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Biomass in Marine Natural Products: Ecological Parameters and High Value Production of Seaweeds in Lavezares, Northern Samar, Philippine

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cultured seaweeds, ecological conditions, biomass, Lavezares, Northern Samar

Abstract

The study examined the ecological conditions of a seaweed farming site, focusing on factors such as salinity, light penetration, temperature, substrate, water depth, water current, and biotic factors. It assessed the biomass production in both control and experimental groups, analyzed the significant difference in biomass production between these groups, and explored the relationship between biotic factors and biomass production. The independent variable was the ecological factors, while the control and experimental groups served as moderator variables, and biomass production acted as the dependent variable. The study followed an experimental research methodology, with physical parameters monitored weekly and biotic factors monitored daily for a duration of 30 days. The research took place in Barangay Magsaysay, Lavezares, Northern Samar. The findings indicated that the ecological conditions in both the control and experimental groups were favorable for seaweed farming in terms of salinity, light penetration, temperature, substrate, water depth, and water current. However, the study revealed that certain ecological factors had a greater influence, particularly on the experimental group, leading to harmful effects on the cultured seaweeds. Regarding biomass production, the data demonstrated that the control group exhibited production, while the experimental group had none due to the impact of biotic factors. There was a significant difference in biomass production between the control and experimental groups, as only the control group registered notable biomass production. Additionally, a significant relationship was found between biotic factors and seaweed biomass production, with more grazers in the seaweed farm resulting in reduced biomass. Based on these findings, the conclusion drawn from the study is that culturing seaweeds in a confined space, referred to as "caging," should be avoided. Cages serve as a sanctuary for grazers, particularly siganids, and allow the growth of algae and epiphytes, which trap the nutrients carried by the water current. These circumstances eventually lead to the development of "ice-ice" disease in seaweeds.

1. Introduction

Seaweed farming has emerged as a viable livelihood option for fishermen in developing tropical countries such as the Philippines. This practice originated years ago as a response to the depletion of marine resources caused by illegal fishing practices. In order to address this issue, the establishment of marine sanctuaries and protected areas has been promoted. Poverty is often considered the underlying factor driving fishermen to engage in these unsustainable practices, leading to the overexploitation of marine resources. Seaweed farming is seen as a promising alternative livelihood that can improve the living conditions of fishermen. It requires less capital compared to other forms of aquaculture, is not labor-intensive, and does not rely on inputs that could harm the environment. In the Philippines, the most commonly farmed seaweeds are Kappaphycus and Euchema. The seaweed farming industry in the country is primarily export-oriented, supplying carrageenan to affluent nations such as the United States, Australia, and Europe. Seaweed-derived products serve as key ingredients in various sectors, including food, dairy, cosmetics, and pharmaceuticals.

The overexploitation and depletion of finite marine resources have been caused by the rapid growth of the population, while unrestricted access to these resources has led to intense competition among users. Consequently, there is a clear need for resource management. In line with this, during the late 1990s, the Bureau of Fisheries and Aquatic Resources (BFAR), Northern Samar Provincial Office, took the initiative to establish and promote a seaweed farming project in Barangay Magsaysay, Lavezares, Northern

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Samar. However, as pointed out by researcher Gavino C. Trono, the development of seaweed farming is influenced by various factors such as biological/ecological, socio-economic, and cultural aspects.

As of now, no research has been carried out by BFAR, the Fisheries Department of the College of Agriculture at the University of Eastern Philippines, or any other entity, regarding the impact of ecological factors on seaweed biomass production in the aforementioned areas. Consequently, there is a lack of information concerning certain potential sites that could be utilized for successful seaweed farming. Recognizing this significant knowledge gap, the conceptual and theoretical foundation of this study is built upon the urgent necessity to address this issue.

The findings of this study served as a reliable basis and a framework of reference to coastal resources managers/stakeholders and the Bureau of fisheries and Aquatic Resources (BFAR), Northern Samar Provincial Office and other LGUs who are contemplating to involve and venture on seaweed farming business in the future, in policy directions and recommendations in their seaweed project operation and management. It was also an additional input to the data bank of the college of science on seaweed studies.

The result of this study made the seaweed farmers aware of the importance of the influence of the environmental factors on the growth and production of seaweeds. It will inform the community the best method on how to enhance production in the seaweed farm. They will be informed that “caging” The seaweeds is not favorable for its growth and biomass product. *Kappaphycus alvarezi*i is a good species of seaweed for culture because it can be harvested for only 30 days and it had a high carrageenan content and high market value.

2. Methodology

The municipality of Lavezares is situated in the northwestern region of Northern Samar province in terms of its geographical location. It consists of a total of 24 barangays, with 15 of them positioned along the coastal areas. Specifically, Barangay Magsaysay is found on Bani Island, positioned at a latitude of 120° 33' 5" N and a longitude of 124° 22' 16" E.

Barangay Magsaysay is positioned on the coastline of Samar Sea, situated at the hillside and swamp area of Barangay Bani's mountain. Accessible by boat, it is located approximately 10 kilometers away from the water. The farming site is encompassed by mangroves, found between Bani Island and San Juan Island. The substrate consists of a mixture of rocks and sand, and the water in the area is clear with a moderate wave current.

Barangay Magsaysay in Lavezares, Northern Samar was selected as the study site due to its convenient accessibility and the presence of established seaweed farming operations.

The selected study site offers advantages such as abundant labor, availability of materials, and convenient access to transportation and communication. The survey of the study site confirmed that the seaweeds were cultivated in an area positioned between the low tide and reef edge, ensuring that it remains submerged even during the lowest low tides. Furthermore, the site is situated at a distance of 250 meters from Barangay Magsaysay, where the caretaker or farmer responsible for the seaweed cultivation resides. This proximity facilitates easy and accessible monitoring of the seaweed growth. Prior to conducting the study, the researcher obtained permission from the Barangay Captain to ensure authorization for the research activities in the farming area.

The study area encompassed a total of 100 square meters, allocated equally for the experimental and control groups. The researcher employed the monoline method for seaweed cultivation. Seedlings were planted at intervals of 1 foot along the monoline, with a distance of 1.5 meters between each monoline. In the experimental group, six monolines were established, while another six monolines were set up in the control group, both using the same amount of planting material. However, the key distinction between the two groups was the presence of a net enclosure surrounding the monolines in the experimental group. The seaweeds were suspended on nylon no. 200 using sift tie straw, which in turn was attached to floaters. The mother line, a primary rope with a diameter of 10-15 millimeters, was tied to floaters at both ends, and additional floaters were fastened along the monolines at 2-meter intervals. To anchor the monolines, compressors were utilized at both ends, securing them to the seabed.

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The seedlings were purchased from Brgy. Sawang, Capul, Northern Samar, and underwent an acclimatization process prior to planting. Each seedling weighed 200 grams and was securely tied at its strongest point, ensuring a balanced position that allowed for free movement and ample room for growth.

The seedlings in both the experimental and control groups were simultaneously planted, with the two setups positioned adjacent to each other.

The farmer employed a boat to inspect the farm, ensuring the seaweeds were properly monitored and cleaned. They assessed the condition of the cage and the monolines located outside the net, addressing any issues such as repairing broken lines, fixing damaged stakes, and tightening loose nets. Additionally, the farmer conducted weekly monitoring of environmental parameters like salinity, light penetration, temperature, substrate, water depth, and water currents. On a daily basis, they observed and documented biotic factors including sea urchins, siganids, sea turtles, epiphytes, as well as the occurrence of ice-ice disease. This data collection process continued for a duration of 30 days.

Data Gathering Procedure

a. Harvesting of the seaweeds

The seaweed were harvested after 30 days when they reached the weight of approximately 800-1 kg. if the seaweeds weer allowed to grow more than 30 days, the plants become heavy that cause them breakage of the branches. Materials such as snacks, knife and googles were prepared. The farmer harvested the plants from the line one by one using a sharp knife and was placed inside the sack, one sack for every monoline harvested plants. All the harvested plants were collected by boat and were weighed. The weight of the plants from the control and experimental groups was recorded separately.

b. Ecological factors

Data on the following environmental factors were collected, to wit;

1. **Salinity**- analysis of the saline content seawater of the study sites was done using refractometer.

2. **Light penetration** in determining water transparency was done using Secchi disc, a 30 cm diameter white circle. It simply recorded the water depth (D) at which the secchi disc was visible from the water surface to study site.

3. **Temperature-** of the study are different periods of time were determined using a mercury thermometer submerged six (6) inches from the surface of the water for five (5) minutes.

4. **Substrate-** a sample of the substrate from the study area was collected and brought to the Bureau of soil, Department of agriculture, Northern Samar Province office for classification.

5. **Water Depth-** the measurement of water depth in the upper as well the lower limit of the vertical distribution of seaweeds was done through the use of a rope or calibrated bamboo pole from the surface until it touches the bottom area. The length of the rope was measured by the use of meter stick.

6. **Water current-** of the study areas was determined by measuring the T (time in meter per second) by using a floater.

7. **Biotic factors-** to determine the influence of animal grazers, this study determined the presence of sea urchins, siganids and epiphytes in both experimental and control groups every day. The kind of grazer that was present in the sampling area was counted and removed from the sampling area. The number of fishes in the control and experimental groups was done by approximately counting the fishes by the hundreds. Fishes samples were collected with a scoop net and the size of the fish was measured by the use of caliper. The following scoring was used to measure the extent of grazers.

Biotic factor scale	Interpretation
0-10	low
11-30	Noticeable
31-50	significant
51-above	severe

This was a numerical evaluation of the extent of the effect of grazers upon the seaweed biomass production for statistical purposes and interpretation.

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Biomass Production

$$Biomass = \frac{final\ weight - initail\ weight}{time\ lapsed}$$

The initial weight is the total weight of the seaweeds planted or the seedlings planted in the control and experimental sites. The initial weight was deducted from the total weight of the harvested seaweeds divided by the number of days the seaweeds divided by the number of days the seaweeds were planted up to the time it was harvested. The result was the biomass produced.

A focused Group Discussion (FGD) was done also. An interview for active seaweed farmers was conducted. Some important information from the farmers also enhanced the data on the biomass production of *kappahycus*. Seaweed farmers were gathered with the assistance of the president of the seaweed association of the Barangay Magsaysay. A discussion was done in the barangay to gather some information from the farmers seaweed farming.

3. Results and Discussion

Table 1 shows that ecological conditions of the control and experimental groups in terms salinity. It had a mean of 33. 25 ppt which within the range of ideal salinity range of 30-35 ppt for seaweed farming. The light penetrated up to 7 meters deep, meaning the water is clear which is in accordance with the ideal condition of site that should not be muddy or turbid. The mean of temperature was 28.75^{0}C and within temperature of 25^{0}C to 30^{0}C. the rocky- sandy substrate is the appropriate substrate to floating monoline method of seaweed farming. The water monoline and in terms of water current. It registered an average of 1.5 min./10 m which allowed moderate water current as the area is protected from big waves and stormy winds by the mountain of Bani Island.

Table 1. Ecological conditions of the control and experimental groups in terms salinity

Ecological factors	control					Standard Environmental Parameters
	Wk 1	Wk 2	Wk 3	Wk 4	Ave.	
Salinity (ppt)	32	36	33	32	33.25	30-35
Light penetration (m)	7	7	7	7	7	5-7
Temperature (^{0}C)	29	28	29	29	28.75	25-30
Water Depth (m)	7	7	7	7	7	5-7
Water current (m/min)	2.30	1.30	2.0	1.15	1.5	1 min/ 20-40 m
Substrate	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy
Ecological	**experimental**					**Standard Environmental Parameters**
	Wk1	Wk2	Wk3	Wk4	Ave.	

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Salinity (ppt)	32	36	33	32	33.25	30-25
Light penetration (m)	5	5	5	5	5	5-7
Temperature	29	28	29	29	28.75	25-30
Water Depth (m)	5	5	5	5	5	5-7
Water Current (m/ min)	2.30	1.25	2.0	1.10	1.5	1min/20-40 m
Substrate	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy	Rocky-sandy

Based on the data presented in Table 1a to Table 1d, it is evident that among the ecological factors taken into account, the biotic factors have the greatest impact on the cultivated seaweeds, particularly on the experimental group, while having a minimal effect on the control group. While it is evident that salinity, temperature, light penetration, water depth, water current and substrate had in one way or the other contribute and influenced the growth of the cultured seaweeds, findings showed, however, that the biotic factors tremendously affected the experimental group.

Table 1a displays the impact of biotic factors on the experimental and control groups of cultured seaweed during the first week. At the beginning of the week, no fish species or algae were observed in the cultivated seaweed. However, as the days progressed, *Stolephorus* sp., measuring approximately 0.30 cm in size, and estimated to be present in numbers ranging from 500 to 1,000, were found in the area. Additionally, *Abudefduf* sp. or Murayburay, measuring around 2 cm, with an estimated population of 15 individuals, were also observed. It should be noted that these species were not grazers as they lacked teeth and primarily consumed plankton. Furthermore, the growth of *Chaetomorpha* sp. (filamentous algae) was observed within the bamboo cage. During the first week, the kappaphycus seedlings exhibited satisfactory health in both the control and experimental groups.

TABLE 1a. Presence of biotic factors in the experimental and control groups for week 1

Day	Fish species found in the area	Size (cm)	Number of fish (Estimate)	Other algae Present in the net	Observation
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	Stelephorus (Bolinao)	.30 cm 2.0 cm	500-1,000 15	Chaetomorpha	

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	Abudefduf (Muray-buray)			Sp. started to grow in the bamboo cage	
6	Stelephorus (Bolinao) Abudefduf (Muray-buray)	.30 cm 2.0 cm	500-1,000 15	Chaetomorpha Sp.	
7	Stelephorus (Bolinao) Abudefduf Stelephorus (Bolinao) Abudefduf	.30 cm 2.0 cm	500-1,000 15	Chaetomorpha Sp.	Within the first week of culture, kappaphycus seedling were in good condition both in control and experimental group

According to Table 1b, during week 2, it was observed that *Stolephorus sp.* were present in the area with an estimated population ranging from 500 to 1,000. Additionally, *Abudefduf sp*. (muray-buray) measuring approximately 2cm in size were also recorded, with an estimated number of 15-30 individuals. Furthermore, from November 16-20, 2008, siganids fry were spotted, measuring around 0.20 cm in size, with an estimated population ranging from 200 to 500. On another note, throughout four days in week 2, the seaweeds *Padina sp*., *Sargassum sp*., and *Acanthopora sp*. were observed to have grown within the net of the cage.

A significant observation was made in the experimental group, where additional types of algae (*Padina sp*., *Sargassum sp*., and *Acanthopora sp.*) were noticed growing inside the net enclosure of the cage. Furthermore, siganids fry were observed in the experimental group a few days after the seedlings were planted. These siganids fry were observed grazing on the tips of the plants, as they tend to be the softer areas of the Kappaphycus.In the same period, the algae present continued to grow in the net of the experimental group. Then on, siganids fry continued to graze both in the control and experimental groups but heavier on experimental groups as they were trapped in the cage and the algae continued to grow in the net of the cage. The *Stolephorus sp.* and *Abudefduf sp*. were still seen inside the cage.

Table 1b. Presence of Biotic factors on experimental and control Groups for week 2

Day	**Fish species found in the area**	**Size (cm)**	**Number of fish (Estimate)**	**Other algae Present in the net**	**Observation**
8	Stelophorus (Bolinao)	.30	500-1000	Chaetomorpha sp.	Other algae were observable within the cage

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	Abudefduf (Muray-buray)	2.0	15	other algae spottings	frame covered with net
9	Stelophorus (Bolinao) Abudefduf (Muray-buray)	.30 2.0	500-1000 15	Chaetomorpha sp. other algae spottings	-do-
10	Stelophorus (Bolinao) Abudefduf Siganids fry (Kuyog)	.30 2.0 .20	500-1000 15 200-500	Chaetomorpha sp. other algae spottings	Siganids fry were sighted in the experimental group 5 days after the seedlings were planted
11	Stelophorus (Bolinao) Abudefduf Siganids fry (Kuyog)	.30 2.0 .20	500-1000 15 200-500	Padina sp. Sargassum sp. Acanthophora sp.	The siganids grazed the tips of the seedlings because it is the soft part of the plant algae grow on the net of the experimental group
12	Stelophorus (Bolinao) Abudefduf Siganids fry (Kuyog)	.30 2.0 .20	500-1000 15 200-500	Padina sp. Sargassum sp. Acanthophora sp	Siganids were the species of fish that graze in the experimental group the other fishes (Bolinao and muray-buray) graze the control group algae grew in the net of the cage of experimental group

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13	Stelophorus (Bolinao) Abudefduf Siganids fry (Kuyog)	.30 2.0 .20	500-1000 15 200-500	Padina sp. Sargassum sp. Acanthophora sp	-do-
14	Stelophorus (Bolinao) Abudefduf Siganids fry (Kuyog)	.30 2.0 .20	500-1000 15 200-500	Padina sp. Sargassum sp. Acanthophora sp	-do-

Based on the information presented in Table 1c, it can be observed that *Stolephorus sp*. maintained its presence, with an estimated size of 0.30 cm and a population ranging from 500 to 1,000 individuals. Additionally, *Abudefduf sp*. (muray-buray) measuring approximately 2.0 cm in size and estimated to be present in numbers of 15 to 30 individuals, along with siganids sp. fry measuring between 1.0 and 2.5 cm, were also recorded. The estimated population of siganids sp. fry was found to be between 200 and 500 individuals.

Furthermore, the table demonstrates that certain algae species, particularly *Padina sp*. (brown algae) and *Acanthopora sp*. (red algae), which were initially observed in week 1, continued to flourish. A notable observation was the impact on water currents within the experimental group, which became slower due to the algae growth that trapped the flow of water. Additionally, the rapid growth of algae led to the entrapment of nutrients, preventing the *kappaphycus* from recovering from wounds caused by grazers. The seaweeds were also affected by "ice-ice disease," resulting in their deterioration and ultimately the death of plants within the experimental group.

Table 1c. Presence of Biotic factors on Experimental and Control Group for week 3

Day	**Fish Species found in the are**	**Size (cm)**	**Number of Fish (estimate)**	**Other algae Present in the net**	**observation**
15	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 0.20	500-1,000 15 200-500	*Padina. Sp.* *Sargassum sp.* *Acanthophora sp.*	do
16	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray)	0.30 2.0	500-1,000 15	*Padina. Sp.* *Sargassum sp.*	do

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	siganids fry (Kuyog)	1.0-2.0	200-500	*Acanthophora sp.*	
17	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 15 200-500	*Padina. Sp.* *Sargassum sp.* *Acanthophora sp.*	The grazers continued to attack the seaweeds both in control and expiremental groups. Seaweeds on the experimental group started to observe with disease due to lack of nutrients because of the presence of algae that grew in the net. They serve as competitors' nutrients.
18	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 15 200-500	*Padina. Sp.* *Sargassum sp.* *Acanthophora sp.*	The grazers continued to attack the seaweeds the algae that grew in the net of the cage grew rapidly from this week.
19	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 15 200-500	*Padina. Sp.* *Sargassum sp.* *Acanthophora sp.*	do
20	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 15 200-500	*Padina. Sp.* *Sargassum sp.* *Acanthophora sp.*	do
21	*Stelephorus* (Bolinao) *Abudefdaf*	0.30	500-1,000	*Padina. Sp.*	do

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	(Muray-Buray) siganids fry (Kuyog)	2.0 1.0-2.0	15 200-500	*Sargassum sp.* *Acanthophora sp.*	

Table 1d shows that during the fourth week, *Stolephorus sp*. persisted in the area, with an estimated size of 0.30 cm and an estimated population ranging from 500 to 1,000 individuals. Additionally, *Abudefdaf sp*. (muray-buray) with an estimated size of 2.0 cm and an estimated number of 15 to 30 individuals, along with siganid sp. fry measuring approximately 2.0 cm and estimated to be present in numbers ranging from 200 to 500 individuals, were also recorded.

Furthermore, *Padina sp*. and *Acanthopora sp*. exhibited continuous growth and maintained a healthy state. Notably, the grazers persisted in consuming the seaweeds in both the control and experimental groups. Seaweeds in the experimental group still manifested the presence of "ice-ice disease" in a greater extent due to insufficient nutrients and the presence of algae that grew in the net which served as competitors for nutrients. The grazers fed on the seaweeds. The algae found on the net had probably absorbed most of nutrients and *kappaphycus* did not recover from the damage done by the grazers wherein it resulted to the death of almost all of the pants.

Table 1d. Presence of Biotic factors on Experimental and Control Group for week 4

Day	**Fish species found in the area**	**Size (cm)**	**Number of fish (estimate)**	**Other algae present in the net**	**observation**
22	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	do
23	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	water current within the experimental group slowed down due to the presence of algae growing in the net, which resulted in the entrapment of the current by the algae
24	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray)	0.30 2.0	500-1,000 5-20	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	Because of the rapid growth of algae, the nutrients were

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	siganids fry (Kuyog)	1.0-2.0	200-500		trapped and the *kappaphycus* were not able to recover from the wound made by the grazers. The seaweeds in the experimental group suffered from ice-ice disease, leading to the development of unhealthy plants, and unfortunately, the majority of the seedlings did not survive.
25	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	do
26	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 2.0-2.5	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	do
27	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 2.0-2.5	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	do
28	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 2.0-2.5	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp.*	do
29	*Stelephorus* (Bolinao) *Abudefdaf*	0.30 2.0	500-1,000 5-20	*Padina sp.* *sargassum sp.*	Because of the rapid growth of algae, the

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	(Muray-Buray) siganids fry (Kuyog)	1.0-2.0	200-500	*Acanthopore sp*.	nutrients were trapped and the *kappaphycus* were not able to recover from the wound made by the grazers. The seaweeds developed ice-ice disease, unhealthy plants and most of the seedlings in the experimental group died.
30	*Stelephorus* (Bolinao) *Abudefdaf* (Muray-Buray) siganids fry (Kuyog)	0.30 2.0 1.0-2.0	500-1,000 5-20 200-500	*Padina sp.* *sargassum sp.* *Acanthopore sp*.	do

Biomass Production of Seaweeds

Table 2 shows that in the control group with monoline method, line 1 with initial weight of 40,000 g had a final weight of 14, 750 g with a biomass of 358.33 grams; line with initial weight of 4,000 had a final weight of 11,500 grams with a biomass of 250 grams; line 4 with initial weight of 4,000 grams had a final weight of 13,500 grams with a biomass of 316. 67 grams, line 5 with initial weight of 4,000 grams had a final weight of 12,500 grams with a biomass of 283 grams; and line 6 with initial weight of 13,250 grams with a biomass of 308.33 grams. Thus, the total biomass production of the control group was 1,824.99 grams in one-month duration.

While in the experimental group with monoline method, line 1 with initial weight of 4,000 grams had a final weight of 2,000 grams with a biomass of -66.66 grams; line with initial weight of 4,000 grams had a final weight of -500 grams with a biomass of -116.67 grams; line 3 with initial weight of 4,000 grams had a final weight of 1,500 grams with a biomass of -83.33 grams; line 4 with initial weight of 4,000 grams had a final weight of 1,000 grams with a biomass of -100 grams; in lines 5 and 6, seedlings did not grow because these were afflicted by ice-ice disease. As gleaned from findings, the seaweeds in the experimental group did not grow instead they had deteriorated and those in line 5 and 6 died because of “ice-ice” disease.

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Table 2. Biomass Production of Control Group with Monoline Method

Line #	No. of seedlings/ line	Initial weight in grams/ line	Control group		Experimental Group	
			Final weight/ line (g)	Biomass g/mo	Final weight/ line (g)	Biomass (g)
1	20	4000	14, 750	358. 33	2,000	-66. 66
2	20	4000	13, 250	308.33	.500	-116. 67
3	20	4000	11, 500	250	1,500	-83. 33
4	20	4000	13, 500	316. 67	1,000	-100
5	20	4000	12, 500	283. 33	0	0
6	20	4000	13, 250	308. 33	0	0
Total			**78, 750**	**1, 824.9**	**5,000**	**-366.67**

The experience of Seaweed Farmers in Barangay Magsaysay

It was gathered from the key informants that seaweed farming in Barangay Magsaysay started only in 1998 during the time of Governor Madeleine Mendoza Ong through the Bureau of fisheries and Aquatic Resources (BFAR). The seaweeds brought in the area were 100 kilos. More than 15 farmers were encouraged to plant seaweeds. Few harvest periods were successful but succeeding harvest periods were already a failure because of the absence of buyers. One of the farmers went to Tacloban to sell the dried *Eucheuma spinosum* but was disappointed because the price was very low only P10/kl and they bought the seedling for P25/kl. The farmers were discourage to plant *E. spinosum* although they liked this species of seaweed because of its high resistance to disease and good growth performance. In 2004, NGO brought another seedling for the seaweed farmers in Brgy. Magsaysay from Bicol. The seedling did not grow because the thalli were already diseased, when they reached the site, so, there was a minimal harvest that time.

When focused Group Discussion was conducted only active seaweed farmers were called by the president of the seaweed Association as they were only 4, composed of 3 male and 1 female. It was gathered from the discussion that in 1998 they were able to harvest 1 ton only. The farmers were not able to sustain the production because they were discouraged and disappointed. But according to them, if it was sustained it could really help improve their way of living. The only problem they had encountered was the market. There were no buyers of *E. spinosum* because of low carrageenan content and the price was low.

4. Conclusion

The ecological conditions of the farming site in Brgy. Magsaysay, Lavezares, Northern Samar, were found to meet the standards set by BFAR for both the control and experimental groups in terms of salinity, light penetration, temperature, substrate, water depth, and water current. These favorable ecological conditions contributed to the growth of seaweeds in the control group. However, in the experimental group, certain ecological factors negatively affected the seaweeds, resulting in no biomass production. Among the various ecological factors considered, the biotic factors, particularly the presence of "grazers," had a significant influence on the cultured seaweeds, especially in the experimental group, but had minimal effects on the control group. There was a notable disparity in biomass production between the control and experimental groups, as the experimental group exhibited a negative biomass production compared to the control group. There exists a significant relationship between the

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biotic factors and biomass production of the seaweeds, as the presence of more grazers in the study site corresponded to a decrease in biomass production.

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