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STUDIES ON THE FAUNA ASSOCIATED WITH THE CULTURED SEAWEED *GRACILARIA EDULIS*

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ABSTRACT

With a view to study the fauna associated with the cultured seaweed *Gracilaria edulis* in coastal waters of the Palk Bay and the Gulf of Mannar and to assess the damage, if any, caused by any of the organisms, samples of all animals associated with the cultured seaweeds were collected from the seaweed culture sites. Qualitative analysis of the samples indicated that the fauna is mainly composed of crabs, amphipods, polychaetes, isopods, copepods, gastropods, bivalves, holothurians and fishes. Quantitatively, crabs were found to be more numerous than all other groups, followed by amphipods and polychaetes.

Observations indicated damage to growing tips of the seaweed during April to August. This period coincides with the period when the direction of the wind changes from east-west to south-north direction. In order to ascertain whether any of the major organisms like fishes and crabs were grazing on the seaweed, fishes were captured by operating traps and cast nets in the vicinity of the culture frames. The crabs were hand picked. Analysis of the stomach contents of the fishes revealed that of the sixteen species of fishes encountered, only *Siganus javus* was found to feed voraciously on the seaweed. The crabs represented by *Thalamita crenata* and *T. integra* though not found to feed on the seaweed, could cause extensive damage to growing parts of the seaweed by merely clipping them with their chelipeds as they crawl about amongst the seaweeds. However, greater part of the damage to the cultured seaweed during the period appears to be caused by wind and wave action when the sea becomes rough.

INTRODUCTION

FAUNA associated with seaweeds have attracted the attention of many scientists from various parts of the world. Colman (1940) studied the fauna of the algae in the tidal zone from the English Channel. Wieser (1952) studied the phytal fauna from the English Channel and the Mediteranean and Chapman (1955) from the Azores. Dahl (1948) and Sloane *et al.* (1961) also contributed to this aspect of study from Swedish Coast and Lough Ine Rapids. In India, Sarma and Ganapathy (1972, 1975), Sarma (1974) and Joseph (1978 a, b, c) studied the fauna associated with the seaweeds. However, most of these observations were from the natural seaweed beds.

The Central Marine Fisheries Research Institute has been engaged in the cultivation of seaweeds for the past few years. Observations on the cultured seaweed *Gracilaria edulis* revealed the association of a number of groups of animals with the cultured seaweeds. Further, considerable damage to the growing tips was also noticed especially during the months April to August. Since detailed observations have so far not been available on the fauna associated with the cultured seaweed and the probable damage, if any, by

various animals to the seaweed, the present study has been initiated. The results of this study are given in this paper.

Material and Methods

Periodic collection of all animals were made from the seaweed culture frames (made up of coir ropes) by removing them to the shore and picking up the animals found on the seaweeds. At times, portions of the frames with seaweed were washed in big tubs to separate the animals attached to the seaweeds. Later, they were preserved in 5% formalin for laboratory analysis. Some of the crabs belonging to the genus *Thalamita* were brought alive to the laboratory and kept in glass tubs containing seawater to observe whether they were feeding on the seaweeds supplied to them. Cast nets and fish traps were operated to capture the fishes that hover around the culture frames. Stomach contents of these fishes were analysed, for qualitative analysis of food items. All the above collections were made from four different culture sites in the Gulf of Mannar near the CMFRI jetty, Hare Island, Vedalai and Marakayarpatnam during the year 1979.

Observations

The analysis of samples of fauna collected from the cultured seaweed (*G. edulis*) indicated that amphipods, copepods, decapods, gastropods, holothurians, isopods, pelycypods and polychaetes are associated with the seaweeds.

Quantitatively, crabs (genera *Thalamita*, *Plagusia* and *Charybdis*) were found to be more numerous than all other groups followed by amphipods and polychaetes.

In order to ascertain whether the major predatory organisms like fishes and crabs were grazing on the seaweeds, the stomach contents of the fishes belonging to sixteen species collected from the culture sites were analysed. The details are given below.

Table 1. *Details of analysis of stomach contents of fishes and crabs captured from seaweed culture sites*

Species	No. of specimens examined	Size range (mm)	Stomach contents
Fishes			
Allanetta sp.	200	56—110	Amphipods, digested animal matter, copepods, partly digested crustacean appendages, isopods, partly digested plant matter.
Belone incisa	5	217—402	Bones and scales of fishes, Seagrass (*Diplanthera uninervis*).
Chaetodon sp.	5	98—102	Partly digested animal matter, *Gracilaria edulis*.
Ellochelon waigiensis	4	132—285	Seagrass sand particles, digested plant matter, copepods.
Epinephelus sp.	3	48—218	Partly digested animal matter.
Gerres sp.	1	109	Partly digested animal matter.
Gobius sp.	1	51	Crustaceans, fish scales, molluscs and amphipods.
Gymnothorax undulates	1	402	Empty.

Species	No. of specimens examined	Size range (mm)	Stomach contents
Hemirhampus sp.	2	142—148	Empty.
Leiognathus daura	76	75—102	Copepods, amphipods and other crustaceans.
Lethrinus sp.	8	131—255	Digested plant and animal matter.
Lutjanus sp.	6	42—177	Amphipods, fish scales, crustacean appendages.
Parapercis sp.	1	61	Algal matter.
Penaeus indicus	5	184—240	Partly digested plant and animal matter.
Plectorhyncus sp.	21	136—313	Partly digested animal matter.
Plotosus sp.	32	43—51	Copepods, decapods and amphipods.
Psamoperca waigiensis	4	120—156	Crabs and other crustaceans, partly digested plant matter seagrass.
Scarus ghobban	22	160—264	Pulpy matter.
Scatophagus argus	1	126	Empty.
Siganus canaliculates	11	129—172	*Gracilaria edulis* and partly digested plant matter.
Siganus javus	25	34—143	*Gracilaria edulis*, *D. uninervis*, algae (*Chaetomorpha* sp., *Lyngbia* sp., *Cladophora* sp., *Champia* sp.), Copepods.
Sphyraena sp.	4	63—71	Crustacean larvae.
Tetrodon sp.	10	39—73	Partly digested animal matter, molluscs, sand particles, seagrass, *G. edulis*.
Therapon puta	64	26—60	*D. uninervis*, Blue green algae (*Lyngbia* sp.), amphipods, decapods, pycnogonids, fish scale, copepods, gastropods and isopods.
Thrissa setirostris	35	43—101	Partly digested matter.
Upeneus sp.	1	56	*D. uninervis*, animal matter.
Crabs			
Thalamita crenata	33	32—48	*D. uninervis*, animal matter, sand particles.
Thalamita integra	639	6—49	*D. uninervis*, animal matter, sand particles, *G. edulis*.
Plagusia sp.	8	12—34	Seagrass and sand particles.
Charybdis sp.	14	49—76	Animal matter, sand particles, *Gracilaria edulis*.

Ellochelon vaigiensis

The size range was 165 mm to 285 mm. The stomachs were only half full in most of the fishes examined. The stomach contents included sea grass (*Diplanthera univervis*) and some microscopic algae, copepods and sand grains. No seaweeds were found.

Allanetta sp.

The size range was 56 to 110 mm. Stomachs were either empty or contained traces of semidigested food. The stomach contents included isopods, fish scales, copepods, crustacean appendages and partly digested animal matter. These fishes also have not been found to have fed on seaweeds, even though they were found in large numbers near the culture sites. Large number of fishes of this species were collected, but only 180 specimens were examined for stomach contents.

Therapon puta

The size range was 26 to 65 mm. Most of the fishes have fed well, their stomachs being three-fourths full. This species was also found in good numbers near the culture sites, but they were not found to have fed on the seaweed. The food items included mainly amphipods and copepods. Fish scales, gastropods, pycnogonids and decapods were also found. Blue green algae such as *Lyngbya* sp. and seagrass *Diplanthera uninervis* were found in very small quantities.

Upeneus sp.

The size of the fish examined was 56 mm. The stomach contents included small quantities of partly digested animal matter. Seagrass (*Diplanthera uninervis*) was also found.

Siganus javus

The size range was 34 to 143 mm. Most of the fishes have fed very actively and their stomachs were full or three-fourths full. Almost all the fish examined fed well on *G. edulis*, the seaweed forming almost three quarters of the food consumed. Some have exclusively fed on the seaweed. Eventhough these fishes have also been found to accept animal food (as evidenced by fishermen using prawn heads as baits in traps to capture these fishes), in natural conditions, they seem to prefer only plant food. Fishes collected near the culture sites also fed on other materials such as *Diplanthera uninervis*, *Champia parvula*, *Cladophora* sp. and *Chaetomorpha* sp. However, they seem to prefer *G. edulis*.

Siganus canaliculates

The size range was 129 to 172 mm. They have fed on *G. edulis* in considerable quantities. Of the 11 fishes examined all but two had their stomachs half full with this seaweed. Partly digested plant matter was also found in its stomach.

Leiognathus daura

The size range was 75 to 102 mm. They have fed upon copepods, amphipods and other crustacean. No seaweed or any other plant food was noticed in their stomach.

Scarus ghobban

The size range was from 160 to 264 mm. Pulpy matter was found in the stomachs of all the fishes examined.

Thrissa setirostris

The size range was 43 to 101 mm. Here also the stomachs contained only pulpy matter and no trace of seaweed was identified.

Other fishes

Other fishes that were studied occurred only in very limited numbers. Of these, the stomachs of *Gymnothorax undulates* and *Scatophagus argus* were found empty. *Epinephelus* sp. and *Gerres* sp. had partly digested animal

matter in their food. Algal matter was found in traces in *Parapercis* sp., *Psamoperca waigiensis* preyed upon crabs and other crustaceans and their stomachs were full. Seagrass (*D. uninervis*) was also found in their stomach. The stomach contents of *Gobius* sp. included crustaceans, crustacean appendages, gastropods and fish scales. *Belone incisa* had bones and scales of fishes and seagrass (*D. uninervis*) in its stomach. *Plotosus* sp. mainly fed upon copepods, amphipods and decapods. *Lutjanus* sp. preyed upon amphipods and other crustaceans. Fish scales were also found in their stomachs. *Tetrodon* sp. preyed upon molluscs and seagrass. Large quantities of sand were also found in their stomachs. In one specimen, bits of *G. edulis* were found. *Chaetodon* sp. had partly digested animal matter and had negligible amount of *G. edulis* in one of the specimens. The stomachs of *Hemirhamphus* sp. and *Chaetodon* sp. were found empty. *Lethrinus* sp. and *Penaeus indicus* had partly digested plant and animal matter in their stomachs. *Sphyraena* sp. had crustacean larvae in their stomach.

Crabs

Thalamita crenata and *T. integra* had seagrass and animal matter along with sand particles. In one of the specimens of *T. integra* bits of *G. edulis* were found. *plagusia* sp. had seagrass and sand particles. *Charybdis* sp. had partly digested plant and animal matter along with sand. Of the fourteen specimens examined, *G. edulis* formed half of the stomach content in one and only traces in another.

Discussion

As seen from the above results, of twenty-six species of fishes that were captured in the vicinity of seaweed culture sites, only *Siganus javus* and *S. canaliculates* were found to have fed on *G. edulis*. Some of the fishes like *Therapon puta* and *Leiognathus daura* collected in good numbers near the culture sites were found to be feeding mainly on animal food. Fishes belonging to the species *Allanetta* were found in large numbers around the culture frames, but they have not been found to feed on *G. edulis*. It is possible that some of the fishes might have got their algal food from the seaweed (*G. edulis*) on which they are epiphytic. Animals that were found in the stomach contents of fishes collected at the culture sites were also found associated with the seaweeds. Therefore, it is evident that these fishes and crabs and other organisms congregate around the seaweed for food or shelter or both, but not to prey directly on the seaweed, except in the case of fishes mentioned above. Crabs have been found to feed on seagrass. Of all the species, only *Siganus javus* have fed voraciously on the cultured seaweeds and *S. canaliculates* have fed considerably. But the abundance of this species captured near the culture sites was not so high to believe that the damage to the growing tips could be entirely due to grazing by this fish. Occurrence of very small bits of *G. edulis* in the gut contents of one specimen each of *Tetrodon* sp. and of one crab *T. integra* could be accidental. Two specimens of the crabs *Charybdis* caught in traps had *Gracilaria edulis* in their stomachs. The bait used in the traps was the same seaweed.

Joseph (1978 a) observed that feeding by algivores results in partial or total destruction of algal fronds. He (1978 b) also observed that the food habits affect the distribution of algae. According to him *G. edulis* is one of the algae preferred by the gastropods as food. The gastropods mentioned by him include *Pyrene versicolor, Aplysia benedicti* and *A. leneolata*, the bivalve *Modiolus striatus* and the polychaetes *Polyophthalamus pictus Pseudonereis anomala, Streblosoma persica Syllis* (*Typosyllis*) *krochnti, S. prolifera* and *Thelepus plagiostema* which, according to him, occur in fairly large numbers.

Closer observations in the culture sites indicated that damage to the growing tips can also be caused by the crabs by merely clipping them with their chelipeds as they crawl about amongst the seaweeds. Crabs that were brought to the laboratory alive and observed in glass troughs with seaweed suspended from above were also found to cut the seaweed into bits, confirming what was observed in the field. But in the other months, when crabs were found to be associated with well grown seaweed, no damage was found. However, the amount of damage caused to the growing tips of the seaweeds during the reported period of April to August is so enormous that grazing by the fish *S. javus* and clipping by the crabs could not account for the loss completely. During this period, the direction of wind changes from east-west to south-north direction, with the result that the sea becomes very rough with strong waves and heavy churning of coastal waters. These conditions are not only not congenial for growth of seaweed, but break off the twigs and also cover them with mud and silt which smother the weed completely. Hence, it is possible that these factors also contribute to the damage to the cultured seaweed during this period.

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