Indian J. Fish., 45(1) : 79-83, Jan.-Mar., 1998

Note

Seagrass production in Minicoy Atoll of Lakshadweep Archipelago

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ABSTRACT

Minicoy lagoon harbours extensive beds of *Thalassia hemprichii* in association with *Syringodium isoetifolium, Halophila ovalis* and *Halodule uninervis*. The total area occupied by seagrass flat ranges from 2.0 to 2.2 sq.km. Net primary production (NPP) of seagrass species varied from 5.0 gC/m^3/day (0.5 gC/kg (wet wt.)/day for *Syringodium* to 10 gC/m^3/day (1.0 gC/kg (wet wt.)/day for *Halodule*. It was estimated that an impairement upto 50 % on the NPP of *Thalassia* plants was caused by the prolonged exposure of the beds to bright sunshine in the intertidal areas during ebb stage when compared to those *Thalassia* plants growing in the unexposed habitats. Wet biomass, density of seagrass species and their NPP potential on the community metabolism of the lagoon are discussed.

Minicoy atoll (8°15'N & 73°03'E) has the largest lagoon among the Lakshadweep group of islands and has rich vegetation of seagrass and seaweeds (Untawale and Jagtap, 1984; Kaliaperumal *et al.*, 1989) and incidentally is the most productive (Nair and Pillai, 1972) among other atolls of Lakshadweep sea. Qasim and Bhattathiri (1971) as well as Kaladharan and David Raj (1989) respectively reported on the seagrass prductivity of Kavaratti and Amini atolls. Biomass (wet) and density of seagrass vegetation in Minicoy atoll as on January 1982 was studied by Untawale and Jagtap (1984). However, information on the relative contribution of seagrass production to the overall primary productivity of the atoll is inadequate. This paper is intended to highlight (1) the total biomas of seagrass species as well as their relative abundance, (2) the contribution of net primary production (NPP) of seagrass to the productivity of the lagoon and (3) the impact of desiccation of upper parts of *Thalassia* leaves on the primary productivity in the Minicoy lagoon.

Seagrass species were sampled from the respective bed randomly for their biomass using a 0.25 sq.m wooden quadrat and the area under seagrass cover was recorded during the low tide. Entire plants including rhizomes, roots and scale leaves; removed from the quadrats were weighed instantly for their wet biomass. The standard light and dark bottle method as described below was employed to determine the net primary production (NPP) of seagrass species. Intact plants of *Thalassia hemprichii, Halophila ovalis* (Hydrocharitaceae), *Syringodium isoetifolium* and *Halodule uninervis* (Potamogetonaceae) were collected and thoroughly cleaned with seawater (filtered through filter paper of 0.45 μ) to remove all periphyton and epiphytes if any. Ten g leads of cleaned seagrass material of each species was transferred to light and dark bottles (one litre). The bottles were filled with freshly collected and filtered seawater without any air bubbles. A set of light and dark bottles with water but without any seagrass material was used as controls. Initial oxygen in the ambient water was determined from another set of bottles at the time of incubation. Remaining light and dark bottles along with the controls were incubated for three hours in the habitat by anchoring them in the bed. These experiments were repeated several times from August 1990 to October 1991. NPP was calculated for each species from their net oxygen production values multiplied with a factor 0.536/PQ, where PQ was 1.25 (Westlake, 1963).

Seagrass vegetation in Minicoy lagoon is found extended to an area of 2-2.2 sq.km along the intertidal zone of the lagoon. The mean values for total wet biomass ranged from a minimum of 1.2 kg/m^2 for *H. ovalis* to a maximum of 11.2 kg/m^2 for *S. isoetifolium* (Table 1). However, when considered on area basis *T. hemprichiii* was found dominant (99.5 kg/m^2) spreading almost the entire intertidal area parallel to the beach (Fig. 1). An earlier report (Untawale and Jagtap, 1984) also indicates that *T. hemprichii* as the dominant seagrass in Minicoy with an average wet biomass ranging from 900 g/m^2 to 8.0 kg/m^2. However, the maximum wet biomass of 900 g/m^2 as

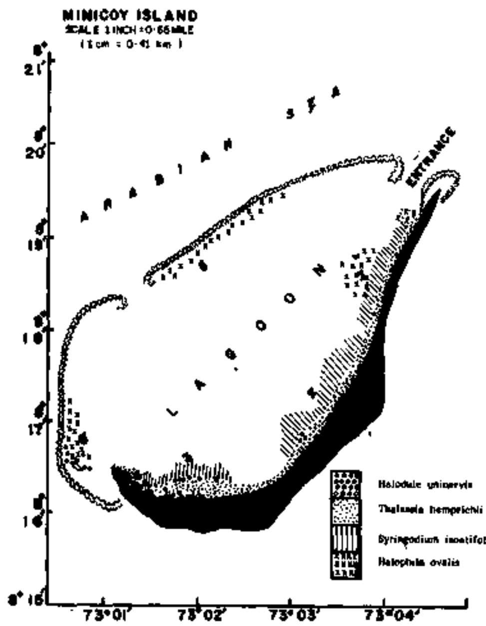

Fig. 1. Minicoy atoll showing the seagrass beds and the sampling sites.

TABLE 1. *Wet biomass in kg/m^{2}of seagrasses in Minicoy lagoon*

Site	*Halodule uninervis*	*Halophila ovalis*	*Thalassia hemprichii*	*Syringodium isoetifolium*
1	1.8 ± 0.872	1.8 ± 0.517	10.0 ± 1.053	13.5 ± 1.213
2	1.5 ± 0.434	-	12.0 ± 1.824	11.0 ± 0.906
3	-	-	11.5 ± 0.825	-
4	2.5 ± 0.219	-	08.0 ± 1.157	09.0 ± 1.611
5	1.0 ± 0.124	1.2 ± 0.228	06.0 ± 0.349	-
6	-	0.8 ± 0.815	-	-
Mean	1.7	1.2	9.5	11.5

reported by Ansari (1984) could be the harvestible biomass without rhizomes and root systems. In the present study underground parts were also included in estimating the biomass because of their importance in oxygen utilization. Perusal of the report by Untawale and Jagtap (1984) indicated that the pattern of distribution of seagrass vegetation has change within ten years in Minicoy lagoon and the major alterations were on the distribution of *H. uninervis, H. ovalis, S. isoetifolium* and *Cymodocea rotundata*. We could not observe any plants of *C. rotundata* among the *Thalassia* beds. On the contrary *S. isoetifolium* was found growing as dense beds (Table 1) along with *Thalassia* which according to them was a drifted mass during 1982. Our results on the biomass of *H.uninervis* and *H. ovalis* are quite agreeing with their results.

Although the net production (P) rates of *Halodule* exceeded that of other three seagrasses especially twice higher than *Syringodium,* their consumption (R) rates varied considerably. The compensation point (P/R) was below one in *Halodule* (0.91) and *Halophila* (0.45) and remained well above one in the case of *Thalassia* (3.34) and *Syringodium* (1.25) (Fig. 2). Similar trends of P/R values as 2.12 for *Thalassia* and 0.93 for *Syringodium* from Kavaratti (Qasim and Bhattathiri 1971) and 1.27 for *Cymodocea* from Amini atolls (Kaladharan and David Raj, 1989) are reported. It was understood from the above observation that the net production by *Halodule* and *Halophila* could not meet the oxygen demand for respiration during the dark period. *Thalassia* beds have been reported to be the most productive in the lagoon systems (Qasim and Bhattathiri, 1971; Odum, 1956).

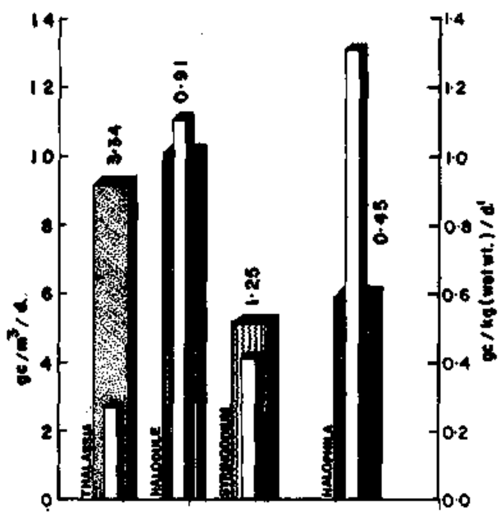

Fig. 2. Net primary production and consumption of seagrass species. Shaded bars represent NPP(P) and the inner unshaded bars denote consumption (R). P/R values are given at the top of respective bars.

Our study also confirms *T. hemprichii* as the most productive in the lagoon owing to their high rate of NPP, low consumption (Fig. 2) and widespread distribution (Fig. 1).

Plants with thin foliage are known to have higher rate of photosynthesis than those with thick or calcareous foliage (Odum, 1959; Kanwisher, 1966). Thin leaved *Halodule* (10.12 g c/m^3/day) and *Thalassia* (9.13 g C/m^3/day) registered NPP at rates higher than the cylindrical and thick leaved *Syringodium*. The reason for the low production rates in *Halophila* in spite of the thin leaves may be assigned to the low content of chlorophyll pigments per unit area of leaves when compared to the other three specie. Low values of compensation point for *Halophila* and *Halodule* were presumed mainly due to their very thin leaves which lack sufficient intercellular air spaces (den Hartog, 1979) in the mesophyll layers which otherwise can retain the oxygen produced during active photosynythesis and re-utilise during non photosynthetic period as presumed in *Syringodium* and *Thalassia. Halodule* and *Halophila* need to avail a major part of oxygen for respiration from the ambient water (Fig. 2). Hence *Halodule* and *Halophila* beds may have a high demand for dissolved oxygen.

The maximum tidal amplitude of Minicoy atoll is 1.57 m (Gardiner, 1930). During extreme ebb tide in bright sunshine hours, the *Thalassia* beds get exposed and the upper parts of leaves desiccate and turn black. This impair the production rates to 50 % (Table 2). Normal healthy green plants growing in submerged areas were considered as controls. Decaying of seaweeds during ebb tide is reported in recent years (Wu, 1990). In *Thalassia* too drying of parts of leaves resulted in the decay. This happens only to *Thalassia* beds in Minicoy lagoon as it is the only species mostly distributed in the shallow areas parallel to the beach. The desiccation and decay of exposed parts of leaves cease to occur when the ebb tide occurs after dusk or before dawn.

The desiccated leaves besides causing a reduction in primary production can bring about considerable demand for dissolved oxygen for respiration as evidenced by the observed hike in oxygen consumption rate of half-dried leaves (Table 2). Impaired production rates and high oxygen consumption rate in half dried *Thalassia* plants as observed in the light and dark incubated plants can be suggestive of similar conditions in the *Thalassia* beds occurring in shallow areas of the lagoon. The studies revealed that the major share of primary production comes from *Thalassia* among other seagrasses and the NPP of *Thalassia* beds fluctuate during the tidal inundations in the Minicoy atoll.

TABLE 2. *Impairment in the primary production of half dried and normal green* Thalassia *plants*

	Net production (P) gc/m³/d	Consumption (R)	P/R
Half dried plants	4.29 ± 0.568	10.868 ± 0.827	0.39
Normal green plants	8.813 ± 1.047	2.227 ± 0.425	3.39

Acknowledgments

The authors are gratefull to Dr. M. Devaraj, the Director, C.M.F.R.I. for the encouragements received. The field assistance rendered by Mr. O. Ismail is also gratefully acknowledged.

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