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An Artificially Made Seagrass Bed: Its Role in a Shallow Subtidal Zone and Probable Consequences

Benjamin J. GONZALES[1,2], Roger DOLOROSA[2], Roger BLANCO[2], Osamu OKAMURA[3] and Tomoyuki MAEDA[3]

1 Department of Cultural Fisheries, Faculty of Agriculture, Kochi University, Nankoku, Kochi: 783, Japan
2 Institute of Marine Sciences, Palawan National College, Puerto Princesa City 5300, Philippines
3 Department of Biology, Faculty of Science, Kochi University, 2-5 -1 Akebono-cho, Kochi 780, Japan

Abstract: This study was carried out to investigate the role of a seagrass bed, made from artificial materials, in a shallow subtidal zone. The artificial seagrass (ASG) units were made of simple and cheap materials such as stones, old nets, floats and ropes. Observations were made by snorkeling. Various fishes in their different stages in life (from larvae to adult) and benthic animals were observed to colonized the bed. The association of these marine faunas to the artificial seagrass units were recorded. Furthermore, the condition and the attracting capability of the ASG units through time were discussed. The disadvantages of the design of ASG units used in the study were likewise considered.

Key words: Artificial seagrass bed; Subtidal zone; Associated fauna; Ulugan Bay, Philippines

Introduction

Natural seagrass beds are reported to perform a wide spectrum of biological and physical functions (Fortes, 1990). They are especially important as nurseries for fish, shrimps, lobsters, scallops and other valuable animals (Meñez *et al.*, 1983). Unfortunately, natural calamities and human activities cause degradation and even destruction of the highly productive marine plant ecosystem. In the attempt to mitigate such degradation and destruction of seagrass beds in the Philippines, studies on seagrass transplants were carried out in several areas, Negros (Calumpong *et al.*, 1992) and Mactan (Largo, 1992) Islands. On the other hand, Fortes (1993) discussed the seagrass transplantation and artificial seagrass systems (STARRS) as tools for the seagrass management and considerations. As part of our Searanching program, a simple experiment was carried out to observe what role (ecological, biological, physical etc.) can a seagrass bed made from artificial materials play in a shallow subtidal environment.

Materials and methods

Two types of artificial seagrass unit were designed for the experiment, using polypropylene rope, old nets, stones, and floats (Fig. 1). Polypropylene was used because of its high buoyancy. The ASG bed was set, 600 m^2 area, in the sandy-muddy, shallow subtidal zone (0.5-1.5 m water depth) at the southeast portion of Ulugan Bay, Palawan, Philippines in June 1990. Underwater observations were done by snorkeling every day for the first week and bimonthly thereafter. Observations lasted for five months.

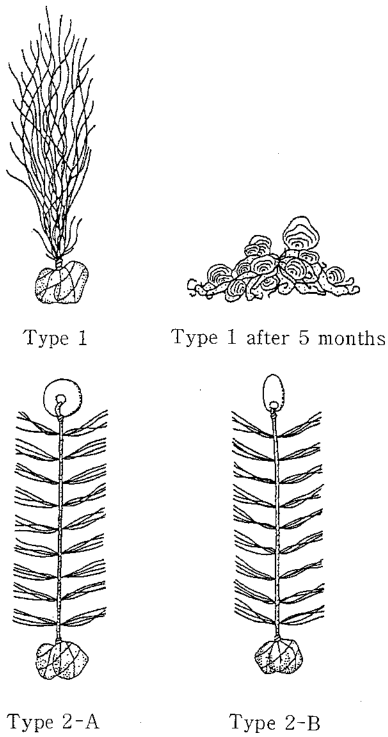

Fig. 1. Types of ASG unit used in the experiment.

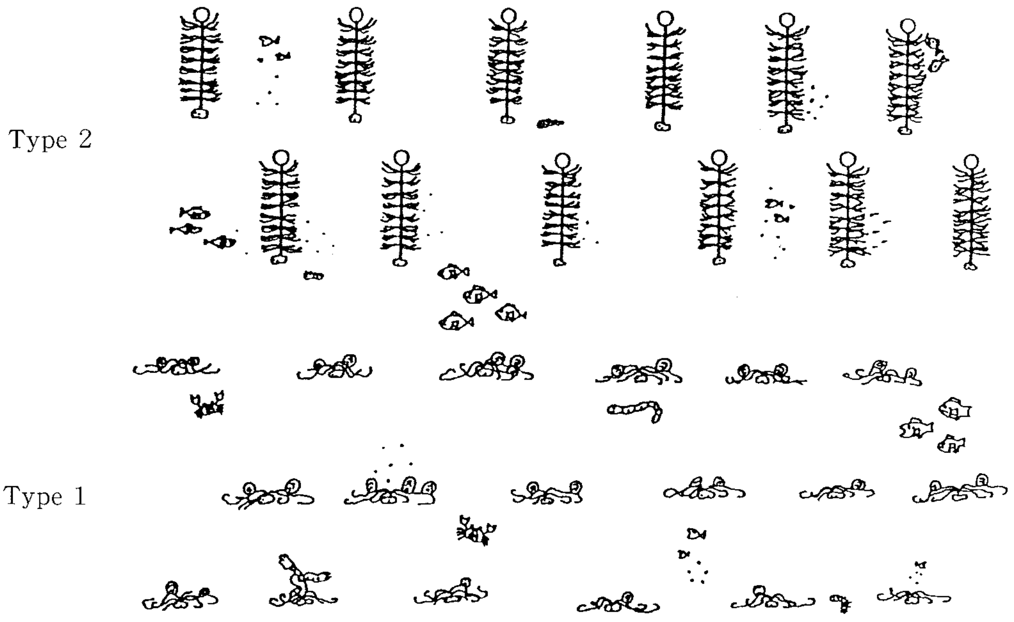

Fig. 2. Profile of the ASG bed after five months set in Ulugan Bay, Palawan, Philippines. Showing type 1 (settled on ground) and type 2 (still at vertical position).

Results and discussion

After 5 months, the fronds of type 1 (ASG) settled to the substrate due to the weight of epiphytes, attached algae (mostly of *Padina* spp.), covering the fibers of the units, thus making it look much more like a natural algae than a seagrass (Figs. 1 and 2). The attached algae on the type 1 design was relatively more than that on type 2-A and 2-B. On the other hand, type 2-A and 2-B still assumed the vertical position, as they were in the first day of setting. This is because of the more buoyant floating materials used, plastic (type 2-A); rubber (type 2-B), and lesser epiphytes on them. However, it is possible that the stem and fronds of type 2-A and 2-B will also settle to the bottom when remain submerge for a longer period. This information will be covered in another study.

Faunas observed in the ASG bed were larvae (including newly hatched), juvenile and adult of varied fishes, a 140 grams crab (*Purtunos sp.*), sea snakes, and three taxa of sea cucumber. The nature of their association with the ASG are described in Table 1. The presence of fish larvae three days after the setting indicates that the ASG bed can serve as a spawning area for fishes even in the absence of the attached algae. On the other hand, the juveniles were only observed after two weeks from setting, when the units were partly covered with algae. This implies that the juveniles were not primarily attracted to the ASG, but to the food (epiphytes) attached to the unit. The adult fishes, swimming in and out of the ASG bed area (Table 1), seem to be scouting for food (smaller fish), though actual preying was not observed. The appearance of the benthic animals after the fronds of type 1 ASG units bent down to the bottom, in three months, may suggests that the benthic animals went to the ASG for shelter and for food that might have accumulated on and under the units. Furthermore, the attached algae, and the different shapes and spaces that the units had subsequently created, after it settled to the bottom, may explain why type 1 ASG unit attracted the most diverse fauna (Table 1).

Table 1. Associations of the various marine animals with the ASG bed.

Faunas	Type 1	Type 2-A	Type 2-B
Fish larvae	✚▲★	✚	✚
juvenile	✚▲★	✚	✚
adult	✚	●	●
Crab	★	■	■
Sea snakes	✚☆	■	■
Sea cucumber	✚	✚	✚

✚ Swim or crawl inside the bed and pass between ASG units.
▲ Feed on fronds of algae-covered ASG.
★ Thrive under or in the ASG.
■ Don't exist.
● Swimming through the ASG bed, going in and out the ASG area.
Mating.

The abundant mysis stage of shrimp in the natural seagrasses of Ulugan Bay (Fortes, 1990) and the numerous squid eggs in the artificial seagrass systems (study area not mentioned) (Fortes, 1993) did not occur in this study, in spite of the proximity, about 300 m offshore, of the present study area to the spawning ground of the squids. Moreover, Watanuki *et al.* (1993), reported spawning area location of different species of cuttlefishes in the deeper portion of the present study area.

The functions of the ASG in this study were similar to that of the natural seagrass bed (shelter, nursery, feeding, mating and spawning area to various marine animals) as reported by den Hartog, 1977; Meñez *et al.*, 1983; Phillips and Meñez, 1988; Fortes, 1990, 1993; Largo and Ohno, 1993. Since the attached algae in natural seagrasses contribute to high productivity of the seagrass ecosystem (Meñez *et al.*, 1983), it is possible that attached algae on the ASG units may likewise effect similar productivity to the artificially made seagrass bed.

Conclusion

The ASG bed can function as a kind of aggregating devise, which provides shelter and food to a variety of fish including larvae and juveniles, sea cucumber and swimming crab. It also can serve as a spawning area to fishes, mating ground for sea snakes and a substrate to the attaching algae in the shallow subtidal zone. It is apparent that the ecosystem of ASG bed can be equivalent to that of a natural seagrass bed.

The volume of space, shape and the amount of attached algae affect the aggregating capability of the ASG. The ASG resembles the concept of artificial reef or any other FADs (fish aggregation devices) employed in different countries, that any structure submerged in the sea would attract fishes and other marine animals.

The disadvantages of ASG type used in this study must also be emphasized. The ASG, without a rhizome as the natural seagrasses, cannot assume the physical function of reducing the wave energy action. Thus, it is advised that these type of ASG should only be used in an enclosed or semi-enclosed bodies of water protected from strong wave action. Furthermore, the artificial materials become unrecognizable when covered by epiphytes and algae, making it disastrous when consumed by seagrass and algae eating animals like marine turtles, birds and dugongs (sea cows). Attention should be given to the durability of design and construction of the units to avoid ending them up as marine water pollutants in the area. Using biodegradable materials, however, can be a solution to this problem.

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