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Note

Studies on phytoplankton productivity in Kavaratti Atoll, Lakshadweep

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ABSTRACT

Productivity contribution of phytoplankton in Kavaratti Atoll, Lakshadweep, was studied for one year (Jan. to Dec., 1989) using light and dark bottle method. Gross production (mg C/m^3/hr) varied between 0.62±0.01 and 6.0±2.5 and net production between 0.2±0.13 and 1.46±0.85. Gross production showed seasonal variations with a fall during monsoon months (June-September). Productivity appeared highly variable and limited by salinity as well as light conditions.

In tropical coral reefs, benthic plants and symbiotic algae being the major components of primary production, (Colinvaux, 1986) the productivity contribution from phytoplankton to the total reef production is low, often insignificant (Sargent and Austin, 1947; Sourina and Ricard, 1976). As part of an effort to find out the productivity of different components in the atoll, the production from selected corals (Suresh, 1991) and seagrass (Suresh and Mathew, 1999) have already been studied. This communication describes the attempts made to study the productivity of phytoplankton in Kavaratti atoll, its seasonal variations and factors influencing productivity.

Light and dark bottle method (Gaarder and Gran, 1927) was used for the study at fortnightly interval. Freshly collected sea water from the lagoon was filtered through a net to eliminate zooplankton and filled in 300 ml clear, transparent, air tight glass bottle and same quantity in dark bottle of same capacity. These bottles, in three replications for each, were exposed to sunlight for 4 hours by suspending them in the lagoon at a depth of one metre. Dissolved oxygen was measured by 'Winkler' method (FAO, 1975) for the sea water before exposure to light (initial) and after the exposure. The results are expressed in milligram carbon per cubic metre per hour. Data on water temperature, pH, salinity, phosphate and nitrate was compiled from Suresh and Mathew (1999).

Oceanic atolls harbour relatively low phytoplankton standing stock (Sargent and Austin, 1949). Wafar (1977) reported a production of 22.1 mg C/m^3/day, equivalent to approximately 1.89 mgC/m^3/hr from Lakshadweep waters. Qasim *et al.* (1972) reported 2.49 (April), 0.51 (November) and 1.43 mg C/m^3/hr in December, from Kavaratti

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TABLE 1. *One way analysis of variance showing seasonal variation in gross and net primary productivity*

Source	D.F.	Sum. sqr.	Mean sqr.	F. value	Remarks
Gross production					
Treatment	1	59.707	29.854	13.94	Hig.sig. (1%)
Error	15	32.131	2.142		
Net production					
Treatment	2	0.512	0.256	0.84	N.S.
Error	15	4.595	0.306		

D.F. - Degree of freedom, Hi.sig. - Highly significant, N.S. - Not significant.

atoll. Monthly mean productivity levels obtained in the present study is shown in figure 1. Maximum gross production ($mgC/m^3/hr$) was in December (6.09±2.5) and minimum in March (0.62±0.01) whereas the highest net production was in April (1.46±0.85) and lowest in July (0.20±0.13). Productivity appeared highly variable in Kavaratti Atoll. Except for January and October-December, the results agreed with that of Qasim *et al.* (1972) and Wafar (1977). Gross production showed significant ($P<0.01$) seasonal variations (Table 1) with a fall during monsoon (June-September) as shown in Fig. 1, while the variation in net production did not conform into any definite seasons indicating a more or less uniform productivity contribution to the secondary trophic level in the atoll. The data available is not sufficient enough to predict the consistency of these variations. The monthly mean levels of hydrographic parameters compilled from Suresh and Mathew (1999) are shown in Table 2. When productivity was correlated with these parameters (n-2=22), except phosphate and nitrate all others were found to be positive. Of these, it was significant only with salinity ($P\leq0.05$, r, 0.677). A parameter can be called limited, when an increase in the flux of which increases a metabolic response as productivity (Parsons *et al.*, 1984). Salinity has direct influence on phytoplankton (Qasim, 1973) and the positive relation indicate that salinity could limit productivity. Light could be a climatic factor that

TABLE 2. *Monthly mean values of water temp., pH, salinity, phosphate and nitrate (Compiled from Suresh and Mathew, 1999)*

Months (1989)	Temp. (°C)	pH	Salinity (ppt)	Phosphate (µg at/l)	Nitrate (µg at/l)
Jan.	28.5	8.10	35.18	0.48	0.06
Feb.	29.5	8.15	35.18	0.45	0.06
Mar.	29.5	8.25	34.18	0.33	0.16
Apr.	30.0	8.33	34.18	0.30	0.10
May	30.0	8.20	34.22	0.32	0.13
Jun.	28.5	8.05	34.40	0.40	0.15
July	27.5	7.84	33.70	0.25	0.03
Aug.	29.5	8.24	34.40	0.25	0.08
Sept.	29.5	8.26	34.45	0.35	0.13
Oct.	30.5	7.98	34.11	0.19	0.12
Nov.	30.5	7.94	34.42	0.26	0.22
Dec.	29.5	8.10	34.45	0.28	0.16

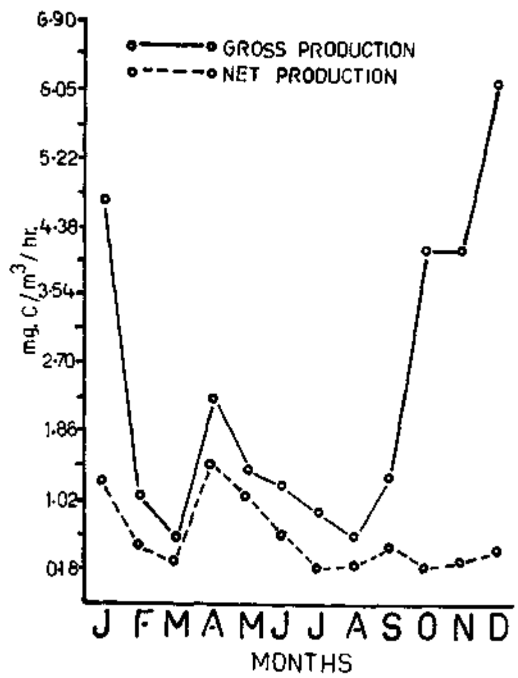

Fig. 1. Monthly variations in the gross and net production in Kavaratti Atoll.

might limit productivity in the atoll as availability of light was lowest during monsoon, due to rain and cloud cover (Suresh and Mathew, 1993), when productivity was also lowest.

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References

Colinvaux, L.H. 1986. Historical perspective on algae and reefs : Have reefs been misnamed ? *Oceanus,* **29** : 43-48.

FAO 1975. Manual of Methods in Aquatic Environment Research. *FAO. Fish. Tech. Paper,* No. 137 : 1-238.

Gaarder, T. and H. Gran 1927. Investigations of the production of plankton in the Oslo Fjord. *Rapp. Proc. verb. Cons. Expt. Mer.* **42** : 1-48.

Parsons, T.R., M. Takahashi and B. Hargrave (Eds.) 1984. *Biological Oceanographic Processes,* 4th edition. Pergamon Press, New York, 330 pp.

Qasim, S.Z. 1973. Productivity of backwaters and estuaries. *In:* Zeitzschei, B. (Ed.), *The Biology of the Indian Ocean. Ecological Studies.* J. Springor-Verlag, Berlin, 143-154.

Qasim, S.Z., P.M.A. Bhattathiri and C.V.G. Reddy 1972. Primary production of an atoll in the Laccadive. *Int. Revueges. Hydrobiologia,* **57** : 207-225.

Sargent M.C. and T.A. Austin 1949. Organic productivity of an atoll. *Trans. Amer. Geophys. Union,* **30** : 245-249.

Sournina, A. and M. Ricard 1976. Phytoplankton and its contribution to primary productivity in two coral reef areas of French Polynesia. *J. Exp. Mar. Biol. Fcol.,* **21** : 129-140.

Suresh, V.R. 1991. Studies on the coral reefs of Lakshadweep. *Ph.D. Thesis.* Cochin Unviersity of Science and Technology, Cochin, 17-59.

Suresh, V.R. and K.J. Mathew 1993. Skeletal extension of staghorn coral *Acropora formosa* in relation to environment at Kavaratti Atoll (Lakshadweep). *Indian J. Mar. Sci.,* **22** : 176-179.

Suresh V.R. and K.J. Mathew 1999. Productivity of seagrass in relation to environment at Kavaratti Atoll, Lakshadweep, with a note on their ecological implications. *Environment and Ecology,* **17** : 49-52.

Wafar, M.V.M. 1977. Phytoplankton production of two atolls of the Indian Ocean, *Mahasagar-Bull. Nat. Inst. Oceanogr.,* **10** : 117-121.