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Primary production of seagrass *Cymodocea serrulata* and its contribution to productivity of Amini atoll,Lakshadweep Islands

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Primary productivity of two adjacent atolls of Lakshadweep islands differing in the presence of *Cymodocea serrulata* (R.Br.) Aschers beds as measured from the diurnal oxygen curve was compared. Amini atoll which sustains extensive beds of seagrass vegetation showed 65% more productivity than the nearest atoll Kadamat which is totally lacking seagrass vegetation. The net primary production of *C. serrulata* was measured to be 6.4 g C.m^{-3}.d^{-1} and this was 6 times more than that of the phytoplankton alone. High rate of production of oxygen by *Cymodocea* beds during intensive photosynthesis is discussed in the light of oxygen budget of the atoll.

Seagrass beds are among the most productive and dynamic ecosystems. Among the marine primary producers, seagrasses can ingest nutrients from the seafloor using their extensive root system and release them to the surrounding water[1]. Though numerous studies on productivity of phytoplankton are available, very few[2,3] are devoted towards benthic flora. The objective of this study is to measure the relative contribution of seagrass and phytoplankton to the total primary production of Amini atoll (lat. 11°07'N, long. 72°44'E) by comparing with the primary productivity of nearest Kadamat atoll (lat. 11°13'N ; long. 72°47'E) which is lacking the seagrass beds in the lagoon.

This study was made during January 1987. Triplicate samples were taken over the beds at 2 h intervals for a period of 24 h for the determination of dissolved oxygen and the measurements were averaged to get diurnal changes in oxygen. Diurnal curve method[4] was used to determine the primary productivity of Amini atoll influenced by *Cymodocea serrulata* (R.Br.) Aschers beds, and Kadamat atoll where seagrass vegetation was absent.

C.serrulata plants were removed carefully along with roots and rhizomes, washed thoroughly with surface water to remove the sand particles and wiped with cotton to remove the epiphytes. Cleaned plants were divided into two lots of equal number of similar size and approximated to equal weight. The rates of oxygen production and consumption by the seagrass and phytoplankton were determined using light and dark bottles, incubated[5] in the habitat with or without the *C.serrulata* plants from the above lots. The experiment was repeated thrice to get an average. The well known conversion factor[6] [0.536/PQ, where PQ = 1.25] was used to convert the dissolved oxygen (DO) values to carbon equivalents. While estimating seagrass productivity, phytoplankton correction was made by using ambient water.

Net primary productivity of Amini atoll as calculated from the diurnal curve of DO (Fig. 1) was 3.327 g C.m.$^{-3}$d^{-1} and that of the nearest atoll Kadamat was found to be 2.013 g C.m^{-3}.d^{-1} (Table 1). This difference of 65% hike in Amini atoll can be attributed to the contribution of seagrass beds especially *C.serrulata* found in Amini atoll and their absence in Kadamat atoll.

The levels of individual contribution towards the productivity by phytoplankton and seagrass (devoid of epiphytes) as measured by light and dark bottle method using intact *Cymodocea* plants (Table 2) showed that seagrass under natural light conditions produced 15 ml O_2.m.$^{-3}$d^{-1}, which is equal to 6.4 g C.m^{-3}.d^{-1} or 1.18 g C.kg^{-1} dry wt. d^{-1}, whereas oxygen production by phytoplankton was only 2.1 ml O_2.m^{-3}.d^{-1} i.e. 0.931 g C.m^{-3}.d^{-1} which is 6 times lesser than that of *C. serrulata*.

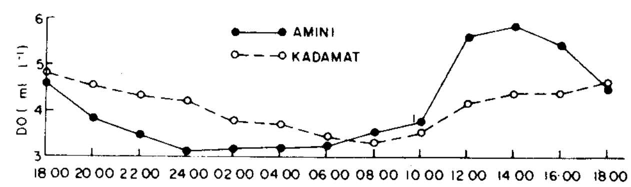

Fig. 1—Diurnal curve of dissolved oxygen content of Amini and Kadamat atolls determined for a period of 24 h

Table 1—Primary productivity of Amini and Kadamat atolls as calculated from diurnal curve (Fig. 1) of dissolved oxygen

Atoll	Seagrass vegetation	Net primary production (P) (g $C.m^{-3}.d^{-1}$)	Percent of control (%)	Respiration (R) (g $C.m^{-3}.d^{-1}$)	P/R*
Kadamat	Absent	2.013	100	2.058	0.97
Amini	Present	3.327	165	3.045	1.90

*P/R > 1 = autotrophic, < 1 = heterotrophic

Table 2—Photosynthetic oxygen release and net primary productivity of *C.serrulata* and phytoplankton (ambient water)

Component producers	Oxygen released ($ml.m^{-3}d^{-1}$)	Net primary production(P) (g $C.m^{-3}.d^{-1}$)	Respiration (R) (g $C.m^{-3}.d^{-1}$)	P/R
Phytoplankton (water)	2.172	0.931	0.926	1.005
C.serrulata (without epiphytes)	14.946	6.409	5.009	1.279
	(2.745)$^+$	(1.178)*	(0.920)*	1.280

+ = ml $O_2.kg^{-1}$ dry wt.d^{-1}

* = g $C.kg^{-1}$ dry wt. d^{-1}

The 2 values are not relative to one another, as quantity of phytoplankton population in seawater collected from the bed was not determined. Phytoplankton could produce 0.931 g $C.m^{-3}.d^{-1}$, whereas intact seagrass plants could contribute additionally 6.4 g $C.m^{-3}.d^{-1}$ even after substracting 0.931 g $C.m^{-3}.d^{-1}$ which could be the probable primary production value by phytoplankton found in the seawater which was used for incubation along with the grass.

Inspite of the high productivity of seagrass there seem to be few organisms which actually consume them. The grazers of seagrass are mainly parrot fishes, surgeon fishes, green turtles and sirenia among vertebrates and sea urchin among invertebrates. Though seagrass species are not directly involved in the food chain of fishes of commercial importance, their high rate of oxygen production will keep the atoll autotrophic and meet the oxygen demand by corals as well as other fauna.

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