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Identification of *Eucheuma cottonii* Seaweed Destruction Organisms at Geger Beach Nusa Dua, Bali

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Abstract. *Eucheuma cottonii* seaweed cultivation in general has a problem that is the attack of disruptive organisms in the form of pests that can cause damage to seaweed plants. This study aims to find out the type, behavior and abundance of seaweed destruction organisms on *Eucheuma cottonii*. Observations were made at 3 points of stakes in the coastal waters of Geger Nusa Dua, Bali. Data collection was conducted through direct observation at the research site using the Underwater Visual Census (UVC) method. The results of the data collection found 19 families of organisms that were self-exposedfrom 17 families of disruptive organisms and 2 families of non-disruptive organisms from 3 points of observation. The disruptive organisms found were: Siganidae, Holothuridae, Pinguipedidae, Labridae, Blenniidae, Paralepididae, Trichiuridae, Palmariaceae, Ulvaceae, Siphonocladaceae, Cladophorales, Caulerpaceae, Halimedaceae, Gelidiaceae, Hypneaceae, Hydrocharitaceae and Corallinaceae. While non-disruptive organisms found were Engraulidae and Scorpaenidae. Disruptive organisms have individual living behaviors (solitary) and swimming habits of disruptive organisms that swim above and crevices of seaweed *Eucheuma cottonii*. Treatment of disruptive organisms that feed on talus and attach / epiphytes on the surface of seaweed talus *Eucheuma cottonii*. The conclusion is individual abundance in stake II had an abundance of disruptive organisms with the highest result of 3.88 ind/$m^{2,}$ while in stake I obtained the lowest abundance calculation of 2.34 ind/$m^{2,}$and in stake III which was 2.62 ind/m^2.

Keywords: Eucheuma cottonii, Disruptive Organisme, Seaweed

I. INTRODUCTION

Seaweed is one of the potential marine resources owned by Indonesia and is a source of foreign exchange because it has a high economic value and useful for ecosystem balance and human needs fulfillment. Along with the increasing human needs, the utilization of seaweed is increasing, namely processed into various types of food and beverages and become raw materials for the pharmaceutical industry, textiles, paints, cosmetics, animal feed, and other products. Increasing the utilization of seaweed requires its fulfillment can not rely solely on the availability of existing stocks in nature therefore, seaweed cultivation business developed [1].

Seaweed cultivation business has been widely developed in various regions in Indonesia, one of which is the island of Bali which has a potential land area of sea cultivation approximately 1,551.75 ha and has only been used for marine cultivation efforts covering an area of 418.5 ha or 26.96% with the type of commodities that have been developed are seaweed types *Eucheuma spinosum* and *Eucheuma cottonii*. One of the seaweed producing areas on the island of Bali is geger beach Nusa Dua located in Badung Regency, Bali Province with a type of seaweed cultivated *eucheuma cottonii* [2].

Eucheuma cottonii seaweed cultivation is still a problem that is the attack of disruptive organisms in the form of pests that can cause damage to seaweed plants, this is because seaweed pests are grazer so that seaweed plants are consumed by pests in the cultivation site. Seaweed pests are attached to seaweed *thallus*, this causes seaweed *thallus* can't receive nutrients and oxygen available in the waters optimally because the surface is covered by a sticking pest and there is also an epiphytic pest is a pest that attaches and takes nutrients from seaweed *thallus* to survive, such as parasite. In addition, there are pests that prey on seaweed that can cause physical damage to *thallus*,where *thallus* will be easily peeled, broken or eaten by pests.

Attacks of these disruptive organisms can lead to changes or normal structures, such as changes in the rate of growth, color and shape that ultimately affect the level of productivity of crops that can result in losses for seaweed farmers. The attack of disruptive organisms on *Eucheuma cotonii* grass that causes harm to seaweed farmers is enough to make the author's reason for lifting this type of seaweed as an observational study.

II. METHODS

Time and Location of the Research

Research on Identification of *Eucheuma cottonii* Seaweed Destruction Organisms began from January to February 2021 in the waters of Geger beach located in Paminge Traditional Village, Sawangan, Nusa Dua, Badung Regency, Bali Province. This location is a location that is used as a place for seaweed cultivation by coastal communities geger. A map of the area where the research was found can be seen in Figure 1

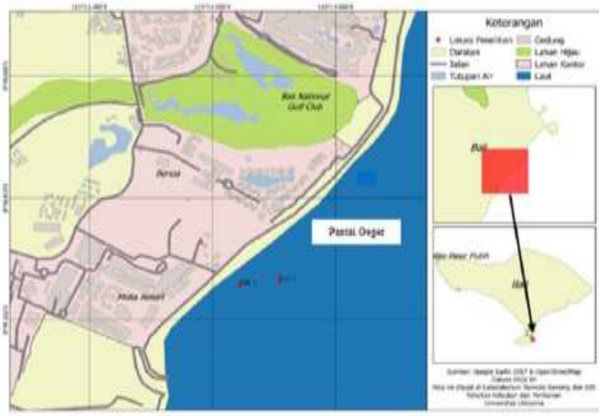

Figure 1. Map of Sampling Location

Data Retrieval Techniques of Disruptive Organisms

Data collection techniques are performed using *the Underwater Visual Census* (UVC) method [3]. The way this method works is that researchers observe the Disruptive Organism at three points of location consisting of stake I, stake II, stake III with the distance between each stake is 20 m. stake I is a seaweed planting area that does not rotate that consists only of sand. While in stake II and III is a seaweed planting area located around the seagrass field. Data collection of disruptive organisms is carried out by 2 divers with the division of tasks of each diver, namely 2.5 m on the left and 2.5 m on the right along 10 m at a depth of <1 meter at low tide and >1 m at high tide. The abundance of disruptive organisms of each type began to be calculated with a limit of 2.5 m monitoring distance on the left and right sides of each stake. Furthermore, theguing organisms found are recorded as their type, to complete the data is also done taking photos and vidio underwater and over water. Then, the identification of disruptive organisms is done ex-situ by observing a video recorded using the book Identification of Disruptive Organisms.

Data collection is done 6 times for 2 months on different days and hours, namely at 06.00 WITA to 18.00 WITA with the duration of observation on each stake is 40 minutes. The observation parameters of disruptive organisms observed in this study include the type of disruptive organism and the behavior of the disruptive organism. The behavior parameters of disruptive organisms observed in this study include the behavior of disruptive organisms in the community, swimming habits and the treatment of seaweed.

Data Analysis

Data analysis is conducted to determine the composition of the type and behavior of disruptive organisms contained in the analyzed region. Inventory of disruptive organisms is carried out on the sampling area by recording the types contained in the area. The disruptive organisms that have been obtained are then separated by family and the identification process is carried out at the family level using the seaweed destruction organism identification book.

Abundance of Disruptive Organisme

Abundance is the number of individuals of an organism of broad unity of observation areas. The abundance calculated in this study is the abundance of disruptive organisms. According to the Equation of [4] the abundance of an organism can be formulated as follows:

$$N = \frac{ni}{A}$$

Where N is the abundance of individual disruptive organisms; ni is the number of individual i-type disruptive organisms; and A is the area of observation (m^2).

III. RESULTS AND DISCUSSION

Types of Seaweed Destruction Organisms

Based on the results of the study found 17 families of seaweed destruction organisms *Eucheuma cottonii* on the beach Geger, Nusa Dua, Bali. The disruptive organisms referred to in this study are all organisms that have the potential to cause damage or disturbance to *eucheuma cotttonii*seaweed. The most commonly found disruptive organisms come from the family Siganidae as many as 116 individuals, Blennidae as many as 88 individuals and Labridae as many as 73 individuals. In detail the disruptive organisms found in this study are presented in TABLE 1.

Based on the results of the study also found 2 families of non-disruptive organisms *eucheuma cottonii seaweed.* The non-disruptive organisms referred to in this study are organisms that do not cause damage or disturbance to *eucheuma cottonii*seaweed. The non-disruptive organisms found in this study were the family Engraulidae as many as 24 individuals and Scorpaenidae as many as 5 individuals. In detail the non-disruptive organisms found in this study are presented in TABLE 1

TABLE 1
THE DESTRUCTION ORGANISM *EUCHEUMA COTTONII*

No	Famili	Attendance count			Total
		I	II	III	
1.	Siganidae	29	52	35	116
2.	Blenniidae	22	35	31	88
3.	Labridae	23	29	21	73
4.	Pinguipedidae	15	22	19	56
5.	Paralepididae	10	25	16	51
6.	Palmariaceae	4	8	5	17
7.	Trichiuridae	5	7	0	12
8.	Cladophorales	2	3	1	6
9.	Holothuridae	0	5	0	5
10.	Hydrocharitaceae	1	3	1	5
11.	Caulerpaceae	1	2	1	4
12.	Hypneaceae	2	0	1	3
13.	Ulvaceae	0	2	0	2
14.	Siphonocladaceae	1	0	0	1
15.	Halimedaceae	1	0	0	1
16.	Gelidiaceae	0	1	0	1
17.	Corallinaceae	1	0	0	1

TABLE 2
THE NON-DESTRUCTION ORGANISM *EUCHEUMA COTTONII*

No	Famili	Attendance count			Total
		I	II	III	
1.	Engraulidae	24	0	0	24
2.	Scorpaenidae	3	2	0	5

The non-disruptive organisms found in this study are the families Engraulidae and Scorpaenidae. Based on the parameters of the observed disruptive organisms, the treatment of the families Engraulidae and Scorpaenidae against seaweed is not epiphytic (attached) and does not feed on seaweed.

The family Engraulidae found in this study swam rapidly*over Eucheuma cottonii* seaweed. According to [5]. Engraulidae family fish generally live in neritic areas in a schooling (*schooling*) and most of these family fish are *filter feeding* zooplankton and eat several types of crustaceans, so this family is classified in the group of carnivorous fish. The family Scorpaenidae found in the study swam quietly in solitary slits of seaweed and were occasionally seen perched on seaweed thallus. According to [6] the family Scorpaenidae belongs to carnivorous fish that mostly feed on crustaceans and smaller fish, usually these fish catching their prey with a trap is changing colors to camouflage or adjusting to the surrounding environment while waiting for the prey to pass through them.

Based on the results of identification, *eucheuma cottonii* seaweed destruction organisms found in this study are mostly fish from plant-eating and macroalgae groups that are epiphytes. The result is in accordance with the statement of [7] that seaweed destruction organisms can be grouped into two groups namely micro pests < 2 cm and macro pests > 2 cm. Macro pests are relatively large pests found in seaweed plants in the form of organisms belonging to plant eaters (herbivores and omnivores) where the organism attacks the talus part of seaweed directly. In addition, seaweed pests also come from competitors who in general are other types of seaweed attached to plants or that grow around cultivated plants.

The plant-eating macro pests (herbivores and omnivores) found in this study came from the families Siganidae, Holothuridae, Pinguipedidae, Labridae, Blenniidae, Paralepididae, Trichiuridae. While macro pests attached to plants that grow around cultivated plants come from the family Palmariaceae, Ulvaceae, Siphonocladaceae, Cladophorales, Caulerpaceae, Halimedaceae, Gelidiaceae, Hypneaceae, Hydrocharitaceae, Corallinaceae.

Judging from the number of seaweed destruction organisms *Eucheuma cottonii* (Table 1) found on the beach Geger Nusa Dua Bali, Siganidae is the family of disruptive organisms most found in this study. This may be because Siganidae is classified as a herbivore fish with a habit of eating marine plants such as seagrass and algae [8]. The family Siganidae is the largest destructive organism in seaweed cultivation that attacks the entire outer talus, as a result of which seaweed is left behind only the skeleton. According to [9] one of the factors that causes the small rate of seaweed growth is the absence of pest attacks. Pests that attack seaweed are baronang fish that come from the family Siganidae, where the pest eats talus and causes talus to break and then break. Fish attacks from the family are seasonal, especially in seed season, so in each area the time of attack is different.

The second most disruptive organism comes from the family Blenniidae, this organism is a type of coral fish belonging to the group of carnivores and herbivores that feed on crustaceans, mollusks, algae and plankton. Later, the third largest seaweed destruction organism found to be from the family Labriidae. The family Labriidae is more dominant in coral reef ecosystems and is generally omnivorous by eating shrimp, starfish, gastropods, small fish and algae. Family labridae is a coral fish that has the largest number of species and is the dominant group in the waters of coral reefs that is about 320 species [10].

Eucheuma cottonii seaweed cultivation area on Geger Beach Nusa Dua Bali is very close to seagrass ecosystem, so seaweed destruction organisms are mostly coral fish. According to [11] fish that live in coral reef ecosystems can migrate foraging in seagrass ecosystems and vice versa. The abundance of fish in seagrass areas is usually higher compared to unvective areas such as sand, coral crushing and mud. This is because seagrass fields have an ecological role in the life cycle of fish, because this area is utilized by fish as habitats, foster areas, areas for shelter from predators, spawning and foraging areas [12].

Behavior of Disruptive Organisms and Community Conduct

Observations from studies that have been conducted behavior in the community of seaweed destruction organisms *Eucheuma cottoni* consisting of the family Siganidae, Pinguipedidae, Labridae, Blenniidae, Paralepididae, Trichiuridae live individually (*solitary*). According to [13] colonizing and foraging is a basic necessity for every living creature so that fish will colonize or forage by forming groups (*schooling)*or individuals. When they feel threatened, the disruptive organisms are observed escaping from seaweed cultivation areas and some are hiding in columns of water covered by seagrass/ seaweed. This is in accordance with [14] that solitary living organisms defend themselves from predator attacks by escaping and hiding. Meanwhile, the family's disruptive organism Holothuridae is observed to live solitary. According to [15] the Holothuridae family can live freely as epifauna either solitary or living in groups. The causative factor of holothuridae family living solitary is influenced by biological factors in the form of competition, predatory and food [16].

Swimming Habits

During the study found seaweed destruction organisms that swam above and were slit by *eucheuma cottonii seaweed.* The disruptive organisms that swim above and crevices seaweed are, family Siganidae, Pinguipedidae, Labridae, Blenniidae, Paralepididae, Trichiuridae. This is because the organism is an active swimmer who has fins and has a small physical shape character making it more possible to enter the cracks of seaweed. Meanwhile, observed holothuridae family organisms that swim in the cracks /at the base of the adhesive (hold*fast*) seaweed because this organism is a bentik animal with slow motion so that the movement is very limited. Holothuridae moves very slowly using tube legs, where in each tube leg there are 2 rows of alternating leg vessels (contraction and relaxation) will result in advanced movement in this family [17]. According to [18] Holothuridae has three swimming habits, namely pelagic (spending his whole life swimming and floating in water columns), benthopelagic (most of his life for swimming) and facultative swimmers (most of his life being bentic animals, but also swimming when there is a disturbance of environmental conditions). *Treatment of Seaweed*

The disruptive organisms that feed on seaweed at the time of observation are Siganidae, Pinguipedidae, Labridae, Blenniidae, Paralepididae and Trichiuridae. Observed the disruptive organism eats the outer talus seaweed actively that begins with swimming with the current, after seeing seaweed *Eucheuma cottonii*, the organism approaches and directly eats by facing down towards seaweed so as to cause physical damage to the talus, where the seaweed talus become chipped, broken or eaten. The way the organism takes food from the natural environment varies greatly depending on size, age, family and nature. According to [19] in an effort to obtain and eat his food is strongly influenced by the position of the presence of prey to be eaten, the movement activity of prey, the shape of food, the size of food and the color of the food to be eaten.

At the time of observation was also found a disruptive organism that has a very limited and slow movement, namely the family Holothuridae. According to [20] the family Holothuridae is a slow-moving animal, living on the basis of sand substrates, sand mud, seagrass, algae as well as in a living/dead coral reef environment. Holothuridae found at the time of observation attached to the base / adhesive (*hold fast*) seaweed, this is in accordance with the statement of [21] that Holothuridae in its habitat is attached to marine plants, immerses itself in substrates and hides in the cracks of rocks and has a habit of eating small organisms, protozoa, diatoms, nematodes, algae, foraminifera, radiolaria and detritus. The larvae of this family first cling and settle on seaweed talus, then grow into large ones. The large larvae feed on seaweed talus directly by inserting the edges of seaweed branches into their mouths. The process of eating the Holothuridae family includes random movement to forage and eat it stimulantly according to the abundance and presence of food [22].

There are also epiphytic disruptive organisms on the surface of seaweed talus, where they are macroalgae belonging to the family Palmariaceae, Ulvaceae, Siphonocladaceae, Cladophorales, Caulerpaceae, Halimedaceae, Gelidiaceae, Hypneaceae, Hydrocharitaceae, Corallinaceae. In general, epiphytes can be interpreted as organisms that live on a plant, with or without anything to do with the availability of nutrients. Macroalgae epiphytes are one of the sources that can result in seaweed cultivation experiencing a decrease in quality and quantity. This is because the presence of macroalgae epiphytes and *seaweed Eucheuma cottonii* have similarities in terms of adequate nutritional needs to survive. [23] states that the existence of macroalgae epiphytes in seaweed cultivation is able to be a competitor to seaweed cultivation, because the sticking of macroalgae epiphytes will interfere with or hinder seaweed cultivation to obtain food, place and light. Thus, this can inhibit the process of photosynthesis in seaweed cultivation, then slowly will result in seaweed talus become thin, mushy, pale and eventually destroyed. In addition, [24] says that some macroalgae epiphytes are parasitic, in some macroalgae *hold fast* can penetrate the host's talus and absorb nutrients from the host. This condition can result in crop failure in seaweed cultivation activities.

Abundance of Disruptive Organisms

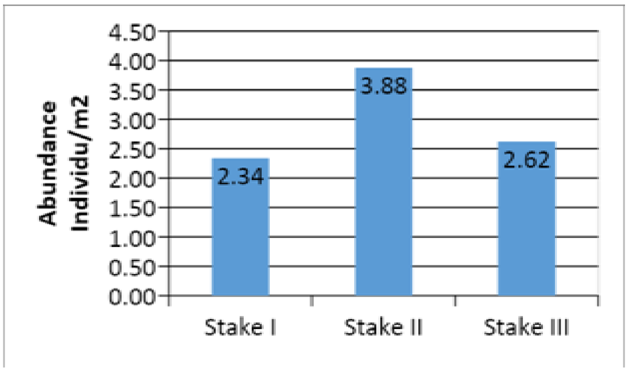

Figure 2. Graphic Abundance of Disruptive Organisms

Based on the results of the calculation of individual abundance in each observation path, the data obtained in stake II has the highest abundance of disruptive organisms which is 3.88 ind/m^{2,} while in stake I obtained the lowest abundance calculation of 2.34 ind/m^{2} ,and in stake III which is 2.62 ind/m$^{2.}$ The high abundance of disruptive organisms can be caused by ecological factors that influence the presence of such disruptive organisms.

The abundance result in stake II and III is high because the seaweed cultivation area on the stake is an area around the seagrass field, while the stake I obtained the lowest abundance results that can be caused because the seaweed cultivation area on the stake does not rotate, which consists only of sand. The abundance of organisms in seagrass areas is usually higher compared to unvective areas such as sand, coral crushing and mud. This is because seagrass fields have an ecological role in the life cycle of organisms such as fish, because this area is utilized by fish as habitats, foster areas, areas for shelter from predators, spawning and foraging areas (Abubakar and Ahmad, 2010).

IV. CONCLUSION

There are 17 families of disruptive organisms and 2 families of non-disruptive organisms. The disruptive organisms found are: Siganidae, Holothuridae, Pinguipedidae, Labridae, Blenniidae, Paralepididae, Trichiuridae,Palmariaceae, Ulvaceae, Siphonocladaceae, Cladophorales, Caulerpaceae, Halimedaceae, Gelidiaceae, Hypneaceae, Hydrocharitaceae and Corallinaceae. While non-disruptive organisms found are Engraulidae and Scorpaenidae.Behavior of individual living disruptive organisms *(solitary)*, swimming habits of seaweed destruction organisms that swim above and dicelah-celah seaweed *Eucheuma cottonii.* The treatment of disruptive organisms is to feed on talus and attach /epiphytes to the surface of the seaweed talus *Eucheuma cottonii.* The abundance of individuals in stake II has the highest abundance of disruptive organisms at 3.88 ind/m^{2,} while in stake I the lowest abundance calculation is 2.34 ind/m^{2}.

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