

# WHAT ARE THE MAIN ASPECTS OF THE USE OF EDIBLE SEAWEEDS IN GUIMARAS ISLAND, PHILIPPINES? - CASE STUDY

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## Abstract

Guimaras is a small touristic island situated between Panay and Negros islands in the Western Visayas. Its coastal waters are endowed with rich marine resources, including seaweed, which has become the coastal community's source of food, livelihood, and employment. This study aimed to determine the diversity, abundance, production and marketing practices of edible seaweeds in Guimaras Island, Philippines in the areas where recreation is set as well. Respondents were the 275 members of Seaweed Farmers Associations in the municipalities of Sibunag and Nueva Valencia using a researcher-made questionnaire. Seaweeds grown were not so diversified, only *Cottonii* brown, green and barako; and the *Spinosum*, green and brown. *Cottonii*-brown and green were the most widely grown seaweeds in the coastal barangays of Sabang, Sebaste and San Isidro in Sibunag and Panobolon in Nueva Valencia. The husbands mostly did production practices from site selection to harvesting and marketing, while wives took charge of recording, receiving, and keeping sales, cleaning, and maintenance. Challenges faced by seaweed growers include ice-ice disease, washed-out and untimely harvests, lack of drying equipment and buyers dictating prices of products.

**Key words:** cottonii-brown, spinosum, gender role, farming, challenges, tourism

## Introduction

Seaweeds are marine resources of various economic uses. The economic importance of which, lies on its utilization as food, industry, pharmacy, medicine and tourism. Seaweed mariculture in the Philippines ranks number one in terms of amount of production among the marine-based products, and it is one of the top three export commodities, thus contributing large source of revenue to the country. For which, nearly 80% (777 963 tonnes) of the world's total *cottonii* (*Kappaphycus*) originates from the country (Elsevier, 2015; Ferdouse, et al., 2018). The commercial species of seaweed in the country are the red seaweeds, Carrageenan (*Eucheuma Cottonii* and *Spinosum*) and the Agar-agar (*Gracilaria* and *Gelidium*). Not only that seaweeds are harvested for direct consumption of the plant itself, but also for the intriguing and functional chemicals or "natural products" they produce, but also for human use. Chemicals derived from seaweed are used in medicines, food, beauty products, and industry. The red and brown algae produce *Phycocolloids* ("phyco"= seaweed, "colloid"=glue) that include agar, alginate and carrageenan. Green algae produce the antioxidant beta carotene which is a precursor to vitamin A (Seaweed Industry Association of the Philippines, 2015).

The use of the seaweeds extracts in food products took off in the second half of the 20th century as the demand for prepared foods increased. And, as more nations become more developed, the need for more prepared foods and pharmaceuticals will increase the demand for seaweed compounds (Brill and Lawrence, 2015).

Seaweed farming in Guimaras, though started few years ago, it has become a fast growing industry for its coastal communities, propagating a total coastal area of 40 hectares producing 10 tons per month yielded during peak months that starts at September and ends in April yearly. The harvested seaweeds are being dried and marketed to consumers and end users. However, the conflict arises in the moisture content declaration of the dried seaweeds among producers. Since the price of the goods is dependent on the moisture content, there is a big discrepancy in terms of sales that is lost during the transaction (Department of Science and Technology, 2015).

In order to respond to the increasing demand in the world market for edible seaweed extracts, and to contribute to the Philippine economy, there is first the need to identify edible seaweeds grown in Guimaras island and its potential of producing seaweed-based processed products for commercialization.

This study aimed to determine the diversity, abundance, production and marketing practices of edible seaweeds in Guimaras Island, Philippines. Specifically, it focused on determining the following: (1) variety of edible seaweeds grown in Guimaras Island; (2) specific locations of identified varieties of seaweeds abundantly grown in Guimaras; (3) gender division of labor in production practices from site selection to harvesting of identified varieties of edible seaweeds grown; (4) post harvest processing

practices employed by the seaweed growers; and (5) the marketing practices and challenges encountered in the disposal of seaweed products.

## Methodology

### Diversity and Abundance

In order to identify the seaweed farmers in Guimaras who were then actively engaged in seaweed farming, coordination was made with the Fishery Sector personnel of the Provincial Office for Agricultural Services (POAS). From the list taken, of the five municipalities of the Province, seaweed farmers' associations were active only in the municipalities of Nueva Valencia, Sibunag and San Lorenzo. Edible seaweeds were only grown from the first two municipalities. Using the researcher-made survey questionnaire, a total of 275 members of the seaweed farmers' association from the coastal barangays of Sebaste, Sabang and San Isidro from the municipality of Sibunag and Barangay Panobolon (98) from Nueva Valencia and where existing seaweed farms are maintained were identified as sources of information for the diversity and abundance of edible seaweeds produced per harvest. The retrieved survey was validated with the municipal Fishery and Aquatic Resource Management Council Chairs to assert validity and to cross-check works of hired enumerators who then were members of the association where they reside.

### Practices

Using the same researcher-made questionnaire, gender division of labor in the existing seaweed production, processing and marketing practices of the local seaweed farmers in the selected coastal barangays were determined. These also included challenges encountered by the seaweed farmers on the disposal of their seaweed products.

### Data Analysis

The data gathered were analyzed using frequency counts and percentages in determining the diversity, abundance, gender division of labor in the existing seaweed production, processing and marketing practices including the challenges encountered by these individual seaweed farmers.

## Results

### Diversity of edible seaweeds grown in Guimaras Island

Seaweeds grown in the identified coastal barangays were not so diversified (Table 1). The seaweed farmers only grew two varieties such as the Cottonii classified as the green, brown and barako; and the Spinosum, classified as the green and the brown. In multiple responses, Cottonii- green posed the highest (91.27%) responses, followed by those planting Cottonii- brown (69.09%), and barako (24.73%), only very few planted Spinosum both brown and green (2.18% and or 1.82%), respectively.

Tab. 1: Variety of seaweed grown\*

Variety/ Type of Seaweed Grown	Frequency	%
Cottonii-Green	251	91.27
Cottonii- Brown	190	69.09
Barako	68	24.73
Spinosum- Green	5	1.82
Spinosum- Brown	6	2.18

\*Note: 275 respondents with multiple responses

### Specific location of these edible seaweeds grown

The edible seaweeds are grown in the coastal barangays of the municipalities of Sibunag and Nueva Valencia, specifically in barangays Sabang, Sebaste and San Isidro in Sibunag and in barangay Panobolon in Nueva Valencia. It turned out that cottonii-brown is the most widely grown seaweed (214 growers) followed by cottonii-green (158 growers). However, cottonii-green is widely grown in Brgy. Panobolon (90 growers), while cottonii-brown is widely grown in Brgy. Sabang (87 growers). Also, it was noted that the salinity and water current have contributed to the growth of these seaweeds.

### Volume of planting materials per specie

For planting materials, 214 planted Cottonii-brown, of this, more than half (52.34%) planted between 26-50 kgs. each, followed by those (27.1%) planting 25 kgs and below, and 76-100 kgs. (16.82%); however, there were few (3.27%) who planted 176-200 kgs. There were 158 who also planted Cottonii-green. The highest volume planted by each (59.5%) grower was between 26-50 kgs., followed by those (22.15%) who planted 25 kgs and below, with only few 15.82%) planting between 76-100

kgs., while the highest volume of 176-200 kgs. was planted by only three growers. Of the total seaweed growers, 66 of them also planted Cottonii-Barako, with the majority (65.15%) having planted 25 kgs. and below each. Spinosum variety was also planted by very few seaweed growers.

Tab. 2: Specific location of variety of seaweed grown\*

Variety	Location				Total Growers/ specie
	Sabang	Sebaste	San Isidro	Panobolon	
Cottonii Sakol-Green	27	20	21	90	158
Cottonii Sakol-Brown	87	40	51	36	214
Cottonii -Barako	26	26		14	66
Spinosum-Green				5	5
Spinosum-Brown	1			5	5
<b>Total</b>	<b>141</b>	<b>86</b>	<b>72</b>	<b>150</b>	

\*Note: 275 respondents with multiple responses

Tab. 3: Volume of Planting Materials

Volume /kg	Cottonii- Green		Cottonii-Brown		Barako		Spinosum-Green		Spinosum-Brown	
	F	%	F	%	F	%	F	%	F	%
25 and below	35	22.15	58	27.1	43	65.15	3	75.0	4	100.0
26-50	94	59.5	112	52.34	17	25.76				
51-75										
76-100	25	15.82	36	16.82	4	6.06	1	25.0		
101-125										
126-150	1	0.63	1	0.47						
151-175										
176-200	3	1.9	7	3.27	2	3.03				
<b>Total</b>	<b>158</b>	<b>100</b>	<b>214</b>	<b>100</b>	<b>66</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>4</b>	<b>100</b>

### Period of planting and harvesting

Seaweed planting in the identified coastal barangays is whole year round (Table 4). It usually starts from the month of June of the current year until May of the succeeding year. Peak months of planting is from September to December and starts to decline from January to May. It can be noted that all varieties are planted from the months of June to September. However, only the Cottonii Green, Brown and Barako thrive whole year round. This means that these species are resistant with the changing weather condition though planting declines with the onset of summer season.

Harvesting is every after two months from planting or after 60 days cycle. There was a big drop in the harvest of seaweed from March to July for all species. This means that the growth of seaweeds is affected by the external factors such as changing weather condition which is uncontrollable and other controllable factors.

### Volume of harvest

Table 5 presents the volume of harvest per specie. Average volume of harvest for Cottonii green and brown on a per quarter bases is from 251-500 kgs and 250 kgs and below. Volume of harvest is declining from the third to fourth quarter. While Spinosum though low in volume is planted and only few of the seaweed growers engaged in planting, volume of which is sustained from first to the fourth quarter for brown at 250 kgs and below to 501-750 kgs.

### Gender division of labor

Production practices from site selection, planting to harvesting (Table 6) are mostly done by males/husbands, while wives took charge of cleaning/maintenance and gathering of washed-outs. Wives also take active part in the site selection, installation of lines and floats, in the procurement of planting materials, planting, cleaning. For some, sons and daughters or hired workers are sought to help in the production processes. This implies that seaweed production is the main gender role of the father and the mother.

### Post-harvest processing practices employed by the seaweed growers

Post-harvest activities (Table 7) are mainly performed by the husband and the wife. Sacking and weighing are mostly done by the husbands, while, recording is mostly done by the wife. Only few

children, son or daughter or other means such as hiring somebody help in the post harvest processing. This implies that post harvest processing practices are mainly the gender roles of both the father and the mother.

### Marketing practices of seaweed growers

Marketing practices (Table 8) were mainly performed by the husband, such as, resacking, transporting, and transacting with buyers. However, recording and receiving/ keeping of sales are mainly performed by the wife. While only very few of the sons and daughters or hired personnel get involved in the marketing. This only means that marketing of seaweed is mainly the gender role or shared responsibility of the father and the mother so as to generate income for the family.

Tab. 4: Period Planted and Harvested

Months	Cottonii-Green		Cottonii-Brown		Barako		Spinosum-Green		Spinosum-Brown	
Planting	F	%	F	%	F	%	F	%	F	%
January	95	34.55	126	45.82	11	4				
February	63	22.91	22	8	7	2.55				
March	43	15.64	12	4.364	6	2.18				
April	32	11.64	11	4	5	1.82				
May	30	10.91	16	5.82	2	0.73				
June	109	39.64	88	32	28	10.18	2	0.73	3	1.09
July	92	33.45	108	39.27	32	11.64	3	1.09		
August	121	44	129	46.91	44	16	2	0.73	2	0.73
September	143	52	115	41.82	53	19.27	2	0.73	4	1.45
October	133	48.36	148	53.82	54	19.64	1	0.36		
November	117	42.55	187	68	56	20.36	1	0.36		
December	138	50.18	201	73.09	38	13.82	1	0.36		
Harvesting										
January	42	15.27	54	19.64	20	7.27				
February	124	45.09	66	24	15	5.45				
March	32	11.64	36	13.09	8	2.91	1	0.36		
April	68	24.73	16	5.82	7	2.55				
May	7	2.55	5	1.82	2	0.73				
June	2	0.73	2	0.73	1	0.36				
July	12	4.36	4	1.45	3	1.09				
August	71	25.82	19	6.91	6	2.18			6	2.18
September	35	12.73	64	23.27	7	2.55	1	0.36	1	0.36
October	32	11.64	44	16	27	9.82	1	0.36	1	0.36
November	95	34.55	92	33.45	26	9.45	3	1.09	5	1.82
December	45	16.36	85	30.91	33	12			2	0.73

\*Note: 275 respondents with multiple responses

Tab. 5: Volume Harvested

	1 <sup>st</sup> Quarter		2 <sup>nd</sup> Quarter		3 <sup>rd</sup> Quarter		4 <sup>th</sup> Quarter	
Cottonii- Green	F	%	F	%	F	%	F	%
250 and below	37	28.24	48	31.17	43	36.44	16	57.14
251-500	47	35.88	64	41.56	39	33.05	10	35.71
501-750	32	24.43	30	19.48	25	21.19	1	3.57
751-1000	4	3.05	1	0.65	2	1.694		
1001-1250	4	3.05	4	2.60	3	2.54	1	3.57
1251 and above	7	5.34	7	4.55	6	5.08		
<b>Total</b>	<b>131</b>	<b>100</b>	<b>154</b>	<b>100</b>	<b>118</b>	<b>100</b>	<b>28</b>	<b>100</b>
Cottonii-Brown								
250 and below	31	16.67	51	28.18	55	59.78	12	80
251-500	86	46.24	88	48.62	21	22.83	2	13.33
501-750	25	13.44	18	9.94	9	9.78	1	6.67
751-1000	21	11.29	11	6.08	2	2.17		
1001-1250	4	2.15	5	2.76	4	4.35		
1251 and above	19	10.22	8	4.42	1	1.09		
<b>Total</b>	<b>186</b>	<b>100</b>	<b>181</b>	<b>100</b>	<b>92</b>	<b>100</b>	<b>15</b>	<b>100</b>
Barako								
250 and below	42	66.67	45	73.77	5	35.71	1	100
251-500	11	17.46	9	14.75	4	28.57		
501-750	2	3.17	3	4.92	2	14.29		
751-1000	4	6.35	1	1.64	1	7.14		

1001-1250	2	3.17	1	1.64				
1251 and above	2	3.17	2	3.28	2	14.29		
<b>Total</b>	<b>63</b>	<b>100</b>	<b>61</b>	<b>100</b>	<b>14</b>		<b>1</b>	<b>100</b>
<b>Spinosum-Green</b>								
250 and below	2	66.67	2	66.67				
251-500								
501-750								
751-1000								
1001-1250								
1251 and above	1	33.33	1	33.33	1	100		
<b>Total</b>	<b>3</b>	<b>100</b>	<b>3</b>		<b>1</b>	<b>100</b>		
<b>Spinosum-brown</b>								
250 and below	1	16.67	1	20	1	16.67	1	50
251-500					1	16.67		
501-750	3	50	3	60	3	50	1	50
751-1000								
1001-1250								
1251 and above	2	33.33	1	20	1	16.67		
<b>Total</b>	<b>6</b>	<b>100</b>	<b>5</b>	<b>100</b>	<b>6</b>	<b>100</b>	<b>2</b>	<b>100</b>

Note: 275 respondents with multiple responses

Tab. 6: Production\*

Production Practices	Husband		Wife		Son		Daughter		Hired/ Others	
	F	%	F	%	F	%	F	%	F	%
Site Selection	219	79.64	155	56.36	19	6.91	2	0.73	4	1.45
Installation	234	85.09	188	68.36	71	25.72	20	7.27	37	13.45
Lines	231	84	194	70.55	77	28	25	9.09	39	14.18
Floats	230	83.64	225	81.82	103	37.45	35	12.73	46	16.73
Planting materials procurement	180	65.45	160	58.18	25	9.09	7	2.55	5	1.812
Planting of Seaweeds	230	83.64	228	82.91	94	34.18	45	16.36	74	26.91
Maintenance/ Cleaning	180	65.45	232	84.36	54	19.64	25	9.09	20	7.27
Replanting	230	83.64	230	83.64	96	34.91	50	18.18	81	29.45
Gathering of washed out seaweeds	204	74.18	215	78.18	59	21.45	30	10.91	29	10.55
Sacking	217	78.91	257	93.45	88	32	28	10.18	66	24
Hauling	196	71.27	152	55.27	72	26.18	17	6.18	64	23.27

\*Note: 275 respondents with multiple responses

Tab. 7: Post- Harvest Processing Practices

Particulars	Husband		Wife		Son		Daughter		Hired/Others	
	f	%	f	%	f	%	f	%	f	%
Installation of drying facility	221	80.36	149	54.18	50	18.18	14	5.09	8	2.91
Drying	222	80.73	193	70.18	80	29.09	24	8.73	29	10.55
Weighing	221	80.36	164	59.64	61	22.18	13	4.73	22	8.00
Storing	219	79.64	171	62.18	57	20.73	14	5.09	11	4.00
Sacking	223	81.09	163	59.27	80	29.09	18	6.55	48	17.45
Recording	56	20.36	216	78.55	8	2.91	3	1.09	1	0.36

\*Note: 275 respondents with multiple responses

Tab. 8: Marketing practices

Particulars	Husband		Wife		Son		Daughter		Hired/ Others	
	f	%	F	%	f	%	f	%	f	%
Weighing	213	77.45	146	53.09	76	27.63	13	4.73	13	4.73
Resacking	220	80	135	49.09	83	30.18	18	6.55	28	10.18
Recording	90	32.73	194	70.55	19	6.91	5	1.82		
Transporting	217	78.91	113	41.09	85	30.91	12	4.36	7	2.55
Transact w/ buyers	186	67.64	166	60.36	24	8.73			3	1.09
Receiving/ Keeping Sales	44	16	221	80.36	5	1.82				

\*Note: 275 respondents with multiple responses

### Challenges encountered in the disposal of seaweed products

Seaweed growers in the process of disposing seaweed products do encountered challenges from the production, post harvest processing and marketing of edible seaweeds (Table 9). During production process, the most common pests identified affecting the growth and volume of seaweeds grown were fish (49.09%), "terek" (36.73%), and algae "lumot-lumot" among others such as sea urchin, starfish and "guma-guma"; diseases such as, "ice-ice" (90.55%), as well as "bungot-bungot" and epiphytes; and other man-made factors such as fishing activities and stealing of seaweed at the farm site.

During harvest time, challenges encountered included reduced volume due to wash-out (42.55%), also slow growth of seaweeds (14.18%). Likewise, the untimely harvesting due to bad weather condition such as typhoon, big waves, and strong winds as revealed by almost half of the respondents (46.55%), and other man-made factors such as stealing and fishing activities. The lack of drying facilities especially during rainy days is the major challenge for the growers (53.45%) during processing after harvest. While during marketing of seaweed products, major challenge was that buyers are the ones dictating the price of dried seaweeds, the buyers are far from the farm site, and even products to be sold are in volume still the prices are the same.

### Discussion

The cottonii-brown seaweed is the most widely grown seaweed in Guimaras. The main uses of brown seaweeds are foods and raw materials for extracting the hydrocolloid alginate. These are found in warmer waters but are less suitable for alginate production and rarely used as food. Originally, harvests of wild seaweeds were the only source. However, since the mid-twentieth century, demand has gradually outstripped the supply from natural resources, and cultivation methods have been developed. Today, seaweed for food comes mainly from farming rather than natural sources (Partnerships in Environmental Management for the Seas of East Asia, 2017).

The variety of seaweed planted is dependent on the type of seedlings made available to them at the time of planting season. However, the seaweed could not resist growing especially during summer time. This time is really good for practicing touristic activities. Changing of weathers greatly affects the growth of seaweeds. Seaweed usually grown and cultivated in nearshore areas for operational and logistical reasons and in order to get enough sufficient sunlight for photosynthesis. In terms of both investment and operating costs, nearshore operations are less expensive (Manjarrez, et al, 2021).

Tab. 9: Challenges encountered

Activities	Challenges	F	%
<b>Production</b>			
Pests	Fish	135	49.09
	Algae (lumot-lumot)	30	10.91
	Terek	101	36.73
	Sea Urchin	7	2.55
	Starfish	55	20.0
	Rubber-like (guma-guma)	23	8.36
Diseases	Ice-ice	249	90.55
	Epiphytes	24	8.73
	Beard-like (bungot-bungot)	61	22.18
Man-made	Fishing activities	23	8.36
	Stolen by others	25	9.09
<b>Harvesting</b>			
Volume	Washed-out	117	42.55
	Total washed out at times	13	4.73

Age/timing	Smaller and slow growth at times	39	14.18
	Low volume (pests)	26	9.45
	Bad weather condition (typhoon, big waves, strong wind)	128	46.55
	60 days (right age but of small stem and lighter weight)	42	15.27
Man-made	Washed-out	36	13.09
	Stolen by others	45	16.36
	Fishing activities	6	2.18
<b>Processing</b>			
Equipment	Lack of drying facility	10	3.44
Drying	Rainy season	147	53.45
<b>Marketing</b>			
Buyer	Low prices	92	33.45
	Far	85	30.91
Volume	Same price even in volume	28	10.18
Price of product	Php 23/kg	79	28.73
	Low price	169	61.45
Other Type	Raw dried seeds	32	11.68

\*Note: 275 respondents with multiple responses

## Conclusion

Variety of seaweeds grown in the three coastal barangays in Sibunag and one island barangay in Nueva Valencia are *Cottonii* (sakol) green, brown, and barako; and *Spinosum* green and brown with *cottonii* green and brown. Peak months of planting from June to December and harvested after two months planting. Husbands perform most of the production, processing and marketing practices with wives performing lighter tasks such as cleaning/maintenance, recording of keeping of sales for products sold. Incidence of pests and diseases as well as changes in weather condition are the major challenges encountered by seaweed growers. They can prosper from recreation in the meantime.

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### Souhrn

Pěstitelé mořských řas na ostrově Guimaras pěstovali pouze odrůdy mořských řas *cottonii* a *spinosum*. Pěstují se v pobřežních barangay Sabang, Sebaste a San Isidro v Sibunagu a barangay Panoblon v Nueva Valencia. Více než polovina zemědělců pěstovala hnědé mořské řasy *cottonii* o objemu 26-50 kg. Vrcholné měsíce výsadby jsou od září do prosince a začínají klesat od ledna do května. Sklizeň probíhá vždy po dvou měsících od výsadby nebo po 60 dnech cyklu. Průměrný objem sklizně bavlníku zeleného a hnědé na čtvrtletní základny je 251-500 kg a 250 kg a méně, zatímco u bavlníku hnědé, který se udržuje od prvního do čtvrtého čtvrtletí, je 250 kg a méně. Manžel a manželka se věnují hlavně produkčním, posklizňovým a obchodním postupům s menším zapojením dcer a synů. Při produkci většina označila ryby za škůdce a ledovku za choroby ovlivňující růst a objem řas. Dalšími faktory jsou rybolovné činnosti a krádeže mořských řas v místě farmy. Problémy, s nimiž se setkávají při sklizni, jsou menší objem v důsledku vyplavování, předčasná sklizeň v důsledku špatných povětrnostních podmínek a nedostatek sušícího zařízení. Hlavním problémem při uvádění produktů z mořských řas na trh je skutečnost, že cenu určují kupující a ceny zůstávají stejné bez ohledu na objem prodaného produktu.

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