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# Challenges in Cultivation of Seaweed: A Recent Experience from RezuKhal, Cox's Bazar Coast, Bangladesh

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**Abstract:** This present study was conducted to identify the challenges in RezuKhal (Cox's Bazar) seaweed cultivation site. Seaweed has an economic and ecological role (it has a great role in climate change adaptation). This research was conducted from December to March 2021. Seaweed growth was good but not excellent since a few challenges control the growth. Sedimentation was the main issue and it was observed that in a short period, seaweed occasionally went beneath the sediment. Eutrophicated/polluted water from "*Niribili Monosex Tilapia Hatchery*" create a huge problem. When contaminated water gets into the cultivation sites, the seaweed turns pale or white. Seaweed that came into contact with contaminated water perished. Seaweed is cut by hermit crabs as soon as it begins to grow. It functions as a razor-sharp blade to chop the seaweed and reduce its growth. During high tide and low tide, current velocity washed away the seaweed from the cultivation site. The neighboring Mermaid resort's garbage was a major issue. For cultivated seaweed, exotic species like *Enteromorpha* sp. pose serious challenges. For space and food, they compete with cultured seaweed. Occasionally, they occupy the net space and grow proliferatively on cultivated seaweed. Seaweed growth was impeded as a result. Kayaking for recreation and fishing with motorboats both significantly slow growth. These watercrafts pass over the seaweed growing area and uproot it. All of these features function as regulatory factors that prevent or slow down seaweed growth. A viable cultivation technique (proposed) that will lessen these dangers is the "*Multitrophic Box Method*". According to the results of the current study, these difficulties should be kept to a minimum when growing seaweed. Otherwise, seaweed growth will be reduced or the venture won't be lucrative.

**Key words:** Seaweed · Cultivation · Challenges · Growth · RezuKhal

## INTRODUCTION

The macroalgae known as seaweed, which has no actual roots, stems, blooms, or leaves, is crucial to the aquatic ecosystem [1-3]. Most seaweeds are found in tropical, subtropical and temperate climates [4]. They flourish on plant bodies like rocks, coral, shells, sand, mud and shells [5]. A versatile raw material, seaweed is used to make fertilizers, industrial gums and chemicals for the food, pharmaceutical and cosmetic sectors [6, 7]. In many other nations, seaweed has long been a mainstay of the cuisine. Globally, seaweed culture production increased by more than three times between 1995 and 2012, reaching 23.8 million tons annually. China and Indonesia accounted for 81% of the total production [8, 9]. Seaweed farming is probably going to be very important in bridging the expanding gap between supply and demand because of environmental concerns.

Bangladesh experiences seaweed growth from November to March, depending on turbidity, salinity and temperature [10, 11]. Seaweed can be culturedin suitable sites using the cost-effective method by training low-income farmers [12]. Bamboo and rope are examples of natural materials that can be used to cultivate seaweed [13, 14]. Seaweed aquaculture can be a beneficial industry for Bangladeshi coastal villages because it requires

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minimal input, produces great returns and employs a lot of people. Excellent areas for seaweed cultivation exist from Cox's Bazar to the Sundarbans [12, 15].

The nutrients needed for bodily growth can be found in seaweed. Furthermore, it may be a profitable source of overseas income[1]. Seaweed cultivation can be another source of income in addition to fishing for seafood. Particularly for women, it can be a lucrative industry [16-18]. There are 138 species of seaweed, including 55 genera and 18 species that are significant for commerce [19]. It is crucial to comprehend and alter the key factors that affect the cultivation of seaweeds with high commercial value. These parameters include water quality, nutrient dispersion, current velocity, surface temperature, light and photoperiod and relationships between them and the physiological response.

Abiotic factors that can have a positive or adverse effect on seaweed productivity and the usage of biomass include current velocity, temperature, light and photoperiod and nutrient dispersion [1]. Seaweed development is hampered by difficulties encountered while experiential seaweed cultivation. The difficulties involved make seaweed farming unprofitable and unsustainable. The purpose of this study was to pinpoint the problems that prevent successful seaweed production.

## MATERIALS AND METHODS

**Study Area:** RezuKhal along the Cox's Bazar coast was chosen for culture following a feasibility analysis (Figure 1). This cultural region was quite close to the coast, where the salinity stays between 23 and 30 ppt.

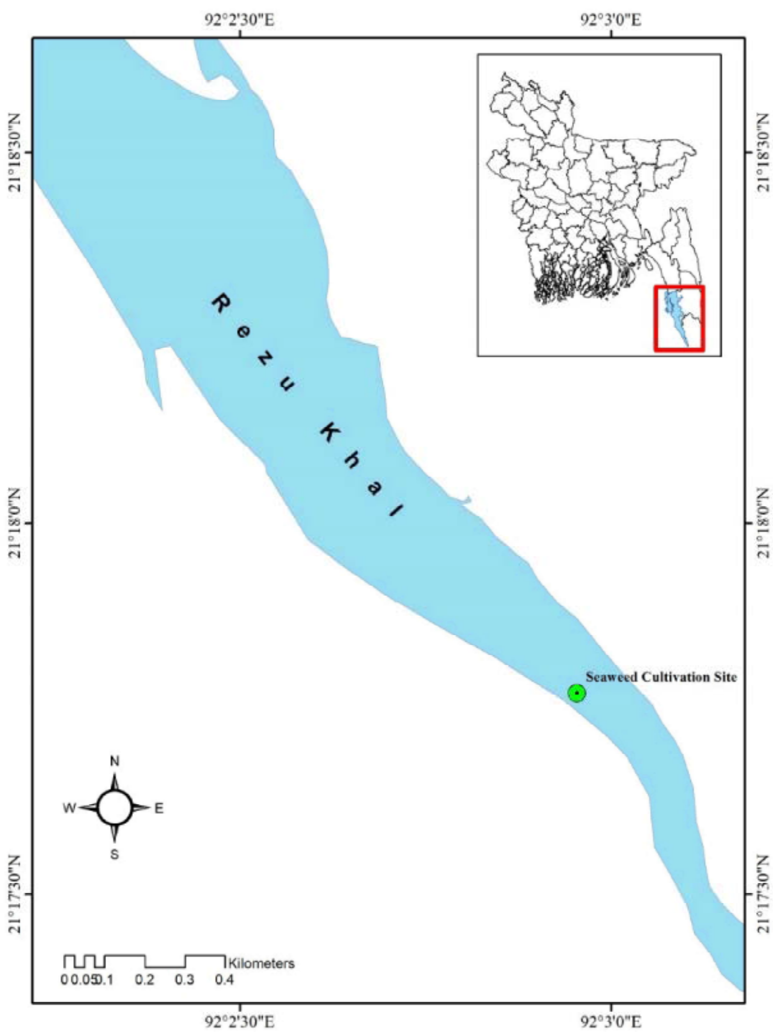


Fig. 1: Map showing the seaweed culture site in Rezu Khal, Cox's Bazar

Fig. 2: *Gracilaria lemaneiformis*

Fig. 3: *Hypnea musciformes*

**Geological Settings:** The seaweed farming site is near the sea. Salinized water consequently enters the Khal. There are many mangrove trees close to the locations. Every day, Mermaid Resort in the east dumps trash into the Khal. Water that has been chemically altered or eutrophicated is frequently released into the Khal by a tilapia hatchery (*NiribiliMonosexTilapia Hatchery*) in the west. The soil at the culture site is mainly sandy, whereas Khal bank is mainly muddy. As a result, there is tremendous sedimentation occurring and the water is not very transparent. Both high and low tides cause significant water flow.

**Selected Seaweed Species for Culture:** For culture, three (3) distinct types of seaweed were chosen (Fig. 2-4). The red seaweeds *Gracilaria lemaneiformis* and *Hypnea musciformes* are well-known for their enormous economic importance. Brown seaweed *Sargasumoligocystum*was

Fig. 4: Sargassum oligocystum

Fig. 5: Net method

another type of seaweed that grow proliferatively. The economic value of these species is very high. These species can be utilized to produce carrageenan and agar.

**Experimental Settings:** The construction of the infrastructure took place in November. In December, the planting process was finished. The locals provided the bamboo. From a nearby market, ropes, knives and other supplies were purchased. Bamboo was cut and ready for growing seaweed. With the help of identifying leaflets, the experimental plots were located. The plot was easier to locate thanks to these identification plates. Information on the project is displayed on a signboard. Here are the specifics of the experimental arrangement.

**Seaweed Cultivation Methods:** For the culture, two methods (such as net and long line) were used (Fig. 5 & 6). Both long lines and nets were used to plant the *Gracilaria lemaneiformis* seed. Five experiment plots

Fig. 6: Long line method

(5m x 5m) were created for the net to be cultured. For long line culture, 5 ropes 20 m long were utilized (5x2 rope in two plots). *Sargassum oligocystum* and *Hypnea musciformes* were sown in the net (4m x 4m). For each species, two experimental plots were established. As culture materials, bamboo matting, jute rope and coir rope were employed. For the net method, four bamboo pillars in each corner and another four bamboo pillars in the center of each side were used to secure the net. This additional pillar was utilized to strengthen the net's ability to withstand high currents. A second bamboo pillar was utilized to create a sturdy framework in the center of the net. The net was secured to the bamboo post with rope. Two bamboo pillars were placed in each corner of the rope when using the long line method. Additional bamboo pillars were placed here in the middle of the rope.

## RESULTS AND DISCUSSION

Farming seaweed has enormous economic potential. In underdeveloped coastal areas around the world, where overfishing is frequently rampant, it also provides development and social alternatives. Although RezuKhal's seaweed aquaculture is good, there are a few obstacles that have led to limited productivity (Below). If these difficulties can be reduced, seaweed production will rise significantly.

### Challenges in Seaweed Cultivation

**Sedimentation:** The RezuKhal is very dynamic. There is a story about the Khal that it kills people. The sand of this Khal moves every day. Veen if you put your establishment under 5 feet under water during low tide, you will find one part of the establishment go under the sand suddenly. Moreover, discharge water from Niribili hatchery is also responsible for sedimentation. There is a drain from Niribiili hatchery that bring sand and mud from upstream. As a result, turbulence and sedimentation increased. Sometimes, seaweed is covered by sediment which reduces seaweed growth (Figure 7). Sometimes seaweed dies if they remain under sediment for a longer period.

**Eutrophicated Water:** In the present study, there was the intrusion of chemical mixed water or eutrophicated water from the nearby tilapia hatchery (*Niribili Monosex Tilapia Hatchery*). The growth of seaweed was very good, but one-day seaweed in one corner of the net was found dead (pale color). But what was the cause of this sudden death was not clear. Since the water quality was good. After close inspection, the hidden cause was identified. The cause was chemical mixed water (green in color) discharge from Niribili hatchery (Figure 8). They discharge eutrophicated water just before sunset and after sunset.

**Hermit Crab:** The hermit crab is just like a sharp blade. It cut down the seaweed very smoothly. This crab was found in huge numbersat the cultivation site. They stick to the seaweed and cut the seaweed when it was growing well (Figure 9). Most probably, these crabs use seaweed as their habitat. They take food and nutrition from

Fig. 7: Sedimentation during culture

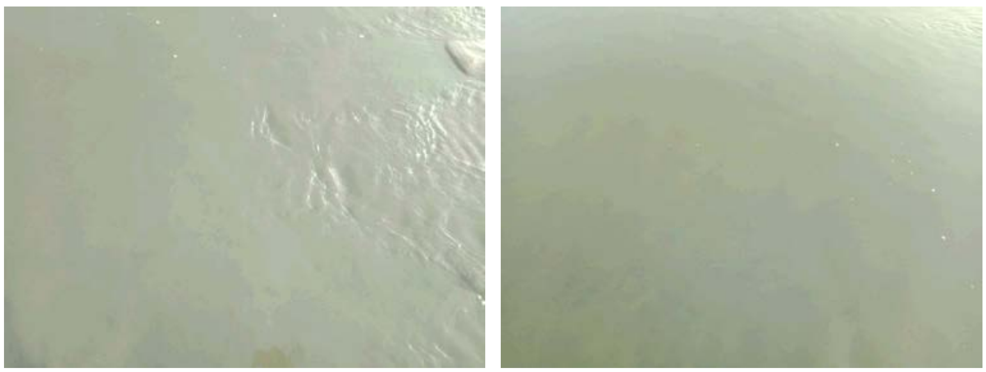

Fig. 8: Chemical mixed or eutrophicated water intrusion in culture area

Fig. 9: Hermit crab in culture site that cut seaweed abruptly

seaweed. As a consequence, they cut seaweed and these seaweeds washed out with current velocity. For this, the growth of seaweed retard and production is reduced.

**Current Velocity:** Current velocity is very important for seaweed cultivation. In the present study, current velocity both in low tide and high tide was not good for seaweed cultivation (Figure 10). Since the cultivation was executed using the net and long line method, when seaweed grows well, they are washed away with the current. As there was no barrier or protection to prevent seaweed from washing out. The typical current velocity at the seaweed culture site ranges from 1.5 to 10 $cms^{-1}$ [20]. A stream velocity of roughly 10 cm/s is adequate to sustain the possibility of seaweed development in nutrient-rich areas [21]. The community of macroinvertebrates can use the mechanism of nutrient mixing and chlorophyll-a dispersion that is supported by the dynamical stability of the current velocity [22, 23].

Fig. 10: Current velocity in the culture site that take away seaweed

Fig. 11: Different garbages in the culture site

Fig. 12: Unwanted Enteromorpha sp. that reduce target seaweed species

**Garbage:** Garbage like polythene bags, polythene ropes, nylon ropes, chips packets, discarded wood and torn parts of trees are common in the culture site (Figure 11). During low tide, the culture has to be clean. Otherwise, these wastes cover (mostly polythene) the seaweed and reduce growth. Thisgarbages mainly comes from local areas during high tide. Fishermen also throw polythene and other waste into the Khal. Mermaid Resort along the Khal is the main contributor of garbage. Everyday they throw their waste materials into the Khal. As a result, cleaning has to perform every day, otherwise, growth will hamper.

**Exotic/unwanted Sp:** During March and April, the natural growth of *Enteromorpha* sp. is proliferative in the RezuKhal. They washed away from their natural bed and stuck to the net and rope of the culture site (Figure12). These *Enteromorpha* sp. stick to the cultured species and compete with the species for space and nutrition. As a result, during March and April, the growth of target seaweed is lesser than the *Enteromorpha* sp. Ultimately, they become dominant species and reduce cultured species growth.

**Kayaking and Engine Boats:** At RezuKhal bridge, there are facilities for Kayaking named "*Cox-Kayaking*" (Figure 13). People used to have fun with Kayaking. But sometimes they come to the culture site and damage seaweed unintentionally. Besides, fishing boats also passed near the culture site and make a strong current that uprooted the seaweed. Moreover, small-scale fishermen fishing near or in the culture site since they get


Fig. 13: Cox kayaking in the Rezukhal adjacent to the cultivation site

huge fish near or in the seaweed culture site. Fish use seaweed culture sites as feeding and nursery ground. Fishermen cast their net in the culture site at night.

**Future Directions:** The cultivation of seaweed on a big scale for commercial and industrial uses must minimize challenges.

- Interaction between the public, private and academic sectors to strengthen the field and exchange knowledge.
- To ensure minimal negative effects on the environment and vice versa, the development of sustainable seaweed production is required.
- It is necessary to clean the cultivation sites frequently.
- Parameters affecting water quality must be regularly monitored.
- The Multitrophic Box Method should be used to reduce these difficulties and boost growth.
- Needed intensive care for best growth.

## CONCLUSION

Seaweed culture has a lot of potential to boost the economy. Coastal communities and fishermen may be able to supplement their incomes during the prohibition period. Women's participation in seaweed production has the potential to alter the economic structure of coastal communities. But challenges make seaweed growth tough. The present study revealed many obstacles to growing seaweed, including sedimentation, contaminated water, hermit crabs, current velocity, trash, unwanted/exotic species, kayaking and engine boats. During the cultivation of seaweed, these risks must be taken into account. Attempts should be made to reduce these difficulties for successful seaweed production.

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