

## Production & Zooplankton Community Structure in the Lagoon & Surrounding Sea at Kavaratti Atoll (Lakshadweep)\*

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Higher values for the environmental parameters were generally obtained for the lagoon stations. Average values of pH, temperature, salinity, dissolved oxygen and phosphate-phosphorus, nitrate-nitrogen, silicate and silicon in the lagoon were 7.5, 31.6 °C,  $35.7 \times 10^{-3}$  ml.l<sup>-1</sup> and 0.8, 1.5 and 3.6  $\mu\text{g-at.l}^{-1}$  while the values from the surrounding sea were 7.7, 30.5 °C,  $34.9 \times 10^{-3}$ , 6.1 ml.l<sup>-1</sup> and 0.5, 1.2 and 4.6  $\mu\text{g-at.l}^{-1}$  respectively. Fluctuations in the secondary production were greater in the surrounding sea (19.9 to 44.8 mgC.m<sup>-2</sup>.d<sup>-1</sup>) than at lagoon (6.6 to 15.7 mgC.m<sup>-2</sup>.d<sup>-1</sup>). Zooplankton community structure was more diverse in the former. The lagoon fauna was characterised by epibenthic forms and zooplankton population was much less compared to the surrounding sea. This depletion in zooplankton may be due to their consumption by the coral reef community when water passes from surrounding sea to lagoon.

The Laccadive Archipelago (Lakshadweep; 10° 35.5' N and 72° 38' E) comprises a group of coral atolls with shallow lagoons surrounded by ring-shaped coral reefs. Some investigations have been carried out on zooplankton distribution in different seasons at Lakshadweep atolls<sup>1-4</sup>. However, no information is available on the short term variations in the environmental parameters and zooplankton population from these atolls. The present communication deals with daily variations in the physico-chemical features, secondary production and zooplankton community structure at the Kavaratti Atoll, Lakshadweep.

### Materials and Methods

Surface zooplankton and water samples were taken between 0900 to 1100 h daily for a week (9 to 15 April 1971) at 8 stations (Fig 1). Zooplankton collections were made with a Heron-Tranter net (mouth area 0.25 m<sup>2</sup> and meshwidth of 330  $\mu\text{m}$ ) fitted with a calibrated 'TSK' flowmeter. The samples were preserved in 5% buffered formaldehyde. A sub-sample of 4 to 10% was examined for the enumeration of zooplankton. The number was calculated for the whole sample and computed per m<sup>3</sup>. Secondary production was calculated from the zooplankton displacement values as per the formulae given by Cushing<sup>5,6</sup>. Physico-chemical features of the water samples were analysed by methods of Strickland and Parsons<sup>7</sup>.

### Results and Discussion

High degrees of illumination due to clear water, thick growth of attached algae and macrophytes and shallowness (av. depth 2 m) influence the hydrographi-

cal features and zooplankton production at the Kavaratti lagoon<sup>2,4</sup>. Daily variations in physico-chemical factors at different stations are shown in Fig 2. Fluctuations in daily values of temperature, salinity, dissolved oxygen, phosphate-phosphorus and nitrate-nitrogen were more in the lagoon than in the surrounding sea. Higher values of pH and silicate-silicon were observed in the surrounding sea compared to lagoon. Variability in chemical parameters were observed earlier<sup>5,6</sup> at the Kavaratti lagoon.

Zooplankton biomass and consequently the secondary production values were higher for stations

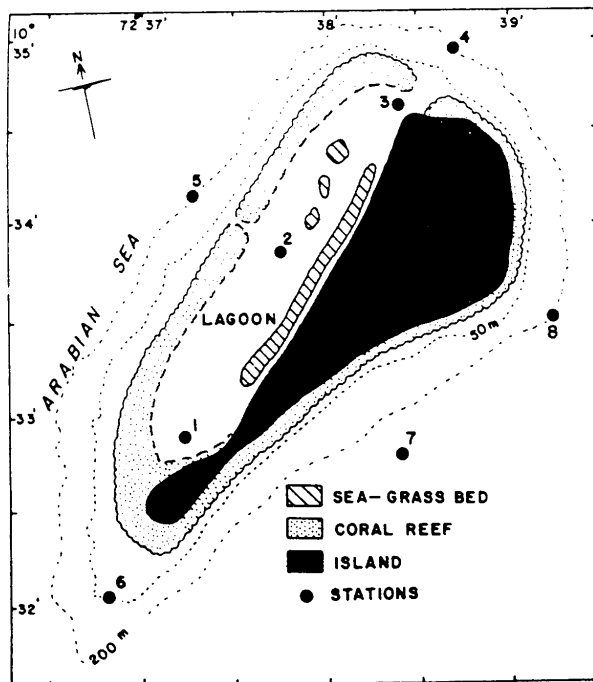


Fig. 1—Station positions

\*Forms part of Ph.D. thesis.

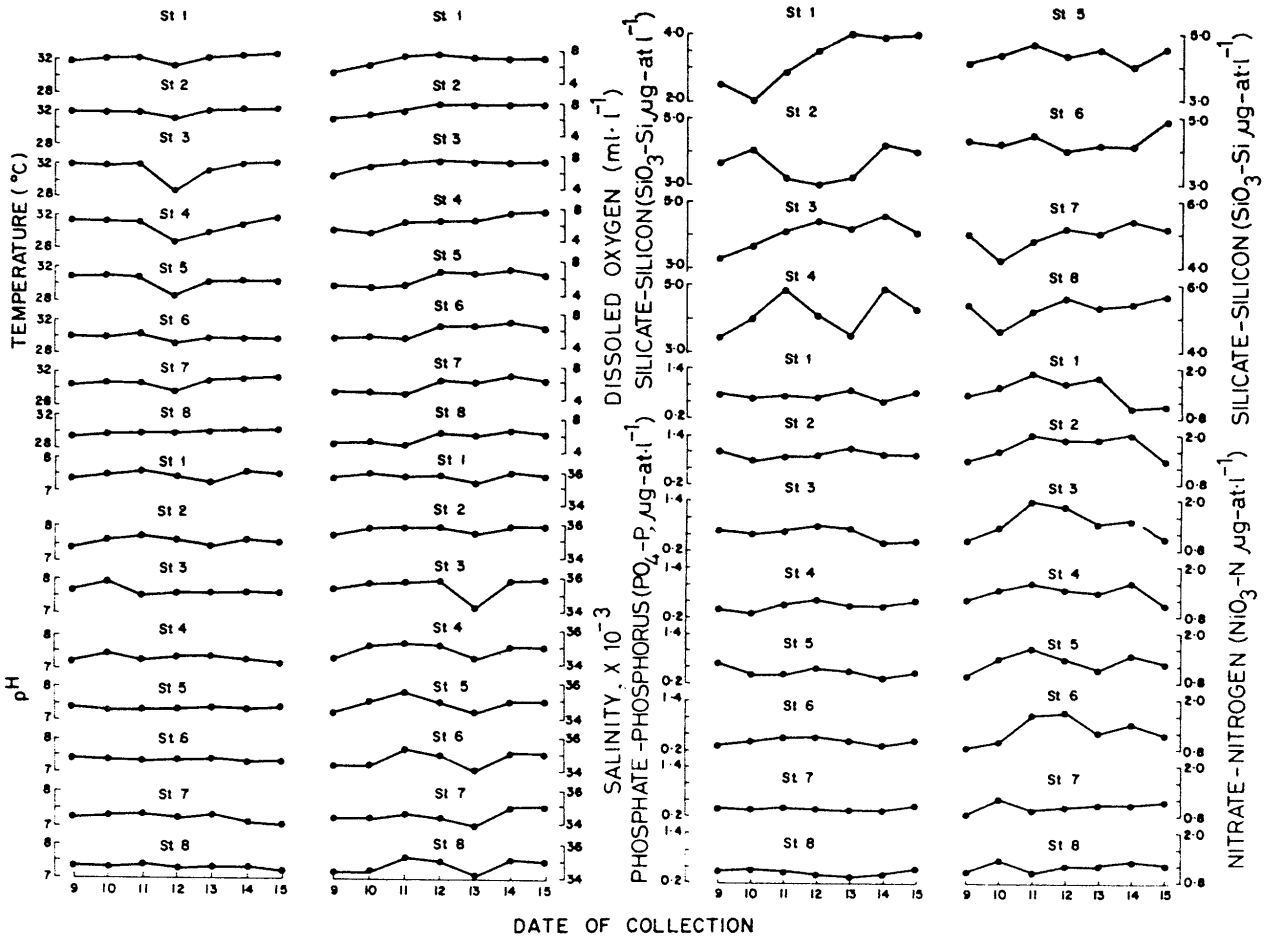


Fig. 2—Daily variations of physico-chemical factors at different stations at Kavaratti Atoll

in the surrounding sea (Fig.3) where the average production obtained was  $32.6 \text{ mgC.m}^{-2}.\text{d}^{-1}$ ; average value in the lagoon was  $10.6 \text{ mgC.m}^{-2}.\text{d}^{-1}$ . Lower zooplankton biomass values from lagoons of Lakshadweep were also recorded earlier<sup>1,2</sup>. Low secondary production values for the surface zooplankton samples, taken during the day at the Kavaratti lagoon may be due to the fact that high incident illumination and temperature may be forcing the plankton to take refuge in the thick growth of sea grass - *Thalassia hemprichii* (Ehr.) and *Cymodocea isoetifolia* (Aschers & Graeb). Simple, partial and multiple correlation coefficient (*r*) values obtained between secondary production, temperature and salinity gave significant negative correlation values with temperature (Table 1) indicating that temperature is an important hydrographical feature in the lagoons. Nocturnal abundance of plankton in the lagoons when temperature was low has been reported<sup>2,10</sup>. Low zooplankton biomass values obtained for the lagoon samples were due to consumption of zooplankton as

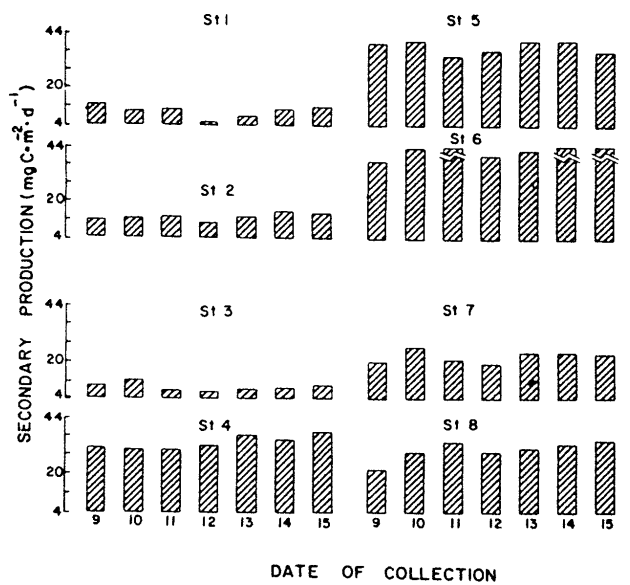


Fig. 3—Secondary production values at different stations at Kavaratti Atoll

Table 1. Simple, Partial and Multiple Correlation Coefficient ( $r$ ) Values Obtained between Secondary Production (S), Salinity (Y) and Temperature (Z)

Sts	$r_{SY}$	$r_{SZ}$	$r_{YZ}$	$r_{SYZ}$	$r_{SZY}$	$r_{YSZ}$
1	0.427*	-0.612†	0.158	0.425*	0.619†	0.496*
2	0.431*	-0.663†	0.350	0.565†	0.313	0.465*
3	0.347	-0.624†	0.330	0.466*	0.146	0.127
4	0.310	0.252	0.162	0.194	0.182	0.222
5	0.212	0.198	0.102	-0.072	0.304	0.093
6	0.110	0.126	0.096	-0.099	0.162	0.130
7	-0.092	0.140	0.110	0.082	0.100	0.062
8	0.182	0.165	0.136	-0.167	0.142	0.103

Level of significance: \*at 5%, and † at 1%.

food by the coral reef when the water passes over the reef from ocean to lagoon<sup>1,2</sup>. Plankton near the coral reefs was reported to be sparse<sup>11,12</sup> but during the present study plankton was abundant. Zooplankton from the surrounding sea showed high diversity in faunal composition and species. Most of the oceanic planktonic groups such as Foraminifera, Siphonophora, Hydromedusae, Appendicularia and Thaliacea were not recorded from the lagoon samples. In all 22 groups were observed, the spatial distribution of 18 groups is shown in Fig.4. Individuals of the remaining 4 groups, viz. Cladocera, Cephalopoda, Copelata and Pteropoda, were quite rare in the collections. Copepods, chaetognaths, decapod larvae, fish eggs and fish larvae contributed the major component of zooplankton community during the period of study.

The copepods dominated the zooplankton community at all stations. The calanoids formed the major component of copepods in the samples from the surrounding sea while harpacticoids were more in the lagoon collections. Based on the total counts, the percentage distribution of calanoid, harpacticoid and cyclopoid copepods at stations in the surrounding sea were 83, 3 and 14 respectively. In the lagoon, the corresponding percentages were 30, 58 and 12. Tranter and George<sup>1</sup> also obtained more harpacticoid copepods in the Kavaratti lagoon. A total of 110 copepod species were identified, out of which 90 were calanoids. Species belonging to the genera *Paracalanus*, *Acrocalanus*, *Centropages*, *Labidocera* and *Calanopia* were most abundant. Most of the oceanic species namely *Eucalanus pseudattenenuatus*, *E. elongatus*, *E. subtemuis*, *Rhincalanus cornutus*, *Euchirella bella*, *Temora discaudata*, *Pleuromamma abdominalis*, *P. xiphias*, *Haloptilus longicornis*, *Metacalanus auri-villi*, *Candacia aethiopia*, *Labidocera truncata*, *L. kroyeri* var. *gallensis*, *Calanopia elliptica*, *Pontella fera*, *P. andersoni*, *Pontellopsis regalis*, *Acartia danae* and *Heterorhabdus* spp were obtained only from the surrounding sea. The

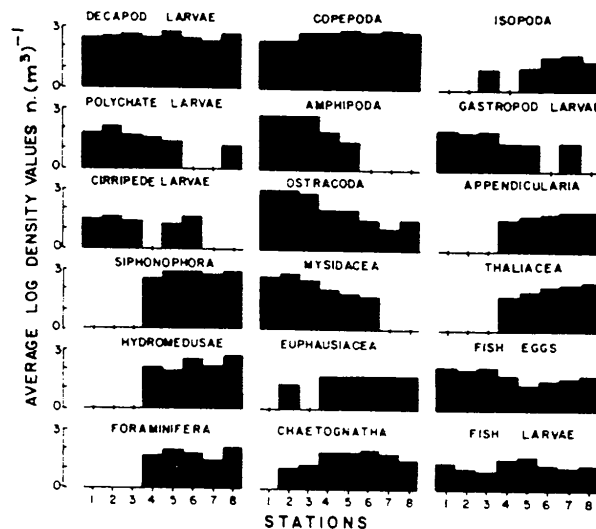


Fig. 4. Distribution of major zooplanktonic taxa at different stations at Kavaratti Atoll

remaining species occurred invariably at all stations. Spatial distribution of some of the common species including harpacticoid and cyclopoid copepods is shown in Fig. 5. Harpacticoids in the samples were represented by 8 species, viz. *Macrosetella gracilis*, *Clymnestra scutellata*, *Microsetella norvegica*, *M. rosea*, *Longipedia scotti*, *Miracia efferata*, *Dactylopus maldivensis* and *Amphidiscus* sp. The last 2 being endemic to the Kavaratti lagoon as reported<sup>2</sup>. However, Madhupratap *et al.*<sup>13</sup> noticed no endemicity of any group or species of plankton from lagoons of Lakshadweep. The cyclopoid population was represented by 5 genera and 12 species such as *Oithona rigida*, *O. nana*, *O. robusta*, *Oncaea tenuis*, *O. conferta*, *Corycaeus gibbulus*, *C. longicornis*, *C. catus*, *Corycaeus* sp., *Copilia mirabilis* and *Sapphirina* sp. Species of *Oithona* and *Oncaea* were numerous in the lagoon while those of *Corycaeus*, *Copilia* and *Sapphirina* in the surrounding sea. *Oithona rigida* and *O. nana* were not recorded earlier<sup>2,13</sup> from the Kavaratti lagoon.

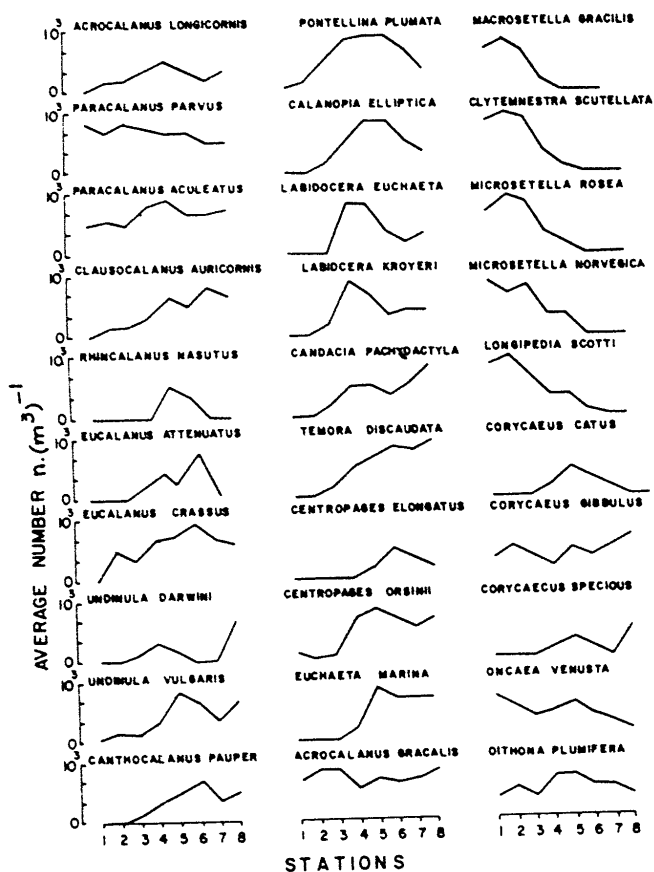


Fig. 5—Distribution of common copepod species at Kavaratti Atoll

The chaetognath population showed much fluctuations in abundance. Nine species were identified and were more in the samples from the surrounding sea. *Pterosagitta draco* and *Krohnitta pacifica* were not observed from the lagoon (Table 2). The individuals of *Sagitta robusta* and *S. neglecta* were either absent or poorly represented there. Nair and Rao<sup>14</sup> also observed less number of chaetognath species in the Kavaratti lagoon. However, they obtained specimens of *S. bipunctata* and *S. hexaptera* at Kavaratti atoll which were not recorded either during the present investigation or in the earlier collections from the Laccadive and Maldive Archipelago<sup>15</sup>.

Decapod larvae in the samples were represented mainly by members of 7 groups which in order of abundance were: Palaemonids (41%), Brachyurans (27.1%), Alpheids (12%), Sergestids (9.0%), Hippolytids (5.0%), Porcellanids (2.3%), Penaeids (0.4%) and others (2.6%). Individuals of Palaemonids, Brachyurans and Sergestids were recorded from the lagoon samples while the remaining groups were absent. The crab zoeae and megalopa larvae constituted the brachyuran population. They were numerous in the lagoon samples and the highest number 526.(100 m<sup>3</sup>)<sup>-1</sup> was obtained at st 1. The larvae and postlarvae of *Metapenaeus* spp and *Parapenaeopsis* sp were the main penaeids and were obtained only at stations from the surrounding sea. *Leptocarpus* spp were the main Palaemonids and Sergestids were represented by *Lucifer typus*, common

Table 2—Population Density [n.(100 m<sup>3</sup>)<sup>-1</sup>] of Chaetognath Species at Different Stations at the Kavaratti Atoll during April 1971

[Values in parentheses indicate mean number]

Species	Sts							
	1	2	3	4	5	6	7	8
<i>Sagitta bedoti</i>	143-981 (412)	296-1201 (631)	162-515 (311)	118-317 (170)	213-542 (390)	46-307 (179)	32-315 (195)	27-191 (150)
<i>S. entlata</i>	12-61 (37)	30-304 (172)	19-225 (124)	68-715 (305)	152-717 (331)	140-642 (286)	78-492 (235)	128-351 (244)
<i>S. pulchra</i>	2-19 (11)	7-23 (16)	1-13 (7)	84-782 (294)	131-785 (445)	120-712 (428)	98-715 (270)	113-962 (425)
<i>S. pacifica</i>	1-9 (6)	4-21 (14)	7-19 (16)	57-812 (463)	110-1124 (746)	192-1052 (911)	196-1020 (624)	132-890 (495)
<i>S. regularis</i>	0	1-6 (3)	0-12 (5)	23-172 (113)	50-323 (162)	48-680 (321)	27-316 (167)	63-765 (370)
<i>S. robusta</i>	0	0-5 (2)	0-3 (1)	17-181 (102)	24-292 (149)	13-181 (143)	52-116 (70)	38-151 (92)
<i>S. neglecta</i>	0	0-5 (2)	0-2 (1)	82-352 (219)	119-792 (414)	64-340 (180)	81-512 (380)	112-515 (233)
<i>Pterosagitta draco</i>	0	0	0	12-81 (44)	18-141 (72)	35-410 (186)	24-215 (166)	41-181 (103)
<i>Krohnitta pacifica</i>	0	0	0	3-18 (10)	8-41 (20)	9-53 (30)	5-72 (35)	11-80 (40)

both to lagoon and sea stations. The fish eggs were numerous in the samples from the lagoon while fish larvae were more in the collections from the surrounding sea. The fish larvae belonged to the families Gobiidae, Myctophidae, Stromateidae and Scorpaenidae. Higher number [ $124.(100 \text{ m}^3)^{-1}$ ] was recorded at st 5.

Species of genera *Typoscolex*, *Glycera* and *Nereis* were the main polychaete larvae in the plankton samples. Euphausiids were represented by *Euphausia diomedea*, *Euphausia* sp and *Stylocheiron* spp. They were abundant in collections from the surrounding sea. members of genera *Animysis*, *Gastrosaccus*, *Siriella gracilis* and *Siriella* spp. formed the mysid population. *S. gracilis* being the most common species in the lagoon. Gammarid amphipods were abundant in the lagoon while species of sub-order Hyperiididae in the surrounding sea. *Diphyses chamissonis*, *Diphyses* sp and *Lensia* sp were the main siphonophores encountered. A few specimens of cladoceran *E:adnetergestina* and Pteropods *creseis* sp were obtained at stations from the surrounding sea.

The present study indicated that it would be wrong to assume that tropical coral reefs live in waters of impoverished plankton content<sup>11,12</sup>. The plankton community structure in the surrounding sea and lagoon is quite different. Some harpacticoid copepod species are endemic to the Kavaratti lagoon.

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