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Seasonal Abundance of Penaeid Prawn Larvae & Postlarvae in the Coastal Waters of Goa up to 50 m Depth Zone

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Seasonal distribution of larvae and postlarvae of commercially important penaeid prawns was studied from Goa waters during 1976-77. Developmental stages of 6 species, viz. *Metapenaeus dobsoni* (Miers), *M. monoceros* (Fabricius), *Penaeus merguensis* de Man, *P. indicus* Milne Edws, *Parapenaeopsis stylifera* (Milne Edws) and *Metapenaeus* sp., were present in the plankton samples collected from 5 to 50 m depth zones. The larvae of *M. dobsoni* were most dominant followed by *P. merguensis*. The larvae were more abundant in the horizontal samples (68.14%) than in vertical samples (31.86%). Maximum and minimum number of the developmental stages of these species were obtained from 10 and 50 m areas respectively. Maximum abundance was noticed during premonsoon and minimum during the monsoon.

PRAWNS are being increasingly exploited from nearshore areas of Goa. Information on the seasonal occurrence of their larvae from this region is essential for locating possible breeding grounds and for proper management of the fishery. Considerable work on these aspects has been done along the south-west coast of India¹⁻⁵. Some investigations have been carried out on the recruitment of penaeid larvae into the estuarine system of Goa⁶⁻⁸. Occurrence of penaeid prawn larvae in the coastal waters of Goa during postmonsoon and premonsoon seasons of 1974-76 has been studied⁹. The present paper deals with the seasonal and spatial variations in the abundance of penaeid larvae and postlarvae in the horizontal and vertical samples collected from different depths up to 50 m.

Materials and Methods

Surface and vertical zooplankton samples were collected for 1 yr (Sept. 1976-Aug. 1977) from stations fixed at 5, 10, 25 and 50 m depth zones in a transect off Cabo Raj Niwas (Fig. 1). Samples were collected between 06.00 and 12.00 hrs once in a month at each depth and 96 samples were studied during the present investigation. The collections were made with modified version of HT net¹⁰. For surface samples, the net was towed for 5 min. Vertical sampling was done by lowering the net close to the bottom and hauling it up. Samples were preserved in 5% buffered formaldehyde and analysed for penaeid larvae which were sorted out from 20 to 100% of the sample depending on their abundance and their number raised to the total. Protozoa and mysis stages have all been grouped together as larvae. Developmental stages of penaeid prawns were identified using the larval characters

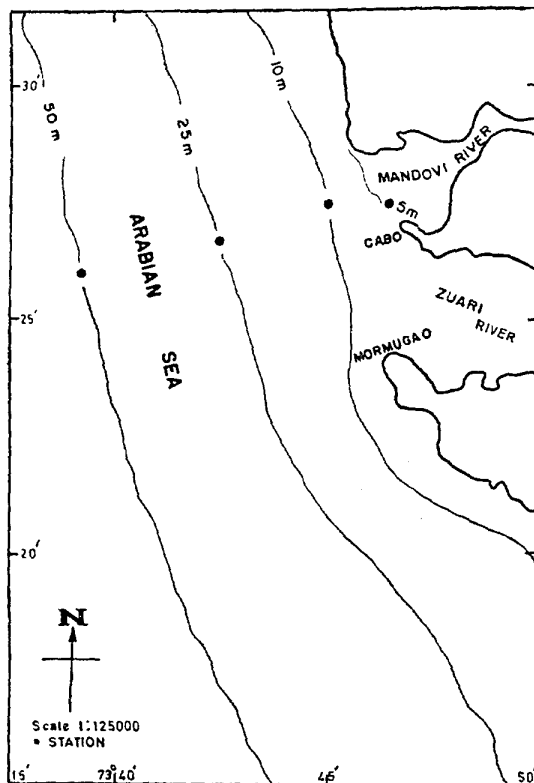


Fig. 1 — Position of sampling stations

described^{4,11-18}. Surface salinity samples were analysed by the standard method¹⁷. Temperature was recorded instantaneously.

Results

Species composition and abundance — Larvae and postlarvae of 6 species of penaeid prawns were recorded and identified from plankton samples. Their order of dominance (%) was *Metapenaeus dobsoni*, 65.5; *Penaeus merguensis*, 18.98; *Metapenaeus monoceros*, 9.2; *Metapenaeus* sp., 4.46; *Parapenaeopsis stylifera*, 1.55; and *Penaeus indicus*, 0.28. Out of 1412 developmental stages of all species combined, 1039 (73.58%) were larvae and 373 (26.41%) postlarvae. As no data on species wise catches of prawns during the particular period are available from these waters, larval occurrence could not be correlated with commercial catches.

Seasonal occurrence of developmental stages — Maximum and minimum percentages of developmental stages were noticed during the premonsoon and monsoon seasons respectively (Table 1). More larvae were obtained during postmonsoon and premonsoon whereas postlarvae outnumbered them during monsoon months. During the present investigations values of average seasonal temperature varied from 27.5° to 30°C and average seasonal salinity from 25.93 to 35.41‰ with lowest and highest values during monsoon and premonsoon seasons respectively (Table 2). Distribution of developmental stages seems to be influenced by prevailing hydrographical conditions. The larvae were recorded more during the period of higher temperature and salinity.

The number of larvae and postlarvae showed an increase from September with a peak in February,

followed by a gradual decrease till August (Fig. 2). Samples taken during November, March, July and August contained more postlarvae than in other months when larvae were abundant. Protozoa stages were dominant during September, February and May while late mysis stages were collected during December, January, April and June.

Distribution of larval stages in different depth zones — Maximum and minimum number of larvae and postlarvae in both horizontal and vertical hauls were noticed at 10 and 50 m depth zones respectively (Table 3).

Peak abundance of larvae at all depths was noticed during February (Fig. 3) while the postlarvae were maximum at 5 m during July and at 10 and 25 m depths during March. At 50 m, the postlarvae were rare.

Larvae and postlarvae of all species were more in the horizontal samples than in the vertical samples except those taken during postmonsoon season in which vertical samples contained slightly more postlarvae (Table 1).

Species distribution and breeding seasons: Metapenaeus dobsoni — Out of 925 specimens obtained during the present study, 638 (68.97%) were larvae and 287 (31.21%) postlarvae, of which 619 occurred in horizontal hauls and 306 in vertical hauls. Postlarvae were more in samples collected during November, March and July than in the remaining months when the larvae outnumbered them (Fig. 4). Maximum (313) and minimum (15) numbers of larvae were obtained during February and August respectively. Depthwise distribution of the larval stages shows their maximum and minimum numbers obtained at 10 and 50 m depths respectively. The peak abundance of the larvae at all depths was observed during February when the average salinity value was quite high (35.17‰); on the contrary, the postlarvae were obtained in large numbers at 5 m zone during the low salinity in the month of July and high salinity in the month of November and at all other depths during March when the salinity was 34.97‰. On the basis of the presence of larval stages in the samples, almost in all the months, it appears that this species breeds throughout the year in the nearshore areas of Goa. Samples collected from 10 and 25 m during September contained numerous protozoae. During November-December, late mysis and early postlarvae were recorded from 5 m depth. The peak breeding activity was observed during premonsoon

TABLE 1 — DISTRIBUTION OF PENAeid LARVAE AND POSTLARVAE DURING DIFFERENT SEASONS

Seasons	Larvae		Postlarvae		Total Percentage	
	H	V	H	V		
Monsoon	67	21	69	29	186	13.17
Postmonsoon	187	75	28	33	323	22.84
Premonsoon	453	236	119	95	903	63.98
Total	707	332	216	157	1412	—

H = horizontal haul; V = vertical haul.

TABLE 2 — AVERAGE TEMPERATURE (°C) AND SALINITY (‰) VALUES AT DIFFERENT DEPTHS AND SEASONS

Seasons	Temperature, °C					Salinity, ‰				
	Depth (m)					Depth (m)				
	5	10	25	50	Mean	5	10	25	50	Mean
Monsoon	29	28.9	28.2	27.9	28.5	25.93	31.36	34.35	34.52	31.54
Postmonsoon	28	27.9	27.8	27.5	27.8	34.47	35.36	35.33	35.25	35.1
Premonsoon	29	28.9	29.4	30	29.3	35.03	35.01	35.18	35.41	35.16
Mean	28.7	28.5	28.4	28.8	—	31.81	33.91	34.95	35.06	—

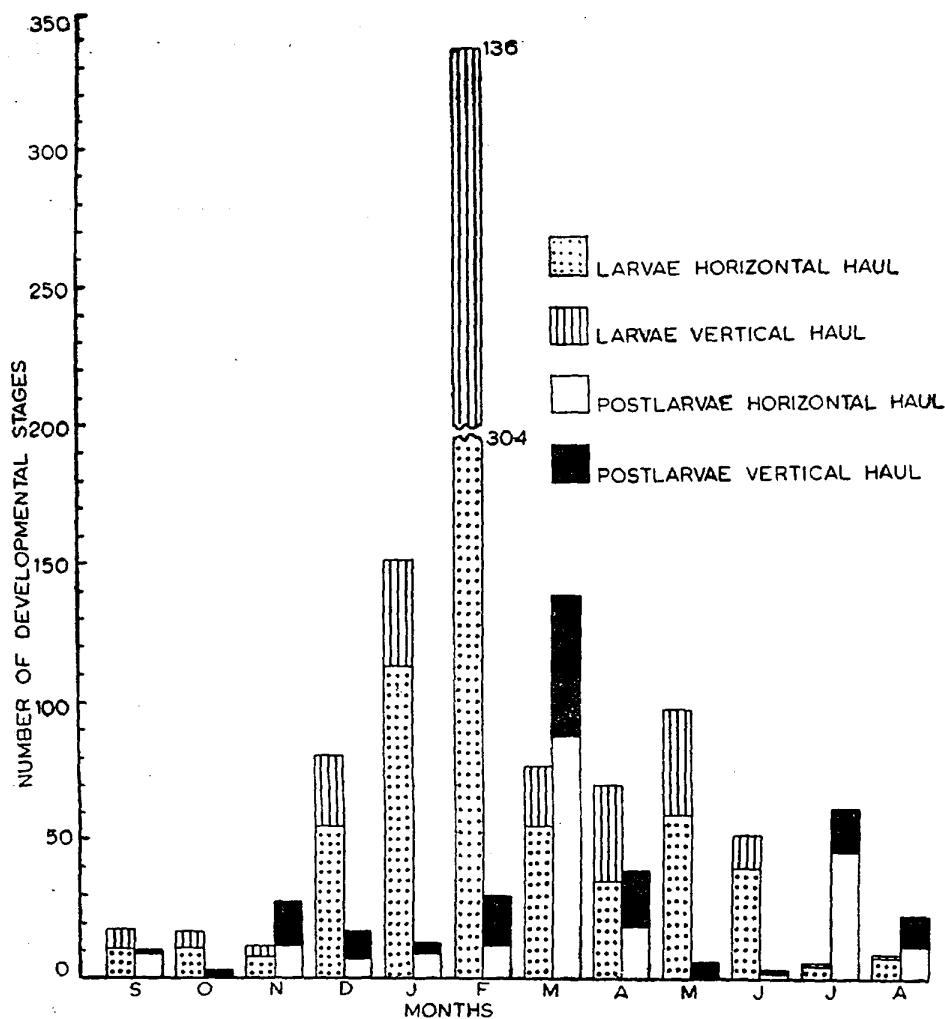


Fig. 2 — Seasonal distribution of larvae and postlarvae of penaeid prawns in the horizontal and vertical hauls

TABLE 3 — DISTRIBUTION OF LARVAE AND POSTLARVAE AT DIFFERENT DEPTHS

	Depths (m)			
	5	10	25	50
LARVAE				
H	194	274	151	89
V	76	152	56	47
Total	270	426	207	136
POSTLARVAE				
H	52	119	26	19
V	42	66	24	25
Total	94	185	50	44
Grand total	364	611	257	180

months especially during February when samples taken from various depths contained mostly protozoae and early mysis stages.

Penaeus merguensis — Total number of developmental stages recorded was 268, of which 187 (69.77%) were larvae and only 81 (30.22%) postlarvae. Maximum and minimum number of larval stages were obtained during premonsoon and monsoon season respectively. The highest number of larval stages was obtained at 10 m. Samples collected from 25 and 50 m depth zone contained mostly protozoae stages during February giving an indirect evidence that this species may be breeding in these depth regions. No postlarvae were observed in the samples from 25 and 50 m depths during June to August but they were comparatively abundant during the corresponding period at 5 and 10 m depths (Fig. 4).

Metapenaeus monoceros — No postlarvae were noticed during the present study; out of the total of 130 larvae recorded, 98 were from 10 m.

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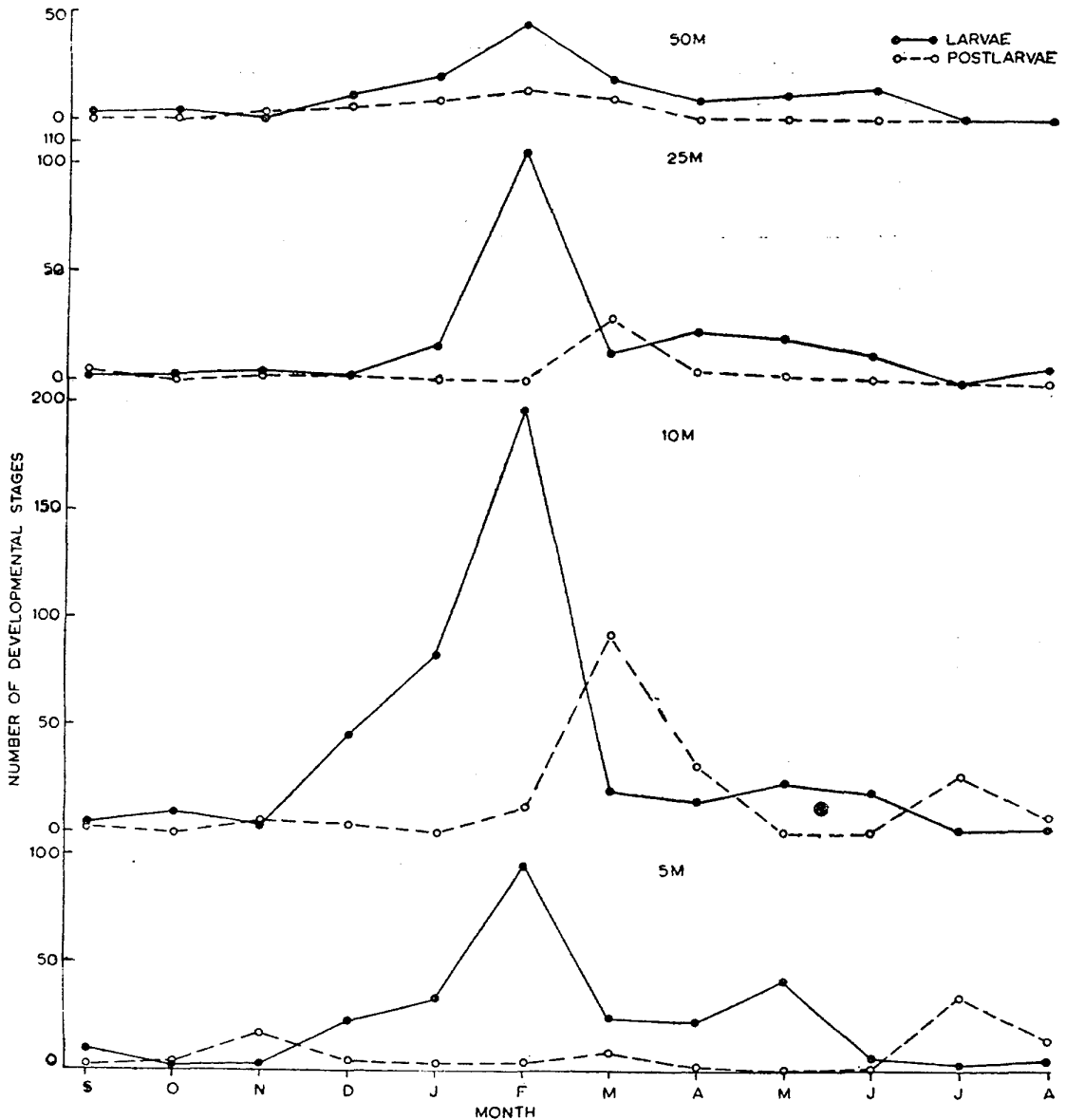


Fig. 3 — Seasonal distribution of larvae and postlarvae of penaeid prawns at different depths

Parapenaeopsis stylifera — Maximum number of larvae were obtained from 50 m and were not observed in the samples collected from 5 m. No postlarvae were recorded from any depth.

Penaeus indicus — Developmental stages of this species were very poorly represented in plankton samples. Out of only 4 specimens obtained, 3 were larvae (mysis stages) and 1 early postlarva.

Metapenaeus sp. — No developmental stage of this species was observed in the plankton samples collected during August-December. Their maximum abundance was noticed during January-February especially during the latter month. Few (8 Nos)

postlarvae were obtained only during February. This species was mostly represented in mysis stage and their maximum number was obtained from 10 m.

Discussion

It is a well known fact that the penaeid prawns breed in the sea and their planktonic larvae and early postlarvae are brought by tides and currents to the inshore and estuarine waters for further development. The presence of developmental stages in the plankton samples would give an indirect evidence of distribution and spawning of penaeids

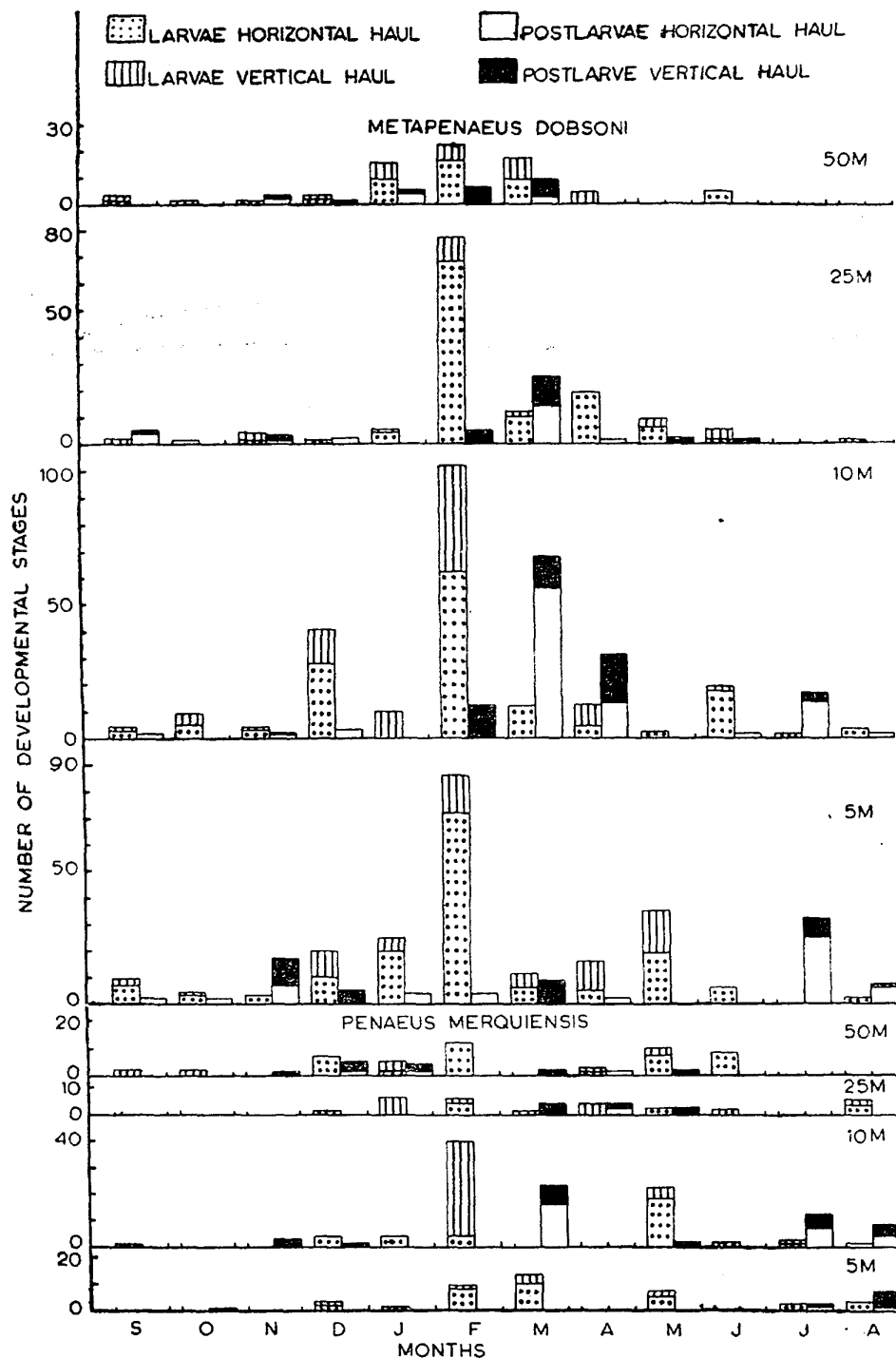


Fig. 4 — Seasonal distribution of larvae and postlarvae of *Metapenaeus dobsoni* and *Penaeus merguensis* in the horizontal and vertical hauls at different depths

in a particular area. As indicated by the occurrence of larvae and postlarvae of *M. dobsoni* and *P. merguensis* in smaller or larger numbers from different depth zones, it would appear that these species are permanent inhabitants of Goa waters with peak breeding activity in February. The year round distribution of *M. dobsoni* has also been reported from the nearshore areas of south-west coast of India^{12,18-20}. The distribution of developmental stages of other four species is discontinuous. Panikkar and Menon²¹ and George and George²² have reported that *P. indicus* and *M. monoceros* are distributed more in offshore areas, but Rao²³ and Shaikmahmud and Tembe²⁴ recorded large number of larvae and adults of these species from nearshore areas of Cochin and Bombay respectively.

During the present investigations, maximum abundance of larvae was noticed during postmonsoon and premonsoon seasons especially during premonsoon when the temperature and salinity values were quite high. The higher abundance of penaeid larvae from other areas has also been reported²⁵⁻²⁸ during periods of higher water temperatures. It is interesting to note the difference in the number of larvae in the horizontal and vertical samples, their maximum number in the former type of haul being invariably higher than that of the latter in all the depth zones studied. This would indicate that once the demersal eggs¹² hatch out and the early larval stages reach the surface layers, while they are being passively transported towards the inland waters by wave and currents, there is very little vertical migratory movement of these larvae.

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References

1. GEORGE, M. J., *Indian J. Fish.*, **9** (1962), 110.
2. GEORGE, M. J., *Indian J. Fish.*, **10** (1968), 135.
3. GEORGE, M. J., *Mahasagar, Bull. natn. Inst. Oceanogr.*, **6** (1973), 133.
4. MOHAMED, K. H., RAO, P. V. & GEORGE, M. J., *FAO fish. Rep.* **57**, **2** (1968), 487.
5. RAO, P. V., *Indian J. Fish.*, **20** (1973a), 308.
6. ACHUTHANKUTTY, C. T., GEORGE, M. J. & GOSWAMI, S. C., *Proc. Symp. Warm Water Zoopl. Spl. Publ. Unesco/NIO*, 1977, 412.
7. SELVAKUMAR, R. A., GEORGE, M. J., ACHUTHANKUTTY, C. T. & GOSWAMI, S. C., *Indian J. mar. Sci.*, **6** (1977), 160.
8. GOSWAMI, S. C. & GEORGE, M. J., *Indian J. mar. Sci.*, (in press).
9. GEORGE, M. J. & GOSWAMI, S. C., *Proc. Symp. Warm Water Zoopl. Spl. Publ. Unesco/NIO*, 1977, 146.
10. TRANTER, D. J., DEVI, C. B. L. & BALAKRISHNAN, K. P., in *IOBC Handbook*, **3** (1972), 6.
11. RAO, P. V., *J. mar. biol. Ass. India*, **15** (1973b), 95.
12. MENON, M. K., *Proc. Indo-Pacific Fish. Coun.*, **3** (1952), 80.
13. RAJE, P. C. & RANADE, M. R., *J. Indian Fish. Ass.*, **2** (1972a), 1.
14. RAJE, P. C. & RANADE, M. R., *J. Indian Fish. Ass.*, **2** (1972b), 30.
15. MUTTU, M. S., PILLAI, N. N. & GEORGE, K. V., *Indian J. Fish.*, **21** (1974), 571.
16. THOMAS, M. M., KATHIRVEL, M. & PILLAI, N. N., *Indian J. Fish.*, **21** (1974), 595.
17. STRICKLAND, J. D. M. & PARSONS, T. R., in *A manual of seawater analysis*, Buzz. No. 167 (Fish Res. Bd. Canada), 1968, 1.
18. GEORGE, M. J., RAMAN, K. & NAIR, P. K., *Indian J. Fish.*, **10** (1968), 46.
19. RAO, P. V., *FAO fish. Rep.* **57**, **2** (1968), 285.
20. SRIVASTSA, K. P., *Publ. Dept of Industries and Supplies, Govt of Saurashtra, Saurashtra, India*, 1953, 1.
21. PANIKKAR, N. K. & MENON, M. K., *Proc. Indo-Pacific Fish. Coun.*, **6** (3), 328.
22. GEORGE, P. C. & GEORGE, M. J., *Curr. Sci.*, **33** (1964), 8.
23. RAO, P. V., *Indian J. Fish.*, **19** (1972), 86.
24. SHAIKMAHMUD, F. S. & TEMBE, V. B., *Indian J. Fish.*, **7** (1960), 69.
25. ELDRED, J. G., WILLIAMS, G. T. & JOYCE (Jr), C. A., *Florida State Board Conservation Technical Series* (1965), 1.
26. CHRISTMAS, J. Y., GUNTER, G. & MUSGRAVE, P., *Gulf. Res. Rep.*, **2** (1966), 177.
27. MUNRO, J. L., JONES, A. C. & DIMITRIOU, *Fishery Bull. Fish. Wildl. Serv. U.S.*, **67** (1968), 165.
28. TEMPLE, R. F. & FISHER, C. C., *Fishery Bull. Fish. Wildl. Serv. U.S.*, **66** (1968), 323.