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THE DISTRIBUTION AND SOME ECOLOGICAL ASPECTS OF MARINE ALGAL GENUS *EUCHEUMA* IN THE INDONESIAN WATERS

by

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ABSTRACT

Eight species of *Eucheuma ait* found to grow in the Indonesian waters making the amount of species of *Eucheuma* which had been found become 17 species. A certain species specifically found only in certain areas. Those species are usually found at the depths of 30 to 150 cm during low tide at the reef flat, moat and algal ridge of the coral reefs where temperatures and salinities varied from 29° to 31° and from 30 to 34‰ respectivelly. There are various habitats of *Eucheuma* i.e. dead and live corals, limestones, sand and shells.

Average wet weight biomass of *Eucheuma* species at the areas investigated varied from 2 to 552 g/m . The highest value is that of *Eucheuma spinosum* found in East Seram (Maluku), and the lowest is that of *E. cottonii* found in the Keifing Island, East Seram. The species of *Eucheuma* commonly found in association with *Acanthopora, Gracilaria* and *Halimeda.*

ABSTRAK

Jumlah jenis *Eucheuma* yang telah didapati dari perairan Indonesia menjadi 17 jenis, setelah hasil penelitian yang dilakukan oleh penulis mendapat 8 jenis. Jenis-jenis tersebut tumbuh pada kedalaman 30-150 cm di rataan terumbu karang dengan suhu antara 29-31° C dan salinitas berkisar antara 30-34%^. Ada beberapa habitat tempat tumbuh *Eucheuma* antara lain karang mati, batuan, kulit kerang pasir dan karang hidup.

Berat rata-rata biomassa *Eucheuma* di lokasi penelitian bervariasi dari 2-552 g/m^2 . Nilai terbesar adalah jenis *Eucheuma spinosum* di Seram Timur (Maluku) dan terendah adalah *Eucheuma cottonii* di Pulau Keifing (Maluku). Jenis-jenis *Eucheuma* biasanya tumbuh bersama-sama dengan jenis lainnya, yaitu *Acanthopora, Gracilaria* dan *Halimeda.*

INTRODUCTION

The Indonesian Archipelagois located between 94° - 141° E and 6° - 11° S, consisted of 13,667 islands with more than 81,000 km of coast line. The Indonesian waters cover two-thirds of the Indonesian territory. Those conditions make the Indonesian waters have a big potential of seaweeds. Therefore the investigation and research on the marine algas in Indonesia are very important.

There are many species of seaweeds grow in the Indonesian waters. From the results of the Siboga Expedition (1899—1900), which focused its attention on the marine flore and fauna and its biogeography, BOSSE (1928) found 14 species of

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red algae of the genus *Eucheuma* in Indonesian waters composed of *Eucheuma leeuwenii, E. serra. E. muricatum, E, crustaeforme, E. horizontale, E. adhaerens, E. edule, E. crassum, E. vermiculare, E. dishotomum, E. cervicorne, E. arnoldii, E. striatum* and *E. simplex.* The red algal genus *Eucheuma* in Indonesian is economically important as carrageenan source, almost all of it production is exported. The seaweeds export from Indonesia mostly of *Eucheuma spinosum.* Most of their production is harvested from the natural stocks. However, the experimental cultivations of some species especially *E. spinosum* have been carried out and developed continuously at some areas in the Indonesian water (SAHUPALA *et al* 1977, MUBARAK 1978 and SOEGIARTO *etal* 1978).

Investigations to reveal aspects of growth and ecology in natural communities will be very important. The present authors are interested in these problems and through this paper attempt to reveal the distribution and some ecological aspects of *Eucheuma* in Indonesian waters.

MATERIAL AND METHODS

The investigations are carried out at some areas in the Indonesian waters : West Jawa, Sunda Strait, Seribu Islands, Bali, Southeast and Central Sulawesi, and Maluku. The kind of substrates, depth, water temperature and salinity are observed on each area investigated.

Transect methods are used in these investigations. Collecting material is done from those areas within one square metre of each ten metres interval along the transect line at the reef flats. Samples collected from each area are weighed for wet biomass. ,

RESULTS

Distribution

The algal genus *Eucheuma* is found to grow at some areas investigated in the Indonesian waters (Table 1 and Figure 1). The authors find eight species *of Eucheuma: E. spinosum (E. muricatum). E. edule, E. serra, E. cottonii, E. crassum, E. arnoldii, Eucheuma* sp. 1 and *Eucheuma* sp. 2. They usually grow on the coral reef flats, commonly in the intertidal zones i.e. on the moats and algal ridges. *E. spinosum* can be found in almost all of the area investigated. Another investigations of *Eucheuma* in the Indonesian waters had been carried out by BOSSE (1928), SURYODINOTO (1970) and MUBARAK (1974) were also described in Table 1 and Figure 1.

Some ecological aspects

Eucheuma mostly grows at the reef flat areas of the fringing coral reefs. There are three types of profiles of the coral reefs (Fig. 2). Accordingly *Eucheuma* grows in

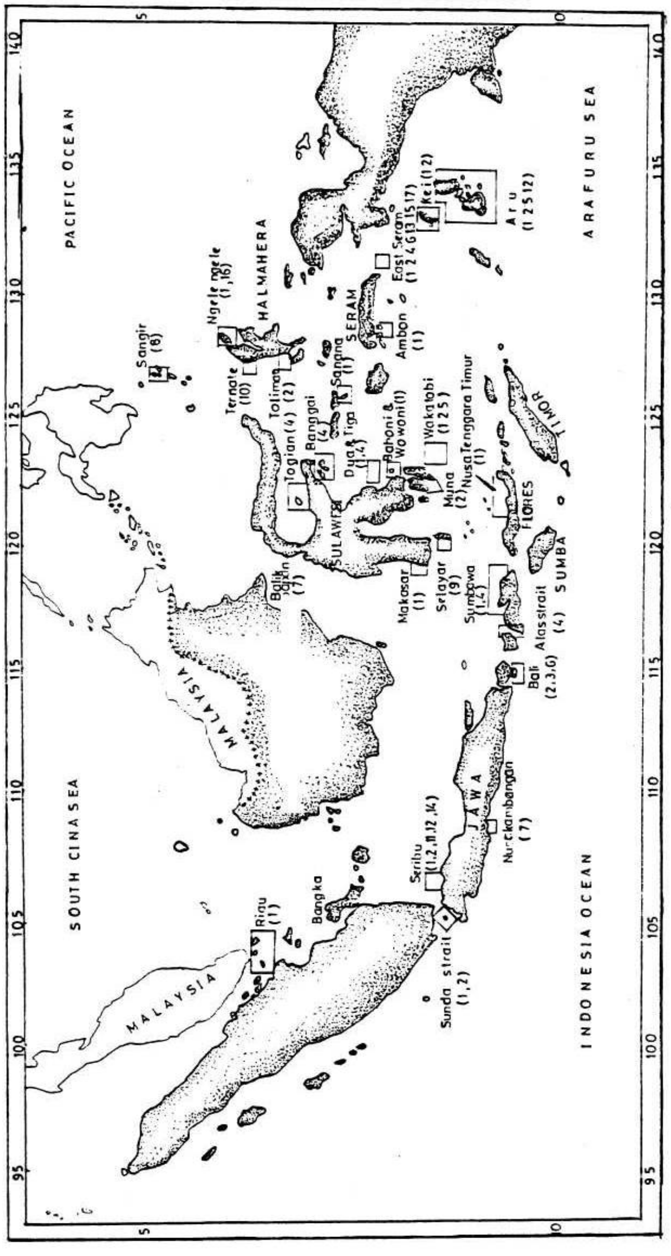

Figure 1. Distribution of *Eucheuma* spp. in Indonesian waters.
(Numbers refer to species as indicated in Table 1).

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Table 1. Distribution of *Eucheuma* spp. in the Indonesia waters.

No.	Species	Locations	Source
1.	*Eucheuma*	Seribu Isls., Sunda strait (Cilurah, Sebesi Isl.). Southeast Sulawesi (Wakatobi and Muna Isl.). Central Sulawesi (Banggai and Togian Isl.), Maluku (Ngele-ngele, Sanana, East Seram Kei and Aru Isl.), Jawa,	The authore
		Seribu Isl, Sumbawa, Makasar, Kei, Aru, Balikpapan, Riau and Ambon.	Van Bosse (1928)
		Sumbawa, Central Sulawesi (Dua, Tiga, Bakori and Wawoni Isl.),	Soeryodinoto (1970)
		Nusa Tenggara Timur and Maluku.	Mubarak (1974)
		Riau Islands.	UNRI (1975)
2.	*E. edule*	Seribu Isls., Bali (Senos and Jimbaran), Southeast Sulawesi (Wakatobi and Muna Isl.), Maluku (Tolimao, East Seram, Kei and Aru Isl.).	The authors
		Seribu Isls. and Kei Isls.	Van Bosse (1928)
		Central Sulawesi (Dua and Tiga Islands).	Soeryodinoto (1970)
3.	*Eucheuma serra*	Bali (Benoa and Jimbaran)	The authors
		Bali	Van Bosse (1928)
4.	*E. cottonii*	Central Sulawesi (Banggai and Togian Isl.). Maluku (East Seram).	The authors
		Alas Strait and Sumbawa, Central Sulawesi (Tiga Isl.).	Soeryodinoto (1970)
5.	*E. crassum*	Southeast Sulawesi (Wakatobi Isl.).	The authors
		Maluku (Aru)	Van Bosse (1928)
6.	*E. arnoldii*	Bali (Benoa)	The authors
		Maluku (Ceser/East Seram).	Van Bosse (1928)
7.	*E. leeuwenii*	Jawa (Nusa Kambangan)	Van Bosse (1928)
8.	*E. crustaeforme*	North Sulawesi (Sangir Isl.).	Van Bosse (1928)
9.	*E. horizontale*	South Sulawesi (Selayar Isl.).	Van Bosse (1928)
10.	*E. adhaerens*	Maluku (Ternate Isl.).	Van Bosse (1928)
11.	*E. vermiculare*	Seribu Islands.	Van Bosse (1928)

Tabel 1. (Continued)

No.	Species	Locations	Source
12.	*E. dichotomum*	Seribu Isls., Maluku (Kei and Elat)	Van Bosse (1928)
13.	*E. cervicorne*	Maluku (Geser/East Seram)	Van Bosse (1928)
14.	*E. striatum*	Seribu Islands	Van Bosse (1928)
15.	*Eucheuma simplex*	Maluku (Geser/East Seram).	Van Bosse (1928)
16.	*Eucheuma* sp. 1.	Maluku (Ngele-ngele kecil).	The authors
17.	*Eucheuma* sp. 2.	Maluku (East Seram)	The authors

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all those at depths of 30 - 150 cm during the means low tide. The water is usually clear, so that the plants can be seen from water surface. Water temperature varies from 29 to 31° C. Salinity usually between 30 - 34°/oo. The lower salinity usually found in the western part of the Indonesian waters and the higher salinity in the eastern part. *Eucheuma spinosum* and *E. cottonii* usually grow on dead coral fragments, *E. spinosum* also grows on shells, limestones (found at Geser Island in Maluku). *Eucheuma serra* is found only at the algal ridges on dead corals (found at Tanjung Benoa and Jimberan, Bali) and usually grows weel at the areas which subjected to the direct surf. *Eucheuma* edule is usually found on dead corals and sandy habitats. All of those algas can also be found to grow at the exposed reef areas.

Average wet weight (biomass) per square metre of *Eucheuma spinosum, E. edule, E. cottonii* and *E. serra* varies from 11 to 552 g, 16 to 114 g, and 49 to 52 g respectively (Table 2). The messurements indicate that the seaweed form mixed population which make the density of *Eucheuma* low.

The other algal genera, such as *Acanthopora, Gracilaria,* and *Halimeda* were always found at the *Eucheuma* community in almost all of the locations investigated.

DISCUSSION

Most of the locations investigated in the Indonesian waters have no *Eucheuma* at all. This algal genus was found only in certain locations. Which is not surprising because *Eucheuma* requires special ecological conditions.

Eucheuma arnoldii displays- a unique characteristic, it was never found in the surf zone. In these investigations, *E. arnoldii* was found only at Tanjung Benoa, Bali and VAN-BOSSE (1928) found at Gaser, Maluku. light and desiccation seem to be the major ecological factors influencing *E. spinosum* which grows in the sheltered waters of inner reefs. *Eucheuma cottonii* shows the greatest tolerance to depth, desiccation, current strength and substrate types (DOTY 1970). SOERYODINOTO (1970) reported *E. spinosum* and *E, cottonii* from the other areas in the Indonesian waters i.e. Sumbawa, Alas Strait, Dua and Tiga Island. He also stated that *E. spinosum* was found in the Madilan Island at the clear water area and from turbid area in the coast of Lambu Bay. *E.spinosum* was also found in Riau (UNRI 1975). The important potential areas of *E. spinosum* in the Indonesian waters are Central and Southeast Sulawesi, Maluku, Nusa Tenggara Timur and Nusa Tenggara Barat (SOEGIARTO *et al.1970).* There is still no information yet about the occurrence of *E. serra* at the other areas in the Indonesian waters except Tanjung Benoa and Jembaran, Bali. This algae has been reported from Ryu Kyu Formosa Japan (LEVRING *et al* 1969) and Luzon (CORDERO 1977). Apparently, *E, serra* requires more specialized habitats than other *Eucheuma* species.

Almost all of the eight *Eucheuma* species found by the authors in the Indonesian waters were also found by CORDERO (1977) in the Philippines waters. One of the species, *E. cottonii,w2iS* not reported by VAN-BOSSE (1928) during the

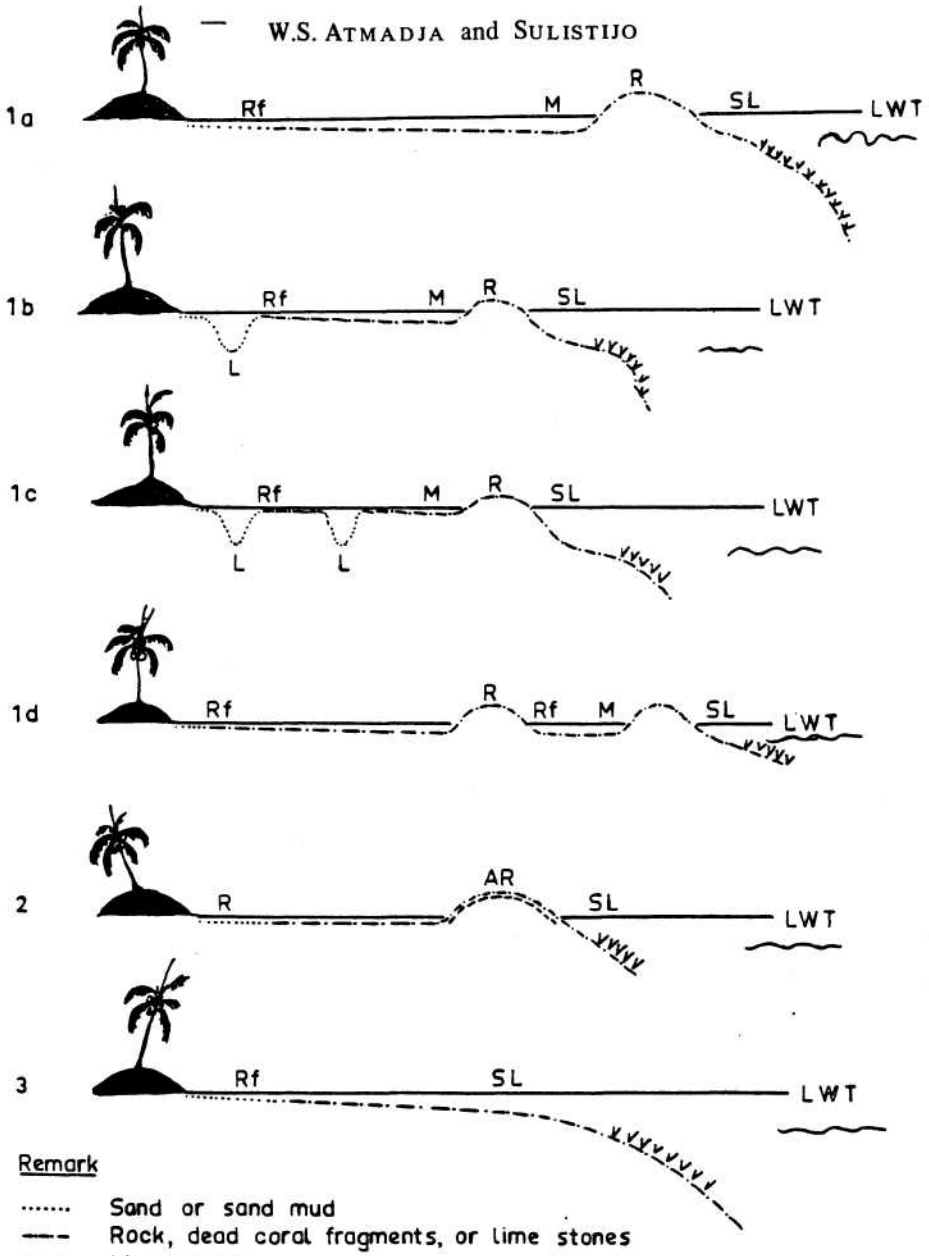

Figure 2. Three profil types of the Coral Reef areas as algal habitats

Tabel 2. Biomass of algal genus *Eucheuma* at some locations in the Indonesian waters.

Algae	Locations	Average biomass (g/m^2)
Eucheuma spinosum	East Seram	552
	Ngele-ngele kecil Isl.	48
	Cilurah	40
	Kobror Isl./Aru	176
	Tayandu Islands/Aru	377
	Seribu Islands Group	11
E. edule	Keifing Island/East Seram	114
	Seribu Islands Group	16
E. cottonii	East Seram	2
E. serra	Tanjung Benoa (Bali)	49
	Jimbaran (Bali)	52
Eucheuma sp. 2.	East Seram	108

Siboga Expedition in the Indonesian waters. The other seven species *of Eucheuma* found by the authors were also reported by VAN-BOSSE (1928), during the Siboga Expedition, even make their distribution become wider in the Indonesian waters. Four species of them i.e. *E. spinosum, E. Edule, E. cottonii* and *E. serra* are of utmost commercial importance. The highest export volume is composed of *E. spinosum* which is harvested from the natural stocks, mostly from Maluku waters. *Eucheuma spinosum* harvested from farming is only from Tanjung Benoa, Bali (SOEGIARTO and SULISTIJO 1981) and Samaringa, Sulawesi (ISMAIL 1982). The highest average value of the biomas (in wet weight) of *E. spinosum* per square metre is 552 g in East Seram, whereas the lowest biomass was measured for *E. cottonii* from Keifing Island, East Seram (Table 2.). They were obtained from the standing crop measurement along the transect lines. Biomass of *E. spinosum* at the selected site in East Seram reached a density of 8,000 g/m .

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