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ZOOPLANKTON COMMUNITY OF THE EGYPTIAN MEDITERRANEAN COAST

Nagwa E.M. Abdel-Aziz and Sawsan M. Aboul-Ezz
National Institute of Oceanography and Fisheries, Alexandria, Egypt.

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ABSTRACT

The zooplankton community during the present study (autumn 2000 – winter 2001) appeared to has low diversity as compared to that found in the whole Egyptian Mediterranean waters. The western side was characterized by higher diversity than the eastern side, which is affected by land based effluents entering the sea from the coastal lakes and the River Nile. The standing crop values indicated poor zooplankton population in the whole study area. The dominance of species showed drastic changes as compared to the previous studies, whereas the previously dominant species are ranked recently as rare species. The identified species exhibited different seasonal patterns of vertical distribution but the majority of them were recorded in the subsurface layer down to 200 m depth.

INTRODUCTION

Since the construction of the Aswan High Dam in 1965 and the drop of the amount of the discharged fresh water due to cessation of the Nile flood, the biological and ecological characteristics of the southeastern Mediterranean waters experienced drastic changes. However, the increase in volume of waste waters reaching the neritic area from the coastal lagoons induced more changes in the water quality and biotic components of the ecosystem in this area. Zooplankton represents one of these components which experienced long term variations in its quantitative and qualitative structure. This community in the offshore Egyptian Mediterranean waters has received but little attention (Dowidar, 1974 & 1988; Hussein, 1977; Anonymous, 1979).

The present paper aims to follow up changes in the dynamics of zooplankton community along the southeastern Mediterranean, including standing crop, species composition, dominance of species and their vertical distribution, particularly in offshore water.

MATERIAL AND METHODS

Zooplankton samples were collected during autumn 2000 and winter 2001 at four sectors, extending offshore perpendicularly to the coast line in front of Sidi Barrani, Matrouh, Alamain and Sahl El-Tina (Fig. 1). From each section, samples were collected through vertical hauls at three to four stations within depth ranges of 25-0m, 50-25m, 100-50m and 200-100m, using plankton net with diameter of 70 cm and mesh size of 55μm. The samples were concentrated to 100 ml and preserved in 4% neutralized formalin. The obtained species were identified according to Rose (1933); Tregouboff and Rose (1957); Edmondson (1959); Marshall (1969); Bradford (1972) and Malt (1983). Three aliquots of 5 ml were counted from each concentrated sample and their average was used in calculating the standing stock of zooplankton. The collection of zooplankton samples was carried out throughout the research plan of the National Institute of Oceanography and Fisheries for oceanographic survey of the Egyptian Mediterranean coast.

RESULTS AND DISCUSSION

The present study recorded relatively low diversity of zooplankton (214 species) in coastal area as compared to the total diversity (498 species) known in the whole Egyptian Mediterranean (Abdel-Aziz, 2002). The spatial distribution of species indicates that the western side of the Egyptian Mediterranean coast harboured more diversified community (101 - 142 species) than the eastern part (63 species). The low number of species in the eastern part may be attributed to the effect of the land-based effluents discharged to the sea off the Nile Delta Region and also to the low number of samples collected from the eastern part. On the other hand, the autumn community at the different sampling sections was represented by markedly higher number of species (47-129 species) than the late winter (26-82 species). From Table 1, it is observed that 33 species are known to the whole area; 16 were restricted to the western part, while 10 species were found only in the eastern part. In the meantime, the rest of species were found sporadically in one or two sampling sections. The species composition demonstrated copepods as the major diversified group in the whole area, represented by 71 species, followed by tintinnids (37 species) and radiolaria (18 species). Both copepods and tintinnids included species, which were found in both the near shore and offshore stations, while all radiolarian species were restricted to the offshore stations. The remaining identified species (88 species) belong to many zooplankton groups (Table 1). The relative abundance of zooplankton groups showed different patterns in various sectors (Fig. 2), where the total copepods formed 63%-92.1% of total zooplankton in the four sectors, while their contribution decreased to 56.3%-87.2% during late winter. Tintinnids constituted 2-3.3% during autumn, and increased to 1.3-11% during late winter. In the meantime, meroplanktonic forms were represented by high percentages (2-16.3%) during autumn, and (5.1-15.5%) in late winter. Among copepods, *Acartia* and *Corycaeous* attained the highest number of species (5 and 7 respectively), while several other genera were represented by 3 species. Meanwhile, the most diversified tintinnid genus was *Tintinnopsis* (7 species) and that of larvaceans was Oikopleura (7 species).

Since copepods were the major zooplankton component, their vertical distribution was considered in order to map depth of occurrence for each species (Fig 3). During autumn, 13 species were restricted to the uppermost 50m, 30 species in the depth range 25-100m and 15 species extended their occurrence to deeper than 100m. During late winter, 14 species were recorded in the uppermost 50m, 9 species down to 100m and 6 species from 100-150m while 12 species appeared in different layers of the water column. From the vertical distribution of copepod species, it could be assumed that several species are considered as shade species, since they are mostly found at depths greater than 100m, while the depth of euphotic zone in the southeastern Mediterranean was reported to have a maximum of 70m in summer (Dowidar, 1988). These species are *Candacia bispinosa, Clytemnestra scutellata, Copilia quadrata, Corycaeus limbatus, Eutideus giesbrechti, Corycaeus typicus, Corycella carinata, Corycella rostrata, Eucalanus crassus, Euchaeta spinosa, Lucicutia clavicornis, Macrosetella gracilis, Mecynocera clausi, Paracalanus Pygmaeus, Spinocalanus abyssalis.* This is in agreement with Halim (1969) and Weikart (1980 and 1987) who suggested that copepods escape to the deeper layers avoiding high temperature at the surface in summer.

The autumn population was dominated by few numbers of species along the whole Egyptian coast, namely, *Euterpina acutifrons, Oithona nana, Oithona plumifera Paracalanus parvus* and *Eucalanus attenuatus*. The late winter population in the sector of Sidi Barrani was dominated by the tintinnid *Epiplocylis blanda*, the copepods *Calocalanus pavo, Eucalanus attenuatus, Microsetella rosea, Oithona nana, Oithona plumifera* and *Paracalanus parvus*, the cladocerans *Evadne spinifera* and the pteropod *Limacina inflata*. In Alamain sector, the dominant winter forms were the copepod species *Eucalanus attenuatus, Oithona nana, Oithona plumifera* and *Paracalanus parvus* and cladoceran *Evadne spinifera*. The Matrouh sector was dominated by the copepods *Paracalanus parvus, Oithona nana, Oithona plumifera, Eucalanus attenuatus, Calanus brevicornis* and the protozoans *Globigerina ides* and *Favella ehrenbergii*. The winter community in the eastern sector (Sahl El-Tina) showed the following dominant species, *Oithona nana, Oithona plumifera Paracalanus parvus, Calocalanus pavo and Clausocalanus arcuicornis*. But it is to be noted that the abundance of all the above mentioned species was mostly low relative to the population density of the total zooplankton in the whole area. Remarkably low abundance of zooplankton was found during the present study, whereas the autumn population density varied along the whole coast between 644 indiv./m^3 at Alamain and 1104 indiv./m^3 at Sahl El-Tina and the late winter population between 156 and 1316 indiv./m^3 in the same sectors respectively. Matrouh and Sidi Barrani sectors were inhabited by 647 and 938 indiv./m^3 during autumn and 252 and 382 indiv./m^3 during late winter respectively. On the spatial scale, the sector of Sahl- El-Tinah was inhabited by relatively high zooplankton population in autumn as compared to other sectors. This means that the fresh water discharge from Lake Manzalah to the Mediterranean coast may affect the plankton productivity in Sahl EL-Tinah. Dowidar (1988) attributed the reduction of zooplankton stock off the Nile Delta in the period from 1970 to 1985 to the heavy grazing by various planktivores. This explanation contradicts with the pattern of the variations of both sardine catch and zooplankton stock during that period, where the catch of sardine showed a gradual decrease during the period from 1979 to 1983 parallel to the similar decrease in zooplankton abundance during the same period. This means that the decrease of zooplankton production may be attributed to ecological factors rather than the effect of intensive grazing by sardine.

It is to be noted that scarce information is so far available about the abundance and structure of zooplankton in the offshore waters of the Egyptian Mediterranean coastal waters. The only known work is that of Anonymous (1979) regarding the zooplankton along the Egyptian Coast from Rosetta to Salloum, but the sampling sites were different from those in the present study which render the comparison between the two studies difficult. However, two sections are yet common among the two studies, upon which comparison could be made. It accordingly seems that the zooplankton standing crop has dropped markedly in the present study as compared to Anonymous (1979). This may be related to the cessation of the Nile flood to the Egyptian Mediterranean coast, which previously promoted high phytoplankton production and consequently high zooplankton count. However, the relative abundance of the existing groups showed no significant difference between the two records as copepods are still the most dominant group (More than 80% of the total count).

The long-term comparison of zooplankton composition indicates that *Paracalanus* and *Oithona* appeared to be the dominant genera during the past three decades in the Egyptian Mediterranean waters, despite the drop of their count recently. In addition, the dominance of species experienced clear variation during the past two decades. According to Dowidar (1988), the following species were dominant in the community of (1984), *Acartia clausi, Acartia latisetosa, Euterpina acutifrons, Centropages violaceous, Isias clavipes, Temora stylifera, Paracalanus aculeatus, Mecynocera clausi, Pleuromamma* spp, while all of these species were either rare or completely missing from records of the present study.

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Table 1- Distribution of zooplankton species along the coastal area of the Egyptian Mediterranean waters.

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Ciliata								
Difflugia lebes	0	0	0	0	0	0	1	0
Paramaecium sp.	0	0	0	0	0	0	0	1
Tintinnidae								
Amplectella collaria	0	0	1	0	0	0	0	0
Codonella aspera	0	1	1	0	1	0	0	0
Codonella galea	0	0	0	0	0	1	0	0
Codonellopsis longa	0	0	0	0	1	1	0	0
Codonellopsis morchella	1	0	0	0	0	0	1	0
Codonellopsis orthoceras	0	0	0	0	1	0	0	0
Coxliella ampla	0	0	1	0	0	0	0	0
Coxliella luciniosa	0	0	1	0	1	0	0	0
Epiplocylis blanda	1	0	1	0	1	1	1	0
Epiplocylis undella	0	0	1	0	0	1	0	1
Eutintinnus fracknoi	0	1	1	1	1	1	0	1
Eutintinnus lusus-undae	0	0	1	0	1	0	1	0
Eutintinnus macilentus	0	0	1	0	1	1	0	0
Favella adriatica	0	1	0	0	0	0	0	0
Favella composita	0	0	0	0	1	0	0	0
Favella ehrenbergii	0	1	1	1	0	0	0	1
Metacylis mediterranean	0	1	0	0	0	0	0	0
Metacylis mereschkowskii	0	0	1	0	1	0	0	0
Parundella difficilis	1	0	0	0	0	0	0	0
Parundella lachmanni	0	1	1	0	0	0	0	0
Proplectella angusta	0	0	1	0	0	0	0	0
Proplectella pentagona	0	0	1	0	0	0	0	0
Rhabdonella amor	0	0	1	1	1	0	0	0
Rhabdonella conica	0	0	1	0	0	0	0	0
Rhabdonella elegans	0	0	1	0	1	0	1	0
Rhabdonella spiralis	0	1	0	0	1	1	0	0
Salpingella attenuata	0	0	1	0	1	0	0	0
Tintinnopsis brandti	0	0	0	0	1	0	0	0
Tintinnopsis compressa	1	0	0	0	0	0	0	0
Tintinnopsis cyathus	1	0	0	0	0	0	0	0

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Tintinnopsis cylindrica	0	1	0	0	0	0	0	0
Tintinnopsis lindeni	0	0	1	0	0	0	0	0
Tintinnopsis lobiancoi	0	1	0	0	0	0	1	1
Tintinnopsis radix	0	1	0	0	0	0	0	0
Undella hyalina	1	0	0	0	0	0	1	0
Undellopsis attenuata	0	0	1	0	1	1	0	0
Undellopsis subangulata	0	1	0	0	0	0	0	0
Radiolaria								
Acanthosphaera sp	0	0	1	0	1	1	0	0
Aulacantha scolymantha	0	0	1	0	0	0	0	0
Cladococcus cervicornis	0	0	0	0	1	0	0	0
Corocalyptera sp.	0	0	0	0	1	0	0	0
Cyphonium ceratospyris	0	0	1	0	1	0	0	0
Dictyocephalus mediterranean	0	1	0	0	1	0	0	0
Heliosphaera echinoids	0	0	1	0	1	0	1	0
Lithostrobus conulus	0	0	0	0	1	0	0	0
Pteroscenium pennatum	0	0	0	0	1	0	0	0
Sethocapsa pyriformis	0	0	0	0	1	0	0	0
Sphaeronectes irregularis	0	0	0	0	0	0	1	0
Sphaerozoum punctatum	0	0	0	0	1	0	0	0
Spongodictyon trigonizon	0	0	1	0	0	0	0	0
Spongotrochus brevispinus	1	1	1	0	1	1	1	0
Staurosphaera jacobi	1	0	1	0	0	0	0	0
Stylochlamydium asteriscus	0	0	1	0	1	0	0	0
Stylocheiron abbreviatum	0	0	0	0	1	0	0	0
Theoconus zancleus	0	1	0	0	1	1	0	0
Acantharia								
Acanthothiaema robescens	0	0	1	0	0	0	0	0
Sphaerocapsa of Gigartacon fragilis	0	0	1	0	0	0	0	0
Foraminifera								
Adelosina elegans	0	0	0	0	0	0	0	1
Ammonia beccari	0	0	0	0	0	0	0	1
Globigerina bulloids	0	0	0	0	0	0	1	0
Globigerina ides	0	1	1	1	1	1	1	0
Globigerina inflata	1	1	1	0	1	1	0	1
Globigerinoides conglobata	0	0	1	0	0	0	0	0
Globorotalia truncatuloides	0	1	0	0	1	0	0	1

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Orbulina universa	0	0	0	0	0	1	0	0
Quiqueloculina striata	1	0	0	0	0	0	1	0
Spirilina vivipara	0	0	0	0	0	0	0	1
Rotifera								
Colourella adriatica	0	0	0	0	0	0	1	0
Lecane luna	1	0	0	0	0	0	0	0
Polyarthra vulgaris	0	0	0	0	0	0	1	0
Coelenterata								
Abylopsis tetragona	0	0	1	0	1	0	0	0
Aglaura haemistoma	0	0	0	0	1	1	0	0
Chelophyes appendicularia	0	0	0	0	1	0	0	0
Chelophyes contorta	0	0	0	0	1	0	0	0
Cucullus campanula	0	0	0	0	1	1	0	0
Ectopleura dumortieri	1	1	1	0	1	0	0	0
Ersaea lessoni	0	0	1	0	1	0	0	0
Eudoxoides spiralis	0	0	1	1	0	1	0	0
Geryonia proloecidelis	0	0	0	0	1	0	0	0
Hippopodius hippopus	0	0	0	0	0	1	0	0
Lensia campanella	0	0	1	0	1	0	0	0
Lensia conoidea	0	0	0	0	0	1	0	0
Lensia multicristata	0	0	1	0	0	1	0	0
Lensia subtilis	0	0	0	0	1	1	0	0
Liriope tetraphylla	0	0	0	0	1	0	0	0
Muggiaea kochia	0	0	0	0	0	1	0	0
Obelia spp.	1	1	1	0	1	0	1	1
Solmundella bitntaculata	0	0	1	0	1	0	0	0
Sphaeronectus irrigularis	0	0	1	0	0	1	0	0
Sulculeolaria biloba	0	0	1	0	0	0	0	0
Sulculeolaria chuni	0	0	0	0	1	1	0	0
Sulculeolaria quadrivalvis	0	0	1	0	0	0	0	0
Turritopsis nutricula	0	0	0	0	1	0	0	0
Ctenophora								
Bero sp.	0	0	1	1	0	0	0	0
Copepoda								
Acartia clausi	0	1	1	1	1	1	1	1
Acartia dana	1	0	1	0	0	0	0	1
Acartia latisetosa	1	1	1	0	0	0	0	1

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Acartia longiremis	1	1	1	0	1	1	1	1
Acartia negligens	0	0	1	0	1	1	1	0
Atedias armatus	1	0	0	0	0	0	0	0
Calanus brevicornis	1	1	1	1	0	0	0	0
Calocalanus pavo	1	1	1	0	1	1	1	1
Candacea armata	0	1	0	1	0	0	0	0
Candacea bispinosa	0	1	0	0	1	1	0	0
Centropages kroyeri	0	0	1	0	1	0	0	0
Centropages typicus	1	1	1	1	1	0	1	0
Centropages violaceus	0	1	1	0	1	0	1	0
Clausocalanus arcuicornis	1	1	1	1	1	1	1	1
Clausocalanus furcatus	0	1	0	0	1	1	0	0
Clytemnestra scutellata	0	0	0	0	1	1	0	0
Copilia mediterranean	1	0	0	0	0	0	0	0
Copilia quadrata	1	0	0	0	1	0	0	0
Copilia vitra	0	0	0	0	1	0	0	0
Corycaeus clausi	1	1	1	1	1	1	1	1
Corycaeus flaccus	1	1	1	0	1	0	0	1
Corycaeus furcifer	0	0	1	0	0	0	0	0
Corycaeus latus	0	1	1	0	0	0	0	0
Corycaeus limbatus	0	0	1	0	1	0	0	0
Corycaeus speciosus	0	0	1	1	1	1	0	0
Corycaeus typicus	0	0	1	0	1	1	0	0
Corycella carinata	1	1	1	0	1	1	0	1
Corycella rostrata	0	0	1	0	1	1	1	0
Cymbasoma rigidium	0	1	0	0	0	0	0	0
Euaetideus giesbrechti	1	0	1	0	0	0	0	0
Eucalanus attenuatus	1	1	1	1	1	1	1	1
Eucalanus elongatus	1	0	1	0	0	0	1	0
Eucalanus crassus	0	1	0	0	0	0	0	0
Euchaeta hebes	0	1	0	0	0	0	0	0
Euchaeta marina	1	1	1	0	1	1	1	0
Euchaeta spinosa	1	1	1	0	0	1	0	0
Euchirella rostrata	0	1	1	0	1	1	0	0
Euterpina acutifrons	1	1	1	1	1	1	1	1
Haloptilus longicornis	1	1	1	1	1	1	0	0
Isias clavipes	1	1	1	0	0	0	0	0

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Lubbokia squalimana	0	0	0	0	1	0	0	1
Lucicutia flavicornis	0	1	1	0	1	1	0	0
Lucicutia ovalis	0	0	1	0	0	0	0	0
Macrosetella gracilis	1	1	1	0	0	0	1	1
Mecynocera clausi	1	0	1	0	1	1	0	0
Macrosetell norvigeca	0	0	1	0	1	0	0	0
Macrosetell rosea	1	1	1	1	1	1	1	0
Mormonilla phasma	0	0	1	0	0	0	0	0
Nannocalanus minor	0	0	1	0	0	1	0	0
Neocalanus gracilis	0	0	1	0	1	0	1	0
Neocalanus tenuicornis	0	0	1	0	1	1	0	0
Nitocera lacustris	0	0	0	0	0	0	0	1
Oithona linearis	0	0	0	0	1	1	0	0
Oithona nana	1	1	1	1	1	1	1	1
Oithona plumifera	1	1	1	1	1	1	1	1
Oncaea conifera	0	0	1	0	1	1	0	0
Oncaea mediterranea	0	0	1	0	1	1	1	0
Oncaea venusta	1	1	1	0	1	1	1	1
Paracalanus nanus	0	1	0	0	0	0	0	0
Paracalanus parvus	1	1	1	1	1	1	1	1
Paracalanus pygmaeus	0	0	1	0	1	1	1	0
Phaenna spinifera	0	0	1	0	0	0	0	0
Pleuromamma abdominalis	0	0	0	0	1	0	0	0
Pleuromamma gracilis	0	0	1	0	1	1	0	0
Rhinocalanus nastus	0	0	1	0	1	1	0	0
Sappharina angusta	0	0	1	0	1	0	0	0
Sappharina mechialosa	1	0	1	0	0	0	0	0
Sappharina opalina	1	0	0	0	0	0	0	0
Scolecithrix brandyi	0	0	0	0	1	0	0	0
Spinocalanus abyssalis	1	0	0	0	0	1	0	0
Temora stylifera	1	0	1	0	1	1	1	1
Nauplius larvae	1	1	1	1	1	1	1	1
Copepodite stages	1	0	1	1	1	1	1	0
Cladocera								
Evadne spinifera	1	0	1	0	1	0	1	1
Evadne tergestina	1	0	0	0	1	0	0	0
Podon polyphemoides	0	0	1	0	0	0	0	0

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Ostracoda								
Conchoecia elegans	0	0	1	0	1	1	0	0
Conchoecia obtusata	1	1	1	0	1	0	0	1
Cypridina castania	0	0	1	0	0	0	0	0
Cypridina mediterranea	0	0	1	0	0	1	0	0
Pteropoda								
Creseis acicula	0	0	1	0	0	1	0	0
Creseis virgula	1	0	1	0	0	0	0	0
Euclio pyramidata	0	0	1	0	1	1	0	0
Hyalocylis striata	1	0	0	0	0	0	0	0
Limacina helicina	0	0	0	0	1	0	0	0
Limacina inflata	1	1	1	1	1	1	1	1
Limacina trochiformis	0	0	1	0	0	1	0	0
Peraclis reticulata	0	0	0	0	1	0	0	0
Heteropoda								
Firola coronata	1	0	1	0	0	0	0	0
Chaetognatha								
Sagitta bipunctata	0	0	0	0	1	0	0	0
Sagitta friderici	1	1	1	1	1	1	0	0
Sagitta inflata	0	1	0	0	1	1	1	0
Sagitta macrocephala	0	0	1	0	0	1	0	0
Sagitta serratodentata	0	0	0	0	1	1	0	0
Sagitta setosa	1	1	0	0	0	0	0	0
Larvacea								
Appendicularia sicula	0	0	1	0	1	0	0	0
Fritillaria borealis	0	1	1	1	1	1	1	0
Fritillaria formica	0	0	0	0	0	1	0	0
Fritillaria haplostoma	0	1	0	0	0	0	0	0
Fritillaria megachile	1	0	1	0	1	0	0	0
Oikopleura albicans	0	1	0	0	0	0	0	0
Oikopleura cophocerca	1	0	1	0	0	1	0	0
Oikopleura dioica	1	0	1	1	1	1	1	0
Oikopleura fusiformis	1	0	1	0	0	0	0	0
Oikopleura intermedia	0	1	1	1	1	1	0	0
Oikopleura longicauda	1	1	1	1	1	1	1	1
Oikopleura parva	1	1	1	1	1	1	1	0

Table 1- Continued

	Sidi Barrani		Matrouh		Alamain		Sahl Al-Tina	
	A 00	W 01	A 00	W 01	A 00	W 01	A 00	A 00
Pegalopleura haranti	0	0	0	0	1	1	0	0
Polychaete sp.	1	0	1	0	1	0	0	1
Free living Nematodes	0	0	0	0	0	0	1	1
Decapoda	1	0	1	0	1	1	1	0
Leucifer acestra	1	0	1	0	1	1	1	0
Euphausiacea	1	1	1	0	0	0	0	0
Stylocheiron sp.	1	1	1	0	1	0	0	0
Mysidacea								
Mysid sp.	1	0	1	0	1	1	0	0
Amphipoda	1	0	1	0	1	1	0	1
Hyperia sp.	1	0	1	0	0	0	0	1
Pseudolyceae sp.	1	0	0	0	1	1	0	0
Thaliacea								
Doliolum denticulatum	0	1	1	0	1	0	0	0
Doliotella gegenbauri	0	0	1	0	0	0	0	0
Salpa fusiformis	1	0	1	0	0	0	0	0
Salpa maxima	0	0	0	0	0	1	0	0
Thalia democratica	0	1	0	0	0	0	0	0

A= Autumn, W=Winter

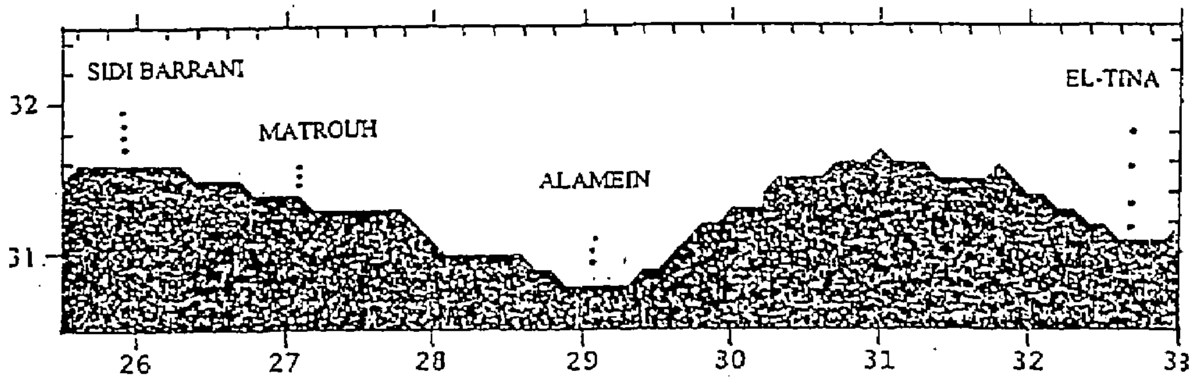
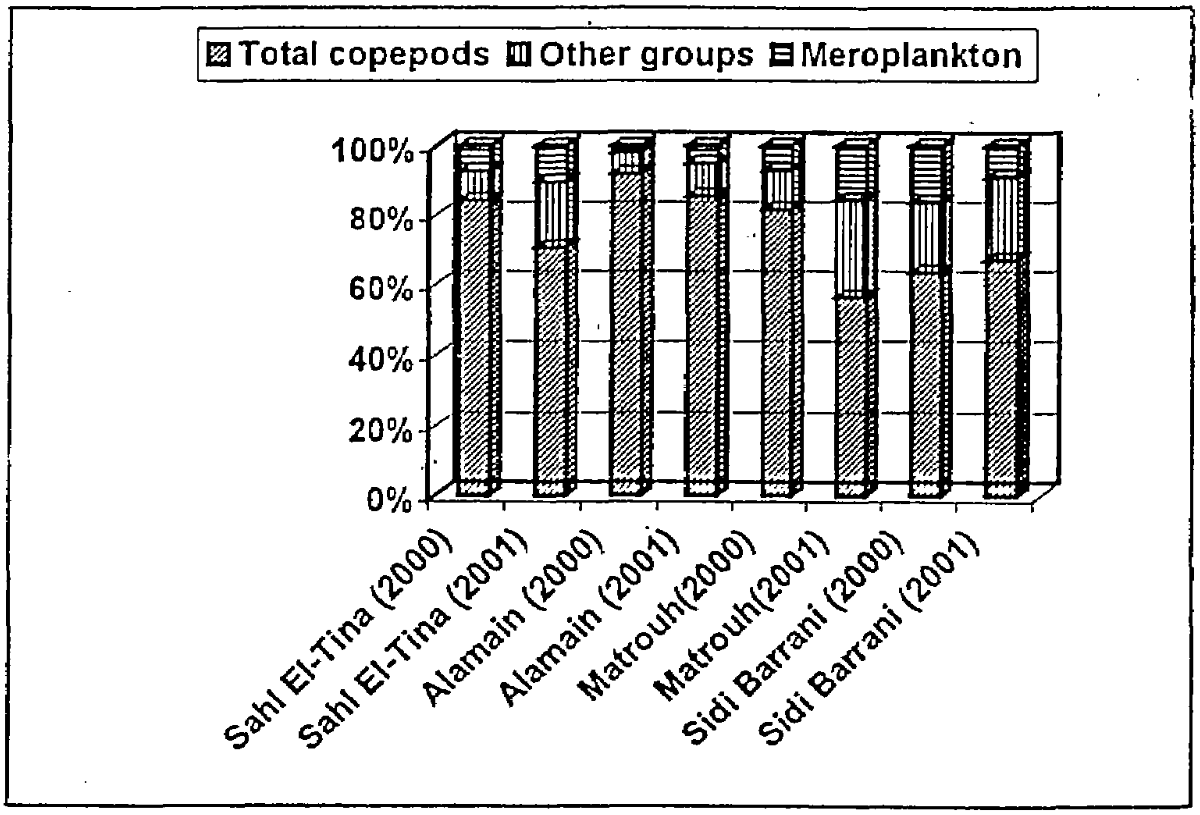


Fig.1- Study area off the Egyptian Mediterranean Waters and Sampling Positions



]. 2- Relative abundance of zooplankton groups along the Egyptian Mediterranean Co

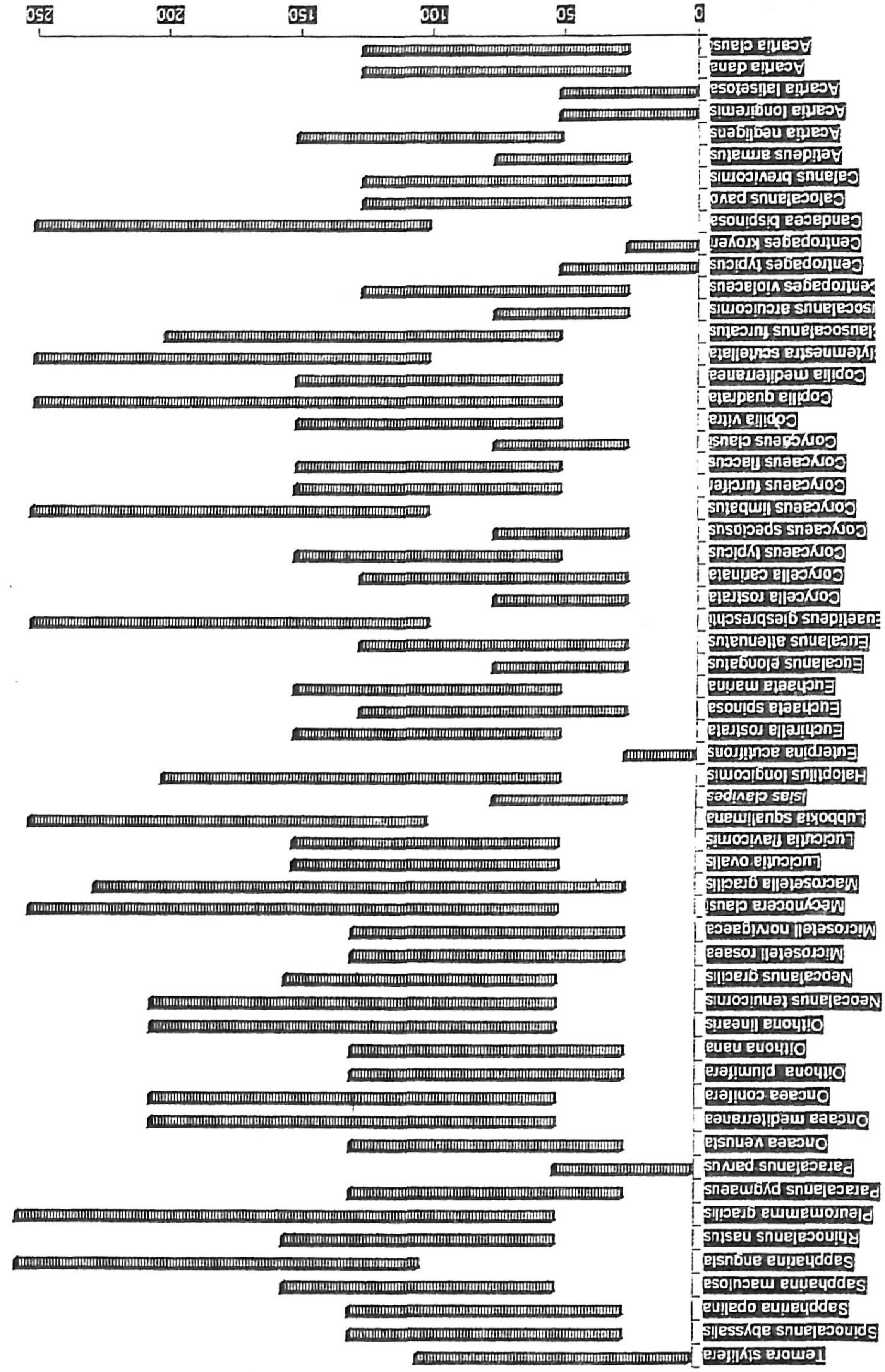


Fig. 3 a- Vertical distribution of copepod species off the Egyptian Mediterranean Coast during autumn

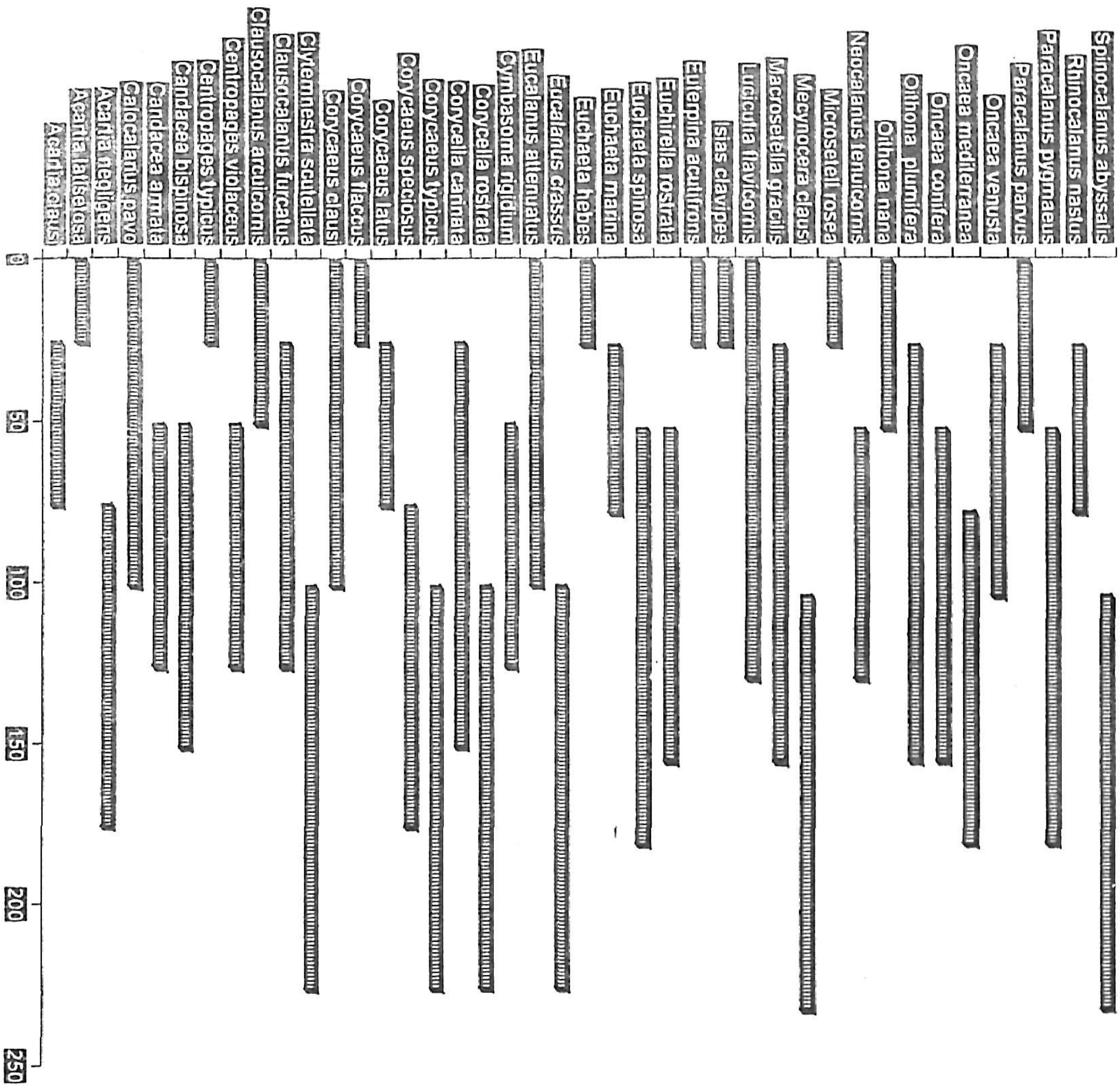


Fig. 3b- Vertical distribution of copepod species off the Egyptian Mediterranean Coast during winter