

NOTES

PRIMARY PRODUCTIVITY OF SOME SEAGRASS BEDS IN THE GULF OF MANNAR

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ABSTRACT

Primary productivity of two seagrass beds and one algal bed in the Gulf of Mannar was studied by diurnal curve method. The sea grass bed close to Mandapam Camp was found to be autotrophic, with P/R ratios ranging from 1.65 to 3.90. The seagrass and algal beds around Kurusadai island were heterotrophic. Production of oxygen by individual sea grasses equalled or exceeded their consumption. Chlorophyll *a* values in the waters over the seagrass bed ranged from 0.893 to 9.49 mg/m³.

Benthic algal communities, considered as specialised marine environments, show organic productivity many times higher than those of oceanic waters (0.01 – 0.03 gC / m² / day) or coastal shallow waters (1–2 gC/m²/day). High values of both gross photosynthesis and community respiration have been reported in these environments (Odum, 1956; Qasim and Bhattathiri, 1971). However, a considerable portion or even the entire organic matter produced is lost by way of community respiration. Thus, these environments are not always autotrophic — in fact, some of them are heterotrophic. The present study was taken up to investigate the community metabolic state of two seagrass beds and one seaweed bed in the Gulf of Mannar.

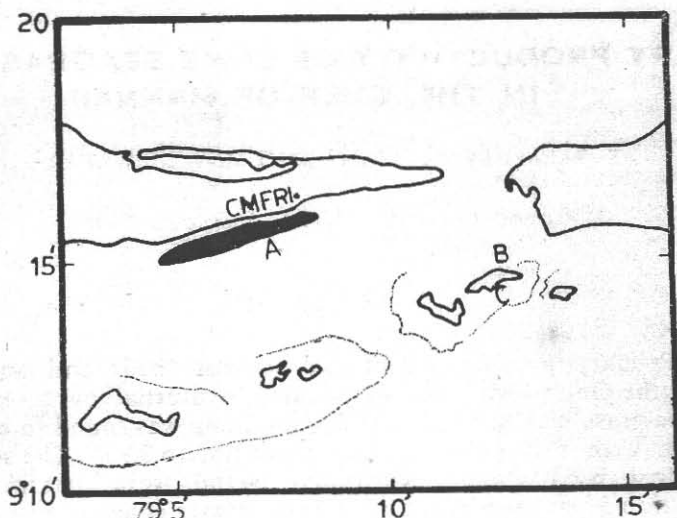
The first seagrass bed (A in Fig. 1)

studied lies in the Gulf of Mannar (Mandapam peninsula), near the jetty of Central Marine Fisheries Research Institute. It covers a distance of about 3 Km from Mandapam Camp to Vedalai, a nearby fishing village. The average width of the bed is about 200 m and the average depth over the bed is about 2 m. The seagrasses found in this bed are *Cymodocea isoetifolia*, *C. serrulata*, *Halophylla ovalis*, *H. stipulacea* and *Diplanthera uninervis*. Of these, *C. isoetifolia* is the dominant species. The second seagrass bed lies north of Kurusadai island (B in Fig. 1). This bed is largely composed of *Enhalus* sp. The algal bed studied (C in Fig. 1) lies in the lagoon along the southern side of the island. It is enclosed by the reef. The seaweeds found in this bed include species of *Halimeda*, *Caulerpa*, *Padina* and *Hypnea*.

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Map showing the location of the seagrass and algal beds.

Diurnal curve method of Odum and Hoskin (1958) was employed to study the community metabolism. Duplicate samples for the determination of dissolved oxygen were taken over a fixed station at 3hr intervals for a period of 27 hours and the measurements were averaged to get an oxygen value representative of the watermass. A curve for the rate of change of oxygen was computed from these values after correcting the diffusion loss or gain.

Gross production and respiration were calculated following the method of Odum and Hoskin (1958). Measurements of community metabolism of the Mandapam bed were made in July, October and December of 1972 and in February, 1973 and those of the beds on Kurusadai island in November, 1973.

Gross production and respiration values (Table 1) and community metabolism curves (Fig. 2) show that the

TABLE I. Gross production and community respiration in the algal beds studied.

| Location of the bed and month of study | Gross Production gC/m ² /day | Respiration gC/m ² /day | P/R |
|--|--|---------------------------------------|------|
| Mandapam bed | | | |
| July, 1972 | 8.04 | 3.25 | 2.47 |
| October, 1972 | 11.56 | 2.96 | 3.90 |
| December, 1972 | 8.35 | 3.72 | 2.24 |
| February, 1973 | 8.64 | 5.24 | 1.65 |
| Kurusadai Island | | | |
| November, 1973 | | | |
| Seagrass bed | 2.40 | 2.95 | 0.81 |
| Seaweed bed | 4.30 | 5.90 | 0.74 |

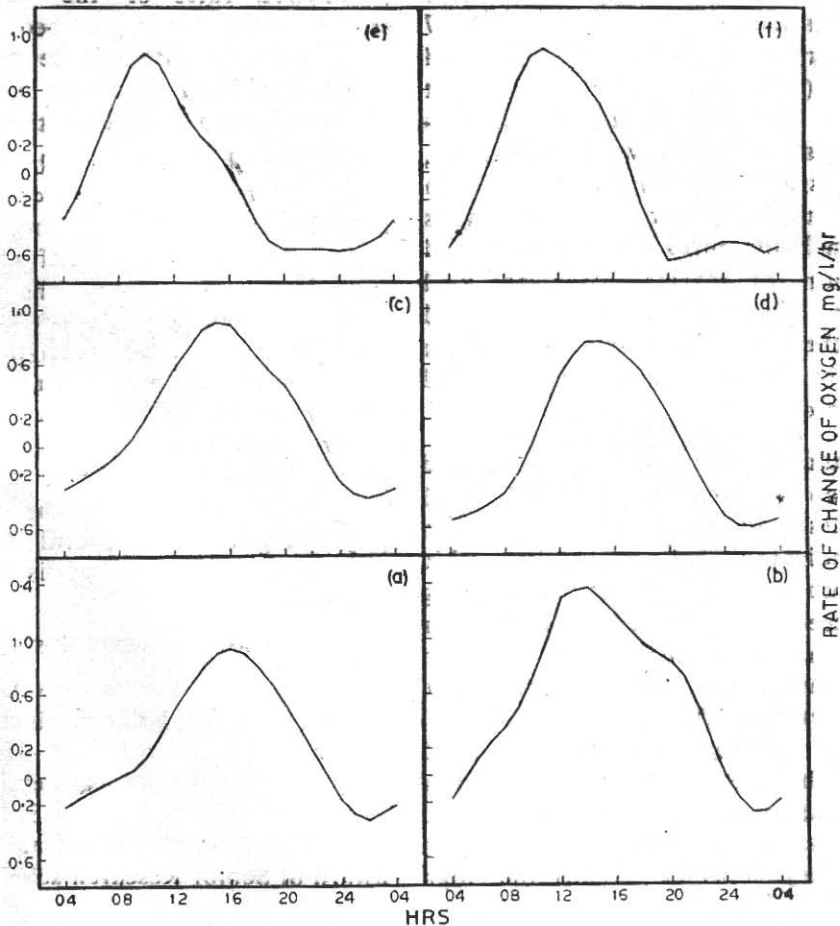


Fig. 2 Community metabolism curves a-d: Mandapam bed in July, October, December, 1972 and February, 1973 e-f: Seagrass and Seaweed beds respectively around Kurusadai Island, in November, 1973.

Mandapam bed is autotrophic. The seagrass and algal beds of Kurusadai island are heterotrophic. Isolated seagrass beds are generally autotrophic. Odum (1956) observed a production of 10.63 gC/m²/day in a turtle grass community. Qasim and Bhattathiri (1971) recorded a productivity of 11.97 gC/m²/day in *Thalassia* and *Cymodocea* bed on Kavaratti atoll. The luxurious growth of the seagrasses in the Manda-

pam bed accounts for the high primary productivity observed here. Rao (1973) has estimated the mean density of seagrasses in the Mandapam area as 558 tonnes/sq. Km. The ecological implications of a high productivity in seagrass beds has been dealt with in detail by Qasim and Bhattathiri (1971). The productivity of both the algal communities around Kurusadai island are low and in addition, they are hetero-

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trophic. The limited expanse of these two beds and the low density of 0.67 Kg of fresh Wt of algae/m as observed by Rao (1972) might probably account for the low productivity and heterotrophic state of these two beds. Further, the possibility of a seasonal minimum of production cannot be ruled out as seasonal differences in the growth and attrition of marine algae are well known. Odum *et al.*, (1959) observed that the consumption in two *Thalassia* beds in Puerto Rico waters exceeded their production.

Studies on the photosynthetic and respiratory rates of the individual seagrasses found in the Mandapam bed indicate that these are autotrophic individually with P/R ratios equalling or exceeding 1, (Table 2). Kanwisher (1966) has shown that under optimum temperature and light conditions the photosynthesis is very high in several species of seaweeds. Qasim and Bhattathiri (1971) observed that many of the seagrasses and seaweeds found on Kavaratti atoll produce more oxygen than they consume. Thus the high

production rates of the individual species make the algal beds highly productive in spite of the combined respiratory demands of the algae and the organisms associated with them.

Chlorophyll *a* values obtained for one year from the waters over the seagrass bed at Mandapam ranged from 0.893 to 9.49 mg/m³. Unfortunately, there is no other data on the pigment values of seagrass bed waters elsewhere for a comparison. Chlorophyll *a* values from this bed are several times higher than those obtained from the coral reef waters in the Palk Bay side of Mandapam (0.177 to 0.695 mg/m³). However, the extent of contribution by free phytoplankton to the overall productivity of the seagrass bed is yet to be ascertained.

ACKNOWLEDGEMENTS

Our thanks are due to Dr. S. Z. Qasim, Director, National Institute of Oceanography, for his guidance and suggestions. We are grateful to the Ministry of Education and Social Welfare, Government of India, for the award of Senior Research scholarships.

TABLE II. Rates of production and consumption in some of the seagrasses found in the seagrass beds of Gulf of Mannar.

| Species | Production gC/gm/hr | Respiration gC/gm/hr | P/R |
|------------------------------|------------------------|-------------------------|------|
| <i>Cymodocea isoetifolia</i> | 0.6012 | 0.6012 | 1.00 |
| <i>Cymodocea serrulata</i> | 0.3261 | 0.3260 | 1.00 |
| <i>Diplanthera uninervis</i> | 0.4084 | 0.1880 | 2.17 |
| <i>Halophyla ovalis</i> | 0.2650 | 0.1130 | 2.35 |
| <i>Halophyla stipulacea</i> | 0.4910 | 0.1880 | 2.61 |

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