International Research Journal of Natural and Applied Sciences
Volume 3, Issue 12, December 2016 Impact Factor 5.46
ISSN: (2349-4077)

Website- www.aarf.asia, Email : editoraarf@gmail.com

ROLE OF NUTRIENTS IN PRIMARY AND SECONDARY PRODUCTION OF THE SHELF WATERS OFF KARNATAKA COAST, INDIA

Rajendra V. Salunkhe
Associate Professor, Department of Zoology, Arts, Science and Commerce College, Indapur, District Pune, Maharashtra state, India

ABSTRACT:

Results of a comprehensive suspended load, primary production and secondary production sampling programme of the shelf waters off Karnataka coast was conducted on the research vessel GaveshaniCruise No. 208. Eight transects across the shelf, covering 25 stations were studied. Depth of stations varied from 17 to 1650 m. Findings of study described the phosphate, nitrate, nitrite, suspended load, primary production and secondary production of surface and bottom waters.

Results presented were on the basis of a sampling programme conducted during the end of post-monsoon period, thus providing information on thespatial pattern of various parameters. Information on temporal (seasonal) variation is essentialin order to define the hydrographic dynamics of shelf waters of the region over the temporal sequence.

Key words:suspended, load, primary, secondary and production.

INTRODUCTION :

Research vessel Gaveshani Cruise No.208 was carried to investigate the hydrography of the shelf waters off Karanataka coast. With the existence of six major estuarine systems namely, Kali at northmost, Gangavali, Aghanashini, Sharavati, Bhatkal, Koondapur and at southern Netravati (Fig. 1). The present work is an effort to fillthe lacuna besides to obtain abaseline data exclusively for the shelf and deep waters of Karnataka coast (from Netravati to Karwar. Since the coastal waters of NorthKanara support an important fishery for the Indian mackerel. Earlier investigation at Karwar [1][2][3] and Mangalore [9] have contributed to our knowledge of the hydrological conditions of Karnataka coast. According to Shenoi *et al.*[8]the surface hydrography during March–April was dominated by the intrusion of low-salinity waters from the south; during May–June, the low-salinity waters were beginning to be replaced by the high salinity waters from the north.

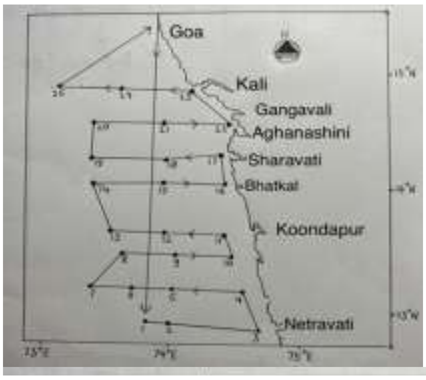

Fig. 1: Cruise track of research vessel Gaveshani Cruise No.208

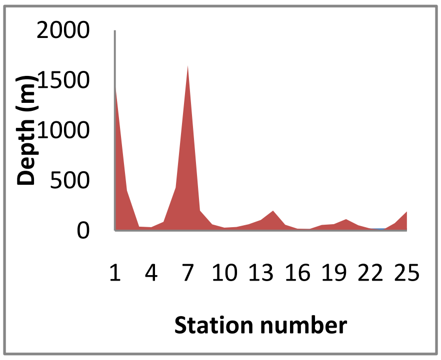

Fig. 2: Depthdistribution amongst the study stations

MATERIAL AND METHODS:

The work was carried out to investigate the hydro-biological features of the continental shelf area of Karnataka coast, on board the Research Vessel Gaveshani, the Cruise No. being 208.The Cruise was undertaken from shelf waters off Mangalore to Goa. The details of locations are given in cruise track. The sampling was done in eight transect across the shelf comprising of twenty five stations of which twenty three were in shelf waters and two in deeper waters off Mangalore. In these four were anchoring stations.The depths of stations varied from 17 to 1650 m. 23rd station was having maximum depth of 1650 m.and 7th station was relatively shallow with a depth of 17 m. Deep water samples were taken from 5 - 10 m above the bottom (Fig.2).

Water samples were collected from two different depths and were utilised for the estimation of nutrients such as phosphate, nitrite, nitrate, suspended load, primary and secondary production, part of analysis was carried out on board the vessel. Surface water was collected by casella bottle. Bottom water collected by Niskin bottle.

RESULTS:

The different hydro-biological parameters studied are nutrients such as phosphate, nitrate and nitrite along with suspended load, primary and secondary production.

Phosphate: Phosphate value of surface water ranged from 0.261 µg/L to 0.044 µg/L and of bottom water it varied from 0.667 µg/L to 0.11 µg/L, at an average of 0.119 µg/L and 0.140 µg/L respectively. Phosphate values varied to a lesser extent at both, surface and bottom waters (Fig.3).

Nitrate: Nitrate values of surface water was ranging from 0.040 µg/L to 5.050 µg/L and of bottom water, it was ranging from 0.042 µg/L to 10.846 µg/L, at an average of 0.842 µg/L and 0.770 µg/L respectively. Variation in nitrate values was drastic at surface as well as bottom waters (Fig.3).

Nitrite: Nitrite values of surface water varied between 0.071 µg/L and 1.600 µg/L and of deep water, it varied between 0.061 µg/L and 3.815 µg/L, at an average of 0.336 µg/L and 0.604 µg/L respectively (Fig.3).

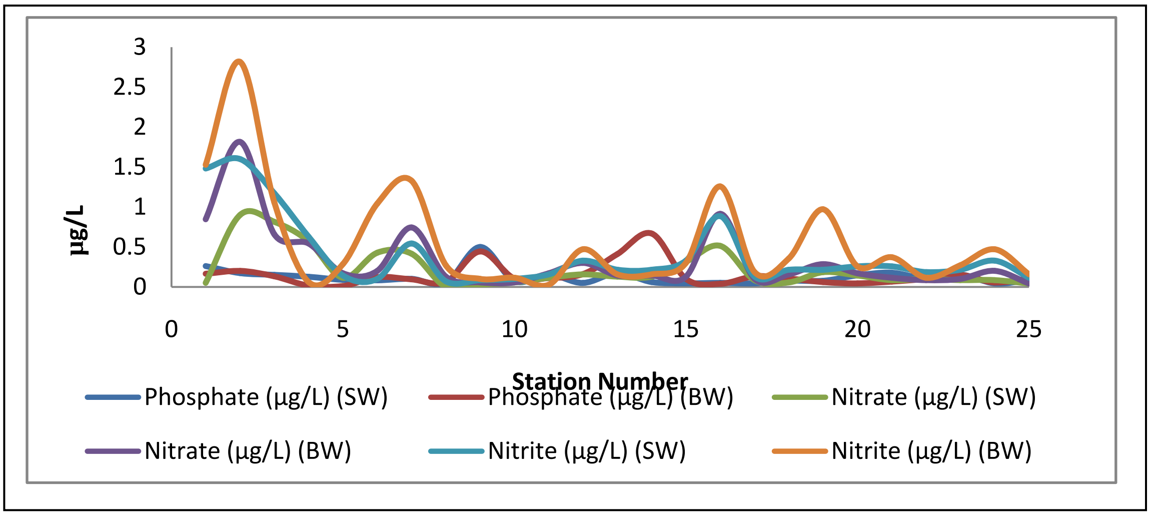

Fig.3: Phosphate, nitrate and nitrite of the study stations

Suspended load: It varied between 12.6 and 30.0 mg/L, at an average of 20.3 mg/L. It varied to a large extent. Suspended load concentration was increasing towards the shelf-edge. At inshore stations it was relatively low (19.00 mg/L), at mid-shelf it was 20.25mg/L and at shelf-edge it was fairly high (21.38 mg/L). A clear increasing pattern was observed from inshore to shelf-edge stations.

Planktonic primary production: It ranged between 0.15 and 0.60 mg/m^{3}at an average of 0.36 mg/m^3.Planktonic primary production at inshore station was fairly high (Mean value is 0.40 chlorophyll mg/m^3). At mid-shelf 3 arca, it lowered (0.30 chlorophyll mg/m^2), at shelf-edge stations, again it increased (0.36 chlorophyll mg/m^3).

Planktonic secondary production: It varied between 99.04 and 2166 mg/100 m^{3}dry wt. at an average of 644.82 mg/100 m^3 dry wt.At inshore stations, the planktonic secondary productivity es relatively less (415.61 mg/100 m^3 dry wt.), than aid-shelf station (881.53 mg/100m^3 dry wt.) or shelf-edge 3 station (670.06 mg/100 m^3 dry wt.).

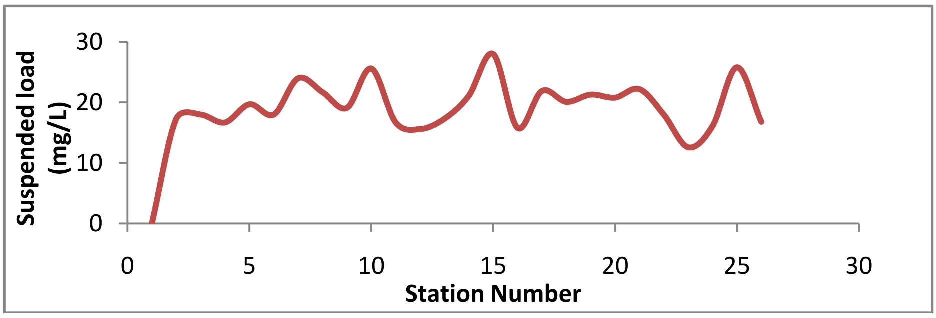

Fig.4: Suspended load of the study stations

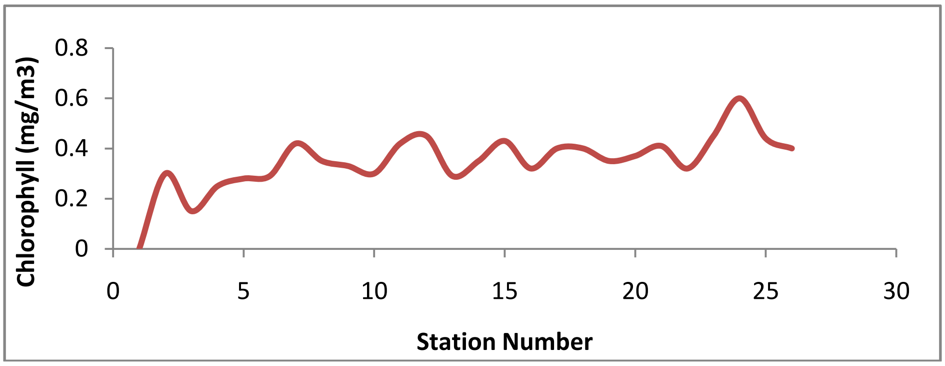

Fig.5: Planktonic primary production of the study stations

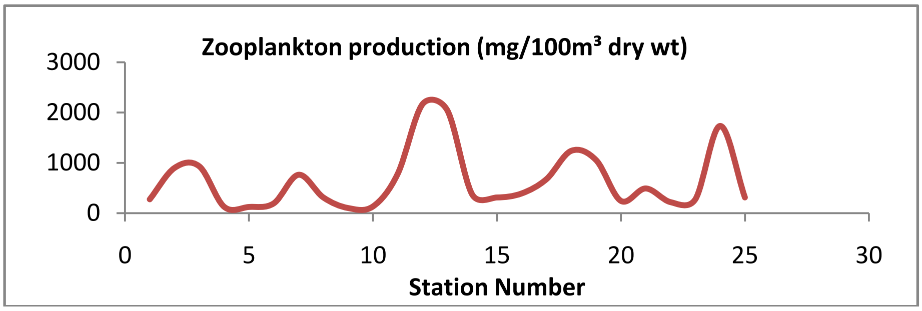

Fig.6: Planktonic secondary production of the study stations

DISCUSSION:

Variation of the nutreints such as phosphate, nitrate, nitrite as well as suspended load, planktonic primary and planktonic secondary production have been descibed.The nutrient concentrations of the bottom waters at the inshore stations were lower when compare with the deeper stations. Phosphate values gradually increased towards the mid-shelf and shelf-edge stations. The surface phosphate content was relatively less at the inshore stations (Mean phosphate concentration is 0.107 µg at/L) than the mid-shelf (0.144 µg at/L) or shelf-edge (0.118 µg at/L) stations. Bottom water phosphate content at inshore stations were low (0.098 µg at/L) than the mid-shelf (0.155 µg at/L) and shelf-edge (0.201 µg at/L) stations. Distribution of phosphate suggests that the availability of this nutrient is adequate to meet the required demand of primary producers. During the high biological active movement period lower values of phosphorus were observed by Kesava Rao [4]. Physical chemical processes are more important than the biological processes in determining the phosphate distribution in the estuary during monsoon.

The surface nitrate was relatively less at the mid-shelf stations (Mean nitrate concentration is 0.217 µg at/L) than the inshore (Mean nitrate content 0.322 µg at/L) or shelf-edge (0.761 µg at/L) stations. However, the bottom water was showing a increasing trend towards the shelf-edge (1.562 µg at/L) was fairly high than inshore (0.361 µg at/L) and mid-shelf (0.367 µg at/L) stations. While studying on the hydrochemical characteristics off the central west coast of India, Sen Gupta *et al.*[7] observed that about 34% of the available nitrate-nitrogen is depleted by denitrification. He found high values of nitrate at all stations during April/May could be attributed to oxidation of ammonical form of nitrogen to nitrite and subsequently to nitrate. Krishnan *et al.*[5] working out off Goa the ammonification, nitrification and denitrification appear to operate in more temporal and spatial proximity than hitherto appreciated in these systems and this gives additional cues on the absence of measurable nitrate at surface waters, which was earlier attributed only to efficient algal uptake. Hence we hypothesize that the alarming nitrous oxide input into the atmosphere could be due to high productivity driven tighter nitrification-denitrification coupling, rather than denitrification driven by extraneous nitrate.

At surface water, nitrite content was decreasing towards shelf-edge, the surface nitrite concentration was fairly high at the inshore stations (0,464 µg at/L) and decreasing towards the mid-shelf (0.410 µg at/L) and shelf-edge (0.210 µg at/L) stations. The bottom water showed a slight inverse relation for the distribution pattern. At inshore station the content was more (0.436 µg at/L), at mid-shelf stations suddenly the concentration was enhanced (0.771 µg at/L) and at shelf-edge stations, again it decreased (0.471 µg at/L). Increase in nitrite concentration in the off-shore station may be due to oxidation of ammonia to more stable forms of nitrogen. Increase in the concentration of nitrite in the offshore regions may be attributedto the bacterial de composition of planktonic detritus. The differences in seasonal variation may be attributed by the variation in phytoplankton excretion, oxidation of ammonia and reduction of nitrate due to nitrifying bacteria.While studying on distribution of nutrients in the 111 coastal and estuarine waters of Goa. Verlencar [11] observed that the nitrite at reference station varied from 0.02 - 1.18 µg at/L during post and premonsoon periods. Nitrite concentration of the offshore water column remained high during October-December. The nitrite concentrations at the estuary varied between 0.00- 1.71 µg at/L.

At inshore station suspended load varied between 12.6 - 30.0 mg/L at station 22 and 4 respectively. At mid-shelf station, suspended load at station 15 and 24 ranged from 15.8 - 25.8 mg/L respectively. At shelf-adge stations, suspended load was low (16.8 mg/L) at station 25 and rich (28.0 mg/L) at station 14 respectively.Investigations on distribution of suspended matter in waters of north-western shelf of India by Rao [6]showed that the suspended matter in surface water varied from 0.3 to 4.6 mg/L while at the bottom, it varied from 0.5 to 13.6 mg/L. High concentration of suspended matter in its coastal water and in the vicinity of river mouth was due to inert material. In regions away from the coast higher concentrations of suspended matter were presumably due to a greater plankton production.The low standing crops in the nutrient-rich patches with active phytoplankton population may be due to the high grazing pressure exhibited by the pelagic animal populations. The observations on the dissolved organic nutrients and phytoplankton production in Mandovi estuary Goa by Verlencar [10]showed zooplankton biomasn varied from 0.3 - 20.7 gm dry wt. 1000/m^3. At the estuarine regions, the peaks of zooplankton bioms as almost coincided with the packs in chlorophylla and primary productivity especially in June and October.

CONCLUSION:

Physico-chemical processes are more important than the biological process in determining the phosphate distribution in the estuary during monsoon.Chlorophyll and phosphate are among the more important factor deciding the primary productivity level in the sea. The effluent discharge point shows increased plankton production. Phytoplankton abundance was found to be largely dependent on nutrient level. Population density of phytoplankton exhibited conspicuous diurnal variations and seems to largely dependent on tidal fluctuations.There is no clear-cut relationship discernibler between primary productivity and secondary productivity. This may be due to the changing food habits of plankton at inshore stations, the planktonic secondary productivity was relatively less.

REFERENCES:

[1] Annigeri, G. G., 1968Hydrology of inshore water a of Karwar bay during 1964-1966. Indian J. Fish. 15 (1 and 2): 155-165.

[2] Annigeri, G. G., 1972. Hydrological conditions in the inshore region of Karwar during 1965-1967. Indian J. Fish. 29: 157-162.

[3] Annigeri, G. G., 1979 Observations on the hydrographical features of the coastal waters ofNorth Kannara during 1965-66. . J. mar. biol. Ass. India, 21 (162): 128-132.

[4] Kesava Rao, C. H. and Indusekar, U. K., 1989Seasonal variation in chemical constituents of certain brown seaweeds and sea water from Saurashtra coast: Carbon, Nitrogen and Phosphorus. Maha sagar Bull. Natn. Inst. Oceanogr., 22 (2): 163–72.

[5] K. P. Krishnan, Sheryl O. Fernandes, P. A. Loka Bharathi, L. Krishna Kumari, Shanta Nair, Anil K. Pratihary, B. Ramalingeswara Rao, 2008.Anoxia over the western continental shelf of India: Bacterial indications of intrinsic nitrification feeding denitrification,Mar. Environ. Res.,65(5):445-55.

[6] Rao, D.P., Sarma, R.V.N., Sastry, J.S. and Premchand, K.. 1976. " On the lowering of the surface temperatures in the Arabian sea with the advance of the south-west monsoon season". Reprinted from the proceedings of the II TM Symposium on" Tropical Monsoons" held at Pune,India:8-10.

[7] Sen Gupta, R., Analia Braganca *et al*, 1980Chemical oceanography of the Arabian Seat Part-V-Hydrochemical characteristics off the Central West-Coast of India. I.J.M.S.,9:240-245.

[8] S.S.C. Shenoi, D. Shankar, G.S.Michael, J. Kurian, K. K. Varma, M. R. Ramesh Kumar, A. M. Almeida, A. S. Unnikrishnan, W. Fernandes, N. Barreto, C. Gnanaseelan, R. Mathew, K. V. Praju and V. Mahale 2005 Hydrography and water masses in the southeastern Arabian sea during March-June 2003.Jour. of Earth Syst.Sci. 114:475–491.

[9] Venkataswamy Reddy,H. R., and Hariharan, V., 1986Distribution of total nitrogen, total phosphorus and organic carbon in the sediments off Mangalore. Mahasagar-Bull. Natn. Inst. Oceanogr., 19(2): 119-122.

[10]Verlencar, X.N., 1984. "Dissolved organic nutrients and phytoplankton production in the Mandovi estuary and coastal waters of Goa". Mahasagar-Bull.Natn.Inst.Oceanogr., 17(3): 141:149.

[11] Verlencar, X.N., 1987. Distribution of nutrients in the coastal and estuarine waters of Goa. Mahasagar Bull. Natn. Inst. Oceanogr.,20(4): 205-215.