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Integrate of culture area for seaweed (*Eucheuma cottonii*) and fishing ground for Stripped Mullet (*Mugil cephalus)* in marine coastal waters

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Abstract. Seaweed culture play role in human food, animal feed, and environmental quality. The intensively study of seaweed culture was conducted in many places. The need to assess seaweed production, fish catch and the water quality of the seaweed culture area was necessary. The present study investigates the integrated system for seaweed culture and fishing ground for *Mugil cephalus* in marine coastal waters area. The purpose of study was to assess the production of cultured seaweed (*Eucheuma Cottonii*) and caught Stripped Mullet (*Mugil cephalus*) in marine coastal waters. The study was conducted from October 2019 until March 2020 in southern marine coastal waters of Bulukumba Regency, South Sulawesi, Indonesia. The method of seaweed culture was longline with a rope length of 50 and the distance between rope stretches of 1 meter with the average number of rope stretches 50 stretches perunit. Stripped Mullet was caught using a surface gillnet 100 length, 2.5 m depth and 1,3/4 inch mesh size. The water quality such as water temperature, salinity, pH, brightness, current velocity was measured. The production of seaweed in this area during planting period between 40-45 days ranged 8.300- 11.600 kg wet/ha and catch Stripped Mullet ranged 43-162 individuals/one day trip. The results of study suggest that a seaweed culture influence on the production of cultured seaweed and caught mullet in marine coastal waters. The water quality parameters during study were favorable for seaweed production grey mullet fish catching.

1. Introduction

Indonesia is one of the main producers of the seaweed world market [1]. Seaweed industry has been widely developed especially in eastern Indonesia [2]. South Sulawesi is one of provinces South Sulawesi has developed the cultivation of seaweed species *E.cottonii*. [3].

There are three marine waters in South Sulawesi including Makassar Strait, Flores Sea, Bone Bay as an area potencial for seaweed culture and fishing ground [4]. Moreover, marine waters of Bulukumba regency as one of many regencies in South Sulawesi has developed as an area for seaweed culture and fishing ground [3].

Seaweed culture play role in human food, animal feed, and environmental quality. The intensively study of seaweed culture was conducted in many places. The need to assess seaweed production, fish catch and the water quality of the seaweed culture area was necessary. The present study investigates the integrated system for seaweed culture and fishing ground for *Mugil cephalus* in marine coastal waters area. The

purpose of study was to assess the production of cultured seaweed (*Eucheuma Cottonii*) and caught Stripped Mullet (*Mugil cephalus*) in marine coastal waters.

2. Materials and Methods

The study was conducted from October 2019 until March 2020 in southern marine coastal waters of Bulukumba Regency, South Sulawesi, Indonesia (Fig. 1).

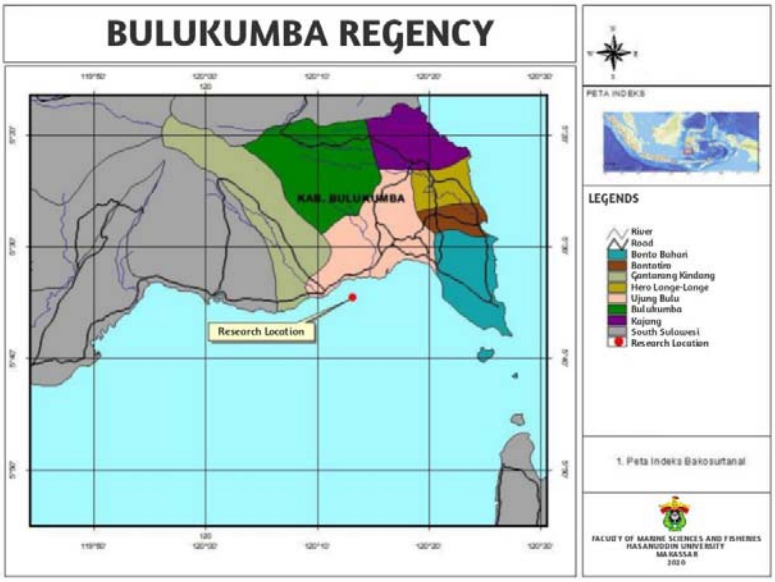

Figure 1. The area of seaweed culture as study site in marine coastal waters, Bulukumba Regency, South Sulawesi.

The method of seaweed culture was longline with a rope length of 50 and the distance between rope stretches of 1 meter with the average number of rope stretches 50 stretches perunit. Stripped mullet was caught using a surface gillnet 100 length, 2.5 m depth and 1,3/4 inch mesh size.

The water quality such as water temperature (ºC), salinity (ppt), pH, brightness (m), current velocity (m/s) was measured in situ. Analysis of water suitability for seaweed ulture suitability was identified following suitability according to [5], namely.

3. Result and Discussion

3.1. Seaweed Production

The method used for seaweed culture in this study was longline method. This method was commonly applied in many coastal in Indonesia and also in some countries such as Malaysia, Philippine, Vietnam, India.

Longline method for seaweed culture with a rope length of 50 and the distance between rope stretches of 1 meter with the average number of ropes stretches 50 stretches per unit. One unit seaweed culture was 2.500 m2 (0.25 hectares). The distance between One unit seaweed culture was 10 meters. The production

of seaweed in this area during planting period between 40-45 days ranged 8.300- 11.600 kg wet/ha (Table 1).

Table 1. The Production of the seaweed culture in marine coastal waters.

No	Distance from Beach Line	Seaweed Production (kg/ha)
1	0-100	8.300 kg wet/ha
2	100-200	10.900 kg wet/ha
3	200-300	10.300 kg wet/ha
4	300-400	11.600 kg wet/ha

Production of the seaweed culture in this study indicate that the seaweed will grow better during the study. The growth of seaweed can be 10 times of weight in 40-45 days culture, For example, after 40-45 days culture of the 100 grams of seaweed, the weight will increase around 1 kilograms. It indicate that the seaweed culture can be an obvious benefit for the farmers.

3.2. Fish Production

Catch stripped mullet (*Mugil cephalus*) during the study ranged 43-162 individuals/one day trip. Total catch was 415 individuals. The highest catch on occurred on estuary habitat (0-100 m from beach line) with 162 individuals, followed by (100-200 m from beach line) and (2000-300 m from beach line) with 124 individuals and 86 individuals respectively. (Figure 2).

The results of study suggest that a seaweed culture influence on the production of cultured seaweed and caught mullet in marine coastal waters. The water quality parameters during study were favorable for seaweed production grey mullet fish catching.

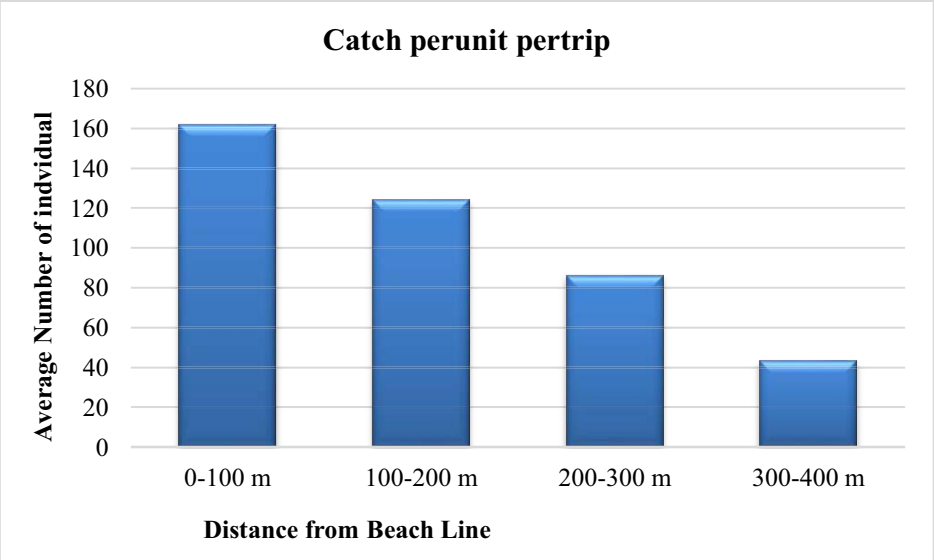

Figure 2. The number of stripped mullet (*Mugil cephalus*) caught around seaweed culture in marine coastal waters.

The longline method of seaweed culture in coastal provides open access to some herbivorous fish including (*M. cephalus)*. Herbivorous fish tend to come to seaweed culture and were followed by carnivorous fishes.

The habitat of striped mullet (*M. cephalus)*. is marine coastal waters seas of the tropical and subtropical zones of all seas [6]. They form huge schools near the surface**.** They spend of time close to shore around the mouths of rivers or in brackish bays, inlets, and lagoons.

The schooling of adults and juveniles of striped mullet occurs in shallow coastal waters and enter lagoons and estuaries to feed [7]. They feed on detritus, diatoms, algae and microscopic invertebrates which they filter from mud and sand through their mouth and gills [8]. Moreover, [9 reported that *M. cephalus* fed mainly on algae, diatoms, plant materials, desmids annelids, crustaceans, bivalves, fish parts, detritus and sand grains.

Based on the result of this study show that the fisheries of striped mullet (*M. cephalus)* can be integrated with the seaweed culture in marine coastal area. The seaweed culture area also as fishing ground for striped mullet fish. This fish is a species of marine estuarine and coastal that contribute to fisheries in many countries [10]. This species also was the commercial fishery in the Cuyutlan Lagoon, Colima, Mexico and Lagoon, Jalisco, Mexico Central Pacific [11], and one of the most important fisheries along the coasts of Mypadu and Krishnapatnam in Nellore District of India [12]. Moreover, the availability of seaweed in marine coastal area could be as an attractor for fishes aggregating, like skipjack tend to aggregate in fish attractor device [13], and small pelagic fish tend to aggregate in light attractor [14,15].

3.3. The water quality parameters

The water qualitiy such as water temperature, salinity, pH, brightness, current velocity is presented (Table 1).

Table 2. The water quality in parameter around seaweed culture in marine coastal waters.

No	Parameter	Unit	Value	Seaweed cultivation criteria**
1.	Temperature	ºC	28.2 -30.3	27-30
2.	Salinity	ppt	27-31	29-33
3.	pH		7-8.3	7-8.5
4.	brightness	m	6-9	> 5
5.	Current velocity	cm/s	4-8	20-40

*Source: *Water quality measurement results; **Kepmen No. 51/MENKLH/2004.*

The results of study (Table 1) regarding water quality parameters that the temperature, salinity pH, brightness were in the highly suitable range for seaweed culture. Current velocity range was between 4-8 cm/s was lower than that Seaweed cultivation criteria.

The structures of seaweed life always response to the environmental factors. The best condition of water temperatures for seaweed growth ranging from 25 to 30°C [16]. Sea temperature effect on seaweed growth. The rising water temperature can reduce 50 % seaweed growth [17]. Striped mullet (*M. cephalus* **)** habitat in from highly salty to fresh waters with temperature from 8 to 24 C.

The water salinity influence on growth of seaweed. Water salinity around 29-33 ppt is a good for seaweed growth. The low salinity will cause the damage of seaweed with white color on the ends of seaweeds.

The water brightness is needed by seaweed for photosynthesis. The water brightness in this study is accordance with the growth of seaweeds. The water brightness ranged 6-9 m indicate that penetrating

intensity of sunrays in into the water column was adequately high. The water brightness allows sunlight to penetrate into the water column. Sunlight is used by the seaweed as a source of energy for its growth.

In general, the change of pH will mostly affected to seaweed, however, pH in this study is accordance with the growth of seaweeds. Current velocity ranged 4 - 8 cm s^{-1}, indicate that the water is relatively calm but still can be used as seaweed culture site.

4. Conclusion

The water quality parameters during study were favorable for seaweed production and stripped mullet (*Mugil cephalus*) fishing ground were namely current velocity, the temperature, the salinity, and the pH, Brightness. The seaweed culture in marine coastal area. can be integrated with the fisheries of striped mullet (*M. cephalus*).

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