Exploring Growth of *Gracilaria* sp. using the Raft Culture Method

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Abstract

The seaweed Kawkawayan (Gracilaria sp.), marketed as a food product in the Ilocos Region, has the potential for high profitability due to its growing demand across various industries. The research, conducted in Sinait, Ilocos Sur, used the raft culture method to assess growth by measuring average weight every 15 days and analyzing its relationship with seawater parameters (dissolved oxygen, pH, turbidity, salinity, water current, conductivity, water temperature, and total dissolved solids). The data were analyzed using a descriptive correlation design, employing the Mean and Pearson Product Moment of Correlation. A 3.5 X 5 m raft with six monolines containing 23 seedlings was installed in the culture site. The results indicated that pH, conductivity, TDS, and turbidity were within the normal range, whereas temperature, salinity, DO, and water current were above the average. Gracilaria's weight increased consistently every 15 days, reaching a peak of 22.99 g on the 105th day. However, there was no significant correlation between the weight gain and the measured seawater parameters. The fluctuations in Gracilaria's weight were linked to thallus breakdown caused by vigorous water movements. The study's findings should be made available to fisherfolks in the coastal community who cultivate Gracilaria; optimal cultivation of this seaweed can be obtained when disturbances are minimal particularly from February to May thus boosting aquaculture productivity. Alternative cultivation methods like tubular nets and cage systems, along with valuable seaweed species, are recommended. Fisherfolks' participation is crucial for their success and the future of seaweed farming and marine resource conservation.

Keywords: *Gracilaria sp; raft culture method; water parameters; growth increment*

Introduction

Growing seaweed provides a nutritious food source and is becoming recognized as a sustainable answer to global food scarcity as well as lessening the impact of climate change. The Philippines is fortunate to have a rich and diverse marine ecosystem, teeming with various marine creatures and vibrant seaweeds, all thriving in its warm tropical waters. According to FAO (2020), seaweeds play a vital role in marine ecosystems, and the Philippines and Indonesia rank among the world's top producers. In 2019, seaweed exports in the Philippines ranked second representing 22% of the country's overall export profits generating US $250 million. The country's harvested 1,499,961.25 metric tons of seaweed exemplifying a rising production and highlighting the importance of this valuable resource. The Autonomous Region in Muslim Mindanao (ARMM), Regions IV-B (MIMOROPA), IX, VI, and VII are the key regions for seaweed production in the country (Department of Agriculture, 2021).

In the Palawan Region, commercially important seaweed species such as *Gracilaria*, *Eucheuma*, *Caulerpa*, and *Sargassum* have been well documented. Beyond their economic value, these species have significant medicinal applications. Seaweeds are rich in vital amino acids, antioxidants, dietary fibers, polyunsaturated fatty acids, phytochemicals, vitamins, minerals, and proteins, making them valuable as healthy dietary supplements for addressing malnutrition, weight control, and even conditions like Alzheimer's and depression. Additionally, they have versatile industrial applications, such as in feed formulation and wastewater treatment (Menaa *et al*., 2021).

Research on seaweed resources in Ilocos Sur provides further insight into the diversity and potential of these marine plants. Studies by Domingo and Corrales (2002), Domingo (2000), and Florendo and Domingo (1998) have comprehensively assessed edible seaweeds, including *Codium* and *Sargassum* species. Domingo and Corrales (2002) identified 23 species of edible seaweeds across five sampling stations, emphasizing the need for sustainable collection, utilization, and further research on cultivation methods. Domingo (2000) highlighted the importance of the *Codium* industry as a livelihood source, discussing challenges in marketing and harvesting practices. Florendo and

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Domingo (1998) focused on the abundance and distribution of *Sargassum*, identifying four species and noting the impact of colder temperatures and moderate water movement on biomass production, which are critical for effective resource management.

Despite the economic and ecological benefits of seaweeds, sustaining maximum production is challenged by coastal zone degradation caused by illegal fishing, siltation, pollution, and overharvesting. Overharvesting, in particular, leads to beach erosion and ecosystem destruction. To mitigate these issues, commercial seaweed farming emerged as a major aquaculture industry in the 1970s. However, to further address contemporary challenges such as extreme weather events and climate change, there is a need for strategic industry initiatives like the Seaweed Industry Roadmap (2022-2026).

Research in the Philippines has predominantly concentrated on "seaweed farmers," "sea grapes" (*Caulerpa lentillifera*), and the genera *Kappaphycus* and *Eucheuma* (Morales *et al*., 2022). In Ilocos Sur, traditional seaweed farming is not locally known despite the diverse seaweed species. *Gracilaria* is among the seaweeds reported to be numerous along its coastal areas and is in high demand in this province. However, it faces problems of sustainability, and to solve that, seaweed culture must be practiced.

Several studies on seaweed farming show different growth rates in the methods used. According to Muzahar *et al*. (2023), *Kappaphycus striatum*, which used the longline method, gave the most effective growth. In floating net cages, Hardan *et al*. (2020) reported the gain highest growth rate in *K. alvarezii*, similar results to Hotta *et al*. (2008), who also found that *K. alvarezii* subjected to fertilizer within the floating raft system increased efficacy in growth and was cost-effective. Hamzah *et al*. (2021) investigated how oceanographic conditions influence the growth and carrageenan content of *Kappaphycus striatum* cultivated with the longline method in Mamuju Regency, Indonesia. The study underscored the significance of environmental factors such as turbidity, phosphate concentration, current speed, and temperature on seaweed development and carrageenan production. The SEAFDEC Aquaculture Department (2017) published detailed guidelines on *Kappaphycus* farming, covering longline and raft techniques. This resource provides practical advice on setting up, maintaining, and harvesting seaweed to achieve optimal growth rates.

Several *Gracilaria* species were successfully cultivated in other countries using different culture methods. Banik *et al*. (2023) observed that biomass production in floating systems was significantly higher by 67.28–135% compared to off-bottom methods. Furthermore, *Gracilaria* species grown in floating long-line systems demonstrated enhanced quality, indicating the potential of this approach as a promising cultivation technique. Similarly, Ben Said *et al*. (2018) highlighted the importance of cultivation depth in determining the growth and nutrient composition of *Gracilaria gracilis* using net pockets. They found that a depth of 0.5 meters led to optimal growth rates, while a depth of 2.5 meters resulted in increased dry matter and ash content. Different cultivation strategies have been created for various seaweed species, such as vertical and horizontal systems, rope culture, and the Single Rope Floating Technique (SRFT), a new method aimed at increasing biomass yield in the seaweed *Gracilaria* (Veeragurunathan *et al*., 2021). In the Philippines, the raft methods were used mostly for *Kappaphycus* and *Eucheuma*.

Physicochemical parameters have a significant role in growth and production. Roleda and Hurd (2019) mentioned that metabolic activities, photosynthetic rate, and nutrient absorption of seaweeds are affected by salinity, pH, temperature, water current, amount of light, and availability of nutrients. Salinity maintains the osmotic balance and integrity of cells, while optimal water temperature can improve cellular functions and enzymatic activities. Additionally, the solubility and availability of nutrients are affected by pH. Nitrogen and phosphorus are essential for high biomass because they influence cellular growth and protein synthesis. Photosynthesis is influenced by the amount of light as it affects energy creation and development. Light intensity affects photosynthesis which influences energy development and creation. Water movement, on the other hand, is crucial for waste elimination during metabolic processes and nutrient distribution. Understanding the interplay between seaweed culture and these water parameters is crucial to enhancing yield and securing sustainable aquaculture systems.

Water parameters significantly affect seaweed performance in various aspects. In 2015, Wilson *et al*. observed shifting species composition, changes in seaweed canopies, and even altered community structure because of the elevated sea surface temperature. Hurd *et al*. (2014) highlighted the importance of physical factors, such as water movement, in seaweed growth and production. Their research revealed that seaweed species in areas with high water agitation experience increased growth rates and biomass, which boosts overall production and ecological effects. Bindoff *et al*. (2022), discusses the effects of tidal changes and temperature variations on marine ecosystems, similar to the statement you provided. It highlights that changes in tidal patterns and temperature can significantly impact marine life, including seaweeds. The report emphasizes that tidal influences can lead to the desiccation of exposed seaweeds, which in turn affects their photosynthesis and respiration. These effects vary across different species, reflecting the diverse ways in which marine ecosystems respond to environmental changes.

Understanding the relationship of these physicochemical parameters to seaweed growth and distribution could lead to more successful sustainable seaweed cultivation practices. Seaweed culture, specifically *Gracilaria*, has great potential for coastal areas like Sinait, Ilocos Sur. The coastal area is suited for seaweed cultivation because of its rich marine resources. The preservation of seaweed resources could result in economic development and the creation of alternative livelihood. Sinait seaweed is rich, but the technology for growing local *Gracilaria* is not yet developed. This study aims to investigate the cultivation and preservation of high-value seaweeds, such as *Gracilaria,* in their natural environment through the raft culture method. Fishermen and others interested in seaweed farming will benefit from the study's results, as it will not only provide revenue but also help to protect marine resources.

Materials and Methods

This study used a descriptive correlation research design to determine the growth of Kawkawayan (*Gracilaria* sp.) in terms of average weight every 15 days and the relationship between seawater parameters (dissolved oxygen, acidity, turbidity, salinity, water current, conductivity, water temperature, and total suspended solids) and growth.

Site of the study

Figure 1 shows the experimental area or seaweed farm at Katipunan, Sinait, Ilocos Sur. Katipunan is located on the island of Luzon, at roughly 17°52'25.78"N, 120°26'52.16"E. The elevation at these locations is calculated to be 7.6 meters or 24.9 feet above mean sea level (PhilAtlas, 2023).

Raft construction and setting

The farm was established using the raft culture method. This approach employed a rectangular frame of 3.5x5 m bamboo poles to form the farm construction. To hold the raft together, each corner was diagonally braced with bamboo. Six monolines, measuring five-meter-long polyethylene ropes, were attached at the two ends of the raft at 5-meter intervals where seedlings were tied. A stone securely anchored the raft.

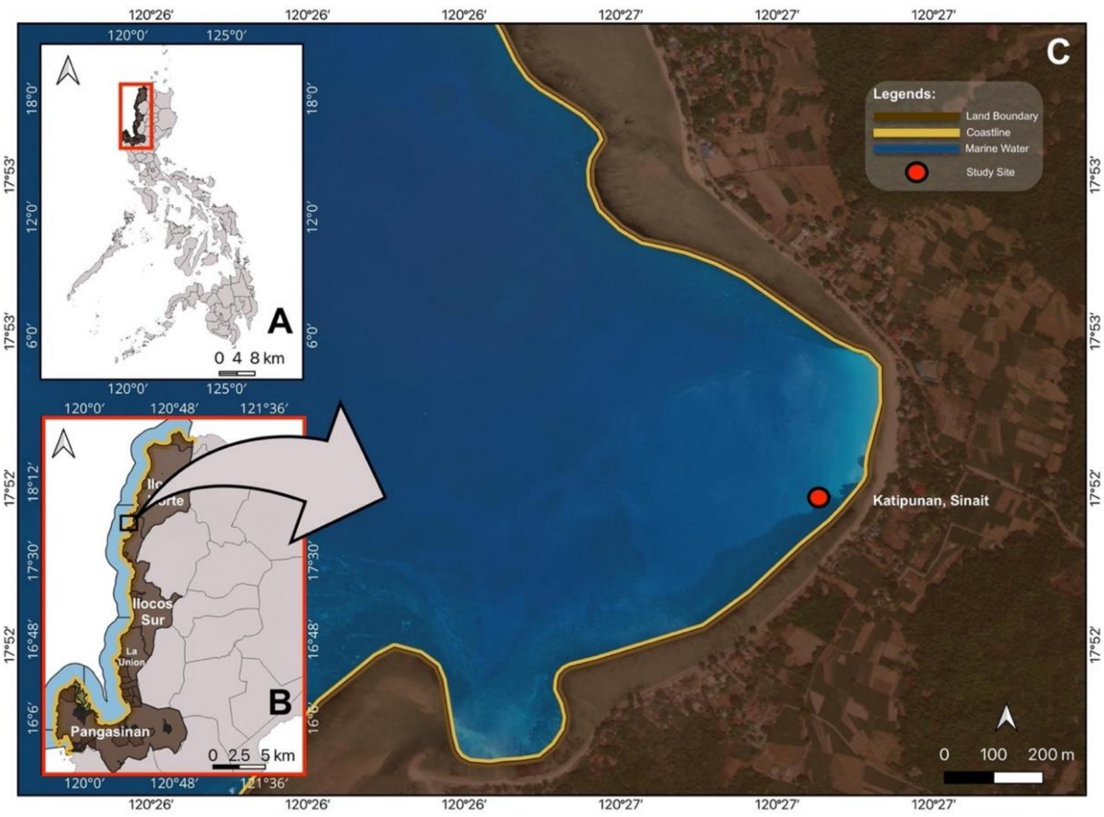

Figure 1. Map showing the study site. A) Map of the Philippines showing Region 1. B) Map of Region 1 showing the Sinait area. C) The map of Barangay Katipunan shows the installed raft marked as red with a black outline.

Collection and preparation of cutting

A careful selection of seedlings is a must; therefore, healthy, strong branches of Kawkawayan (*Gracilaria* sp.) were selected and gathered from nearby coastal Barangay in Sabangan, Sinait, Ilocos Sur. A razor-sharp stainless-steel knife was used to cut the branches. The seedlings were immersed in seawater to keep them alive.

Tying of seedlings

Only the healthy and fast-growing young portion of the seaweeds were used in this study. The initial weight was taken per seedling before tying. Each seedling weighing 10 g was tied using a soft twine called "tie–tie" with enough allowance for proper growth. The seedlings were thoroughly cleaned to remove dirt, epiphytes, and other clinging materials. They were tied to the rope at an 8-inch (20-cm) interval for better growth and spacing.

Monitoring of physicochemical parameters

Throughout each data collection period, kits measured water physicochemical parameters such as dissolved oxygen, pH, turbidity, salinity, water current, conductivity, water temperature, and total dissolved solids.

Weighing the Gracilaria seedlings

Using a weighing scale, the individual weight (g) of *Gracilaria* sp. was obtained and recorded every fifteen (15) days, particularly on the 15th, 30th, 45th, 60th, 75th, 90th, and 105th days.

Statistical analysis

The Mean was used to represent the average weight and growth increment of *Gracilaria* sp. The Pearson Product Moment of Correlation was used to determine whether or not there is a significant relationship between various water parameters such as dissolved oxygen, pH, turbidity, salinity, water current, conductivity, water temperature, and total dissolved solids in the growth of Kawkawayan (*Gracilaria sp.*).

Results and Discussion

Physicochemical properties of seawater

Water parameters are vital in developing cultured or naturally grown seaweeds in the intertidal zone. The coastal water of Katipunan, Sinait Ilocos Sur, was classified as Class SC in the Philippine setting based on DENR Administrative Order 2016-08 (2016). Class SC is intended for commercial and sustenance fishing, such as propagating and cultivating marine life.

Sea surface temperatures ranged from 30.20°C to 31.30°C (Table 1.), with the highest temperature recorded on the 30th day and the lowest on the 60th day of the study period. Although these temperatures are slightly higher than the standard values prescribed by DAO 2016-08 (2016) for marine waters, they were still suitable for cultivating Kawkawayan (*Gracilaria* sp.). The seaweed not only survived but remained healthy throughout the entire cultivation period. It coincides with Bohari and Musbir (2022) result in cultured *Euchema cottoni* with a temperature ranging from 29.10°C to 31.20°C and some gracilarioid species, *Gracilariopsis bailiniae* and *Hydropuntia edulis* that fall within the in-situ ranges from 25.00°C to 32.00°C are well adapted to this temperature. Enzymes are present in seaweed and cannot function at a too-cool or hot temperature, due to seaweed has a defined temperature range (Warnadi *et al*., 2018).

The pH ranged from 7.43 to 8.40 in the study site. The highest pH recorded was in the 1st day-gathering, while the lowest was in the 30th day-gathering period. The acidity or pH level is one of the most important parameters in monitoring water stability. Because each biota has a different pH limit, changes in the pH value of water will affect the life of the biota. Introducing wastewater from the land, such as river effluent, into the aquatic environment raises the pH level from the estuary to the high seas. The pH measurement ranged from 7.53-8.4, sufficient for *Gracilaria* cultivation, according to Better Management Practices (2014), which ranged from 6-9 pH. Sea and coastal waters have a more stable pH and a narrow range, typically ranging from 7-8 (Akib *et al*., 2015, as cited by Sulistiawati *et al*., 2020) and 6.5-8.5 (DAO 2016-08, 2016).

Conductivity refers to the capacity of water to transmit an electric current. The seawater conductivity in the study area ranges between 3 and 6 $S.m^{-1}$. Maximum conductivity levels occur in shallow water between 20 and 100 m below the surface, whereas minimum conductivity values occur in medium water between 1800 and 2600 m (Zheng *et al*., 2018). The conductivity measured in this study, which varied from 49.7 to 58 $mS.cm^{-1}$, is still considered normal because 3-6 $S.m^{-1}$ is equivalent to 30-60 $mS.cm^{-1}$. The electrical conductivity of water offers an estimate of the total concentration of dissolved ions in water. It is a critical attribute of water routinely tested in aquaculture systems (Boyd, 2017). Significantly increased electrical conductivity might indicate contamination in the water. Electrical conductivity cannot identify the pollutant, but it can

Table 1. Physico-chemical parameters of water in Katipunan, Sinait, Ilocos Sur

Water Parameters	Gathering Period per 15 days interval								Standard Values	Authors
	May	June			July		August			
	1st	15th	30th	45th	60th	75th	90th	105th		
Sea Surface Temperature (⁰C)	30.83 ±0.01	31.00 ±0.88	31.30 ±0.10	30.60 ±0.20	30.20 ±0.01	30.40 ±0.01	30.70 ±0.12	30.50 ±0.01	25.00-31.00	(DAO, 2016)
pH	8.40 ±0.2	7.44 ±0.01	7.43 ±0.01	7.61 ±0.02	7.53 ±0.02	7.54 ±0.03	7.56 ±0.01	7.52 ±0.01	6.50-8.50	(DAO, 2016)
Conductivity ($mS.cm^{-1}$)	49.70 ±0.01	55.80 ±0.17	55.50 ±0.01	56.00 ±0.01	56.40 ±0.36	57.70 ±0.02	58.00 ±0.04	57.80 ±0.10	30.00-60.00	(Zheng *et al.*, 2018)
TDS (ppm)	32.60 ±0.01	27.90 ±0.02	27.70 ±0.26	28.00 ±0.04	28.20 ±0.27	28.80 ±0.17	29.00 ±1.00	28.70 ±0.20	< 80.00	(MLE, 2004)
Salinity (‰)	32.10 ±0.10	34.10 ±0.06	34.10 ±0.02	34.50 ±0.10	34.70 ±0.20	35.50 ±0.03	35.70 ±0.13	35.70 ±0.05	31.00 - 35.00	(Naryo, 1989)
DO ($mg.L^{-1}$)	5.55 ±0.01	5.10 ±0.00	5.00 ±0.02	5.20 ±0.10	4.20 ±0.02	5.40 ±0.01	5.50 ±0.17	5.30 ±0.20	5.00	(DAO, 2016)
Turbidity (NTU)	15.00 ±0.01	9.20 ±0.17	9.40 ±0.10	12.20 ±0.35	11.10 ±0.09	0.00 ±0.01	0.20 ±0.00	9.80 ±0.02	30	(PGDIY, 2010)
Water Current ($m.s^{-1}$)	1.64 ±0.01	1.66 ±0.01	1.69 ±0.01	1.65 ±0.01	1.64 ±0.01	1.72 ±0.01	1.58 ±0.02	1.67 ±0.01	0.20-0.30	(Warnadi *et al.*, 2018)

help determine whether a problem could affect invertebrates and fish (Electrical conductivity leaflet, 2013).

Total Dissolved Solid (TDS) comprises organic compounds, inorganic salts, and gas. TDS levels in the study area ranged from 27.7 to 32.6 ppt. Regarding Water Quality Criteria, this range is still in good shape and safe for fishery activity. The limit is set at 80 ppm by (Ministry of Living Environment, 2004 as cited by Yala *et al*., 2017).

As cited by Yala and Sulistiawati (2017), previous studies found that suitable water salinity for seaweed growth ranged from 31 to 35 ppt (Naryo, 1989) and 30 to 35 ppt for *Eucheuma* sp. (Soegiarto *et al*., 1978; Dawes, 1981), and 28-32 ppt (Yala, 2011). It ranged from 32.1-35.7 in this study, which is slightly higher than those previously presented.

The dissolved oxygen measurements obtained in this study, which ranged from 4.2 to 5.51, show that the cultivation location suits seaweed farming activities. A 3-8 $mg.L^{-1}$ dissolved oxygen is required to support the seaweed cultivation industry (Alamsyah, 2016, as cited by Sulistiawati *et al*., 2020). In addition, dissolved oxygen was at the suitable standard in the Environmental Management Bureau set with 5 $mg.L^{-1}$. A slight increase of 0.5 $mg.L^{-1}$ due to the high movement in the water surface that increases dissolved oxygen, such as wave action, was observed.

Turbidity levels in the study area ranged from 0 to 12.2 NTU. The turbidity level was highest in the fourth week and lowest in the sixth week. Particles rise to the water's surface due to shallow water bottoms, solid currents, and muddy, sandy bottoms, especially when the water is disturbed. Turbidity decreases water brightness, which can be important in seaweed cultivation. The acceptable turbidity level for coastal waters, particularly on SW-III waters, to support the reproduction and development of fish and other aquatic resources and to facilitate commercial and subsistence fishing is 30 NTU (Coastal Water Standards, 1986).

Seaweed farms require water flow because water currents significantly transport nutrients, which is especially vital for seaweed growth. The ideal stream velocity for seaweed development varied from 0.2 to 0.4 $m.s^{-1}$ (Marianingsih *et al*., 2013, as cited by Sulistiawati *et al*., 2020). The range of water current in this study was 1.58-1.69 $m.s^{-1}$. According to Sulistiawati *et al*. (2020), a current velocity of more than 40 $cm.s^{-1}$ can damage cultivation infrastructure and kill seaweed branches.

Growth of Kawkawayan (Gracilaria sp.)

To determine the growth of Kawkawayan (*Gracilaria* sp), the bamboo raft culture method was employed. This method which hangs *Gracilaria* seedlings on floating bamboo, was used to improve its growth, which is also a potential strategy for sustainable seaweed farming.

The recorded mean weight of Kawkawayan (*Gracilaria* sp.) gradually increased every fifteen days. The 105th day (63.36 g) of the culture period was revealed to have the highest mean weight, followed by the 90th day (39.74 g), 75th day (36.32 g), 60th day

(32.67 g), 45th day (27.78 g), 30th day (22.29 g), and 15th day (18.29 g) (Table 2.).

Throughout the culture period, the mean weight increment of Kawkawayan (*Gracilaria* sp.) varies every fifteen days. The highest mean weight increment was recorded on the 105th day. The progressive increase of mean weight throughout the study period recommends that Kawkawayan (*Gracilaria* sp.) sustained its growth, with the highest weight gain in the latter part of the culture period. The method of spreading the thallus plays a crucial role in the growth of *Gracilaria* species. According to Hidayatulbaroroh *et al*. (2018), spreading the thallus every two weeks resulted in a 78% boost in productivity compared to when no spreading was done, emphasizing the significance of new thallus formation. This is further supported by Krueger-Hadfield *et al*. (2023), who highlighted that the development of new thalli, especially reproductive tetrasporophytes, is essential for increasing biomass in *Gracilaria vermiculophylla*. This process could potentially aid in the expansion of non-native populations and in adapting to temperature variations.

Cultivating Kawkawayan (*Gracilaria* sp.) using the bamboo raft culture method has improved production and shown promising outcomes. The findings of this research align with those of Santos *et al*. (2019), as referenced by (Panja *et al*., 2022), in identifying optimal conditions for the open-sea cultivation of *Gracilaria edulis* in the Andaman Sea, which produced a yield of 8.150 kg from spores over 120 days. Likewise, as cited by Rivas *et al*. (2021), the study of Almeida *et al*. (2020) demonstrated the successful indoor cultivation of *Gracilaria* sp., offering a feasible alternative to conventional open-water farming techniques. Furthermore, Sobuj *et al*. (2022) verified that cultivating *Gracilaria* species using the floating raft method, with attention to key factors, has the potential to be a profitable venture for large-scale seaweed production in coastal regions.

Correlation of physicochemical parameters with the growth Kawkawayan (Gracilaria sp.)

The table 3 indicates that the calculated correlation (r) between the growth of Kawkawayan (*Gracilaria* sp.) in terms of weight increment and seawater parameters, including temperature, pH, conductivity, Total Dissolved Solids (TDS), salinity, Dissolved Oxygen (DO), turbidity, and water current is not statistically significant. The results imply that the water parameters mentioned above did not affect the growth in terms of the weight increment of *Gracilaria* sp. This might be because various water parameters, notably temperature and water current, are over the standard or acceptable range for seaweed production. Above 25°C, the growth rate of all temperate species decreased. This behavior of the species may be related to their adaptability to their ecological surroundings. (Ma *et al*., 2021) discovered that *Gracilaria* species showed higher growth rates at 25°C to 30°C compared to 20°C. Though water movement is essential for delivering nutrients required for *Gracilaria* development, excessive water current leads the *Gracilaria* thallus to break, resulting in a fluctuation of weight increment (Table 3).

Table 2. Mean Weight of Kawkawayan (*Gracilaria* sp.) per 15 days

Gathering Period per 15 days interval	Mean Weight (g) Monoline						Mean Weight	Mean Weight increment
	1	2	3	4	5	6		
1st	10.00 ±0.00	10.00 ±0.00	10.00 ±0.00	10.00 ±0.00	10.00 ±0.00	10.00 ±0.00	10.00 ±0.00	0±0.00
15th	24.00 ±3.43	17.25 ±1.29	18.75 ±0.79	20.00 ±2.05	17.25 ±1.77	12.50 ±1.19	18.29 ±1.54	8.29±18.29
30th	25.50 ±3.28	18.00 ±1.45	25.50 ±1.70	28.00 ±1.72	18.00 ±1.84	18.75 ±1.41	22.29 ±1.85	4.00±1.85
45th	38.50 ±6.41	21.75 ±1.89	29.25 ±1.94	34.00 ±2.92	21.25 ±1.80	21.90 ±1.45	27.78 ±3.00	5.48±3.00
60th	51.25 ±5.74	25.50 ±1.40	33.00 ±2.15	40.00 ±2.75	21.25 ±1.80	25.00 ±1.38	32.67 ±4.62	4.89±4.62
75th	54.40 ±4.54	32.00 ±2.51	35.00 ±10.97	45.00 ±1.69	23.90 ±1.86	27.50 ±1.36	36.32 ±4.67	3.63±4.67
90th	57.50 ±4.48	38.50 ±1.47	35.29 ±13.04	50.00 ±2.55	26.50 ±1.85	30.00 ±1.56	39.74 ±4.87	3.33±4.87
105th	79.21 ±17.86	53.53 ± 19.72	45.88 ±16.93	106.94 ±33.47	43.24 ±16.03	46.94 ±17.36	63.36 ±10.37	22.99±10.37

Table 3. Correlation coefficient (r) on the significant relationship between seawater parameters and growth of Kawkawayan (*Gracilaria sp.*)

Variables	Weight increment	Remarks
Temperature	-0.15	Not Significant
pH	-0.07	Not Significant
Conductivity	0.31	Not Significant
TDS	0.20	Not Significant
Salinity	0.35	Not Significant
DO	0.16	Not Significant
Turbidity	0.32	Not Significant
Water Current	0.12	Not Significant

Conclusions

Gracilaria sp. exhibits its highest growth (g) increment on the 105th day of cultivation. However, the study revealed no significant correlation between the growth of *Gracilaria* sp. and seawater variables, including temperature, pH, conductivity, total dissolved solids (TDS), salinity, dissolved oxygen (DO), turbidity, and water current. Therefore, it is important to disseminate these findings to fisherfolk, as they indicate that the coastal community could benefit economically from cultivating Kawkawayan (*Gracilaria* sp.). Cultivating this seaweed from February to May may result in fewer physical disturbances and optimized growth. Additionally, exploring alternative growing methods, like the tubular net and cage method, and investigating other highly valued seaweeds could further enhance income opportunities for coastal communities.

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