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VERTICAL DISTRIBUTION OF MACROZOOPLANKTON BIOMASS AND ITS MAJOR CONSTITUENTS IN THE NORTHERN ARABIAN SEA DURING JANUARY TO MAY, 1974.

By

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(With 6 Text-figures)

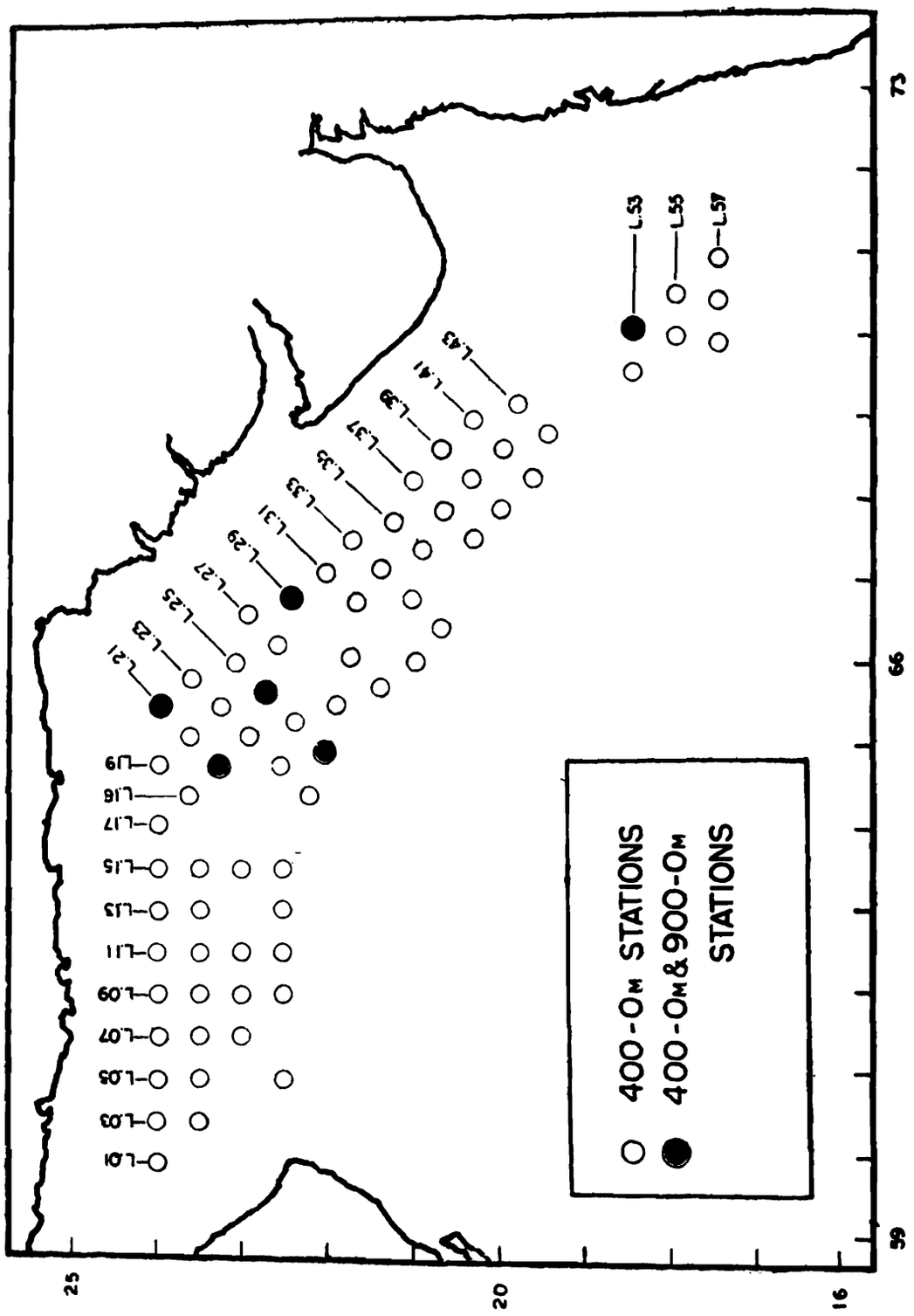
INTRODUCTION

In the tropical region of the Indian Ocean the distribution of the zooplankton in the euphotic zone of the upper 200 metres is known in great detail from the results of Oceanographic Expeditions. The zooplankton biomass distribution from depths below 200 metres and its zoo-constituents are known from (i) the results of the John Murray expedition (Sewell, 1948), (ii) observations at seven stations by R. R. S. 'Discovery' (Foxton, 1957) and (iii) the eastern sector of the Indian Ocean during the R. V. Vityaz Cruise in 1962 (Daniel and Prem Kumar, 1965). Therefore, studies were undertaken on zooplankton samples collected from 400-0 m at 72 stations and from 900-0 m at 6 stations, during the Oceanographic Expedition on I. N. S. DARSHAK in the northern Arabian sea from January to May 1974. In this paper, the biomass and the constituents of macrozooplankton measuring more than 1.32 mm based on these data are presented.

MATERIAL AND METHODS

Macrozooplankton samples were collected with Nansen pattern net of 80 cm mouth diameter, 225 cm total net length and terelene netting bolting cloth 7.5 meshes per linear cm. The net was hauled vertically at a speed of 1 m per second, over a davit from 400 m to the surface at 72 stations and from 900 m to surface at 6 stations (Text-fig. 1). The total displacement volumes in ml were obtained following the techniques of Foxton (1957), Daniel and Premkumar (1965), and Daniel and Jothinayagam (1977). Following Prasad, (1969, P. 400) the displacement volumes have been considered equivalent to total biomass of the sam-

ples. The numbers of each zoo constituent occurring in the entire plankton samples from 400-0 m and from 900-0 m were analysed for estimating the numbers of organisms in a haul. Since, the net used for

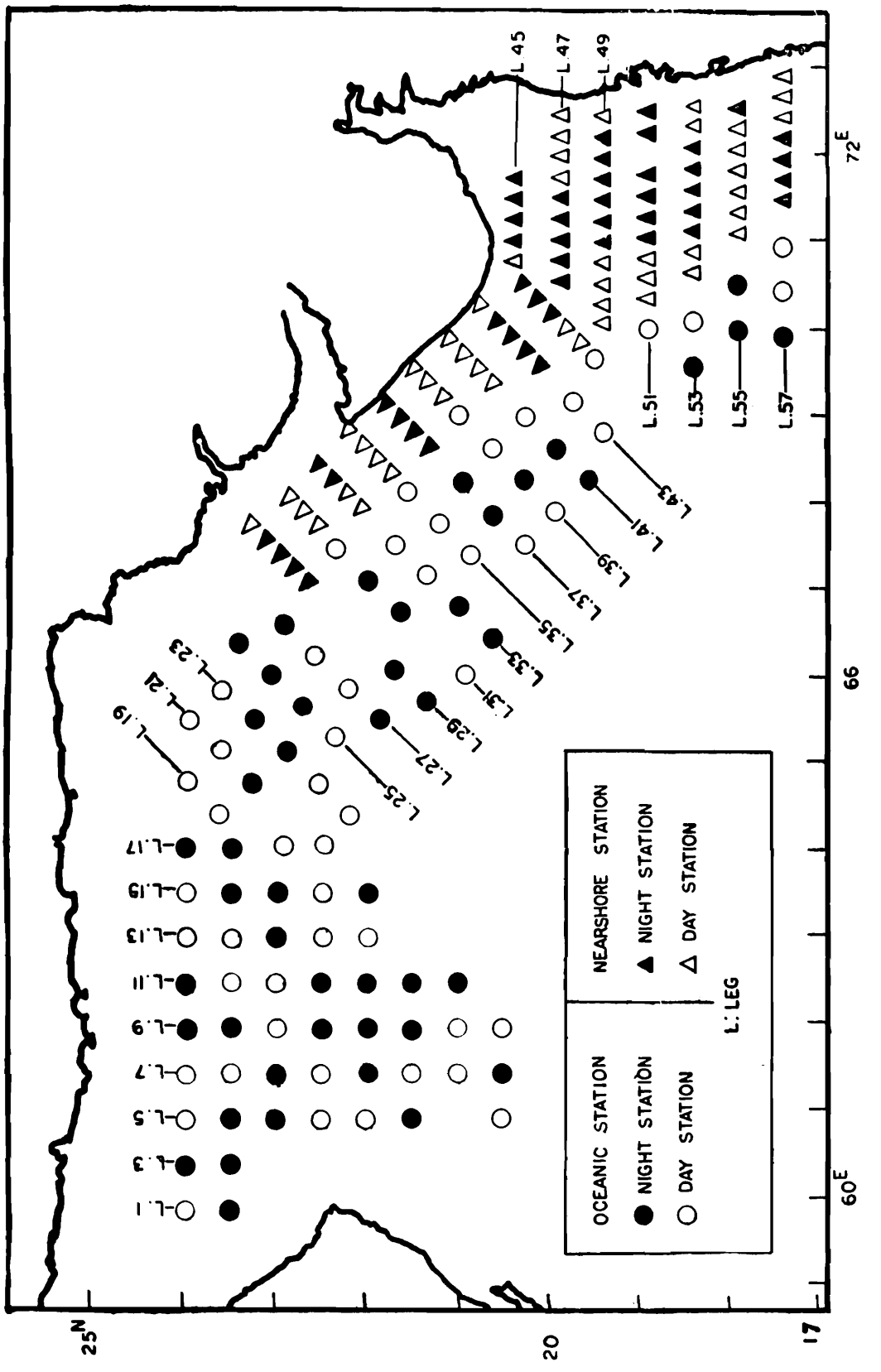


Text-fig. 1. Zooplankton stations from 400-0 m (72 Stns) and from 900-0m (6 Stns) established during expedition.

smpling was of a wider mesh, *vide* supra, only macrozooplankton measuring more than 1.32 mm were collected and the numbers of taxa like copepods were low.

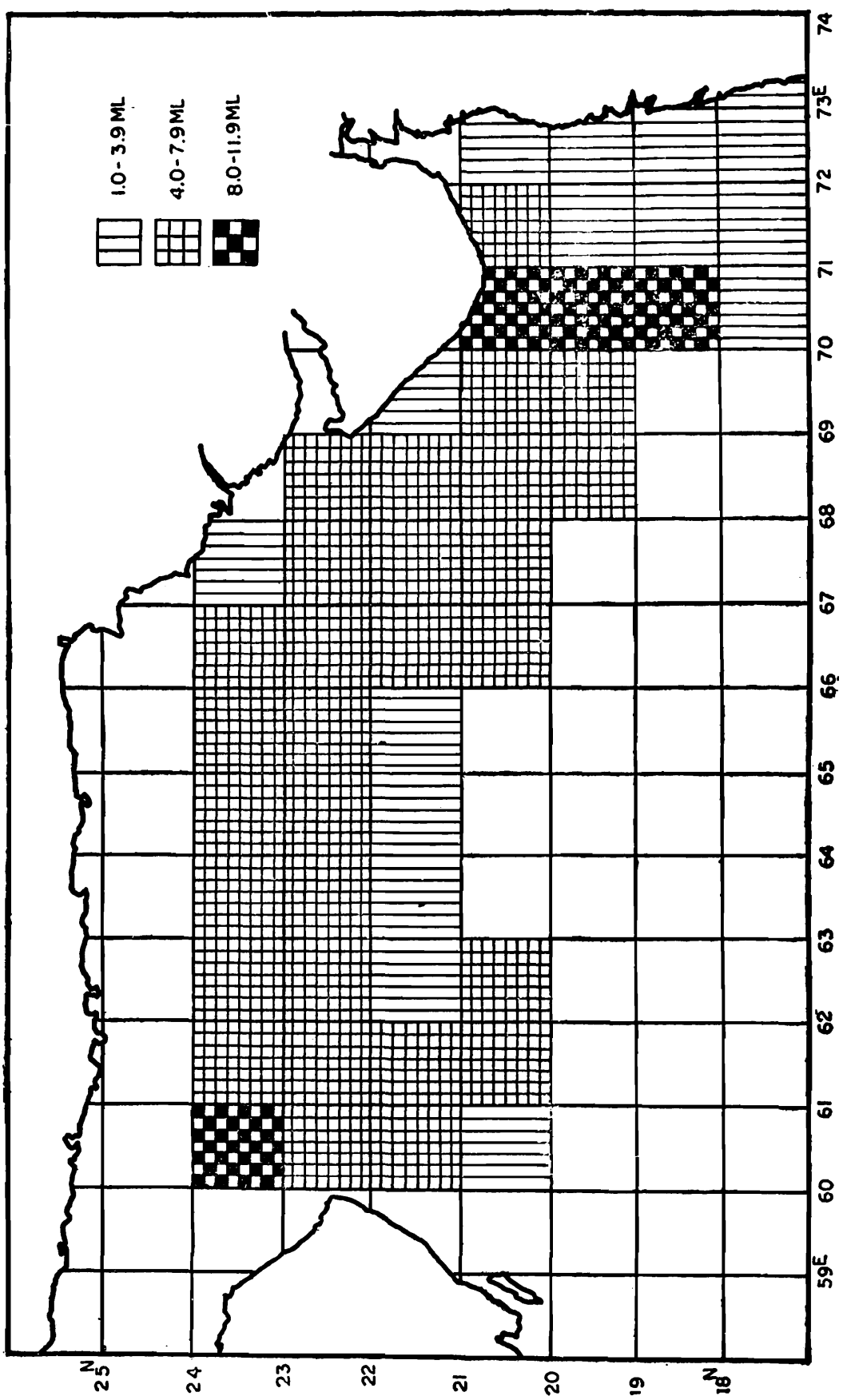
OBSERVATIONS AND CONCLUSION

The biomass of macro-zooplankton measuring more than 1.32 mm and the macrozooplanktonic organisms (*i. e.*, Medusae, Siphonophores, Polychaetes, Ostracods, Copepods, Mysids, Amphipods, Euphausids,



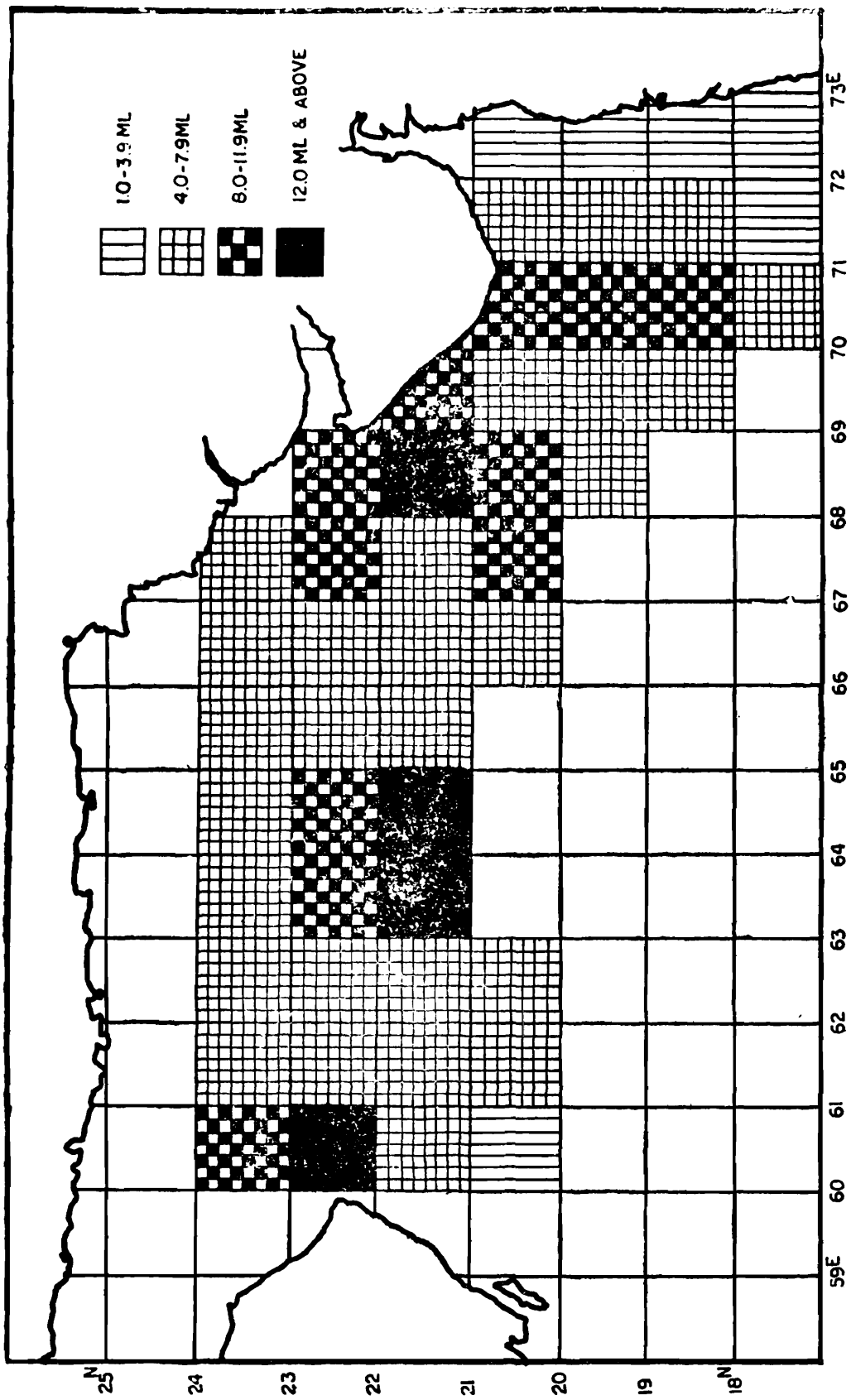
Text-fig. 2. Zooplankton stations from 100-0m in the Oceanic region (100 Stns) and from near seabed to surface from shallow near shore stations (94 Stns).

Shrimp early stages, Mollusca, Chaetognata, Salpa, Fish larvae and others which include heteropods, pteropods and decapod larvae) in the samples are presented in Text-figures 2-6.



Text-fig. 3. Distribution of Zooplankton biomass from 100-0 m (100 Stns) and from near seabed to surface (94 Stns) Day.

The macrozooplankton biomass of the 400-0 m depth samples was very high at 6 stations, namely, 2509, 2907, 3509, 3710, 3906 and 5311



Text-fig. 4. Distribution of Zooplankton biomass from 100-0 m (100 Stns) and from near seabed to surface (94 Stns). Night.

with the displacement values being 20 ml, 21 ml, 25 ml, 23 ml, 29.5 ml and 36 ml respectively (Text-fig. 2-5.). The macrozooplankton biomass

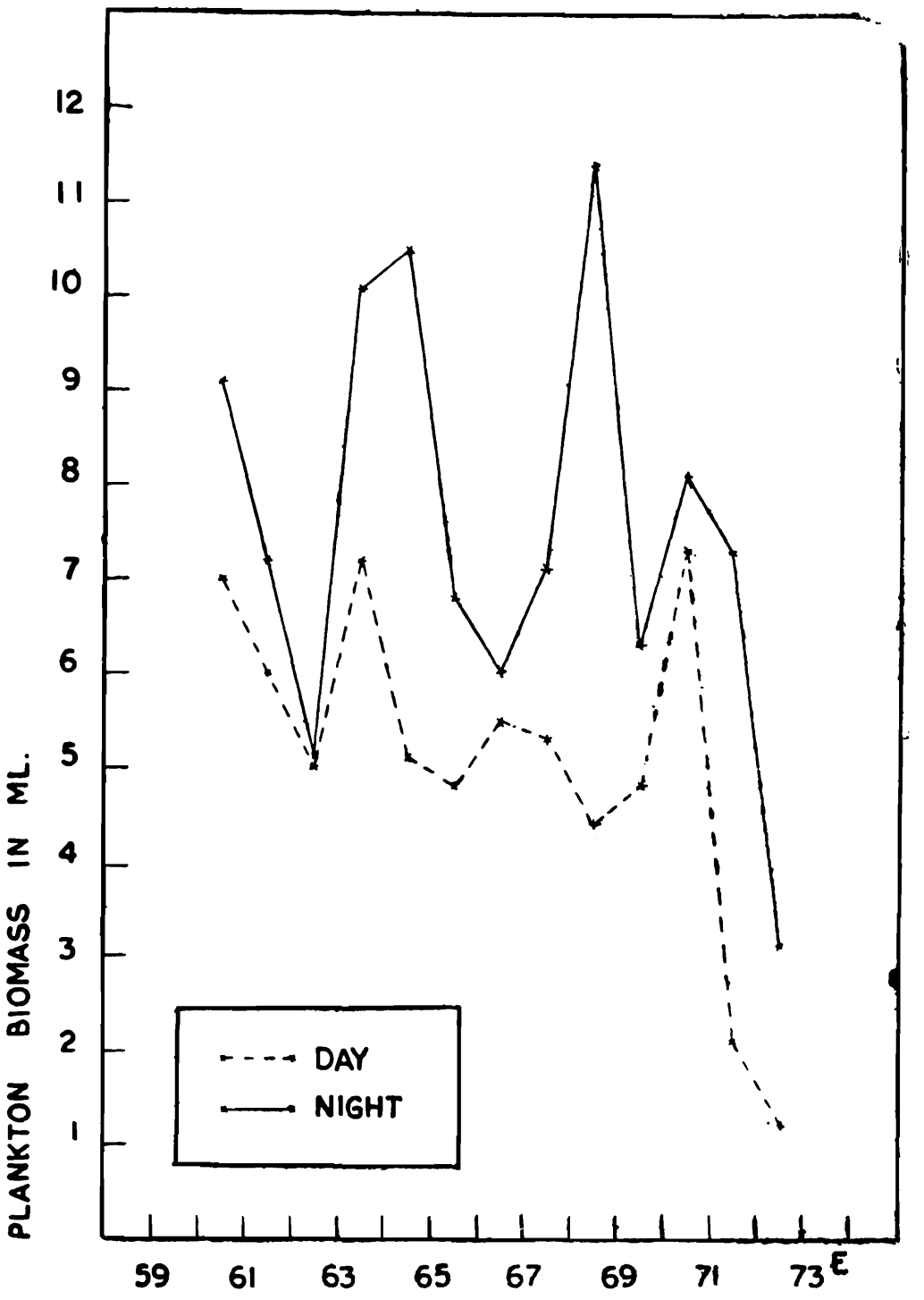
of the 900-0 m depth samples was correspondingly higher at 3 stations (2509, 2907 and 5311) where the displacement values were 28 ml, 32 ml and 60 ml respectively (Text-fig. 6).

From Text-figs. 2.5, it appears that the increase in the total biomass in these samples were contributed by the abundance of siphonophores, scypho and hydromedusae, chaetognaths, shrimps (early stages), euphausiids, ostracods, copepods, amphipods and salps.

At station 2509, swarms of siphonophores [*Diphyes dispar* Chamisso & Eysenhardt, *Bassia bassensis* (Quoy & Gaimard), *Chelophyes contorta* (Lens & Van Riemsdijk)] Scyphomedusae (*Pelagia noctiluca* Peron & Lesuer) Mydromedusae (*Liriope* sp.) chaetognaths (*Sagitta lyra* Krohn, *S. robusta* Doncaster) and shrimps (early stages of *Acetes* sp., *Lucifer* sp.) in both samples contributed to the increase in biomass. At this station, four specimens of *Dimophyes arctica* (Chun) were encountered. Swarms of siphonophores (*Diphyes dispar*, *D. bojani* (Eschscholtz) *Bassia bassensis*, *Hippopodius hippopus* (Forskal) and chaetognaths (*Sagitta lyra*) occurred at the samples of station 2907. Similarly, siphonophores (*Diphyes dispar*, *Sulculeolaria quadrivalvis* Blainville, *Bassia bassensis*), shrimps—early stages, euphausiids (*Euphausia* sp.), salps [*Metacalfina hexagona* (Quoy & Gaimard), *Iasis zonaria* (Pallas)] and ostracods (*Cypridina dentata* Muller) at Station 3509 ; siphonophores (*D. dispar*, *S. quadrivalvis*, *D. bojani*) shrimp—early stages (*Acetes sp.*) and euphausiids (*Euphausia* sp.) at station 3710 ; siphonophores (*D. dispar*, *D. bojani*, *B. bassensis*), polychaetes—(young stages), Scyphomedusae (Pelagia noctiluca), Hydromedusae (*Liriope* sp.) and Salpa (*Metacalfina hexagona*) at station 3906 ; and copepods (*Eucalanus* sp.) amphipods (*Hyperia* sp.), salps (*Metacalfina hexagonae* and *Iasis zonaria*) shrimps—early stages (*Lucifer* sp.) at both samples of station 5311 contributed mainly to the high displacement values.

The biomass is rich ranging from 9.0 ml to 17.0 ml at 23 stations (*vide* Text fig. 2-5) *i.e.*, 0301, 0303, 0501, 0503, 0507, 0901, 1907, 1505, 2105, 2503, 2505, 2703, 2911, 3107, 3109, 4106, 4108, 4110, 4307, 5313, 5512, 5711 and 5713. At stations, 2105 and 2505 the biomass from 900-0 m depth were only slightly higher than the displacement values from the 400-0 m depth samples (Text-fig. 6). Abundant occurrence of siphonophores (*Agalma okeni* Eschscholtz, *D. dispar*, *D. bojani*, *Sulculeolaria chuni* Lens & Van Riemsdijk, *Lensia hotspur* Totton, *Eudoxoides mitra* (Huxley), *Chelophyes contorta*, *B. bassensis*, *Abylopsis tetragona* (Otto) and *A. eschscholtzi* (Huxley), shrimps—early stages (*Acetes* sp. and *Lucifer* sp.) and Scyphomedusae (*Pelagia noctiluca*—young forms), at all stations and ostracods (*Cypridina dentata*) chaetognaths, (*Sagitta lyra*, *Sagitta robusta*,

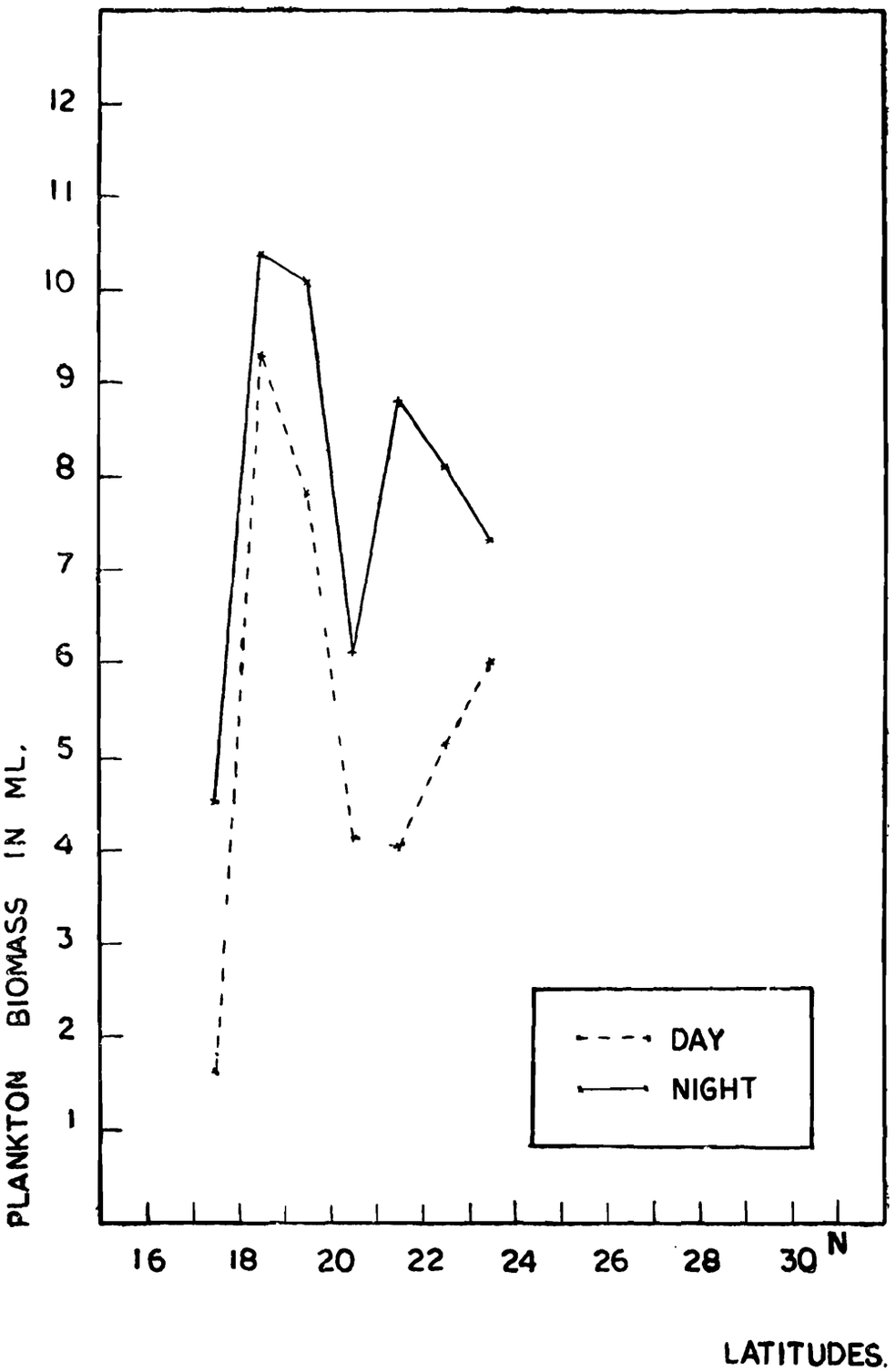
Sagitta hexaptera d'Orbigny, polychaetes—(young forms) and mysids at some of the stations had increased the biomass values (Text-figs. 2-5). The displacement values of the total biomass of macrozooplankton were low, ranging from 3.5 ml to 8.0 ml or less in most of the other stations



Text-fig. 5. Longitudinal variations in the plankton biomass during Day/Night periods for 1° intervals.

i.e., 0101, 0703, 0705, 0903, 0905, 1103, 1105, 1107, 1307, 1507, 2305, 2307, 2309, 2507, 2705, 2913, 3306, 3308, 3310, 3312, 3507, 3706, 3708, 3908 and 4309 for the 0-400 metre depth and stations 2101 for the 0-900 m depth. At 18 stations (*i.e.*, 0701, 1101, 1301, 1303, 1501, 1503,

1701, 1901, 1903. 2101, 2103, 2303, 2311, 2709, 3113, 3910, 5510 and 5709) the total biomass is extremely low, the displacement values ranging from 0.75 ml to 3.0 ml. From Text-figs. 2-6 it is seen that at these 43 stations where the biomass ranged from 0.75-8.0 ml, the numbers of



Text-fig. 6. Latitudinal variations in the plankton biomass during Day/Night periods for 1° intervals.

different zoological constituents were low, probably due to these areas being biologically poor.

Although, a comparison of the data on biomass and zooconstituents

of plankton hauls from the surface (188 stations) (Daniel and Jothinayagam, 1977) 100 m depth (100 stations) (Daniel and Krishnamoorthy, 1977) 200 m depth (165 stations). (Paulinose and Aravindaksham, 1977) 400 m depth (72 stations) and 900 m depth (6 stations) would yield interesting results, since there is much diversity in the gear used for collecting the samples from the different stratified depths (*i.e.*, diameter of the mouth of the sampler, mesh size and the length of the net and speed of haul were different) it is not possible to compare these results. However, it appears from the present study and the papers published earlier, based on samples made from the same area and collected during the same cruises from the surface, 100 m depth, and 200 m depth (Daniel & Jothinayagam, 1977 ; Daniel & Krishnamoorthy (in press) and Paulinose & Aravindaksham, 1977) that (i) zooplankton biomass is comparatively very high at the surface extending upto 100 m in the oceanic regions and upto the thermocline in the shallower inshore regions (Daniel and Jothinayagam, 1977, Daniel and Krishnamoorthy, (in press) (ii) the macrozooplankton below the euphotic zone is not very rich and (iii) swarming of certain meso pelagic macro-zooplankters contributed to the high biomass values in the deeper waters in some stations (see Text-figs. 2-6).

It is of interest to note the occurrence of *Dimophyes arctica* (Chun) in both the 400 m and 900 m samples at station 2509, located at Latitude 22°09' N and Longitude 64°53' E. The occurrence of this species at this station suggests the upwelling of deep water masses in this region, during March, 1974. Further, this is the first record of this species north of 12° latitude in the Arabian Sea, the previous record being off Cochin at the lower boundary of the thermocline, in November (Daniel, 1977). This underlines the need for further investigations on deepwater macroplankton.

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Summary

In the cruises of the INS DARSHAK during January to May 1974 in the northern Arabian Sea studies were made on the macrozooplankton biomass, abundance and distribution of its major constituents at 72 stations of the vertical zone of 0-400 m and at 6 stations of the vertical zone of 0-900 m. It was found that the biomass was very high at certain stations, rich at some, low in few others and very low in the rest, indicating the variations in the fertility of the area. The richness at some stations were attributed to swarms of siphonophores, medusae, chaetognaths, shrimp early stages, euphausiids and ostrocods. It is concluded that zooplankton is very high at the surface extending upto 100 m in the oceanic regions and upto the thermocline in the inshore regions. The occurrence of *Dimophyes arctica* at station 2509 (22°09' N, 64°53' E) is attributed to the upwelling of deepwater in this region.

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