Proceedings of the Second Workshop on Scientific Results of *FORV Sagar Sampada*

Editors

V.K. Pillai
S.A.H. Abidi
V. Ravindran
K.K. Balachandran
Vikram V. Agadi

Department of Ocean Development
Government of India
New Delhi
1996

Department of Ocean Development (DOD)
Government of India
Mahasagar Bhavan, Block No-12
C.G.O. Complex, Lodi Road
New Delhi-110 003
India

ISBN : 81-900656-0-2

Citation Styles

For entire volume

Pillai, V.K. Abidi, S.A.H., Ravindran, V., Balachandran, K.K. & Agadi, V.V. (Eds.) 1996. *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, (Department of Ocean Development, New Delhi), pp. 564.

For individual article

Goswamy, S.C. & Shrivastava, Y. 1996. Zooplankton standing stock, community structure and diversity in the northern Arabian Sea, In: *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, edited by V.K. Pillai, S.A.H. Abidi, V. Ravindran, K. K. Balachandran & V.V. Agadi, (Department of Ocean Development, New Delhi), pp. 127-137.

Designed and Printed by:

Publications & Information Directorate
Council of Scientific & Industrial Research
Pusa Campus, New Delhi-110 012
India

Proc. Second Workshop Scient. Resul. FORV Sagar Sampada, 1996, pp. 97–102

Distribution of heterotrophic bacteria around Laccadive Islands

V. Chandrika

Central Marine Fisheries Research Institute
Dr.Salim Ali Road, P.B.No.1603
Cochin-682 014

ABSTRACT

Distribution of heterotrophic bacteria in water samples collected from surface and 50 m depth in 26 stations around Laccadives in EEZ between 08°50' and 12° and 71° and 74° E onboard *FORV Sagar Sampada* was studied. The size of colonies isolated from surface water were very small when compared to colonies from 50 m depth. Green fluorescent *Pseudomonas* was predominant in some stations. Counts ranged from 0.81 x 10^8/ml to 2.66 x 10^8 /ml in surface waters and 0.9 x 10^8/ml to 2.20 x 10^8/ml in 50 m depth. Night samples harboured less counts when compared to daytime samples. Out of 23 cultures studied *Vibrio*, *Alcaligenes*, green fluorescent *Pseudomonas* formed the main flora and members of Enterobacteriaceae were absent. Both gram-positive and gram- negative bacteria were isolated of which 94.6% were gram-negative rods. Their correlation with environmental parameters are discussed.

INTRODUCTION

Information on the ecophysiology and activity of microbial population from the Indian Ocean around Laccadives is very much limited (Nair, 1979; Loka Bharati & Chandramohan, 1990). Very recently Moriarty (1979) and Moriarty *et al.* (1985) published a comprehensive review on the productivity and trophic role of bacteria on coral reefs. Chandramohan & Ramaiah (1987) found that nearly 50 to 80% of assimilated carbon was respired by heterotrophic activity indicating a very high rate of mineralization. However, very little is known about quantitative and qualitative abundance and the pattern of vertical distribution of bacteria from the Indian Ocean around Laccadives in EEZ between 08°50' and 12°00'N and 71°00'E. In this communication the results of the standing crop of heterotrophic bacteria of water samples

from 0 to 50 m in the Lakshadweep Archipelago and nearby oceanic waters is reported (Fig.1). No station was closer to the land.

MATERIALS AND METHODS

The area surveyed (Fig.1) was lying within 8°- 12°N and 71°- 74°E (around Laccadives) at a depth range of 150- 4000 m. A total of 26 multidisciplinary stations were covered in cruise No.82 between 7th December to 20th December, 1990.

Water samples were collected from the surface and 50 m with the help of Rosette sampler and stored in sterilised screw cap tubes. The samples were analysed immediately onboard using selective mediums Zo Bell 2216 Marine Agar and glucose asparagin agar (GAA) by spread plate technique. Sample (0.5 ml) was pipetted on to the surface of each of three plates and at once spread widely with a fine wire-loop. Plates were incubated for three days and total viable bacterial colonies were counted in a colony counter. The viable count was calculated from the average colony count per plate and the bacterial count is expressed as numbers per ml. For the determination of predominant generic composition, colonies were selected randomly and identified up to generic level by subjecting them to various diagnostic tests. The purified cultures were identified according to a scheme of Simidu & Aiso (1962) and in accordance with Bergy's manual (Buchanan & Gibbons, 1974).

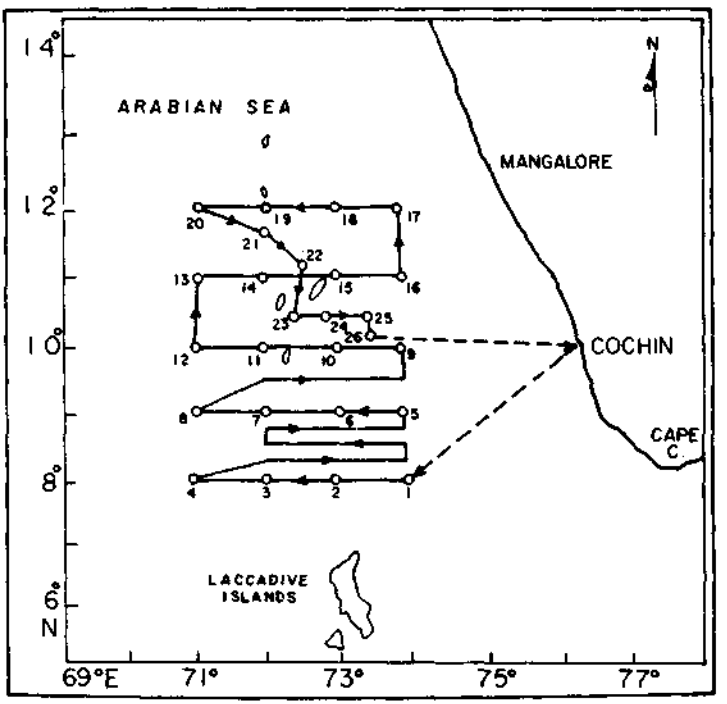

Fig. 1 - Station locations

RESULTS AND DISCUSSION

The morphological, physiological and biochemical properties of heterotropic bacteria isolated from surface water and 50 m depths are shown in Table 1. Of the identified isolates 94.6% were gram-negative short-rods and 23.8% were chromogenic and formed asporogenous rods. In general most of the cultures were highly pleomorphic. The number declined with increasing water depth. The temperature range at the surface was about 25°- 28°C. Station 13 recorded the lowest surface temperature of 18.5°C. Although, the surface of the open ocean is subject to seasonal changes a marked uniformity of temperature was recorded in the surface waters in many stations. In fact the variation was not more than 0.2°-0.3°C in data already available (Austin, 1988). In the present observation the sampling was always in the photic zone and the variation recorded was 2° to 3°C. Oxygen was in the range 1.4 to 3.8 ml/l. Kriss(1959,1976) and his colleagues in their extensive study of the heterotrophic bacteria in the world oceans reported that marine hetrotrophic bacteria will reflect hydrological structure of the oceans. The high counts obtained in the present study reflected the fertility and hydrological structure of the area.

The different genera of bacteria formed were *Alcaligenes* (42.3%), *Vibrio* (34.6%), *Pseudomonas* (20%) and *Flavobacterium* (3.8%). *Alcaligenes* occurred in large numbers in 50 m depth compared to other genera in this region of the Arabian Sea although *Pseudomonas* was the predominant genus occurring in marine environment (Zo Bell, 1946). Simidu *et al.* (1982) reported the predominance of Vibrionaceae among the heterotrophic bacteria in seawater and on the plankton from the terrigenous influenced coastal areas of Japan and in East China Sea as well as in stations remote from the land. In the present study *Alcaligenes*, *Vibrio* and green fluorescent *Pseudomonas* were found predominant in open sea surface waters apparently playing an important role in the biodegradation process of organic matter.

In the present study, the number of sampling layers was only two (0 and 50 m) to draw a conclusion on the detailed hydrological structure of the water column although irregularity in the vertical distribution of the bacterial number was clear. Quantitatively, the counts ranged from 0.8×10^8 /ml to 2.66×10^8/ml in surface waters (Table 1) and 0.9×10^8 to 2.20×10^8/ml in 50 m depth. Night samples harboured less counts when compared to daytime samples. In surface waters counts were more but size of the colony was punctiform even at higher dilutions whereas in 50 m samples size of the colony was bigger but number of colony was found less.

Comparison of bacterial population among the total stations (26) indicated that station 5 recorded highest count of 1220×10^8 /ml in surface water. The high counts at station 5 may be attributed to larger quantities of organic matter from the remains of dead organisms or to upwelling which brings nutrient-rich water to the surface (Gundersen,1976). The 50 m depth layer always recorded lo counts as compared to surface water (Table 1). The counts were comparatively low in stations 1, 2, 6, 8, 12, 16,19,20, 21 in surface waters. The various bacterial intensity indicated the existence

Table 1 - Microbiological and chemical parameters

St. no.	Temp (°C)	$D.O_2$ (ml/l)	Bacteria (x 10^8/ml)
		Surface seawater	
1	29.00	3.30	1.28
2	27.90	2.30	1.96
3	28.50	3.30	18.20
4	26.70	3.00	60.00
5	28.60	3.40	1220.00
6	28.70	3.40	2.09
7	28.90	3.50	336.00
8	28.80	3.40	0.94
9	28.70	3.60	7.90
10	28.50	3.50	14.00
11	27.40	2.50	80.00
12	28.50	3.60	1.06
13	18.50	3.60	20.90
14	28.90	3.60	2.09
15	27.00	2.20	2.30
16	28.00	3.60	0.90
17	27.20	3.40	2.14
18	27.20	3.40	2.14
19	29.00	3.60	1.13
20	25.40	3.30	0.98
21	26.80	1.40	0.01
22	27.00	3.30	16.00
23	27.80	3.60	62.00
24	27.90	3.70	114.00
25	27.00	3.00	106.00
26	25.50	3.00	186.00
		50 m depth	
1	28.50	3.60	196.00
2	28.40	3.20	2.09
3	28.20	3.20	2.09

(Contd ....)

Table 1 — *Contd.....*

St. no.	Temp (°C)	$D.O_2$ (ml/l)	Bacteria (x 10^8/ml)
4	28.00	3.30	302.00
5	29.00	3.40	1060.00
6	27.50	3.60	92.00
7	29.20	3.50	115.00
8	29.00	3.40	0.28
9	29.00	3.50	1.48
10	29.00	3.60	2.42
11	29.50	3.70	104.00
12	29.00	3.50	9.80
13	29.00	2.70	108.00
14	29.40	3.60	2.18
15	29.50	2.20	106.00
16	28.50	3.60	232.00
17	29.00	3.70	3.00
18	29.50	3.60	306.00
19	29.50	3.60	2.06
20	28.20	3.50	290.00
21	29.80	3.40	182.00
22	29.00	3.70	2.50
23	28.50	3.70	102.00
24	28.00	3.60	1.28
25	29.00	3.80	238.00
26	29.00	3.70	90.00

of bacteria in localised pockets of life commensurate with available sources of nutrient (Zo Bell, 1946).

The data obtained on bacterial count and environmental parameters at 0 and 50 m in the 26 stations were treated statistically, and observed that there was no significant relation between the bacterial count and other environmental parameters.

One of the critical factors in the study of bacterial flora from the natural environment is the composition of the media used (Buck,1974). The present study was carried out on Zo Bell's 2216 and glucose asparagine agar. Simidu *et al.*(1982) reported that in PPES-II medium gave more viable counts and colony forming units than Zo Bell

2216 medium. Both the media gave maximum viable counts and with these media the number of pigmented bacteria are especially underestimated. But in the present study it was observed that green fluorescent pigmented bacteria were prodominant in many surface water samples collected during daytime. If these results are also valid for open seawater bacteria the study should be evaluated as a survey of only fast growing organisms. All these zymogenous bacterial flora play a crucial role in the circulation of carbon in the sea quickly degrading various organic compound produced in the marine environment. For more comprehensive understanding of the bacterial processes in the open sea ecosystem, extensive analysis of bacteria is necessary including oligotrophic bacterial flora in the water columns.

ACKNOWLEDGEMENT

The author gratefully acknowledges the assistance of Chief Scientist, Captain and crew of cruise No.82 of the *FORV Sagar Sampada.*

REFERENCES

Austin, B. 1988. *Marine microbiology*, (Cambridge University Press, New York) pp. 222.

Buck, J.D. 1974. Effects of medium composition on the recovery of bacteria from sea water, *J. Exp. Mar. Biol.Ecol.* 15:25-34.

Buchanan, R.E. & Gibbons, N.E. (eds.). 1974. *Bergy's manual of determinative bacteriology* (The Williams and Wilkins Co., Baltimore) pp. 1246.

Chandramohan, D & Ramaiah, N. 1987. Heterotrophic activity and bacterial biomass in coral atolls of Lakshadweep archipelago. In: *Contribution in marine science* , edited by T.S.S. Rao *et al.* (Dr. S.Z. Qasim, Sastyabtapurti Felicitation Committee, NIO, Goa) pp. 117-130.

Gundersen, K. 1976. Cultivation of microorganisms, In: *Marine ecology: A comprehensive integrated treatise on Life in oceans and coastal waters*, Vol. III, Part 1, edited by O. Kinne, (John Wiley, London).

Kriss, A.E. 1959. *Marine microbiology*, (USSR Academy Sciences, Moscow) pp. 455 (in Russian).

Kriss, A.E. 1976. *Microbiological oceanography*, (Nauka, Moscow) pp. 269 (in Russian).

Loka Bharathi, P.A. & Chandramohan, D. 1990. Sulfate reducing bacteria from the Arabian Sea—their distribution in relation to thiosulfate—oxidising and heterotrophic bacteria, *Bull. Mar. Sci.* 47: 622-630.

Moriarty, D.J.W. 1979. Biomass of suspended bacteria over coral rocks. *Mar. Biol.* 53:193-200.

Moriarty, D.J.W, Pollard, P.C. & Hont, W.G. 1985. Temporal and spatial variation in bacterial production in the water column over a coral reef, *Mar. Biol.* 85: 285-292.

Nair, S. 1979. Microbial characteristics of the Laccadive sea (Lakshadweep), *Indian J. Mar. Sci.* 8: 227-231.

Simidu, U. & Aiso, K. 1962. Occurrence and distribution of heterotrophic bacteria in sea water from the Kamogawa Bay, *Bull. Jap. Soc. Sci. Fish.* 28: 1133-1141.

Simidu, U., Kurniko, T. & Yoshiharu, A. 1982. Heterotrophic bacterial population in South China Sea, *Bull. Japan Soc. Sci. Fish.* 48: 425-431.

Zo Bell, C.E. 1946, *Marine microbiology*, (Chronica Botanica, Waltham Mass, USA) pp. 240.

* * *