiroa foliaceae	3.03	0.39	12
Dictyota cervicomis	2.71	0.35	13
Udotea orientalis	2.26	0.29	14
Gelidiella acerosa	1.66	0.22	15
Caulerpa sertularioides	1.49	0.19	16
Ceratodictyon spongiosum	1.08	0.14	17
Halemida velasquezii	1.00	0.13	18
Hydroclathrus clathratus	0.85	0.11	19
Boergesenia forbesii	0.58	0.08	20
Galaxaura fasciculate	0.49	0.06	21
Gracilaria coronopifolia	0.41	0.05	22
Acetabularia dentate	0.40	0.05	23
Chaetomorpha crassa	0.35	0.04	24
Gracilaria eucheumoides	0.29	0.02	25
Cymopolia vanbosseae	0.13	0.01	26
Valonia aegagropila	0.10	0.01	27
Halimeda tuna	0.08	0.01	28
Caulerpa lentilifera	0.05	0.01	29.33
Dictyota dichotoma	0.05	0.01	29.33
Gracilaria arcuata	0.05	0.01	29.33
Total	**768.58**		

Among the species encountered in Bantam, (table 2c) *S. polycystum* was found to be abundant. Density of this species was 349.01 per .25m^2 surface area. Second rank was *S. crassifoliumi* (165.33), followed by *S. cristaefolium* (88.05), *S. oligocystum* (56.48), and *H. cuneiformis* (55.20) in descending order while *C.lentillifera*, *D. dichotoma* and *G. arcuata* were ranked the least (0.05).

Ta ble 2d. Relative distribution of species at San Fernando City, La Union

Species	Density	%	Rank
Sargassum polycystum	232.69	48.44	1
Sargassum crassifolium	104.68	21.79	2
Hormophysa cuneiformis	33.48	6.97	3
Sargassum cristaefolium	21.26	4.43	4
Halimeda tuna	15.40	3.21	5
Padina japonica	14.89	3.10	6
Halimeda macroloba	11.29	2.35	7
Galaxaura oblongota	6.21	1.29	8
Galaxaura fasciculata	6.04	1.26	9
Caulerpa racemosa	5.10	1.06	10
Udotea orientalis	4.41	0.92	11
Ceratodictyon spongiosum	3.28	0.68	12
Halimeda cylindracea	2.60	0.54	13
Cymopolia vanbosseae	2.56	0.53	14
Dictyota cervicomis	2.30	0.48	15
Halimeda velasquezii	1.95	0.41	16
Amphiroa fragilissima	1.88	0.39	17
Dictyota dichotoma	1.83	0.38	18
Gelidiella acerosa	1.74	0.36	19
Neomeris vanbosseae	1.26	0.26	20
Hypnea pannosa	1.01	0.21	21
Gracilaria eucheumoides	.096	0.20	22
Caulerpa sertularioides	0.81	0.17	23
Masthopora rosea	0.71	0.15	24
Chaetomorpha crassa	0.68	0.14	25
Caulerpa serrulata	0.43	0.09	26
Gracilaria saliconia	0.41	0.09	27
Gracilaria arcuata	0.19	0.04	28
Acetabularia dentata	0.15	0.03	29
Valonia aegagropila	0.10	0.65	30
Boergesenia forbesii	0.06	0.01	31
Total	**768.58**		

Of the 31 species found in San Fernando City, (table 2d) *S. polycystum* ranks first in terms of density of 232.69 per .25m^2 surface area. This was followed by *S. crassifolium* (104.68), *H. cuneiformis* (33.48), *S. cristaefolium* (21.26), and *H. tuna* (15.40). The least species was *B. forbesii* (0.06).

Table 2e. Relative distribution of species at Sto. Tomas

Species	Density	%	Rank
Sargassum polycystum	167.96	70.29	1
Sragassum oligocystum	31.36	13.13	2
Padina australis	18.94	7.93	3
Dictyota cervicomis	3.73	1.58	4
Galaxaura oblongata	3.04	1.27	5
Amphiroa fragilissima	3.01	1.26	6
Sargassum crassifolium	2.14	0.90	7
Halimeda velasquezii	2.06	0.86	8
Gracilaria coronopifolia	1.88	0.79	9
Cymopolia vanbosseae	1.59	0.67	10
Enteromorpha intestinalis	1.05	0.44	11
Padina japonica	0.90	0.38	12
Malemida macrophysa	0.73	0.30	13
Neomeris vanbosseae	0.25	0.11	14
Caulerpa taxipolia	0.15	0.06	15
Hydroclathrus clathratus	0.06	0.03	16
Caulerpa sertularioides	0.05	0.02	17.5
Udotea orientalis	0.05	0.02	17.5
Total	**238.95**		

In Sto. Tomas, (table 2e) 18 species were recorded, *S. polycystum* had the highest density of 167.96 per .25m^2 surface area. This was followed by *S. oligocystum* (31.36), *P. australis* (18.94), *D. cervicornis* (3.73), and *G. oblongata* (3.04). the least species were *C. serlularioides* and *U. orientalis.*

Table 2f. Relative distribution of species at Rosario, La Union

Species	Density	%	Rank
Sargassum polycystum	54.76	42.31	1
Sargassum oligocystum	28.96	22.38	2
Sargassum crassifolium	13.41	10.36	3
Acetabularia dentate	9.16	7.08	4
Dictyota cervicornis	6.88	5.31	5
Galaxaura oblongata	5.48	4.23	6
Padina japonica	4.25	3.28	7
Padina australis	3.00	2.32	8
Hypnea pannosa	1.15	0.89	9
Gracilaria coronopifolia	0.75	0.58	10
Hydroclathrus clathratus	0.65	0.50	11
Halimeda velasquezii	0.36	0.28	12
Gracilaria salicornia	0.31	0.24	13
Caulerpa lentillifera	0.21	0.17	14
Hormophysa cuneiformis	0.09	0.07	15
Total	**129.43**		

Among the species recorded in Rosario, (table 2f) *S. polycystum* was found to be abundant with a density of 54.76 per .25m^2 surface area. This was followed by *S. oligocystum* (28.96), *S. crassifolium*(13.41), *A. dentata* (9.16), *D. cervicornis* (6.86). the least species was *H. cuneifromis.*

Table 3. Similarity Index of species (%) between Seaweeds Communities

Seaweed Communities	Similarity Index of Species (%)
1. Luna-Balaoan	65.00
2. Luna-Bacnotan	57.50
3. Luna-San Fernando City	52.50
4. Luna-Santo Tomas	23.53
5. Luna-Rosario	25.71
6. Balaoan-Bacnotan	72.50
7. Balaoan-San Fernando City	55.80
8. Balaoan-Santo Tomas	23.08
9. Balaoan-Rpsario	21.95
10. San Fernando City-Santo Tomas	22.85
11. San Fernando City-Rosario	15.38
12. Santo Tomas-Rosario	45.45
13. Bacnotan-San Fernando City	60.00
14. Bacnotan-Santo Tomas	25.00
15. Bacnotan-Rosario	27.03
Mean	**39.552**

Seaweed communities of the six areas under study were compared in terms of the species present. Similarity indices were determined and presented in table 3.

Findings indicate a relatively high similarity indices ranging from 15.38 to 72.50% implying that all areas belong to almost one geographical area. That is, the commonness or similarity of the seaweed species could be attributed to the coral lines nature of the areas.

Among the species, 26 were common to Luna and Balaoan, 23 for Luna and Bacnotan, 21 for Luna and San Fernando City, 8 for Luna and Santo Tomas. Balaoan and Bacnotan had the highest similarity with 29 species, 24 for Balaoan and San Fernando City, 9 for Balaoan and Santo Tomas, 9 for Balaoan and Rosario. For SanFernando and Santo Tomas there were 8 common species, 6 for San Fernando City and Rosario, and 24 for Sam Fernando City and Bacnotan. There were 9 common species for Bacnotan and Santo Tomas, 10 for Bacnotan and Rosario and 5 for Santo Tomas and Rosario.

Overall, the average similarity index was pegged at 39.55

Field monitoring, aside from the data obtained was used to determine the seasonality of seaweeds. La Union as part of region I belongs to two pronounced seasons, dry from November to April and wet, during the rest of the year. As observed, species that abounds during dry season were *Caulerpa spp. Acetabularia spp., Amphiroa spp., Boergensenii forbesii, Ceratodictyon spongiosum, Chaetomorpha crassa, Galaxaura spp., Gracilaria spp., Halimeda spp., Hydroclatrus clathratus, Neomeris van-bosseae, Cymopolia van-bosseae, Padina spp., Udotea orientalis, Valonia aegagropila.* These species showed decline in terms of biomass during rainy season (Appendices 1c, 2c, 3c, 4c, 5c, 6c). Species noted during wet season were *Dictyota spp., Enteromorpha crassa, H. durvillae; Sargassum spp. and Hormophysa cuneiformis* were distributed throughout the seasons.

Table 4. Mean number of seaweed species by distance from shore

Distance From Shore (m)	Sampling Areas							
	LUNA	BALAOAN	BANTAM	Sn. FDO. CITY	STO. TOMAS	ROSARIO	TOTAL	MEAN
5	2.00	4.25	2.25	3.25	1.75	1.50	15.00	2.50
10	2.25	3.00	1.25	3.75	2.00	1.75	14.00	2.33
15	2.50	3.25	2.25	3.50	1.50	0.75	13.75	2.29
20	2.00	3.00	2.00	3.50	1.75	1.50	13.75	2.29
25	2.50	3.00	2.50	4.00	2.00	1.75	15.75	2.63
30	2.00	2.50	2.50	3.50	2.25	2.25	15.00	2.50
35	2.00	2.50	2.50	2.50	2.00	2.00	13.50	2.25
40	2.25	2.75	2.75	3.00	3.00	2.00	15.75	2.63
45	2.25	2.75	2.25	3.00	1.75	1.75	13.75	2.29
50	2.25	2.75	2.75	2.75	2.00	1.75	16.25	2.71
55	3.00	3.50	2.50	3.25	1.50	1.25	15.00	2.25
60	2.75	3.50	3.00	4.00	1.50	1.75	16.50	2.75
65	2.00	2.75	3.25	3.50	1.50	1.00	14.00	2.33
70	2.75	3.25	2.75	3.00	0.75	1.50	14.00	2.33
75	2.75	3.50	2.50	3.25	1.25	1.25	14.50	2.42
80	2.75	3.50	3.00	2.50	1.50	1.25	14.50	2.42
85	2.75	4.25	2.75	3.00	1.50	1.50	15.75	2.63
90	2.75	4.25	2.75	3.25	1.00	1.25	15.25	2.54
95	2.25	3.25	2.50	2.50	0.75	1.25	12.50	2.08
100	2.25	3.75	0.75	2.50	1.25	1.50	12.00	2.00
Total	**49.00**	**66.25**	**48.75**	**63.50**	**32.50**	**30.50**	**290.50**	**48.17**
MEAN	**2.45**	**3.31**	**2.44**	**3.18**	**1.63**	**1.53**	**14.53**	**2.41**

Table 4 presents the mean number of species occurred per quadrat basis (area=0.25m^2) with respect to sampling areas and distance from shore.

In Luna, the presence of species ranged from 2.0 to 3.25 corresponding to a mean of 2.45 species per 0.25m^2 of the intertidal zone. High number of species in quadrat was found at 50-55m strata.

High number of species was found at 50-60 m distance in Balaoan. Occurrence of species however, ranged from 2.5 to 4.25 corresponding to mean of 3.31.

In Bacnotan, higher number of species was also found within 60-65m distances from shore. Seaweed species occurrence ranged from 0.75 to 3.25 corresponding to a mean of 2.44 (Fig. 4).

Table 4a. Similarity (%) of Seaweed Species by Distance from Shore

Distance from shore (m)	Sampling Area						
	Luna	Balaoan	Bacnotan	Sn. Fdo. City	Sto. Tomas	Rosario	Mean
5-10m	30.76	45.00	55.56	55.56	50.00	18.18	42.51
10-15m	26.67	19.05	16.67	47.37	55.56	42.86	34.70
15-20m	12.50	25.00	6.25	64.71	85.71	80.00	45.70
20-25m	28.46	50.00	38.46	42.86	87.50	18.18	45.91
25-30m	50.00	37.50	17.65	50.00	54.55	23.08	38.80
30-35m	45.45	66.67	66.67	41.18	70.00	70.00	60.00
35-40m	70.00	75.00	61.54	37.50	66.67	45.45	59.36
40-45m	50.00	57.14	33.33	50.00	46.15	50.00	47.77
45-50m	69.00	73.33	66.67	35.29	66.67	27.27	56.37
50-55m	47.06	52.63	61.54	26.32	55.56	33.33	46.07
55-60m	35.29	40.00	46.67	52.63	50.00	50.00	45.77
60-65m	46.15	56.25	56.25	30.43	71.43	44.44	50.83
65-70m	58.33	71.43	71.43	36.84	28.57	50.00	52.77
70-75m	46.67	58.582	75.00	47.06	33.33	37.50	49.73
75-80m	37.50	47.37	69.23	35.29	37.50	42.56	44.91
80-85m	57.14	34.78	35.29	69.23	50.00	37.50	47.32
85-90m	69.23	70.00	100.00	78.57	66.67	57.14	73.60
90-95m	33.33	30.43	31.25	27.78	40.00	42.86	34.28
95-100m	80.00	47.37	30.00	53.85	60.00	83.33	59.09

Similarity (%) of seaweed species by distance

Table 4a shows the similarity indices (%) of seaweed communities by distance from shore at 5 meters interval.

In Luna, similarity indices exceeding 50% were noted from 35-40m, 40-45m, 45-50m, 65-70m, 80-85m and 85-90m at 5 meters interval. From 80-85m to 85-90m, distances were assumed to be homogenous in seaweed species composition.

In Balaoan, similarity indices exceeding 50% were found from 30-35m, 70-75m, and 85-90m. These distances were noted to be homogenous in seaweed species composition. Other intervals fall below 50% with 5-10m the least.

In Bacnotan, distance from 5-10m, 30-35m, 35-40m, 50-55m, 60-65m, 65-70m, 75-80m, and 85-90m had more than 50% similarity indices. From 30-35m to 85-90m intervals, species compositions were considered homogenous.

In San Fernando City, distance at 25-30m, 35-40m, were found to be 50% similarity while distances from 5-10m, 15-20m, 55-60m, 80-85m, 85-90m, 95-100m showed indices exceeding 50% while distance 50-55m with the least.

Santo Tomas, intervals with 50% similarities were noted with distances 5-10m, 55-60m, and 80-85m. Distances with similarities more than 50% were noted from 10-15m, 15-20m, 20-25m, 25-30m, 45-50, 50-55m, 60-65m, 85-90m, and 95-100m. The 70-75m distances had the least similarity with 33.33%.

In Rosario, distances with 50% similarities were found at 40-45m, 55-60m, and 65-70m, while distances 30-35m, 85-90m, and 95-100m showed more than 50% similarities. The rest indicated below 50% similarity.

In general, 85-90m distances exhibited the greatest similarity index with 73.6% followed by intervals 30-35m with 60% similarity. Distances from 30-35m to 85-90m were assumed to be homogenous in seaweed species composition with 44.91% to 73.6% similarities. However most indices may be considered moderate or low since most are below 50%. As observed, seaweed communities are more diverse than the areas totally exposed than those areas not exposed due to presence of tidal pools. A distance from high tide level mark to the lowest tidal mark was obviously not flat. And this may caused low similarities in between intervals.

SUMMARY, CONCLUSION and RECOMMENDATION

Summary

This study was conducted to determine the seasonality and abundance of commercially important seaweeds in La Union and to inventory the natural stocks of the different seaweeds in coastal areas of La Union. Sampling was done at selected sampling station using the transect-quadrat method along intertidal zones of six seaweed communities along coastal areas of Luna, Balaoan, Bacnotan, San Fernando City, Santo Tomas and Rosario from February 2002 to January 2003.

Findings reveal the following:

1. There are 46 species of seaweeds along the areas of La Union comprising three classes, 19 families, 13 order and 23 genera. There are 21 species that belong to class *Chlorophyta,* 12 to *Phaeophyta* and 13 to *Rhodophyta.*

2. There are 6 species o *Caulerpa,* 6 species of *Halimeda,* 1 specie *U. orientalis,* 1 *Chaeototomorha crassa,* 2 *Acetabularia,* 1 *Boergensenia forbesii,* 1 specie of *Valonia aegagropila,* 1 specie of *Enteromorpha intestinalis,* 2 species *Dictyota,* 2 species of *Padina*, 5 species o *Sargassum,* 1 specie of *Turbinaria,* 1 *Gelldiella,* 2 *Galaxaura,* 2 *Amphiroa,* 4 *Gracilaria species,* and 1 *Hypnea pannosa.*

3. Balaoan has the most specie recorded and identified consisting of 36 species followed by Bacnotan and San Fernando City with 31 species. Luna has 30 species being recorded, while Santo Tomas and Rosario has the least with 18 and 15 species respectively.

4. Similarity indices from Luna-Balaoan, Balaoan-Bacnotan, and Luna-San Fernando City are high ranging from 52.50% to 72.50%. While from Luna-Santo Tomas and Luna-Rosario are below 50% similarity, likewise, areas from Luna-San Fernando have higher similarities compared to areas from Santo Tomas and Rosario. Overall, the average similarity index was pegged at 39.55%.

5. In terms of distance, similarity above 50% was noted from 30-35m to 85-90m. These distances were assumed to be homogenous in seaweed species composition with 44.91% to 73.6% similarities. However, most indices most indices are considered moderate or low since most are below 50%. As observed, seaweed communities are more diverse than the areas totally exposed than those areas not exposed due to the presence of tidal pools. Distance from high tide level mark to the lowest tidal mark was obviously not flat. And this may caused low similarities in between intervals.

6. Five species appeared high in terms of density. These are *S. polycystum, S. crassifolium, S. cristaefolium, S. oligocystum* and *Padina australis*. The dominant species found throughout the sampling areas is *S. polycystum.*

7. The average number of seaweeds on quadrat basis is 2.41, indicating that at least 2 species is encountered every-time a quadrat is laid.

Conclusion:

In the light of findings, the following are concluded:

1. That the intertidal zones of Luna, Bacnotan and San Fernando City have high seaweed diversity. There are at least 46 species occurring in this area, with Balaoan representing the most number of specie of 36 while Bacnotan, and San Fernando City have 31 species. Santo Tomas has the least number of seaweed sampled.

2. Of all the seaweeds found in La Union, *S.polycystum* is found to be the most dominant species having frequency value of 18,664, cover value of 8,326.6 and a total biomass of 100,656 grams. *Sargassumi species* are found to be the most dominant species over other species. *G. coronopifolia* is considered subdominant along with *H. velasquezii, B. forbesii, C. sertularioides & G. salicornia.*

3. Similarity indices between seaweed communities are average with a mean of 39.55%. 26 were common to Luna and Balaoan, 23 for Bacnotan, 21 for Luna and San Fernando City, 8 for Luna and Santo Tomas. Balaoan and Bacnotan had the highest similarity with 29 species, 24 for Balaoan and San Fernando City, 9 for Balaoan and Santo Tomas, 9 for Balaoan and Rosario. For San Fernando City and Santo Tomas there were 8 common species, 6 for San Fernando and Rosario, and 24 for San Fernando and Bacnotan. There were 9 common species for Bacnotan and Santo Tomas, 10 for Bantam and Rosario, and 5 for Santo Tomas and Rosario.

4. In terms of composition and distribution by distance, indices are considered low or moderate in between intervals. Homogenous species are likely to be found from distance 30-35m to 85-90m.

Recommendation:

1. There's a need to implement seaweed management programs to minimize or at least preserve their biodiversity.

2. Information materials on the identities of commercially important seaweeds in La Union should be made available.

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APPENDICES

List of economically important seaweed species in La Union

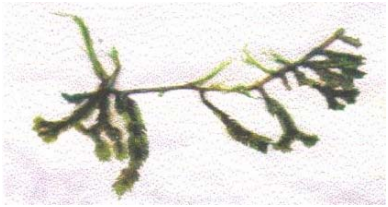
Class: CLOROPHYCEAE
Order: BRYOPSIDALES
Family: CAULERPACEAE

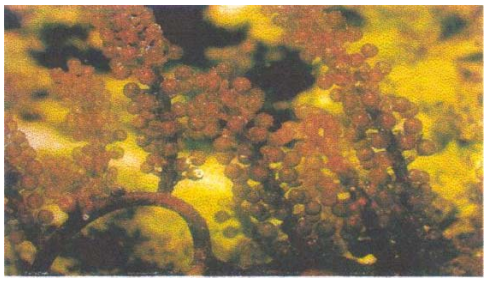
Caulerpa *peltata* (Lamourox) Eubank
Local Name: Payong-payong
Commercial value: Human food
Balaoan, Bacnotan, La Union

Caulerpa *racemosa*
Local Name: Ar-arusip
Commercial value: Human food; with vitamins
Luna, Balaoan, Bacnotan, San Fernando City, La Union

Caulerpa *serulata* (Forsskal) J. Agardh
Local name: Galgalacgac
Commercial value: Human food
Balaoan, Bacnotan, San Fernando City, La Union

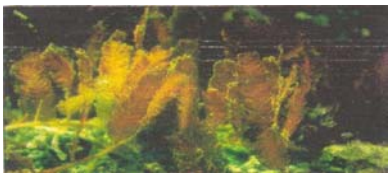
Caulerpa *sertularioides* (Gmelin) Howe
Local name: Salsalamagui
Commercial value: Human food
Balaoan, Bacnotan,San Fernando City, La Union





Caulerpa *lentillifera*
Local name: Ar-arusip
Commercial value: Human food; Mineral content Ca, K, Ma, Na, Cu, Fe, and Zn
Bacnotan, Rosario, La Union

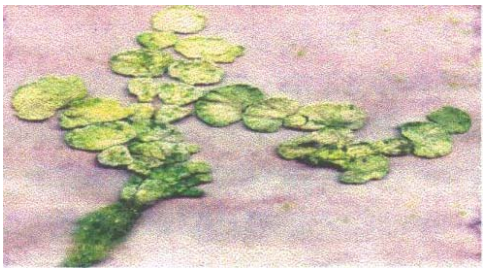
Caulerpa *taxifolia*
Local Name: Lukay-lukay
Commercial value: Human food; Antifungal, Lowers blood pressure Bacnotan, Santo Tomas, La Union

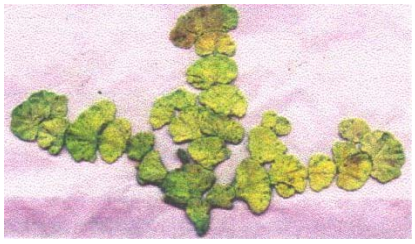


Class: CLOROPHYCEAE
Order: BRYOPSIDALES
Family: HALIMEDACEAE

Halimeda *cylindracea*
Local name: Tuon-tuon
Commercial value: Antibacterial
Luna, Balaoan, San Fernando City La Union

Halimeda *incrassata*
Local name: Tuon-tuon
Commercial value: Antibacterial
Balaoan, La Union





Halimeda *macroloba*
Local name: Tuon-tuon
Commercial value: Antibacterial
Luna. Balaoan, Bacnotan, Sam fermamdo City La Union

Halimeda *macrophysa*
Local name: Tuon-tuon
Commercial value: Antibacterial
Rosario, La Union

Halimeda *tuna*
Local name: Tuon-tuon
Commercial value: Antibacterial
Luna, San Fernando City, La Union

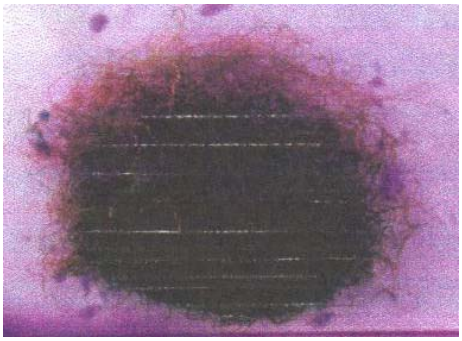
Halimeda*velasquezii*
Local name: Tuon-tuon
Commercial value: Antibacterial
Luna, Balaoan, Bacnotan, San Fernando City, San Tomas, Rosario, La Union

Class: CHLOROPHYCEAE
Order: BRYOPSIDALES
Family: UDTEACEAE

Udotea *oreientalisi*
Local name: Ab-abaniko
Commercial value:
Balaoan, Bacnotan, San Fernando City, La Union

Class: CHLOROPHYCEAE
Order: CLADOPHORALES
Family: CLADOPHORACEAE

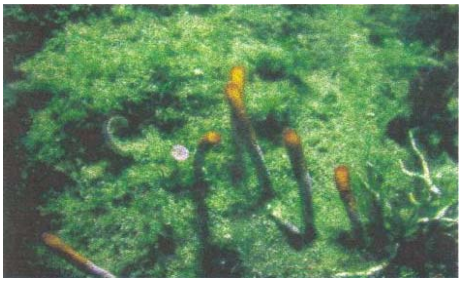
Chaetmorpha *crassa*
Local name: Rip-ripies
Commercial value: Human food
Balaoan, Bacnotan, San Fernando City, La Union



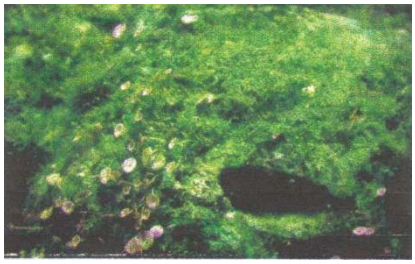
Class: CLOROPHYCEAE
Order: DASYCLANDALES
Family: DASYDACEAE

Cymopolia *vanbosseae*
Local name:
Commercial value:
Luna, Bantam, San Fernando City, La Union

Neomeris *vanbosseae*
Local name:
Commercial value:
Luna, Balaoan, San Fernando City, Santo Tomas, La Union



Class: CLOROPHYCEAE
Order: DASYCLADALES
Family: POLYPHYSACEAE



Acetabularia *dentata*
Local name: Payong-payong
Commercial value:
Bacnotan, San Fernando City, La union

Acetabularia *major*
Local name: Payong-payong
Commercial value: Medicine for renal troubles
Balaoan, La Union

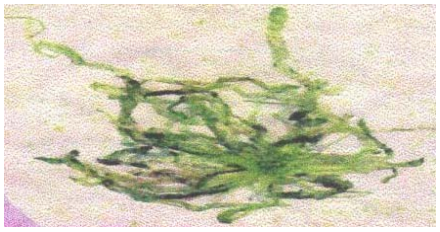
Class: CLOROPHYCEAE
Order: SIPHONNOCLADALES
Family: SIPONNOCLADACEAE

Boergesenia *forbesii*
Local name: Payong-payong
Commercial value: Medicine for renal trouble
Balaoan, Bacnotan, San Fernando City, La Union

Class: CLOROPHYCEAE
Order: SIPHONNOCLADALES
Family: VALONIACEAE

Valonia *aegagropila*
Local name:
Commercial value:
Luna, Balaoan, Bacnotan, San Fernando City, La Union

Class: CLOROPHYCEAE
Order: ULVALES
Family: ULVACEAE



Enteromorpha *intestinalis*
Local name: Lumot
Commercial value: Human food; animal feed
Luna, San Fernando City, La Union

Class: PHAEOPHYCEAE
Order: FUCALES
Family: SARGASSACEAE

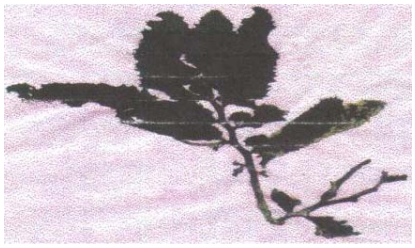
Sargassum *crassifolium*
Local name: Aragan
Commercial value: Human food; animal feed; fertilizer, medicine; vitamins and minerals
Luna, Balaoan, Bacnotan, San Fernando City, Santo Tomas, Rosario, La Union

Sargassum *cristaefolium*
Local name: Aragan
Commercial value: Human food; animal feed; fertilizer, medicine; vitamins and minerals
Luna, Balaoan, Bacnotan, San Fernando City, La Union

Sargassum *oligocystum*
Local name: Aragan
Human food; animal feed; fertilizer; medicine; vitamins and minerals
Luna, Balaoan, Bacnotan, Santo Tomas, Rosario, La Union

Sargassum *polycystum*
Local name: Aragan
Commercial value: Human food; animal feed; fertilizer; medicine; vitamins and minerals
Luna, Balaoan, Bacnotan, San Fernando City, Santo Tomas, Rosario, La Union

Sargassum *ilicofolium*
Local name: Aragan
Commercial value: Human food; animal feed; fertilizer, medicine; vitamins and minerals Balaoan, La Union

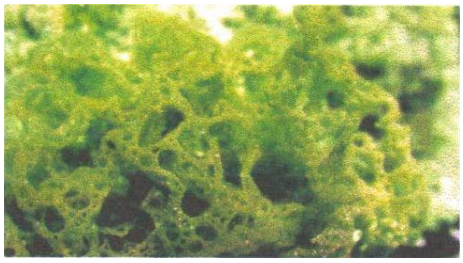


Turbinaria *ornate*
Local name: Aragan
Commercial value:
Balaoan, La Union

Class: PHAEOPHYCEAE
Order: FUCALES
Family: CYSTOSEIRACEAE

Hormophysa *cuneiformis*
Local name: Aragan
Commercial value: Human food; animal feed; fertilizer, vitamins and minerals
Balaoan, La Union

Class: PHAEOPHYCEAE
Order: SCYTOSIPHONALES
Family: SCYTOSIPHONACEAE

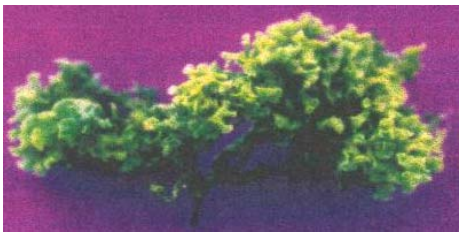


Hydroclathrus *clathratus*
Local name: Balbalolang
Commercial value: Human food; animal feed; source of algin; fertilizer; medicine, vitamins; iodine & manitol; growth regulator
Luna, Balaoan, Bacnotan, Santo Tomas, Rosario, La Union

Class: RHODOPHYSACEAE
Order: CORALLINALES
Family: CORALLINACEAE

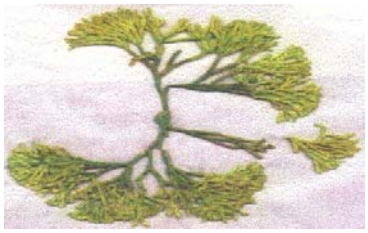
Amphiroa *foliacea*
Local name:
Commercial value
Luna, Balaoan, Bacnotan, La Union

Amphiroa *fragilissima*
Local name:
Commercial value:
San Fernando City, Santo Tomas, La Union



Mastophora *rosea*
Local name:
Commercial value:
Luna, Balaoan, Bacnotan, San Fernando City La Union

Class: RHODOPHYSACEAE
Order: BONNEMAISONIALES
Family: GALAXAURACEAE



Galaxaura *oblongata*
Local name:
Commercial value: Source of sulfated polysaccharide related to carrageenan
Luna, Balaoan, Bacnotan, San Fernando City Santo Tomas, La Union

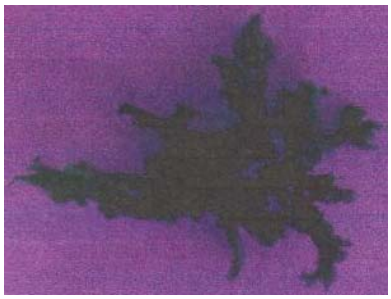
Galaxaura *faciculata*
Localname:
Commercial value: Source of sulfated Polysaccharaide related to carrageenan
Luna, Balaoan, Bacnotan, La Union

Halymenia *durvillaei*
Local name: Aragan ti ilik gamet
Commercial value: Human food; Source of carrageenan
Luna, La Union

Class: RHODOPHYSACEAE
Order: GELIDIALES
Family: GELIDIECEAE

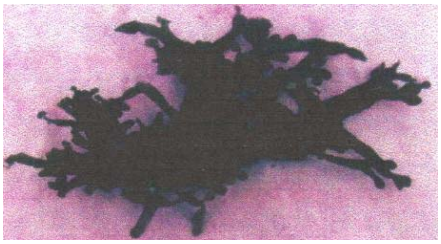
Gelidiella *acerosa*
Local Name: Kulot
Commercial value: Human food; Source of agar
Luna, Balaoan, Bacnotan, San Fernando City, La Union

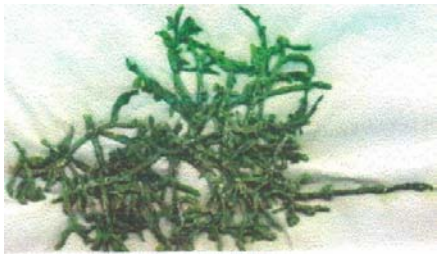
Class: RHODOPHYSACEAE
Order: GIGARTINALES
Family: GRACILARIACEAE



Gracilaria *arcuata*
Local name: Caocaoayan
Commercial value: Human food; Source of agar, animal feed; growth regulator;
Balaoan, Bacnotan, San Fernando City, La Union

Gracilaria *eucheumoides*
Local name: Canocanot
Commercial value: Human food; Source of agar
Luna, Balaoan, Bacnotan, San Fernando City, La Union





Gracilaria *salicornia*
Lcoal name: Susueldo
Commercial value: Human food; source of agar
Balaoan, Bacnotan, San Fernando City, La Union

Class: RHODOPHYSACEAE
Order: GIGARTINALES
Family: GELIDIECEAE

Hynea *pannosa*
Local name: Culot
Commercial value: Human food; source of agar; medicine; antibacterial, antifungal
Luna, Balaoan, San Fernando City Rosario, La Union

Appendix 1a. Total frequency value, (Fv) of seaweeds in La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Boergenzenii forbesii			48	24	72
Caulerpa racemosa	39.2	8			47.2
Ceratodictyon sponguissum			16	64	80
Cymopolia vanbosseae		16	16		32
Dictyota dentata	40	748	60		848
Dictyota dichotoma		12	8		20
Valonia aegagropila				4	4
Amphiroa foliaceae				224	224
Galaxaura fastigiata				84	84
Galaxaura oblongata	140	256		125	521
Gellidiela acerosa		24	144	56	224
Gracilaria arcuata	4	40	36		80
Gracilaria coronopifolia	16	138		60	214
Gracilaria eucheumoides		12			72
Halimeda incrassata		32	60		32
Halimeda macroloba	12				12
Halimeda velasquezii			14		24
Halymenia durvillae		4			4
Hormophysa triquetra	212	440	424	664	1740
Hydroclathrus clathratus	320				320
Hypnea pannosa	256		60		316
Enteromorpha intestinalis			64		64
Masthopora rosea	112		80	60	252
Neomeris vanbosseae				32	32
Padina australis	67		520	216	803
Padina japonica	792		909	316	2017
Sargassum crassifolium	440	6876	288	548	9152
Sargassum cristaefolium	112	1216	228		1556
Sargassum olygocystum				60	60
Sargassum polycystum	884	460	1636	472	3452
Seagrass			124	80	204

Appendix 1b. Total cover value, (Cv) of seaweeds in Luna, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Boergenzenii forbesii			2.0625	1.3125	3.375
Caulerpa racemosa	2.36	0.375			2.735
Ceratodictyon sponguissum			2.25	5.625	7.875
Cymopolia vanbosseae		0.75	0.75		1.5
Dictyota dentata	4.125	54.1875	7.5		65.8125
Dictyota dichotoma		0.9375	0.75		1.6875
Valonia aegagropila				0.1875	0.1875
Amphiroa foliaceae				13.688	13.6875
Galaxaura fastigiata				4.5	4.5
Galaxaura oblongata	62.25	24.5625		13.125	99.9375
Gellidiela acerosa		1.5	15.75	2.625	19.875
Gracilaria arcuata	0.75	2.0625	3.75		6.5625
Gracilaria coronopifolia	6	19.125		75	32.625
Gracilaria eucheumoides		0.5625	3.375		3.9375
Halimeda incrassata		1.3125			1.3125
Halimeda macroloba	3				3
Halimeda velasquezii			1.125		1.125
Halymenia durvillae		0.1875			0.1875
Hormophysa triquetra	74.25	66	122.63	206.63	469.5
Hydroclathrus clathratus	79.5				79.5
Hypnea pannosa	147.75		6.5615		154.3115
Enteromorpha intestinalis			4.875		4.875
Masthopora rosea	14.25		6.75	3.9375	24.9375
Neomeris vanbosseae				1.5	1.5
Padina australis	37		84.188	11.25	132.4375
Padina japonica	167.44		115.5	20.813	303.7525
Sargassum crassifolium	110.63	848.438	177.38	117.69	1254.13
Sargassum cristaefolium	39.5	377.438	55.125		472.0625
Sargassum olygocystum				9.1875	9.1875
Sargassum polycystum	374.06	119.25	902.25	133.69	1529.2475
Seagrass			36.188	37.6875	37.6875

Appendix 1c. Total Biomass in grams of seaweeds in Luna, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Boergenzenii forbesii			234	28	262
Caulerpa racemosa	11.2	4			15.2
Ceratodictyon sponguissum			255	187	442
Cymopolia vanbosseae		4	54		58
Dictyota dentata	49	423	591		1063
Dictyota dichotoma		17	120		137
Valonia aegagropila				4	4
Amphiroa foliaceae				482	482
Galaxaura fastigiata				169	169
Galaxaura oblongata	548	483		374	1405
Gellidiela acerosa		3	522	48	573
Gracilaria arcuata	5	7	243		255
Gracilaria coronopifolia	13	356		254	623
Gracilaria eucheumoides		26	384		410
Halimeda incrassata		12			12
Halimeda macroloba	13				13
Halimeda velasquezii			60		60
Halymenia durvillae		3			3
Hormophysa triquetra	740	1202	6081	4726	12749
Hydroclathrus clathratus	998				998
Hypnea pannosa	719		787		1506
Enteromorpha intestinalis			370		370
Masthopora rosea	136		622	152	910
Neomeris vanbosseae				24	24
Padina australis				279	279
Padina japonica	1869			582	2451
Sargassum crassifolium	1477	9763	3519	2967	17726
Sargassum cristaefolium	184	9763	2779		12726
Sargassum olygocystum				300	300
Sargassum polycystum	3386	2348	17730	3007	26471

Appendix 2a. Total Frequency value, Fv of seaweeds in Balaoan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia major				12	13
Boergenzenii forbesii		20	8	4	32
Bossea		4	12		16
Caulerpa racemosa	184.	236	38	24	482.8
Caulerpa serrulata		40			40
Caulerpa sertularioides	20	4			24
Ceratodictyon spongiussum			4	4	8
Chaetomorpha crassa				20	20
Dictyota dentata		148	112	12	272
Dictyota dichotoma			20	4	24
Valonia aegragropila				72	72
Amphiroa foliaceae				68	68
Galaxaura fastigiata				164	164
Galaxaura oblongata	96	256	178	80	610
Gellidiela acerosa		204	60	212	476
Gracilaria arcuata				44	44
Gracilaria coronopifolia	8	24	156	92	280
Gracilaria euecheumoides				40	40
Gracilaria salicornia				8	8
Halimeda incrassata				16	16
Halimeda macroloba	8	104			112
Halimeda velasquezii		380	588	40	40
Hromophysa triquetra	180	4		716	1864
Hydroclathurs clathratus	224	56	40		228
Hypnea pannosa	254	323	8	72	422
Masthopora rosea	56			104	491
Neomeris vanbosseae			776	12	12
Padina australis	79			388	1243
Padina japonica	364			240	604
Sargassum crassifolium	350	1112	1092	680	3234
Sargassum cristaefolium	44	460	216	420	1140
Sargassum filamentosa			76		76
Sargassum olygocystum			300	84	384
Sargassum illicofolium			4		4
Sargassum polycystum	184	136	884	670	1874
Seagrass		424	468	824	1716
Turbinaria ornate		8	12	4	24
Udotea orientalis				8	8

Appendix 2b. Total Cover value, Cv of seaweeds in Balaoan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia major				0.5625	0.5625
Boergenzenii forbesii		0.9375	0.75	0.1875	1.875
Bossea		0.1875	0.9375		1.125
Caulerpa racemosa	23.1	18	1.125	1.125	43.35
Caulerpa serrulata		3.5625			3.5625
Caulerpa sertularioides	0.9	0.375			1.275
Ceratodictyon spongiussum			0.375	0.375	0.75
Chaetomorpha crassa				0.9375	0.9375
Dictyota dentata		5.25	15	0.5625	20.8125
Dictyota dichotoma			1.125	0.375	1.5
Valonia aegagropila				3.5625	3.5625
Amphiroa foliaceae				4.125	4.125
Galaxaura fastigiata				20.8125	20.8125
Galaxaura oblongata	21.75	35.0625	23.437	12.9375	93.187
Gellidiela acerosa		13.125	4.125	15	32.25
Gracilaria arcuata				11.625	11.625
Gracilaria coronopifolia	0.375	3.375	30.1875	18.9375	53.25
Gracilaria euecheumoides				1.875	1.875
Gracilaria salicornia				0.375	0.375
Halimeda incrassata				0.75	0.75
Halimeda macroloba	0.375	4.9			5.275
Halimeda velasquezii				1.875	1.875
Hormophysa triquetra	57.75	82.5	210.1875	241.125	591.5625
Hydroclathurs clathratus	62.53	0.1875			62.7175
Hypnea pannosa	66.75	9.75	1.3125	3.9375	84.75
Masthopora rosea	18.14	21.375	0.5625	6.5625	46.64
Neomeris vanbosseae				0.5625	0.5625
Padina australis	50		78.1875	55.6875	183.875
Padina japonica	115.5			38.06875	153.56875
Sargassum crassifolium	112	241.3125	528	202.5	1093.8125
Sargassum cristaefolium	17.25	210.9375	42.5625	45.375	316.125
Sargassum filamentosa			17.0625		17.0625
Sargassum olygocystum			96	18.9375	114.9275
Sargassum illicifolium		11.8125			11.8125
Sargassum			0.375		0.375
Sargassum polycystum	71.25	72.375	488.25	237.5625	869.4375
Seagrass		92.25	301.5	419.25	813
Turbinaria ornate		0.375	0.5625	0.1875	1.125
Udotea orientalis				0.375	0.375

Appendix 2c. Total Biomass in grams of seaweeds in Balaoan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Acetabularia major				16	16
Boergenzenii forbesii		14	14	8	36
Bossea		2	14		16
Caulerpa racemosa	242.2	178	37	47	504.2
Caulerpa serrulata		349			349
Caulerpa sertularioides	2	7			9
Ceratodictyon spongiussum			9	25	34
Chaetomorpha crassa				31	31
Dictyota dentata		53	166	16	235
Dictyota dichotoma			28	16	44
Valonia aegagropila				79	79
Amphiroa foliaceae				140	140
Galaxaura fastigiata				625	625
Gellidiela acerosa		214	102	316	632
Gracilaria arcuata				285	285
Gracilaria euecheumoides					50
Gracilaria salicornia				16	16
Halimeda incrassata				27	27
Halimeda velasquezii				92	92
Neomeris vanbosseae				24	24
Padina japonica	1177			572	1749
Sargassum filamentosa			157		157
Sargassum olygocystum			1923	479	2402
Sargassum polycystum		191			191
Sargassum crassifolium			9		9
Seagrass					
Turbinaria ornate		3	14	8	25
Udotea orientalis				8	8

Appendix 3a. Total frequency Value, Fv of seaweeds in Bacnotan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Sargassum polycystum	232	608	1328	2452	4620
Boergenzenii forbesii		4		32	36
Caulerpa peltata		24			24
Caulerpa racemosa		164		184	348
Caulerpa rentifera			8		8
Caulerpa serrulata	4	76	20		100
Caulerpa sertularioides	124	80		16	220
Ceratodictyon		8	4	40	52
Chaetmorpha crassa		20		12	32
Cymopolia vanbosseae		8	8		16
Dictyota dentata	20	208		16	244
Dictyota dichotoma			4		4
E. valonia				8	8
F. amphiroa				156	156
Galaxaura fastigiata			8	8	16
Galaxaura oblongata	108	216	8	56	388
Gellidiela acerosa		28	4	52	84
Gracilaria arcuata			16		16
Gracilaria coronopifolia				12	12
Gracilaria eucheumoides				12	12
Halimeda incrassata		4			4
Halimeda velasquezii		108		36	144
Hormophysa triquetra	112	148	206	496	962
Hydroclathrus clathratus	201				201
Mastophora rosea	8	44	12	112	176
Padina australis	74	1120	124	136	1454
Padina japonica				204	204
Sargassum crassifolium	40	18260148	960		2974
Sargassum cristaefolium	904	780	80	32	1796
Sargassum olygocystum		268	712		980
Seagrass			404	964	1368
Udotea orientalis		64	84	108	256

Appendix 3b. Total Cover Value, Cv of seaweeds in Bacnotan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Boergenzenii forbesii		0.1875		1.5	1.6875
Caulerpa peltata		405			4.5
Caulerpa racemosa		23.1825		8.625	31.8075
Caulerpa rentifera			0.375		0.375
Caulerpa serrulata	0.19	12.1875	0.9375		31.315
Caulerpa sertularioides	3.19	21		0.75	24.94
Ceradictyon sponguissum		0.375	0.375	2.25	3
Ceratodictyon		0.9375		0.5625	1.5
Chaetmorpha crassa		0.375	0.375		0.75
Cymopolia vanbosseae7.69	12		0.9375		20.6275
Dictyota dentata		0.375			0.375
Dictyota dichotoma			0.375		0.375
E. valonia			9.5625		9.5625
F. amphiroa		1.5	0.375		1.875
Galaxaura fastigiata	28.58	14.25	1.5	5.0625	49.3925
Galaxaura oblongata		4.5	0.1875	3.75	8.4375
Gellidiela acerosa			1.5		1.5
Gracilaria arcuata				0.5625	0.5625
Gracilaria coronopifolia				0.5625	0.5625
Gracilaria eucheumoides		0.375			0.375
Halimeda incrassata		5.25		1.6875	6.9375
Halimeda velasquezii	22.75	24	44.813	113.81	205.375
Hormophysa triquetra	5.4375				5.4375
Hydroclathrus clathratus	0.75	2.25	1.25	6.9375	11.0625
Mastophora rosea		65.625	6.9375	7.8625	80.425
Padina australis				21.575	21.575
Padina japonica	30	679.125	32.2	338.25	1079.575
Sargassum crassifolium	360.5	338.255	36.75	10.875	746.3797
Sargassum cristaefolium	18.75	98.0625	316.31		414.375
Sargassum olygocystum		292.313	633.38	1443.3	238.75
Seagrass			116.25	215.25	331.5
Udotea orientalis		3.5625	5.0625	5.0625	13.6875

Appendix 3c. Total Biomass in grams of seaweeds in Bacnotan, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Boergenzenii forbesii		4		42	46
Caulerpa peltata		58			58
Caulerpa racemosa		288		170	458
Caulerpa rentifera			4		4
Caulerpa serrulata	2	288	12		302
Caulerpa sertularioides	65	34		20	119
Ceradictyon sponguissum		4	4	78	86
Ceratodictyon		8		20	28
Chaetmorpha crassa		6	4		10
Cymopolia vanbosseae7.69	37	141		39	217
Dictyota dentata			4		4
Dictyota dichotoma				8	8
E. valonia				242	242
F. amphiroa			23	16	39
Galaxaura fastigiata	318	270	23	161	772
Galaxaura oblongata		38	4	91	133
Gellidiela acerosa			4		4
Gracilaria arcuata				33	33
Gracilaria coronopifolia				23	23
Gracilaria eucheumoides		6			6
Halimeda incrassata		39		41	80
Halimeda velasquezii	172	503	812	2929	4416
Hormophysa triquetra	68				68
Hydroclathrus clathratus	7	45	23	201	276
Mastophora rosea		686	94	132	912
Padina australis				277	277
Padina japonica	744	6977	571	4935	13227
Sargassum crassifolium	3736	2916	252	140	7044
Sargassum cristaefolium		720	3798		4518
Sargassum olygocystum	950	2706	8069	16196	27921
Seagrass					
Udotea orientalis		41	62	78	181

Appendix 4a. Total Frequency value, Fv of Seaweeds in San Fernando City, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia dentata	4	8	20	20	52
Aegagrapila valonia			8		8
Amphiroa fragilissima			12	60	72
Boergenzenii forbesii		8			8
Caulerpa racemosa	319	36	8	156	519
Caulerpa serrulata				40	40
Caulerpa sertularioides	124				124
Ceratodictyon spongiussum			32	84	116
Chaetodictyon crassa			12	16	28
Cymopolia vanbosseae		52			52
Dictyota dichotoma	188	48	4	12	252
Galaxaura fastigiata			64	96	160
Galazaura oblongata	276			102	378
Gellidiela acerosa	386.4			32	418.4
Gracilaria arcuata		12	32	44	88
Gracilaria eucheumoides			4		4
Gracilaria salicornia			52		52
Halimeda		20			20
Helimeda cylindriceae		248	144		392
Halimeda macroloba	238	48		168	48
Halimeda taxifolia			8	4	438
Halimeda velasquezii		4		120	12
Hormphysa triquetra	12	4	288	208	124
Hypnea pannosa			64		512
Masthopora rosea	28			24	64
Neomeris vanbosseae			12	76	52
Padina japonica	252	716	112	124	88
Sargassum crassifolium		180	408	1488	1204
Sargassum cristaefolium	964		148	40	2076
Sargassum polycystum	2536	60	1260	1092	1152
Udotea orientalis		84	128	290	502

Appendix 4b. Total Cover Value, Cv of seaweeds in San Fernando City, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia dentata	0.375	0.375	1.3125	0.9375	3
Aegagrapila valonia			0.375		0.375
Amphiroa fragilissima			0.9375	6.9375	7.875
Boergenzenii forbesii		0.375			0.375
Caulerpa racemosa	18.5	4.3125	0.75	12.1875	35.75
Caulerpa serrulata				2.25	2.25
Caulerpa sertularioides	3.19				3.19
Ceratodictyon spongiussum			1.6875	14.0625	15.75
Chaetodictyon crassa			0.5625	1.5	2.0625
Cymopolia vanbosseae		10.125			10.125
Dictyota dentata	21	6.75	0.1875	0.75	28.6875
Dictyota dichotoma			2.625	6.9375	9.5625
Galaxaura fastigiata	42			7.3125	49.3125
Galazaura oblongata	58.8			1.6875	60.4875
Gellidiela acerosa		1.875	1.875	3.1875	6.9375
Gracilaria arcuata			0.75		0.75
Gracilaria eucheumoides			4.125		4.125
Gracilaria salicornia		1.3125			1.3125
Halimeda		96.188	7.6875		103.875
Helimeda cylindriceae		24			24
Halimeda macroloba	58.44	1.6875		8.8125	68.94
Halimeda taxifolia			0.375	0.1875	0.5625
Halimeda velasquezii		0.1875		6.1875	6.375
Hormphysa triquetra	1.125	0.375	82.25	56.437	140.187
Hypnea pannosa			7.5		7.5
Masthopora rosea	3.75			1.5	5.25
Neomeris vanbosseae			1.125	3.5625	4.6875
Padina japonica	19.875	53.063	6.375	9.1875	88.5
Sargassum crassifolium		17.438	52.75	454.5	524.6875
Sargassum cristaefolium	152.42		28.313	5.25	185.9825
Sargassum polycystum	652.5	7.5	498.19	483	1641.1875
Udotea orientalis		4.875	7.5	16.875	29.25

Appendix 4c. Total biomass in grams of seaweeds in San Fernando City, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Acetabularia dentata	2	6	8	16	32
Aegagrapila valonia			8		8
Amphiroa fragilissima			40	110	150
Boergenzenii forbesii		5			5
Caulerpa racemosa	131.6	40	35	201	407.5
Caulerpa serrulata				34	34
Caulerpa sertularioides	65				65
Ceratodictyon spongiussum			40	222	262
Chaetodictyon crassa			25	29	54
Cymopolia vanbosseae		205			205
Dictyota dentata	76	81	4	23	184
Dictyota dichotoma			28	118	146
Galaxaura fastigiata	325			158	483
Galazaura oblongata	455			42	197
Gellidiela acerosa		25	30	84	139
Gracilaria arcuata			15		15
Gracilaria eucheumoides			77		77
Gracilaria salicornia		33			33
Halimeda		1094	138		1232
Helimeda cylindriceae		208			208
Halimeda macroloba	559	74		270	903
Halimeda taxifolia			8	4	12
Halimeda velasquezii		3		153	156
Hormphysa triquetra	7	17	1501	1153	2678
Hypnea pannosa			81		81
Masthopora rosea	9			48	57
Neomeris vanbosseae			9	93	101
Padina japonica	129	816	105	141	1191
Sargassum crassifolium		784	1148	6442	8374
Sargassum cristaefolium	1102		474	125	1701
Sargassum polycystum	4775	249	8172	5419	18615
Udotea orientalis		66	76	211	353

Appendix 5a. Total Frequency Value, Fv of seaweeds in Santo Tomas, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia dentata	18.7				18.7
Amphiroa fragilissima			152		152
Caulerpa sertularioides		4			4
Cymopolia vanbosseae			68		68
Dictyota dentata	52	224	48		324
Galaxaura oblongata	64	204			268
Gracilaria			12		12
Halimeda macrophysa		48			48
Halimeda velasquezii		176			176
Hydroclathrus clathratus	41				41
Intemorpha intestinalis		44			44
Neomeris vanbosseae	68				68
Padina australis	948				948
Padina japonica	67				67
Sargassum crassifolium		52	20		72
Sargassum olygocystum		456	4		460
Sargassum polycystum	438	1180	1228		2846
Seagrass		200	464		664
Caulerpa taxipolia		8			8
Udotea orientalis			8		8

Appendix 5b. Total Cover Value, Cv of Seaweeds in Santo Tomas, La union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Cv**
Acetabularia dentata	0.88				0.88
Amphiroa fragilissima			14.438		14.4375
Caulerpa sertularioides		0.1875			0.1875
Cymopolia vanbosseae			5.1825		5.1825
Dictyota dentata	3.375	25	2.25		30.625
Galaxaura oblongata	5.44	16.875			22.315
Gracilaria			4.5		4.5
Halimeda macrophysa		2.25			2.25
Halimeda velasquezii		9.56			9.56
Hydroclathrus clathratus	0.19				0.19
Intemorpha intestinalis		3			3
Neomeris vanbosseae	3.56				3.56
Padina australis	176.6				176.6
Padina japonica	49				49
Sargassum crassifolium		6.5625	2.25		8.8125
Sargassum olygocystum		204.375	0.1875		204.5625
Sargassum polycystum	521.06	407.625	607.31		1535.9975
Seagrass		37.5	177.75		215.25
Caulerpa taxipolia		0.5625			0.5625
Udotea orientalis			0.375		0.375

Appendix 5c. Total Biomass in grams of seaweeds in Santo Tomas, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Cv**
Acetabularia dentata	12.2				12.2
Amphiroa fragilissima			241		241
Caulerpa sertularioides		4			4
Cymopolia vanbosseae			127		127
Dictyota dentata	31	480	37		548
Galaxaura oblongata	52	191			243
Gracilaria			150		150
Halimeda macrophysa		58			58
Halimeda velasquezii		165			165
Hydroclathrus clathratus	5				5
Intemorpha intestinalis		84			84
Neomeris vanbosseae	20				20
Padina australis	1515.5				1515.5
Padina japonica	24				24
Sargassum crassifolium		101	70		171
Sargassum olygocystum		2489	20		2509
Sargassum polycystum					
Seagrass		12			12
Caulerpa taxipolia			4		4
Udotea orientalis					

Appendix 6a. Total Frequency Value, Fv of seaweeds in Rosario, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia dentata	588				588
Bossaeae		48			48
Caulerpa rentifera		16			16
Dictyota dentata	24	164			288
Galaxaura oblongata	26	112			138
Gracilaria coronopifolia	32	20			52
Gracilaria salicornia		26			26
Halimeda velasquezii		168			168
Hormophysa triquetra	8				8
Hydroclathrus clathratus	60				60
Hypnea		76			76
Padina australis	240				240
Sargassum crassifolium		340			340
Sargassum olygocystum		492			492
Sargassum polycystum	168	756			924
Seagrass		80			80

Appendix 6b. Total Cover Value, Cv of seaweeds in Rosario, La Union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Fv**
Acetabularia dentata	43.74				43.74
Bossaeae		4.6875			4.6875
Caulerpa rentifera		1.5			1.5
Dictyota dentata	1.31	18			19.31
Galaxaura oblongata	2.82	19.5			22.32
Gracilaria coronopifolia	2.63	1.3125			3.9425
Gracilaria salicornia		1.6875			1.6875
Halimeda velasquezii		10.3125			10.3125
Hormophysa triquetra	0.75				0.75
Hydroclathrus clathratus	11.81				11.81
Hypnea		9			9
Padina australis	26.06				26.06
Sargassum crassifolium		79.4625			79.4625
Sargassum olygocystum		200.688			200.6875
Sargassum polycystum	30.7	331.938			362.6375
Seagrass		12			12

Appendix 6c. Total Biomass in grams of seaweeds in Rosario, La union

Seaweed Species	**1st**	**2nd**	**3rd**	**4th**	**Total Biomass**
Acetabularia dentata	732.7				732.7
Bossaeae		125			125
Caulerpa rentifera		17			17
Dictyota dentata	30	520			550
Galaxaura oblongata	61.02	377			438.02
Gracilaria coronopifolia	31	29			60
Gracilaria salicornia		25			25
Halimeda velasquezii		29			29
Hormophysa triquetra	7				7
Hydroclathrus clathratus	52				52
Hypnea		92			92
Padina australis	240				240
Sargassum crassifolium		1073			1073
Sargassum olygocystum		2317			2317
Sargassum polycystum	272	4109			4381
Seagrass	0	0	0	0	0