

EDIBLE SEAWEEDS OF ILOCOS NORTE: FOOD PREPARATIONS OTHER LOCAL USES AND MARKET POTENTIALS

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Abstract

The study deals with the economic importance of seaweeds in Ilocos Norte, which is an account of the researcher's survey of edible seaweeds of the province. Seaweed gatherers and vendors in public markets were interviewed to determine the respondent's socio-economic profiles, the species of seaweeds that are commonly harvested for home consumption and for market both inside and outside the province, and the marketing channels and practices of the vendors.

Also, the researchers determined what seaweeds the respondents prefer to eat, their methods of preparation, and some of the uses of seaweeds. The local names of the seaweeds were noted. Fresh samples from the sea and dried samples from the markets were brought in the laboratory for identification.

Frequencies, percentages and means were used in the analysis of data gathered from the interview schedule. Fresh samples from the markets were brought to the laboratory for proper identification.

Result of the study shows that majority of the respondents of this study are young, majority female and majority married, elementary graduates belonging to small and medium household size. Majority have minimum income which is not sufficient for their basic needs.

There are 22 genera of seaweeds belonging to green, brown and red algae that are used as food in Ilocos Norte. Food preparation of the seaweeds may be in the form of salad, vegetable for viand, dessert or pickles. Other local uses include: medicine, fertilizer and insect repellent.

The flow of the wet/raw seaweeds from gatherers to consumers passes through several middlemen before it reaches the consumers. The current market price of seaweeds ranges from Php50.00/kg fresh form and Php300/kg dried form.

Based on the result of the social aspect and the presence of potential species of seaweed in Ilocos Norte, there is a need to develop food products for the gatherers to meet their basic needs in life.

Key words: edible seaweeds, food preparation, market potential

Introduction

The coastline of Ilocos Norte which runs along China Sea has rugged topography. This contributes to the diversity, in kind and in number, of marine macro algae or seaweeds in this part of the country. Most seaweeds are benthic, that is, they are anchored to the substratum by root-like holdfast. This holdfast is for attachment only, not for drawing nutrient as the root of higher plants.

Representatives of macro-algae include green (Chlorophyceae), brown (Phaeophyceae) and red algae (Rhodophyceae). Seaweeds are known by their dialect names of which they depict their physical appearance.

The resources of the sea are not only confined to animal products such as fish, crustaceans and mollusks but also include a myriad of plant products most notably the edible seaweeds. From nearly ancient times, almost all Ilocanos were accustomed to eat various species of seaweeds not only to those living near the seashore but also to those in the hinterlands. It is an alternative food for the fisher folks during turbulent weather which deters fishermen to catch fish. Seaweeds are accepted by the people as main food preparations either in fresh or dried forms.

The seaweed industry in Ilocos Norte is confined to gathering and commercial culture is not practiced. As a local industry it became significant means of livelihood and source of other income. Sun drying is the only post-harvest processing employed by the gatherers to extend the shelf-life of the seaweeds. Fresh and dried seaweeds are sold in public market in Ilocos Norte. The biggest market for dried seaweeds is in the public market of Laoag City and the Ilocano “balikbayans”. It is their favorite take home or “pasalobong” when they return back to their residence abroad.

The economic importance of seaweeds may be better understood and appreciated through a study to look into botanical aspects of edible species but into the industry itself as it influences the socio-economic lives of the people.

Review of Related Literature

Seaweeds are vegetable of the sea that are rich in vitamins, minerals and trace elements (Ridulme, 1983). It contains a variety of protective compounds that may help ward off some serious health threats.

Thousands of years ago, the Chinese have been using seaweeds as vegetable in their diets and have introduced dried algae as foodstuff in Japan. The Japanese eat seaweeds as regular as the people of the United States eat tomatoes and lettuce. Hawaii, Philippines, Malaysia and Indonesia use a great deal of seaweeds for food, whereas in Scotland, Ireland, British Europeans, Scandinavia and France, they employ seaweeds in small amounts as food adjuncts. The *Porphyra*, locally known as “gamet” and popularly known as “nori” in Japan, has grown steadily so that the production of the seaweeds as farm vegetable has reached proportions (Dawson, 1966).

The occurrence of *Porphyra* in the Philippines is restricted to some places in Ilocos Norte and Cagayan due to some hydrographical conditions. They grow at the supralittoral spray zone and are gathered during the cold months of the year, from November to February. *Porphyra* seaweeds command the highest price of all seaweeds sold in the local market and are classified in their color and texture – lustrous purple black is more expensive than the dull brownish ones. Early appearance of the plants are considered better class in November and December, while the proper or inferior class are gathered in January to February when the plants are about to disappear (Agngarayngay, 2000).

Several writers have previously published food potentials of seaweeds (Montilla and balance 1953; Galutira and Velasquez; 1963; Bersamin et al; Cordero, 1974; Tungpalan, 1983; and Agngarayngay, 1983). The genera utilized as food includes: *Beorgesenia*; *Caulerpa*; *Chaetomorpha*; *Codium*; *Dictyosphaeria*; *Enteromorpha*; *Ulva*; *hydroclathrus*; *Sargassum*; *Turbinaria*; *Laurencia*; *Liagora*; *Rhodymenia*; *Acanthophora*.

Objectives

This study was conducted to determine the species of seaweeds gathered for food, for other uses, and their market potentials. Specifically it aims to:

1. determine the profile of the seaweed gatherers and market vendors;
2. identify the species of edible seaweed found in different coastal areas of I.N;
3. present food preparations, other local uses and photographs of seaweeds; and
4. determine the marketing channel and market prices.

Significance of the study

The seaweed gatherers will benefit from this study. The findings of this study will serve as basis to improve the post harvest method and the marketing aspect of the product. This is compliance with the government thrust in putting up local industries in the coastal areas particularly product development from seaweeds. This activity will encourage the promotion of livelihood projects in the localities.

Methodology

The conduct of this study was limited to the coastal areas of Currimao, Burgos and Pagudpud, Ilocos Norte. The selection of the collection areas was based mainly on the type of substratum. This is one of the important factors that would affect the type of seaweeds that grow in an area. The first collection town was Currimao in barangay Pangil. It has a relatively wide corally reef coastline with somewhat narrow tide pools. Along the edge of the reef is the surf beaten area characterized by a steep rock-face that drops off abruptly. The second collection town was Burgos in two barangays namely: Paayas and Ablan. The former has sandy and muddy stratum with scattered rock boulders. It is characterized by a wide mid-littoral zone. The latter has promontory of

coral reef forming deep and wide tide pools which are periodically filled with water by heavy surf from the sea. This area is characterized as supralittoral zone or spray zone.

Fifty-two seaweed gatherers/vendors were the respondents of the study. A questionnaire was used in gathering the data. This is supplemented with informal interview with the respondents. Frequencies, percentages and means were used in the analysis of data. Also, information as to what seaweeds the respondents prefer to eat, their method of preparation, and some other uses of seaweeds were asked. The local names of the seaweeds were noted. Fresh samples from the sea and dried samples from the markets were brought in the laboratory for proper identification. All available references were used and consultations were conducted to obtain high confidence on taxonomic identification.

Result and Discussion

Table 1. The social profile of seaweed gatherers and market vendors of I.N. (n=52)

Profile Factors	Frequency	%
Age: Young (below 41-50)	31	59.6
Middle (51-60)	15	28.9
Old (61 and above)	6	11.5
Sex: Female	36	69.2
Male	16	30.8
Civil Status: Single	7	13.5
Married	38	73.0
Widow/widower	7	13.5
Educational Attainment: Elementary	25	48.1
High School	18	34.6
College	9	17.3
Household Size: Big (10-14)	16	30.8
Medium (6-9)	18	34.6
Small (2-5)	18	34.6
*Main Occupation: Seaweed Gathering	33	63.4
Market Vendor	12	23.0
Seaweed Gatherer & Vendor	8	15.3
Fishing	14	26.9
Farming	15	28.8
Carpentry	10	19.2
Driving	8	15.3
Monthly Income: 4,500 – 5,000 and above	12	23.0
4,000 – 4,495	7	13.4
3,500 – 3,995	0	0.0
3,000 – 3,495	11	21.1
2,500 2,995	0	0.0
2,000 – 2495	14	26.9
Cannot quantify	8	15.3
Number of years engaged in the industry		
Long (11 year and above)	24	46.2
Quite Long (6-10 years)	18	34.6
Recently (1-5 years)	10	19.2
Sufficiency of income from the industry to support the family		
More than sufficient	7	13.5
Sufficient	12	23.1
Not sufficient	33	63.4

*Multiple response

Socio-economic Profile

Table 1 shows the economic profile of seaweed gatherers and market vendors. Most of the respondents were young (59.6%) from 41-45 years old, female (69.2%), and married (73%). Most of them were elementary graduates (41.1%) with small (34.6%) to medium (34.6%) household size. Majority were engaged in seaweed gathering (63.4%) who got an income of Php2,000 – 2495 per month (26.9%). Their farmer or fishermen husbands augment their income for their daily needs. It's been a long time that they work in the seaweed gathering industry and they admitted that their income from seaweed gathering is not sufficient (63.4%) for their food, clothing and education of their children.

Table 2 Seaweeds found in different coastal areas of Ilocos Norte

Genera	Coastal Areas		
	Currimaos	Burgos	Pagudpud
Red Algae			
<i>Acatopora</i>	X	X	X
<i>Gracilaria</i>	X	X	X
<i>Halymenia</i>	X	X	X
<i>Hypnea</i>	X	X	X
<i>Laurencia</i>	X	X	X
<i>Liagora</i>	X	X	X
<i>Porphyra</i>	-	X	X
<i>Scinia</i>	-	X	X
<i>Callophyllis</i>	X	X	X
<i>Eucheuma</i>	-	X	X
<i>Kappaphycus</i>	-	X	X
<i>Betaphycus</i>	-	X	X
Brown Algae			
<i>Hydroclathrus</i>	X	X	X
<i>Sargassum</i>	X	X	X
<i>Rosenvingae</i>	-	X	X
<i>Hormophysa</i>	X	X	X
Green Algae			
<i>Caulerpa</i>	X	X	X
<i>Chaetomorpha</i>	X	X	X
<i>Cladophora</i>	X	X	X
<i>Codium</i>	X	X	X
<i>Enteromorpha</i>	X	X	X
<i>Ulva</i>	X	X	X

Distribution of Edible Genera

The number of genera of edible seaweeds in Ilocos Norte used as food is: twelve for red algae, four and six for brown ones and green ones respectively. Seaweed occurrence in different coastal areas of the province is shown in Table 2. All genera are

found in the three coastal areas except for *Rosenvingae*, *Porphyra* and *Scinia* which are found in Burgos and Pagudpud.

Food preparation of seaweeds

In Ilocos Norte, seaweeds occupy an important position as human food. It is not an exaggeration to say that there is no other place in the country, besides Ilocos Norte where seaweeds are used so abundantly as food. The well being of the Ilocanos living near the sea can be attributed to their diet which comprised mostly sea foods, particularly seaweeds.

About 22 genera of seaweeds belonging to green, brown and red algae are used as food in Ilocos Norte. Food preparations of the green (Table 3), brown (Table 4) and red algae (Table 5) may be in the form of salad, vegetables for viand, dessert or pickles.

It can be observed in table 3 that green algae had only one type of preparation, that is, into salad because their thalli are soft flat papery and some contain water when fresh. It is obvious from the table that common name is the same for the different species of each genus.

Table 3. Food Preparation of the green algae (*Chlorophyceae*)

Scientific Name	Common Name	Food Preparation
<i>Ulva lactuca</i>	Gamgamet	Salad
<i>Enteromorpha compressa</i>	Bagisbagis	Salad
<i>Chaetomorpha crassa</i>	Riprippiis	Salad
<i>Chaetomorpha media</i>	Riprippiis	Salad
<i>Cladophora rugulosa</i>	Kulkulasisi	Salad
<i>Cladophora rupestris</i>	Kulkulasisi	Salad
<i>Caulerpa lentillifera</i>	Ararusip	Salad
<i>Caulerpa racemosa</i>	Ararusip	Salad
<i>Caulerpa racemosa var. peltata</i>	Ararusip	Salad
<i>Caulerpa racemosa var. uvifera</i>	Ararusip	Salad
<i>Codium edule</i>	Pukpuklo	Salad
<i>Codium repens</i>	Pukpuklo	Salad

The brown algae can be prepared into salad or cooked with fish or meat. Salad preparation is suited for the soft thallied brown algae such as *Hydroclathrus* and *Rosenvingae* as well as the tender tops of *Hormophysa* and *Sargassum*, but they must be blanched before garnishing. Whole plat of *Hormophysa* and *Sargassum* can be cooked with fish or meat.

The red algae had the most number of edible species and have a variety of food preparations. Table 5 shows that common names vary even of the same genus. For example, the genus *Gracilaria* has nine edible species but it is called by eight different names. *Eucheuma*, *Kappaphycus* and *Betaphycus* have single common name, that is,

Table 4. Food Preparation of the brown algae (Phaeophyceae)

Scientific Name	Common Name	Food Preparation
<i>Hydroclathrus clathraus</i>	Balbalulang	Salad
<i>Rosenvingae intricata</i>	Samsamit	Salad
<i>Hormophysa triquetra</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum cintum</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum confusum</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum cristaefolium</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum gracillimum</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum hemiphyllum</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish
<i>Sargassum kushimotoense</i>	Aragan	Salad (tender tops) Lining of pot when boiling fish

Gracilaria is also called “kanutkanot”, that is *G. arcuata*, and this can be explained by the close resemblance in external appearance of *Gracilaria arcuata* to the three genera which are *Eucheuma*, *Kappaphycus* and *Betaphycus*.

Table 5. Food Preparation for the red algae (Rhodophyceae)

Scientific Name	Common Name	Food Preparation
<i>Bangia fuscopurpurea</i>	Bubuok	Salad
<i>Porphyra crispate</i>	Gamet	Salad; mix with viand
<i>Porphyra suborbiculata</i>	Gamet	Salad; mix with viand
<i>Porphyra marcosii</i>	Gamet	Salad; mix with viand
<i>Trichogloea requienii</i>	Barisbaris	Salad; mix with viand
<i>Scinaia hormoides</i>	Gargarnatis	Salad; mix with viand
<i>Gelidiella acerosa</i>	Kulot	Salad; mix with viand
<i>Halymenia diatata</i>	Gayunggayong	Salad; mix with viand
<i>Halymenia Durvillaei</i>	Gayunggayong	Salad; mix with viand
<i>Halymenia harveyana</i>	Gayunggayong	Salad; mix with viand
<i>Halymenia maculate</i>	Gayunggayong	Salad; mix with viand
<i>Callophyllis sp.</i>	Lablabig	Salad; mix with viand
<i>Titanophora weberae</i>	Aragan elik	Salad; mix with viand
<i>Gracilaria arcuata</i>	Kanutkanot	Salad; mix with viand; dessert
<i>Gracilaria blodgettii</i>	Guraman	Salad; mix with viand; dessert
<i>Gracilaria eucheumoides</i>	Anggapang	Salad; mix with viand; dessert
<i>Gracilaria incurvata</i>	Marakawayan	Salad; mix with viand; dessert
<i>Gracilaria firma</i>	Kawkawayan	Salad; mix with viand; dessert

<i>Gracilaria salicornia</i>	Lunglonggan	Salad; mix with viand
<i>Gracilaria temistipitata var. lui</i>	Lumot	Salad; mix with viand
<i>Gracilaria textorii</i>	Lablabig	Salad; mix with viand
<i>Gracilaria coronopifolia</i>	Kawkawayan	Salad; mix with viand
<i>Eucheuma arnoldii</i>	Kanutkanot	Salad; mix with viand
<i>Eucheuma denticulatum</i>	Kanutkanot	Salad; mix with viand
<i>Eucheuma muricatum</i>	Kanutkanot	Salad; mix with viand
<i>Kappaphycus cottonii</i>	Kanutkanot	Salad; mix with viand
<i>Kappaphycus striatum</i>	Kanutkanot	Salad; mix with viand
<i>Betaphycus philippinensis</i>	Kanutkanot	Salad; mix with viand
<i>Hypnea charoides</i>	Kulot ti pusa	Salad; mix with viand
<i>Hypnea pannosa</i>	Kulot	Salad; mix with viand
<i>Hypnea saidana</i>	Kulot	Salad; mix with viand
<i>Acanthophora spicifera</i>	Kulot	Salad; mix with viand
<i>Bostrychia tenella</i>	Pakpako	Salad; mix with viand
<i>Laurencia composite</i>	Kulot	Salad; mix with viand
<i>Laurencia intermedia</i>	Kulot	Salad; mix with viand
<i>Laurencia papillosa</i>	Kulot	Salad; mix with viand
<i>Laurencia pinnata</i>	Kulot	Salad; mix with viand
<i>Laurencia undulate</i>	It-ittip	Salad; mix with viand
<i>Laurencia sp</i>	Bangi	Salad; mix with viand
<i>Gymnogongrus sp</i>	Salingongo	Salad; mix with viand

There are many ways to prepare seaweeds for food but the people of Ilocos Norte just do it simply, that is, eating them raw after washing and add a dash of salt and sliced tomato or vinegar, or just mix it with “dinengdeng” (vegetable), fish or meat sinigang. They prepare dessert out of seaweeds by just simply boiling previously dried and leached *Gracilaria* species for several hours until the colloids is extracted. Strain while hot, add sugar and then let it cool. Seaweed species are presented below.

Seaweed recipes

Salad

Seaweed Salad

Ingredients:

Seaweeds (Any of the following: *Chaetomorpha*, *Ulva*, *Enteromorpha*, *hydroclathrus*, *Rosenvingae*, *Trichogloea*, *Gelidiella*, *Halymenia*, *Callophyllis*, *Titanophora*, *Gracilaria*, *Gymnogongrus*, *Laurencia*, *Eucheuma*, *Kappaphycus*, *Betaphycus*, *Hypnea*, *Acanthopora*, *Bostrychia*, *Laurencia*)

Vinegar or calamansi

Tomatoes

black pepper

Onions

Ginger

Salt or bagoong (fermented fish)

Procedure:

1. Clean seaweeds from debris and sand and wash well with fresh water
2. Pour boiling water and let stand for several minutes to soften the parts
3. Drain and gently squeeze out the remaining water
4. Add seasoning and garnishing in such proportion as to suit the taste

*Seaweeds in dried form are soaked in cold water until they are rejuvenated, then, prepare in the same manner as for fresh state. Blanching may be omitted to soften thalassoid seaweeds

*for “gamet” the dried sheets are roasted or fried in a small amount of oil to bring out the aroma before soaking it in water. Drain and add the desired seasoning and garnishing.

Ar-arusip (Caulerpa) Salad**Ingredients:**

- 2 cups ar-arusip
- 2 large tomatoes
- 1 medium onion
- ¼ cup vinegar
- 2 spoons sugar
- 1 pinch table salt
- ½ tsp ground black pepper

Procedure:

1. Wash the ar-arusip well removing fibrous roots
2. Mix together vinegar, sugar, salt and pepper and set aside
3. Arrange the ar-arusip in a platter and top with tomatoes and onion
4. Pour vinegar mixture onto the platter and serve immediately

***Note:** Most households prepare ar-arusip salad by just adding tomatoes

Pukpuklo (Codium) Salad**Ingredients:**

- 2 cups pukpuklo
- 2 large tomatoes
- 1 medium onion
- 1 pinch table salt
- 1 sq inch ginger (crushed)

Procedure:

1. Wash pukpuklo very well
2. Drain it then place on a platter
3. Add 1 tomato and salt onto the seaweed a mix well
4. Garnish with onion and the other tomatoes cut into wedges

Gamet-Balangege Salad**Ingredients:**

- 1 piece dried gamet 4 inches²
- 3 cups balangege (kangkong)
- 1 cup boiling water
- ¼ cup water
- 1tbsp bagoong (fermented fish)
- 1tbsp calamansi
- ½ cup sliced tomatoes

Procedure:

1. Drop balangege in boiling water
2. Cook for 5 minutes
3. Place on one side of the platter
4. Place gamet over live charcoal for one minute
5. Moisten the water and separate the compact mass
6. Season with bagoong and calamansi
7. Garnish salad plate with tomatoes and eggs

Kanutkanot Salad**Ingredients:**

- ½ cup vinegar
- ½ cup kanutkanot
- 2 tomatoes
- 1 onion
- 1 spoon sugar
- 1 sq inch ginger (crushed)
- Dash of salt

Procedure:

1. Wash the kanutkanot very well
2. Cut into small pieces and blanch it for 3 minutes. Meanwhile make dressing by mixing the vinegar, sugar, ginger and salt.
3. Finally mix the blanched kanutkanot with the dressing and garnish the whole with sliced tomatoes and onion rings

Gracilaria Salad
(Anggapang, Kawkawayan, lablabig)

Ingredients:

2 cups seaweeds
2 large tomatoes

Procedure:

1. Wash the seaweeds well removing dirt and rock chips
2. Cut into small pieces and blanch it for 3 minutes
3. Finally mix the blanched seaweeds with a dash of salt and diced tomatoes

Note: Dried seaweeds are soaked first with cold water before washing.

Fresh Gulaman Salad

Ingredients:

1 cup seaweeds (Gracilaria)
½ cup vinegar
1 spoon sugar
1 sq inch ginger (crushed)
1 pinch salt
1 pinch pepper
2 pcs sliced tomatoes
1 pc sliced boiled egg

Procedure:

1. Blanch the seaweeds
2. Drain to remove excess water
3. Marinate with vinegar, sugar and ginger
4. Sprinkle enough salt and pepper to taste
5. Serve with sliced tomatoes and boiled eggs

Seaweeds for Viand

Fish Sinigang with Seaweeds

Ingredients:

1 kg fish
1 pc onion
4-5 med tomatoes
1 pack tamarind soup base
Salt to taste

250 grams seaweeds

Procedure:

1. Wash thoroughly the seaweeds, cut into pieces and set aside
2. Combine fish, onion and tomatoes in a large pot with water and boil
3. Cook for 5 minutes, or just until the fish is cooked
4. Add tamarind soup base and seaweeds
5. Removed from fire immediately Serve hot

Pork Sinigang with Seaweeds**Ingredients:**

1 kg pork
1 pc onion
4-5 med tomatoes
1 pack tamarind soup base
Slat to taste
250 g seaweeds

Procedure:

1. Wash thoroughly the seaweeds, cut into pieces and set aside
2. Sprinkle enough salt on pork then mix thoroughly
3. Sutaе pork, onion and tomatoes in a large pot
4. Add water enough to cover and boil until the meat is tender
5. add seaweeds when almost done
6. Remove from fire immediately Serve hot.

Miscellaneous Uses of Aragan**Procedure**

1. The tender tops of aragan us prepared in the form of salad and vegetable for pork or fish sinigang
2. the matured thallus could be used to line the bottom if the pot locally termed as “apin” to improve the taste and also protect the fish from getting burned

Dessert**Crude Gulaman (Gracilaria) Dessert****Procedure:**

1. Boil the dried or blanched seaweeds for a few hours with the corresponding amount of water until the gelose is extracted
2. While hot, strain the solution through cheese cloth
3. The digested liquid, add the desired ingredients and flavors, such as sugar, to suit your taste and coconut if desired
4. Pour the hot liquid mixture into a fancy mold and let it stand to solidify
5. Refrigerate and serve cold

Fruit Agar Gel

Ingredients:

2 cups apple juice
¼ cup agar powder
1 cup fruit
2 tablespoons karo syrup

Procedure:

1. Soak the agar and 1 cup apple juice in a saucepan for 10-15 minutes
2. Meanwhile, wash fruits
3. Mix fruit with the remaining apple juice and karo syrup in a blender then set aside
4. Boil the agar-apple juice mixture, simmer stirring frequently until all agar is dissolved
5. Let cool slightly and then pour the mixture into the blender with the blended fruit. Blend briefly to combine
6. Pour into desired mold and allow cool in the refrigerator

Plain Agar Gel

Ingredients:

2 cups sweet fruit juice
2 table spoon agar powder

Procedure:

1. Place fruit juice in a pot and boil
2. Add agar powder and cook for 2-3 minutes
3. Pour into a mold and cool in the refrigerator

Pickles

Seaweed Pickles

Procedure:

1. Wash seaweeds thoroughly, removing dirt and rock chips
2. Drain seaweeds to remove excess water
3. Prepare sauce by boiling vinegar, sugar, corn, pepper and salt
4. Strain in cheesecloth
5. Mix Sliced garlic, ginger and native onions in the strained liquid
6. Boil again
7. Place seaweeds in jars and add the sauce with the rest of the ingredients
8. Seal while hot

Methods of Blanching Seaweeds

Plain water or Rice Washings

Procedure:

1. Clean seaweeds and soak in either plain water or rice washing overnight
2. Expose under the sun for several days with occasional sprinkling of water

Weak Lime Solution or Weak Hypochlorite Solution

Procedure:

1. Wash seaweeds and soak in either 3-5% calcium carbonate for about 40 minutes or in 5% sodium hypochlorite solution for 10 minutes
2. Wash well with fresh water then bleach under the sun
3. Sprinkle water as needed

Other local uses of Seaweeds

It was the general consensus that eating seaweeds is healthful and will help restore good health. Aside from that there are some seaweed that are use as medicine, as fertilizer and as insect repellent. These are:

Phorphyra – to alleviate loose bowel movement of infants

Method of Preparation: Roast the seaweeds until crispy, then pulverized and mixed with milk for the baby to drink it.

Sargassum – to make the soil fertile

Method of preparation: Seaweed is hung on the trellies of vegetables such as squash, bottle gourd, sponge gourd and bitter gourd.

It is worthy to note one species of red algae, locally known as "bododo" and scientifically known as *Digenea simplex* could no longer be found in the collection areas, This goes to show that there is also an extinction in the species of algae in Ilocos Norte.

Photographs of the Seaweeds

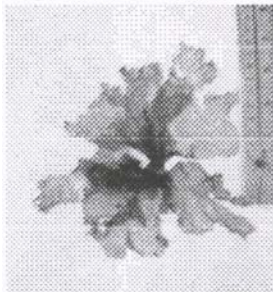
The seaweeds are grouped into Chlorophyceae, Phaeophyceae and Rhodophyceae. The photographs of the seaweeds are labeled with their scientific names including the authors of the species.

Chlorophyceae

Marine benthic green algae, or chlorophyceae, are primarily macroscopic in form. The grass green color is ascribed to pigments similar to the higher plants – chlorophylls A and C, xanthophylls and carotenes. Starch is the reserved product which surrounds the pyrenoid, a specialized organelle localized in the chloroplast of the cell.

Insert picture to be scan

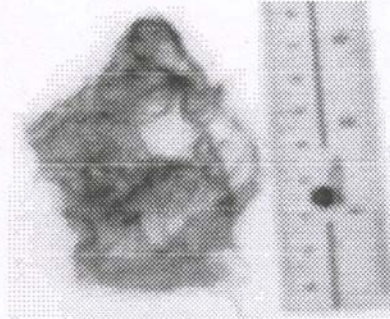
Plant habits of twelve green algae used as food are shown below:



Ulva lactuca Linnaeus



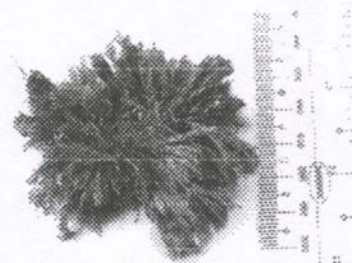
Enteromorpha compressa (L.) Greville



Chaetomorpha crassa (C. Agardh)
Kützting



Chaetomorpha media
(Wulf.) C. Agardh



Cladophora rugulosa Martens



Cladophora rupestris Kuetzing



Caulerpa lentillifera J. Agardh



Caulerpa racemosa (Forsskal)
J. Agardh



Caulerpa racemosa var. *peltata*
(Lamouroux) Eubank



Caulerpa racemosa var. *uvifera*



Codium edule P.C. Silva



Codium repens P.C. Silva

Phaeophyceae

Brown algae, or Phaeophyceae, are conspicuous in the littoral zone, generally macroscopic and most strictly marine of all seaweeds. The brownish color exhibited by Phaeophyceae is attributed to the special accessory carotenoid pigment, fucoxanthin, which cover up the other pigments including chlorophyll a and c. However, the color varies from olive green to dark brownish black. Foods are reserved partly as laminarin, a unique polysaccharide and partly mannitol, a complex alcohol.

Plant habits of nine species of brown algae used as food are shown below:



Hydroclathrus clathratus
(C. Agardh) Howe



Rosenvingea intricata
(J. Agardh) Boergesen



Hormophysa triquetra (L.) Kuetzing



Sargassum cinctum J.G Agardh



Sargassum confusum J.G Agardh



Sargassum cristaeifolium C.A. Agardh



Sargassum gracillimum Reinbold



Sargassum hemiphyllum C.A. Agardh

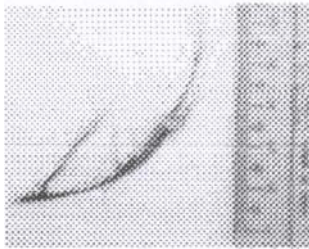


Sargassum Kushimotoense

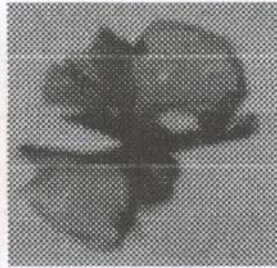
RHODOPHYCEAE

The Rhodophyceae or red algae are predominantly marine, growing in the supralittoral to the intertidal down to the subtidal zone. Chlorophylls a and b and the pigments r-phycoyanin and r-phycoerythrin are present. The r-phycoerythrin is responsible for the red color and it plays an important role in the photosynthetic activity, because they absorb blue light (wavelength) well enough. Owing to the wide range of habitat, their red color varies from rose-red or violet to olive or nearly black. Reserve products are principally floridean starch or floridoside and mannoglycerate.

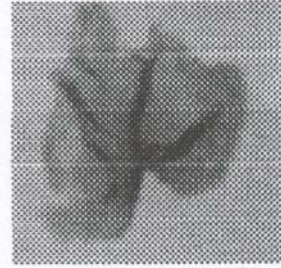
Plant habits of thirty nine species of red algae used as food are shown below:



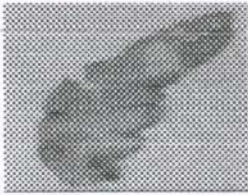
Bangia fuscopurpurea (Dillwyn)
Lyngbye



Porphyra crispata Kjellman



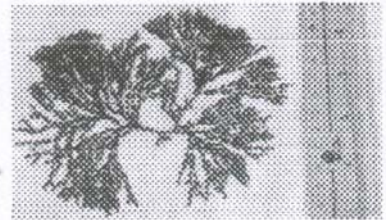
Porphyra suborbiculata Kjellman



Porphyra marcosii Cordero



Trichogloea requienii (Montagne)
Kutzing



Scinaia hormoides Setchell



Gelidiella acerosa (Forsskal)
Feldmann and Hamel



Halymenia dilatata Zanardini



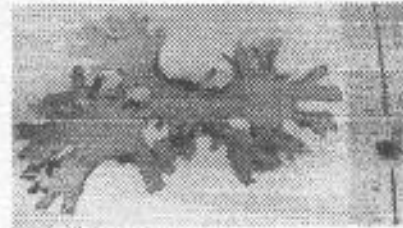
Halymenia durvillaei
Bory de Saint Vincent



Halymenia harveyana



Halymenia maculata J. Agardh



Callophyllis sp



Titanophora weberae Boergesen



Gracilaria arcuata Zanardini



Gracilaria blodgettii Harvey



Gracilaria eucheunoides Harvey



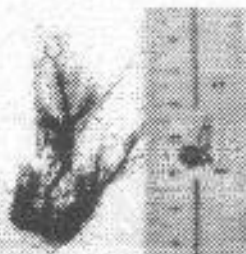
Gracilaria incurvata Okamura



Gracilaria firma Zhang et Xia



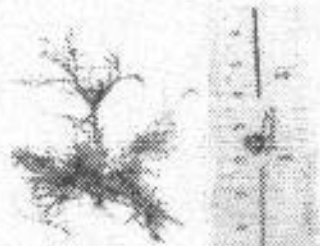
Gracilaria salicornia
(C. Agardh) Dawson



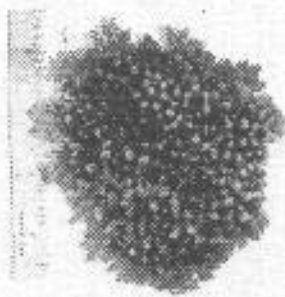
Gracilaria tenuistipitata var. *lji*
Zhang et Xia



Gracilaria textori (Suringar)
De Toni



Gracilaria coronopifolia J. Agardh



Eucheuma arnoldii
Weber-van Boss



Eucheuma denticulatum
(N.L. Burmann) Collins and Harvey



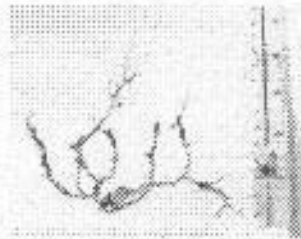
Eucheuma muricatum (Gmel.)
Weber-van-Bosse



Kappaphycus cottonii (Weber-van-
Bosse) Doty



Betaphycus philippinensis, Doty
(-*Eucheuma gelatinosae*, J. Agardh)



Hypnea charoides Sonder



Hypnea pannosa J. Agardh



Hypnea saidana Holmc



Acanthophora spicifera (Vald)
Boergesen



Bostrychia tenella (Lamouroux)
J. Agardh



Laurencia composita Yamada



Laurencia intermedia Yamada



Laurencia papillosa (C. Agardh)
Greville



Laurencia pinnata Yamada



Laurencia undulata Yamada



Laurencia sp



Gymnogongrus sp

Seaweeds commonly sold in the markets of Ilocos Norte

The principal market for seaweeds used directly in food is in Laoag City, the capital city of Ilocos Norte. Edible fresh and dried seaweeds are available everyday in Laoag City public market. The principal genera of seaweeds sold are drie *Hypnea*; *Laurencia*; *Gelidiella*; *Acanthophora*; and *Porphyra*.

Hypnea is locally known as “kulot ti pusa” while *Laurencia*, *Gelidiella*, and *Acanthophora* are collectively called “Kulot”. The most expensive and highly preferred seaweed is *Porphyra*, locally known as “gamet”.

These seaweeds are either in fresh or indried form. Likewise, with other genera are *Eucheuma* (kanutkanot); *Gracilaria* (kawkawayan or marakawayan), *Halymenia* (gayunggayong), *Callophyllis* (lablabig), and *Ulva* (gamgamet)

The genera that are sold seasonally in fresh state are *Codium* (pukpuklo), *Caulerpa* (ar-arusip), and *Hydroclathrus* (balbalulang). *Codium* and *Caulerpa* are the most popular green salad alga in Ilocos Norte. They are usually served in parties.

Inhabitants living near the sea use seaweeds more extensively as food. They practically make use of all the soft thallied seaweeds or just get the tender tops. The genera of seaweeds consumed as food by the seashore dwellers that are not found in the market are the following: *Boergesenia*; *Chaetomorpha*; *Dictyosphaeria*; *Enteromorpha*; *Cladophora*; *Halimeda*; *Rosenvergea*; *Sargassum*; *Turbinaria*

However, *Sargassum* (aragan) can be found along with fresh fish in the market and is given as free if you buy fish. It is interesting to note that you can find lesser number of seaweeds in kind in the public markets of the coastal towns of Ilocos Norte. One can find only three to four genera of seaweeds sold in public markets of the seven coastal towns of Ilocos Norte namely: Pagudpud; Bangui; Burgos; Pasuquin; Currimao; and Badoc. The seaweeds commonly sold in the public markets of Ilocos Norte. However, the biggest market of these is in the immediate towns of Ilocos Sur, which are Sinit and Cabugao

Market prices of commonly sold seaweeds in local markets of Ilocos Norte

Table 4. Shows the market prices of seaweeds.

Market prices of commonly sold seaweeds in local markets of Ilocos Norte

Local Name	Class	Scientific Name	Price (per kg)
Pukpuklo	Green algae (Chlorophyceae)	<i>Codium repens</i> C. <i>edule</i>	80.00 fresh form
Ar-arusip	Green algae (Chlorophyceae)	<i>Caulerpa racemosa</i> <i>C. lentilifera</i>	80.00 fresh form
Balbalulang	Brown algae (Phaeophyceae)	<i>Hydroclathrus</i> <i>clathratus</i>	50.00 fresh form

Gamet	Red algae (Rhodophyceae)	<i>Phorphyra crispata</i> <i>P. marcosii</i> <i>P. suborbicolata</i>	2,400 – 3,000 dried form
Lablabig	Red algae (Rhodophyceae)	<i>Gracilaria arcuata</i>	80.00 fresh form
Kulot kersang	Red algae (Rhodophyceae)	<i>Laurencia papillosa</i>	600.00 dried form
Kulot Bangi	Red algae (Rhodophyceae)	<i>L.</i>	1,000.00
Gayunggayong	Red algae (Rhodophyceae)	<i>Halymenia durvillaea</i> <i>H.</i>	1,000.00 dried form
Gargarnatis	Red algae (Rhodophyceae)	<i>Scinaia hormoides</i>	50.00 fresh form

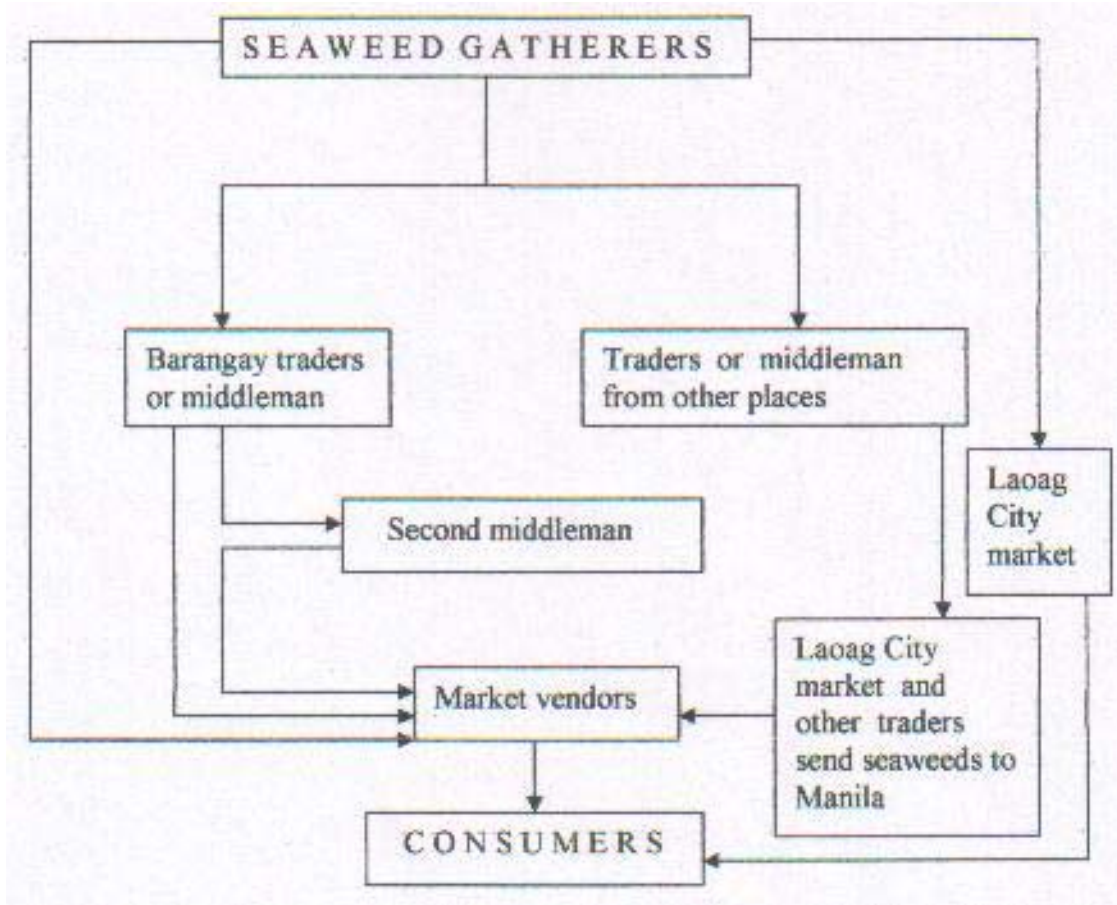
Note: Laoag super market commands higher prices of seaweeds than in any of the public market of Ilocos Norte

The most expensive seaweed is Porphyra or “gamet”. The price is from Php 2,400 – 3,000/kg. Actually they are not sold by kilogram rather by sheet with weighs about 125 – 130g per sheet. These sheets of Porphyra are sold at Php300-400. The market vendors could even command a price of Php500.00/sheet of Phorphyra when harvested on the onset of their growth. The cheapest is *Hydroclathrus* or “balballulang”, about Php 50.00 per kilogram.

Marketing channels

The flow of the wet/raw seaweeds from gatherers to consumers passes through several middleman represented by small fringe buyers. Small- scale gatherers may sell their produce to distributors and or vendors who buy seaweeds in bulk. Others dry their seaweeds and sell primarily to buying agents or collectors. Still, other seaweed gatherers sell their harvest to nearby public markets. But those who intend to go to Laoag City for other purpose such as buying basic commodities and other personal needs sell their harvest to the city market for higher price.

The marketing channel is presented below:



Current status of the seaweed industry

The seaweed industry in the Ilocos is confined to gathering from the wild. Sun drying is the only post lengthens shelf life. Current production of seaweeds in Ilocos Norte is entirely feral in nature and does not in any manner assure predictable volume for continuity of supply. However, attempts have been made by researchers in the area to culture seaweeds but did not prosper due to some problems such as social and environmental. These problems are related to the distraction of the seaweed set up. The former problem comes in when people in the area take away the materials in the set up and the later when storm strikes the place. A big investment to construct a semi protected area to put up a seaweed culture could solve the problem. As a local industry, it has evolved into a significant means of livelihood and source of income. The biggest market of dried seaweeds is the Ilocano balikbayans who are resident in other countries. However, in the local market alone, it entails quite a big market due to the fancy of the people to eat seaweeds, not only for their known nutritive value but also for their taste.

Statistics on seaweed production are not readily available, but production comes mainly from *Codium*, *Caulerpa*, *Hydroclathrus*, *Phorphyra*, *Hypnea*, *Laurencia*, *Acanthophora*, *Gracilaria*, *Eucheuma*, *Betaphycus*, and *Halymenia*.

Problems and Needs

The local seaweeds industry is experiencing problems which must be given prompt and proper concern to improve the economic condition of the people in the coastal areas of Ilocos Norte. These problems comprise gathering, post harvest processing and marketing of seaweeds. Gathering problem enfolds absence of gathering paraphernalia such as baskets, gloves and bancas. Post harvest processing and marketing problems involve drying facilities and inefficient marketing pricing system respectively.

Impacts of the Study

Social Impact

The study can enhance awareness of the fisher folks to protect the coastal resources particularly, the seaweeds from destructive fishing practices thereby promoting a strong sense of community ownership.

Economic Impact

It can propose additional income of fisher folks from seaweed gathering and processing. And development of a livelihood program in the locality. Processing and utilization of seaweed and seaweed products centers not only on the known commercial products but also on the development of non-technical ones.

Ecological Impact

Good practice in seaweed gathering can enhance the natural regeneration of this dwindling resource. It can serve as a starting point for the proper management in the gathering and processing of seaweeds.

Political Impact

This study can create social mobilization strategies that helps trigger attitudinal changes and can significantly contribute to economic development goals along income generation and poverty reduction.

Summary and Conclusion

Majority of the respondents of this study are young, majority female and majority married. Mostly are elementary graduates belonging to small and medium household size. Majority are engage in seaweed gathering for quite sometime with a minimal income which is not sufficient for their basic needs which are their household expenses are augmented by the income of their husbands. The increasing need to utilize seaweed for the development of new food products that will meet consumers acceptability and help generate concern of technology packed constitute the justification for a concerted efforts on surveys of seaweed resources. Thus the result of the interview shows the need to boost the economic conditions of the seaweed gatherers in order to assure satisfactory lifestyle of the seaweed gatherers.

There are 22 genera of seaweeds belonging to green, brown and red algae that are used as food in Ilocos Norte. Food preparations of the seaweeds may be in the form of salad, vegetables for viand, dessert or pickles. Other local uses include> medicine,

fertilizer and insect repellent. Development of other possible food products from seaweeds should be encouraged to the seaweed gatherers to consumers for a livelihood.

The flow of the wet/raw seaweeds from gatherers to consumers passes through several middlemen represented by small fringe buyers before it reaches consumers. The current market price of seaweeds ranges from Php300/kg to Php6,000/kg. The seaweed genera *Hydroclathrus* or 'balbalulang' is the cheapest and *Phorphyra* or "gamet" is the most expensive. An appropriate packaging material for processed seaweeds should be introduced to the seaweed gatherers to insure high product quality and long shelf life and in turn generate market competitiveness.

Recommendations

For the improvement of the socio-economic status of the seaweeds gatherers and the boosting of the seaweed industry in Ilocos Norte the following recommendation are deemed necessary;

1. The government should launch a program to implement rules and regulations for the public to observe in the harvest of seaweeds in order not to deplete the natural seaweed stock;
2. The researchers should assist the seaweed gatherers in improving their harvest method in order for the product to be accepted widely in the market; and
3. The researchers should also assist the seaweed gatherers in developing food products from seaweeds which opens livelihood to fisher folks.

Definition of Terms

Benthic – growing or living on the sea bottom; attached to substrate

Coastline – often used as a general term, the edge of land viewed from the sea more precisely the line reached by the highest storm waves

Edible seaweeds – are marine algae that are utilized for food

Food preparation – are means of setting food for the table

Fringing reef – platform of coral bordering

Habit – the general form of a plant

Habitat – the place of growth of a plant, its environment

Holdfast – the structure by which an alga is attached to the substratum; a process similar to but larger than a rhizoid, or made up of a number of rhizoids

Inter-tidal – lying between high and low tide levels, the shallow region that is periodically covered

Market potential – highly possible product for sale

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