GENERAL PRELIMINARY CONTRIBUTION TO THE PLANKTON OF EGYPT

By

MOSTAFA SALAH

Institute of Oceanogoaphy and Fisheries, Alexandria, Egypt

and

GIZELLA TAMAS

Biological Research Institute of the Hungarian Academy of Sciences, Tihany, Hungary

I.—INTRODUCTION AND SYNOPSIS

The plankton of Egypt has received little attention (c.f. SALAH 1963). This paper is mainly concerned with the plankton observed in the material examined from the various aquatic habitats (marine-brackish-fresh) in Egypt. The object, has been to fill the gaps and to enlarge the knowledge of this economically important group, as a source of fish production. The collections were made (see map) from the following sources:

1.—Mediterranean Sea

2.—Suez Canal

3.—Bitter Lakes

4.—Gulf of Suez

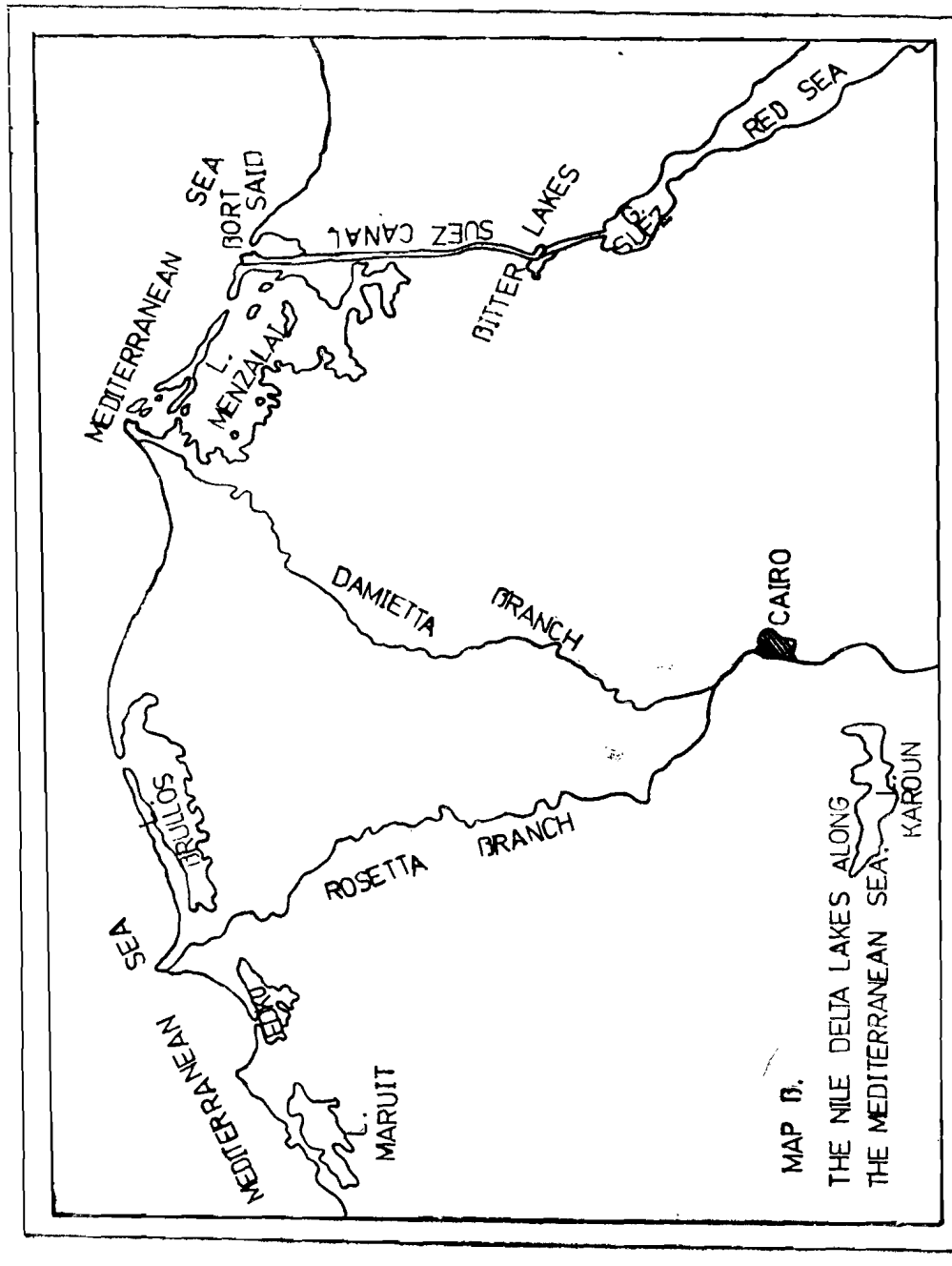
5.—Red Sea

6.—Delta Lakes

7.—Lake Koroun

8.—Nile River

The materials were taken by surface towing and during the trawling and dredging operations throughout the years 1964-65. So, however, the list of species is offered as a general preliminary contribution to the plankton of Egypt, particularty as regards *Flagellates, Bacillariophyceae, Cladocera* and *Copepoda.*


RED SEA
SUEZ
BITTER LAKES
SUEZ CANAL
PORT SAID
SEA
MEDITERRANEAN
L. MENZALAH
DAMIETTA BRANCH
CAIRO
BRULLOS
ROSETTA BRANCH
SEA
MEDITERRANEAN
L. MARUIT
KAROUN
MAP 8.
THE NILE DELTA LAKES ALONG
THE MEDITERRANEAN SEA.

Briefly, the Delta lakes receive Nilewater via the land-drains, and these are connected with the Mediterranean by certain natural openings. Lake Karoun in particular, differs as it is completely isolated from the sea. Salinity varies according to the different localities and seasons, from mostly freshwater to nearly marine. Variation in temperature of water is seasonal; the highest is during summer, while the lowest is in winter. The general characteristics of the Mediterranean and the Red seas resemble more or less those of the temperate and the tropical regions respectively.

It is worthmentioned to repeat here again that the total fauna and flora of the Egyptian Mediterranean is greatly influenced by the Nile (c.f. STEUER 1935; LIEBMANN 1935 and SALAH 1963). Going from about Alexandria province to the East, there is an increasing enrichment caused by the progressive dilution of the sea-water (LIEBMANN 1935). Moreover, the opening of the Suez Canal contributes a remarkable eastern influence to the Mediterranean basin (c.f. also GREEN 1961).

Accordingly, the area investigated shows a large numbers of distinguished species derived from different diverse habitats. besides some interesting new forms. The new species will be published in separate papers (the authors, under preparation., 1967; 1968; 1969).

Terminology: The term plankton refers in this investigation to those forms that can produce and act in the productivity, ICES Symposium, Bergen 1957.

II.—SYSTEMATIC ACCOUNTS

The taxonomic arrangement for the *Bacillariophyceae* and the *Flagellates* is that of HUSTEDT (1927-1959; 1959-1962) and LEBOUR (1925; 1930) except that forms of *Amphora* and *Pleurosigma* are tabulated according to PERAGALLO (1897-1908; 1880-1891). The classification adopted for the *Crustacea* is by G.O. SARS. It is much the simplest, in addition that it furnishes a place for every valid genus.

The appendages of the specimens are dessected and mounted for accurrate determination of the species. Also dimensions refer only to the specimens actually measured in carrying out this work.

1.—Flagellates :

Dinophysis tripos GOURRET. LEBOUR (1925), p. 72, Fig. 22. A tropical warmer water form. KOFOID (1929) descripes this species as sub-tropical neritic extending into the estuaries. It is widely distributed over the entire Mediterranean coast. Mostly of small twin sized specimens about 60 μ, with two points to the hypotheca, the dorsal being shorter. Perennial in the Mediterranean (cf.. LEBOUR 1925).

Dinophysis caudata KENT. LEBOUR (1925), p. 82, Fig. 21 C. Very common among the Mediterranean collections, with length ranges from 60-80 μ and usually of yellowish colouration. KARSTEN (1905) listed *Dinophysis caudata* as a tropical form.

Peridinium cerasus PAULS. LEBOUR (1925). 130, Pl. 27, Fig. 1. Fairly common. Diameter about 40 *u* ,globular with a conspicuous apical horn; girdle oplique, not excavated. Transparent. Very common in the Mediterranean.

Peridinium cinctum EHR. SCHILLER (1937), p. 152. Most common. It evidently grows well in shallow coastal waters where there is some dilution. According to its distribution, it may be descriped as a surface inshore species that can stand considerable diluted waters (SALAH 1963). The investigations show that the growth conditions are stimulated by lower dilutions whereas the rate of division decreases with stronger concentrations (c.f. BRAARUD 1935; BRAARUD and RAPPES 1951).

Ceratium macroceros (EHR.) CLEVE. LEBOUR (1925), p. 155, Pl. 35, Fig. 1. Widespread. Like so many others *Cer. macroceros* shows occasional sings of increase very near to the coast (c.f. also LUCAS 1941) and characteristic of temperate warmer regions. Body with long horn. Epitheca concave and somewhat shorter than hypotheca.

Ceratium furca (EHR.) CLAPAREDE and LACH. LEBOUR (1925), p. 145, Pl. 30, Fig. 3. Widely distributed. Breadth about 42 μ, length about 110 *u*, epitheca narrow and drawn into a larger apical horn. The left horn is longer than the right.

Ceratium massilense (GORRET and KARSTEN) JORG. JORGENSEN (1920), p. 85, Fig. 78. Occurs along the entire coastal shore. Typically anchor-shaped, strongly flattened, breadth about 42 μ, with spines at each angle. Very common in brackishwater habitats.

Ceratium fusus (EHR.) DUJARD. LEBOUR (1925), p. 146, Pl. 31, Fig. 1. Common along the sea-shores. *Cer. fusus* is widely distributed in tropical and subtropical waters, and JORGENSEN (1955) commented on its extreme euryhaline nature. Rather long individuals with about 25 μ, hypotheca narrow; right horn rudimetary.

Ceratium tripos (MULLER) NITZSCH. LEBOUR (1925), p. 148, Pl. 32, Figs. a, b. Tropical and subtropical species. Body broad, epitheca rather fattened and as long as or a little shorter than the hypotheca. Very common in brackishwater (LOHMANN 1908).

Gymnodinium lohmanni PAULSEN. PAULSEN (1908), pp. 99-100. Individuals of this form have been reported along the shores. These forms, on the whole, are probably too delicate as a group to be recorded adequately. Free swimming with broadly ellipsoidal body, rounded at the apices. Medium sized specimens about 14 μ.

2.—Bacillariophyceae :

Melosira granulata (EHR.) RALFS var. *angustissima* MULLER. HUSTEDT, Kieselalg. I, p. 250, Fig. 104 d. Very common in the Nile and contributes to the lakes through the drains. Survives chiefly in comparatively low water salinities, and is frequently found along the sea shore; with 20-25 μ diameter. The occurrence of this form, in particular is a clear indication of the eutrophic status of the original habitat.

Melosira crucipunctata BACHM. BACHMAN (1930), p. 2, Figs. 1, 2, 3. Common among the lake water and survives in slightly brackish water habitat. Valves narrow 12-18 μ diameter.

Melosira jurgensii AG. HUSTEDT, Kieselalg. I, p. 238, Fig. 89. A rather uncommon diatom in the lakes and along the Mediterranean-coast. Valves usually united in short chains. Frustules globose, with slightly flattened end. Dameter about 22 μ.

Podosira montagnei KÜTZ. HUSTEDT, Kieselalg. I, p. 281, Fig. 122. Collected from the Mediterranean shore. Valves discoid with 35-50 μ diameter.

Cyclotella meneghiniana KÜTZ. HUSTEDT, Kieselalg. I, p. 341, Fig. 174. A most cosmopolitan species, present in almost every type of surface water, as it tolerates a wide range of habitats. Valves about 22 μ in diameter with sharp marked ring at the base of the radial straie.

Coscinodiscus excentricus EHR. HUSTEDT, Kieselalg. I, p. 388, Fig. 201. Distributed along the coastal waters. Small sized specimens about 30 μ in diameter. Sculpture hexagonal meshes arranged in slightly curved rows.

Coscinodiscus granii GOUGH. LEBOUR (1930), p. 44, Figs. 20. Always occurred with low frequence but seems to be fairly distributed on the coasts. The determination rests principally on its highly characteristic girdle wiew. Sculpture extremely fine but very distinct, radiating. No central nodule. Diameter 50-60 μ.

Coscinodiscus gigas EHR. PERAGALLO (1897-1908), p. 118, Fig. 3, Distributed fairly along the coasts. Sculpture coarse with large strong meshes and broad margin. Conspicuous central nodule. Cells arranged in star-shaped clusters. Valve diameter about 90 μ. Hexagonal meshes towards the border; meshes become smaller and circular towards centre.

Actinoptychus vulgaris SCHUM. PERAGALLO (1897-1908), p. 410, Pl. 3, Figs. 2, 3. Oceanic, though less frequent over the marine areas. Rare in the brackish surface water. Valve about 42 μ diameter, divided into sectors of the same size, alternately raised and depressed with a hexagonal central space.

Skeletonema costatum (GREV.) CLEVE. HUSTEDT, Kieselalg. I, p. 311, Fig. 149 A. Neritic species, widespread along the coastal areas. Cells delicate 8-10 μ diameter, hyaline attached together by numerous thread like process.

Guinardia flaccida (CASTR.) PERAG. PERAGALLO (1897-1908), p. 559, Pl. 122, Figs. 1-3. An occanic form characteristic of warmer seas and is fairly distributed uniformely over the whole marine areas, yet there is a slight tendency to decrease inwards around the lakes' outlets. *Guinard. flaccida* is unable to bear a large decrease in the salinity, so its occurrence among the lake waters is rather seldom and confined to the extremes. Valve almost flat with diameter about 40 μ. Mediterranean and Red seas (PAULSEN 1912).

Dactyliosolen mediterraneus PER. PERAGALLO (1897-1908), p. 456, Pl. 122, Fig. 6. Prominent and mostly distributed along the Mediterra nean coastal shore. It can stand low salinities. This is shown by its abundant occurrence at the Deltas' lakes. Cells about 12-16 μ diameter, in chain, longer than broad.

Rhizosolenia hebetata (BAIL.) GRAN f. *semispina* (HENSEN) GRAN. HUSTEDT, Kieselalg. I, p. 592, Fig. 338. Observed from the marine habitats. Valves about 6-8 μ diameter and end in a long curved hair-like spine. Tropical ocean form (PAULSEN 1912).

Rhizosolenia alata BRIGHTW. PERAGALLO (1897-1908), p. 466, Pl. 124, Fig. 7. Present in marine and brackish water types. Diameter varies from 12-18 *u*.

Rhizosolenia shrubsolei CLEVE. PERAGALLO (1897-1908), p. 466, Fig. 5. Oblique, pointed with small wings at the base. Valve diameter about 20 *u*. Cosmopolitan and one of the most frequent representatives of the genus. OSTENFELD (1913) classifies the species as oceanic, although it occurs most abundantly near to the shore. Mediterranean and Red seas (PAULSEN 1912).

Rhizosolenia stolterfothii PER. PERAGALLO (1897-1908), p. 460, Pl. 122, Fig. 7. Present sporadically. A typical Mediterranean neritic form. Cells in curved chains, often spiral with 12-16 *u* diameter.

Rhizosolenia calcar avis SCHULTZ. HUSTEDT, Kieselalg. I, p. 592, Fig. 339. Occurred rather irregularly from the marine habitats. A typical neritic and probably carried along by the currents since its occurrence is concurrent with other temperate neritic forms. It also shows that it is able to accommodate to varied salinities. Cells single or in bundles, more regularly curved at the apex with 25-30 *u* diameter.

Rhizosolenia fragillima (BERGON) GRAN. LEBOUR (1930), p. 92, Fig. 65. Frequent. Valves united in short chains with 12 *u* diameter.

Bacteriastrum hyalinum LAUDER. HUSTEDT, Kieselalg. I, p. 615, Fig. 345. Very common. Small sized specimens of about 18 *u* diameter. Terminal bristles have the bifurcations parallel to the chain axis instead of transerve. Characteristic of the Indian Ocean and eastern tropical waters generally (PAVILLARD 1924).

Bacteriastrum delicatulum CLEVE. PERAGALLO (1897-1908), Pl. 136, Fig. 8. Fairly common. Reported both with elliptical and triangular valves, which are extremely delicate; frustules cylindrical about 22 μ in diameter. Mediterranean and Red seas (PAULSEN 1912).

Chaetoceros affinis LAUDER. HUSTEDT, Kieselalg. I, p. 695, Fig. 396. Very widely distributed along the shore surface water. Particularly abundant in the mixed water. Chains straight with the terminal bristles strongly divergent and thick. Valve diameter about 14 *u*.

Chaetoceros didymus EHR. HUSTEDT, Kieselalg. I, p. 688, Fig. 390. Abundant along the coasts. Mostly with rather small sized specimens. Breadth about 14 *u* and with straight chains. This *Chaetoceros* is regarded by LEBOUR (1930) as a characteristic of wrmer seas and typical Mediterranean form. Neritic (PAULSEN 1912).

Chaetoceros curvisetus CLEVE. PERAGALLO (1897-1908), p. 479, Pl. 133, Fig. 5. Numerous. Chain is spirally curved filament, without distinct end valves about 12 *u* broad.

Chaetoceros decipiens CLEVE. PERAGALLO (1897-1908), p. 485, Pl. 130, Figs. 4-8. Occurs in considerable numbers on the sea-shore waters. The size variation within this species is enormous but all with cells arranged in straight chains. It is but little sensitive to changes in the salinity and belongs to the group of species which can penetrate into more or less brackish coastal waters (c.f. GRONTVED 1949). Characteriscic of warm Mediterranean region (Pavillard 1905).

Chaetoceros lauderi RALFS. PERAGALLO (1897–1908), p. 481, Pl. 132, Fig. 3. Individuals with somewhat twisted chains are dominant and 12-18 *u* diameter. Especially characteristic of the brackishwater habitats. Mediterranean-Neritic (PAVILLARD 1905).

Climacodium biconcavum CLEVE. LEBOUR (1930), p. 189, Fig. 149 b. Most frequent. Valves straight and flat, easily controlled, about 35 *u* broad.

Hemiaulus heibergii CLEVE. PERAGALLO (1897-1908), p. 392, Pl. 94, Figs. 3, 5. Frequent with a wide range of distribution. Merely tropical. Valves elliptical single or in chains with breadth about 28 *u*.

Lithodesmium undulatum EHR. HUSTEDT, Kieselalg. I, p. 789, Fig. 461. Valves three-corned with undulating margins 35-40 *u* broad. Rather distributed along the coasts. Littoral.

Ditylum brightwellii (WEST) GRUN. HUSTEDT, Kieselalg. I, p. 784, Fig. 459 a. Common, but small sized specimens only. Individuals single or in short chains. With regard to distribution, *Dit. brightwellii* is very similar to *Dit. intricatum*, both are neritic, but as a rule less numerous among the plankton. The transverse diameter not exceeding 25 *u*. The valve is furnished with stronlgy siliceous straight hollow spines and a marginal strenghthened by ribs.

Ditylum intricatum (WEST) BRUN. PERAGALLO (1897-1908), p. 395, Pl. 96, Fig. 415. It thrives fairly well in the freshwater habitats and occurs constantly along the coastal shore. Individuals solitary or united in short chains by the spines. The transverse diameter about 48 *u*. Temperate neritic Meditern ranean (PAULSEN 1912).

Triceratium (*Biddulphia*) *alternans* (BAIL.) GRUN. ex. V.H. HUSTEDT, Kieselalg. I, p. 825, Fig. 488. This neritic form is very common and widely distributed. Frustules frequently in pairs. Valves triangular, sides slightly convex at the middle with diameter 40-60 *u*. The angles are broadly rounded and cut off by a broad band of coarse reticulation and a narrow band of finer reticulation. Surface with puncta of irregular shape, larger at the centre and diminishing towards the apices of the angles.

Biddulphia mobiliensis BAIL. HUSTEDT, Kieselalg. I, p. 840, Fig. 495; LEBOUR (1930), p. 174, Fig. 134. The species forms a significant part of the diatom plankton. Clearly distinguished by its two large bristles placed equally far from the processes and directed obliquely outwards. Valves with breadth 24-30 *u*, single or in short chains, elliptical lanceolate. Mediterran ean and true neritic (PAULSEN 1912).

Biddulphia rhombus (EHR.) W. SMITH. HUSTEDT, Kieselalg. I, p. 842, Figs. 496-497; LEBOUR (1930), p. 178, Fig. 138. Fairly distributed along the coastal shore as one of the most characteristic species of the plankton. Purely neritic, with diameter 40-60 *u*. Valve outline orbicular-rhomoboidal, strongly sculpture, with small thorns over the surface and few sttronger spines in the neighbourhood of the margins. Processes small, short and obtuse.

Biddulphia aurita (LYNGB.) BRÉBISSON and GODEY. HUUTEDT, Kieselalg. I, p. 846, Fig. 501. Abundant all over the whole shores. Breadth of valve 25-40 *u*, with usually two spines. Valves united in straight or zigzag chains by the mucous threads of the processes. This neritic species is common in the plankton of all temperate seas (HENDEY 1958).

Biddulphia obtusa (KUTZ.) RALFS. BOYER (1926-1927), Pl. 127, p. 123; LEBOUR (1930), p. 179, Fig. 139. This species has a general distribution especially in parts with fairly low salinity. Frustules united in zigzag chains by cushions of mucous. Very near *Bidd. aurita*, from which it is chiefly distinguished by the absence of central spines and by the shortness of the processes.

Biddulphia favus (EHR.) V.H. LEBOUR (1930), p. 180, Fig. 140. Widely distributed along the Mediterranean area. Valve outline with three sharp corners, with slightly concave or convex sides. Zonal view quadrangular. Common in the triangular form.

Biddulphia vesiculosa (AG.) BOYER. LEBOUR (1930), p. 181. Fairly common. Though it is known as a marine form, it is capable to accomodate itself in varied salinities and has been collected from different habitats along the coastal shore. Diameter of valve about 50 *u* with rounded four corners and more or less concave sides.

Asterionella japonica CLEVE and MOLLER. HUSTEDT, Kieselalg. 2, p. 254, Fig. 734. Of greater abundance along the Mediterranean coast. GRAN (1905), LUCAS (1941) and GRONTVED (1952) characterised *Aster. japonica* as being temparate-atlantic neritic. Its regular occurrence along the shores may be explained by the fact it belongs in the group of temperate plankton species. Colonies arranged in star-shaped clusters with breadth 45-60 *u*.

Rhabdonema adriaticum KUTZ. HUSTEDT, Kieselalg. 2, p. 23, Fig. 552. One of the most important plankton diatoms. Less noticeable in slightly low salinity. Valves usually small sizes, not exceeding 36 *u*. United to form flat, ribbon-like bands.

Climacosphenia elongata BAIL. PERAGALLO (1897-1908), p. 352, Pl. 86, Figs. 1-4. Widespread and prominent among the plankton of the Mediterranean.

Grammatophora marina (LYNGB.) KUTZ. HUSTEDT, Kieselalg. 2, p. 43, Fig. 569. Generally distributed. It occurs in typically long chains with very fine striae.

Grammatophora angulosa EHR. HUSTEDT, Kieselalg. 2, p. 39, Fig. 564. Common. Length of valve about 40 *u*, linear-lanceolate. Cells colonial rectangular in girdle view with transverse striae.

Licmophora gracilis (Ehr.) GRUN. var. *anglica* (KUTZ.) PER. HUSTEDT, Kieselalg. 2, p. 60, Fig. 583. This neritic form is found occasionally either solitary or chain forming cells. Valves club-shaped with length about 40 *u*, at one (the lower) narrow and end pointed, at the upper end broader, usually rounded, with a middle distinct pseudoraphe. Striae fine, perpendicular 20-24 in 10 *u*, with a well-marked pseudoraphe.

Synedra ulna (NITZSCH) EHR. HUSTEDT, Kieselalg. 2, p. 195, Fig. 691 a. Abundant at the lakes. Valves linear-lanceolate with variable ends, but mostly more or less rounded and pointed. Transverse striae coarse about 10, very finely punctate. Pseudoraphe narrow.

Synedra tabulata (AG.) KUTZ. HUSTEDT, Kieselalg. 2, p. 218, Figs. 710 a-d. Recorded at all habitats along the Mediterranean shore. Valves lanceolate and gradually tapering towards the apices, sometimes with blunt ends. Transverse striae are very short and arranged on the border 10 in 10 *u*. Pseudoraphe forms a large lanceolate space. *Syn. tabulata* is regarded by the limnologists (c.f. ROUND and BROOK 1959; HUBER-PESTALOZZI 1942) as a typical planktonic diatom characteristic of eutrophic lakes.

Thalassionema nitzschioides GRUN. HUSTEDT, Kieselalg. 2, p. 244, Fig. 725. Distributed along the sea-shores. Valves united in star-like or zigzag chain, slightly curved. Length very variable from 16-24 *u*, breadth 3-5 *u*. Neritic (PAVILLARD 1905) Mediterranean and Red seas.

Cocconeis placentula EHR. var. *euglypta* (EHR.) CLEVE. HUSTEDT, Kieselalg. 2, p. 349, Fig. 802 c. Fresh and brackishwater of general distribution, almost everywhere. It tolerates a wide range of habitats and not sharply restricted to certain region. Easily recognised by the raphae of the upper valve crossed by four to five longitudinal blank bands.

Rhoicosphenia curvata (KUTZ.) GRUN. HUSTEDT, Kieselalg. 2, p. 430, Fig. 879. Very common and is not restricted as sregards to habitat. It shows a wide range of distribution. Length of valve about 14-16 *u* with 20 striae in 10 *u*.

Mastogloia braunii GRUN. PERAGALLO (1897-1908), p. 33, Pl. 6, Figs. 6, 9. This beautiful species is characterised by the slightly undulating lines of puncta and the small marginal loculi. Length 45 *u*, breadth 16 *u*. Mainly estuarine, and stands high salinities.

Mastogloia elliptica (A.G.) CLEVE. HUSTEDT, Kieselalg. 2, p. 501, Fig. 927 a. The elliptic oblong valves with rostrate apices, are furnished with marginal loculi that extend almost the whole length of the margin. Those in the middle being longer than the others. Axial area very narrow or absent, central nodule small, circular. Length 48 u, breadth 64 u.

Mastogloia exigua LEWIS. HUSTEDT, Kieselalg. 2, p. 569, Fig. 1003. Observed irregularly from the brackishwater habitats. Loculi few 2 to 6 in the middle of each margin, with somewhat rounded interior edges.

Mastogloia pumila (GRUN). CLEVE. HUSTEDT, Kieselalg. 2, p. 553, Fig. 983 Recorded occasionally along the Mediterranean collections. Charaterized by the broadly elliptical valves with strongly marked raphe which hooked in the same direction at both apices, and the uniform marginal band of loculi. The size varies, but mostly in the range of 55 u lenght, and the breadth about 30 u. Loculi 6-8 on each side, of unequal size, the median being largest.

Diploneis pseudovalis HUSTEDT. HUSTEDT, Kieselalg. 2, p. 668, Fig. 1063 c. Spread over the Mediterranean shore. The fact that it occurs in different water masses indicates that it possesses great ecological amplitude. Costae rather fine and alternate with a double rows of alveoli.

Diploneis aestuarii HUSTEDT. HUSTEDT (1939), p. 612, Figs. 41, 42. This aestuarine *Diploneis* is, however, fairly widespread as a regular member of the local plankton. It is observed along the different habitats especially around the lakes' outlets. The specimens are always under the size usually given for this species varying from 22-26 u in length. Costae crossed by longifudinal lines.

Navicula cryptocephala KUTZ. var *intermedia* GRUN. HUSTEDT (1930), p. 295, Fig. 497 b. A typical freshwater form that can survive in brackish water. Valves usually small and minute with scarcely capitate apices. Striae 18 in 10 u, radiate and slightly convergent towards the apices, finely lineat. Length about 24 u, breadth 8 u.

Navicula humerosa BREB . var *minor* HEIDEN. HEIDEN in A. SCH. Atlas, Pl. 243, Fig. 7. Mainly estuarine. Easily recognized by the strong and distinctly ribs together with the slightly constricted frustules in girlde view. Very variable in the coarseness and direction of the striae. Length about 45 u, breadth 26 u.

Navicula lyra EHR. var. *altanica* SCHUM. CLEVE (1895), p. 63; PERAGALLO (1897-1908), p. 134, pl. 22, Fig. 14, Sporadic. Valves elliptic-lanceolate with produced rostrate-apiculate apices. Valve surface striate. Striae very punctate 16 in 10 u, slightly radiate and interrupted by lateral hyaline areas extending from the central part; lateral areas usually curved, lyre-shaped. Length about 62 u, breadth 24 u. According to HENDEY (1958), *Nav. lyra* is widely distributed in temperate and tropical seas.

Navicula pygmaea KUTZ. HUSTEDT (1930), p. 312, Fig. 561. Brackishwater with a wide range of distribution at various habitats. This species are of small sizes (28 u) with fine striae. Valve siliceous hyaline, elliptical. Lateral areas convergent and constricted in the middle.

Gyrosigma distortum (W. Sm) Cleve. Hustedt (1930), p. 224, Fig. 334. The occurrence of this species is in the main limited to certain localities. The ends of the sigmoid frustules are abruptly bent in opposite directions. The specimens recorded are usually less protracted than those described and very finely striated.

Gyrosigma spencerii (W. Sm) Cleve. Hustedt (1930), p. 225, Fig. 336. Characteristic of the diverse habitats along the Mediterranean shore. Valve sigmoid. Raphe somewhat flexuose, striae punctate. Transverse and longitudinal striae equidistant.

Gyrosigma kutsingii (Grun) Cleve. Hustedt (1930), p. 224, Fig. 333. Recorded at various habitats. Mainly estuarine. Rhombic-lanceolate valve with gentle sigmoid lines towards acute apices. Striae are equidistant with the transverse striae 24 in 10 u.

Pleurosigma minutum Grun. Peragallo (1897-1908), p. 164, pl. 33, Fig. 11. Spread all over the shores. Valves with slightly protracted acute apices. Median line flexuose.

Pleurosigma aestuarii (Breb). SM. Cleve (1894), p. 2 ;Peragallo (1897-1908), p. 164, pl 33, Fig. 9. Estuarine form. It is able to accommodate to varied salinities and to occur in different habitats. Valves lanceolate with slightly rostrate apices and sigmoid raphe. Transverse and oblique striae equidistinct, 22 in 10 u.

Amphiprora paludosa Sm. var. *duplex* Donk. Peragallo (1897 - 1908), p. 184, pl. 38, Figs. 12-20. Sparsely along the shores. Median line slightly sigmoid. Frustules weakly siliceous with rounded apices. Raphe strongly sigmoid. Very finely striae. Striae about 30 in 10 u. Lenght about 22 u.

Tropidoneis lepidoptera (Greg). Cleve. Cleve (1894), P. 25; Peragallo (1897-1908), p. 188, pl. 39, Figs. 3, 7. Present on the shore in relatively small numbers. Valves linear-lanceolate with acute apices. Central area often indistinct. Keel unilateral, projecting above the median line, somewhat tilted over.

Amphora ovalis Kutz. Hustedt (1930), p. 343, Fig. 628. One of the most dominant form in the freshwater habitats. As the salinity becomes higher, however, the species decreases in occurrence.

Amphora coffeaeformis Ag. Hustedt (1930) p. 345 Fig. 634. A brackish water form. It tolerates a wide range of salinity and occurs along the entire shores. Frustules elliptic-lanceolate. Striae 24 in 10 u. Length about 12 u.

Amphora turgida (Greg). Gregory (1857) p. 510 Fig. 63; *Peragallo* (1897-1908) p. 231 pl. 50 Fig. 33. More or less frequent in the mixed waters. Frustules with rostrate apices, distinctly striated. Length about 18 u breadth 8 u.

Amphora elegans Per. Peragallo (1897-1908) p. 223 pl. 49 Fig. 29. Sporadic and present on the sea shores in relatively small numbers.

Amphora marina Sm. Peragallo (1897-1908) p. 200 pl. 44 Figs. 15-17. Occurs sporadically in the plankton. Generally minute specimens are found on the shores with length about 60 u, breadth 12 u. Striae 12 in 10 u.

Nitzschia tryblionella Grun. Hustedt (1930) p. 399 Fig. 757. Few. Valves broadly rectangular, slightly constricted in the middle, with cuneate apices. Longitudinal fold almost central. Valve surface striate, striae almost straight or only a little curved towards the apices. Length about 32 μ, breadth 14 μ.

Nitzschia closerium (Ehr) Sm Hustedt (1930), p. 424, Fig. 822. A cosomopolitan species. Valve solitary, very finely striate 28 in 10 μ. Lenght of valve about 45 μ . Freely movable, with hair-like bent ends, usually slightly curved in a semicircle.

Nitzschia microcephala Grun Peragallo (1897-1908), p. 206, pl. 73, Figs. 23, 24. One of the dominant plankton form in the Delta lakes, but confined in relatively smaller frequencies along the Mediterranean coast.

Nitsschia sigma (Kutz) Sm Hustedt (1930), p. 420, Fig. 813. Fairly common with a wide range of distribution at different types of habitats. Valves sigmoid with acute apices. Keel distinct, puncta 9 in 10 μ.

Nitzschia flexa Schum. Hustdt (1930), p. 420, Fig. 812 Found in the Delta lakes and is doubtless carried into the Mediterranean by currents.

Nitzschia longissima Breb. Peragallo (1897-1908), p. 293, pl. 84, Fig. 20. Frequently encountered along the Mediterranean shore. Small sized specimens fairly striate with length about 56 μ. Keel puncta 8 in 10. u.

Nitzschia seriata Cleve, Peragallo (1897-1908), p. 290, pl. 84, Figs. 4, 6. Very important element among the plankton as it has a wide range of distribution. *Nitzsch. seriata* is known to thrive in quantity along the coastal waters (c.f. Gran and Braarud 1935; Braarud and others 1953). Valves united at the ends in long hair like chains; spindle-shaped with rounded apices about 40 μ long and 6 μ broad. Neritic (Paulsen 1912).

Nitzschia bilobata Sm. var. *minor* Grun. Peragallo (1897-1908), p. 273, pl. 70, Fig. Recorded extensively along the Mediterranean shore. Linear-lanceolate, constricted in the middle. Marginal keel prominent. Striae 20 in 10 u.

Nitzschia obtusa SM var. *scalpelliformis* Grun. Hustedt (1930), p. 422, Fig. 817 d. Common at the Delta lakes.

Epithemia sorex Kutz. Hustedt (1930), p. 388, Fig. 736. Almost a fresh water form with a limited range of distribution in the lakes. Oligohalobous.

Cymatopleura solea (Breb) Sm. Hustedt (1930), p. 425, Fig. 823. Absolutely fresh and sensitive to slight rise in salinity. Recorded only from the lakes. Otherwise, it is rarely detected but with rather dead or recently dead frustules. Oligohalobous.

Surirella striatula TURP. HUSTEDT (1930), p. 445, Fig. 869. Frequent along the shores. FOGED (1948) regards *Sur. striatula* as a marine or brackishwater form.

Surirella gemma EHR. HEURCK (1980-1885), pl. 74, Figs. 1-3 : PERAGALLO (1897-1908), p. 254, pl. 68, Fig. 4. Rarely recorded. Valve outline elliptic-ovate with the broader apex not bluntly rounded, but slightly produced, giving a cuneiform appearance. Length about 45 μ, breadth 32 μ.

Campylodiscus daemalianus GRUN PERAGALLO (1897-1908), p. 238, pl. 52, Fig. 6. Encountered intermittently from the lakes and at various localities along the Mediterranean coast. Valves orbicular, bearing radial costae which appear double near the margin for about half the length, thereafter single. Between the main costae are several shorter lines, usually 3-or 4. The apical area may be hyaline. Diameter about 70 μ.

Campylodiscus parvulus BREB PERAGALLO (1897-1908), p. 242, pl. 54, Fig. 9. This well known freshwater diatom, is occasionally found along the Mediterranean samples. *Campylod. parvulus* is characterized by the almost circular valve, and the narrow costae, without central differentiated area. Diameter about 60μ.

3.—Cladocera :

Fam. *Sididae*

gen. *Diaphanosoma* FISCHER

Diaphanosoma excisum SARS. SARS (1885), p. 13, pl. 2. Female : carapace oblong, truncate posteorly; body rather elongate, with height and breadth about equal. Total lenght about 0.6 mm. Recorded in somewhat large numbers, mostly with shorter antennae.

Fam. *Daphnidae*

gen. *Daphnia* MULLER

Daphnia longispina MULLER var. *hyalina* LEYDIG. RYLOV (1953), Dis Binnengewässer 15; SARS (1903), p. 164, 167, pl. 4, Fig. 2. Antennules slightly curved, with about ten notches on the distal part; lateral spines on the terminal claws four-five. Parthenogenetic females and ephippial females and males. Common.

Daphnia barbata WELTNER. WELTNER (1898); OCIOSZYNSK WOLSKA (1935). p. 145, pl. 24, Figs. 16-18. This daphnid is the chief component of the Cladoceran. Specimens included males and ephippial females, mostly with small sizes.

Daphnia lumholtzii SARS. SARS (1885), p. 18, pl. 1, Figs. 1-10. Female : ephippium with an armed rod with a double row of small posteriorly directed denticles; large spine jutting forth posteriorly from the carapace. Total lenght about 0.8mm. Male : head somewhat depressed, spine of carapace comparatively short, and margin slightly incurved and with very few denticles. Distinguished by the ephippium and the remarkably long and distant marginal denticles of the valve.

gen. *Ceriodaphnia* SCHOEDELER

Ceriodaphnia dubia RICHARD. SARS (1916), p. 317, pl. 34, Figs. 1,1 a, b. Female : eye comparatively large, anal denticles about ten on each side, the outermost one smaller than the others; apical claws without any secondary denticles. Total lenght about 0.4 mm.

Ceriodaphnia cornuta SARS. SARS (1885), p. 26, Figs, 1, 3, pl. 5. Female : head much depressed, body pellucid. Total length about 0.35 mm. Few small specimens both with and without horns, were recorded.

Ceriodaphnia rigaudi RICHARD. SARS (1916), p. 319, pl. 34, Figs 3, 3 a, b. Female : body semipellucid, carapace nearly rounded, anal denticles rather thin, six to eight on each side ; apical claws smooth. Total length about 0.3 mm. Recognized by the acuminate beak projection from the head.

gen. *Moina* BAIRD.

Moina dubia GUERNE and RICHARD. SARS (1916), p. 322, pl. 35, Figs. 4, 4 a, b. Female : body slightly pellucid, carapace comparatively small ; antennulae of moderate size and densely ciliated behind; anal denticles only seven on each side. Total lenght 0.4 mm. Parthenogenetic females only. A specific species characteristic of a high water salinity.

Fam. *Lyncodaphnidaae*

gen, *Macrothrix* BAIRD.

Macrothrix spinosa KINGS. SARS (1888), p. 25, pl. 3; SARS (1916), p. 326, pl. 36, Figs. 3, a, b. Female: body rather pellucid, antennulae strapshaped, slightly curved with about six notches along the anterior edge, each with a tuft of very minute hair, those of male much larger, anteriorly with a ciliated seta at some distance from the base; tail armed with a single row of strong denticles. Total length about 0.35 mm. Male : much smaller and the carapace somewhat narrower, the antennulae much larger and less curved.

Fam. *Bosminidae*

gen. *Bosmina* BAIRD.

Bosmina longirostris MULLER. LEYDIG (1860), p. 205, Pl. 8. Famale : the antennulae are slightly curved with about ten notches on the distal part; lateral spines on the terminal claws are four-five Total length about 0.2 mm. Generally distributed and rather common.

4.—Copepoda :

Sub-order *Calanoida*

Fam. *Calanidae*

gen. *Calanus* LEACH, 1816.

Calanus minor CLAUS. GIESBRECHT and SCHMEIL (1898), Das Tierreich, Lief. 6, Copepoda, p. 15. Female : Head fused with the first segment; inner margin of

the first basipod of the fifth legs with a straight edge, and more coarsely toothed. Total length about 1.5 mm. Male : a little smaller; the terminal segments of the right fifth exopod with only two inner setae and a short terminal spine. Fairly well distributed

gen. *Undinula* SCOTT, 1909.

Uundinula vulgaris DANA. SCOTT (1909), Sibboga—Expeditie, 29 a, Copepoda, Pl. I, p. 16. Female : fifth segment with pointed posterior corners turned ventrally; inner margin of fifth basipods armed with setae. Total length around 1.5 mm. Male : right fifth leg very short, endopod three-segmented, without setae and tipped with two spines; left fifth leg with an endopod. Rather common.

Fam. *Eucalanidae*

gen. *Eucalanus* DANA, 1853.

Eucalanus attenuatus DANA. GIESBRECHT and SCHMEIL (1898), Das Tierreich, Lief. 6, Copepoda, p. 20. Female : head triangular with an indentation on either side of the frontal margin; fifth segment rounded at the posterior corners. Male : head triangular, without the marginal identation. Recorded in limited numbers.

Fam. *Paracalanidae*

gen. *Paracalanus* BOECK, 1864.

Paracalanus parvus CLAUS. SARS (1901), Crustacea of Norway, Vol. 4, p. 17, Pls. 8, 9. Female : body short and stout; fifth legs uniramose, two-segmented, inner terminal seta as long as the distal segment. Total length about 0.5 mm. Male : head thickened; fifth legs uniramose, right one two-segmented, left one five-segmented. Well distributed among the brackish and marine habitats.

gen. *Calocalanus* GIESBRECHT, 1888.

Calocalanus pavo DANA. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 185, Pls. 1, 4, 9, 36. Female : fifth legs four-semgented, the terminal segments with four or five plumose setae. Total length about 0.5 mm. Male : right fifth leg four-segmented.

Calocalanus plumosus CLAUS. GIESBRECHT and SCHMEIL (1898), Das Tierreich, Lief. 6, Copepoda, p. 26. Female : segmentation indistinct; fifth legs much longer than in the preceding species, each four-segmented, end segment tipped with a single long plumose seta and three spines, both margins heavily fringed with long hairs. Recorded in limited numbers.

Fam. *Pseudocalanidae*

gen. *Clausocalanus* GIESBRECHT, 1888.

Clausocalanus arcuicornis DANA. GIESBRECHT and SCHMEIL (1898), Das Tierreich, Lief. 6, Copepoda, p. 27. Female : body elliptical in outline, genital segment

longer; caudal rami as wide as long, each with four setae of about equal length. Total length about 0.9 mm. Male : body oval in outline; setae of caudal rami more unequal in length, the second inner one the largest.

gen. *Pseudocalanus* BOECK, 1872.

Pseudocalanus minutus KROYER. KROYER (1842), Vol. 3, Pl. 4, Copepoda I, p. 57, Pl. 1, Fig. 8; WILSON (1932), p. 43, Fig. 25. Female : anterior body elongate-elliptical in outline; genital segment enlarged and projecting ventrally; fifth legs entirely lacking. Total length about 0.8 mm. Male : much smaller; fifth legs uniramose, asymmetrical, left leg five-segmented. Occasionally quite frequent.

Fam. *Euchaetidae*

gen. *Euchaeta* PHILLIPPI, 1843.

Euchaeta marina PRESTANDREA. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 245, Pls. 1, 15, 16. Female : a pointed knob projecting forward just above the base of the rostrum; basipods and rami of fourth legs smooth. Total length 0.9 mm. Male : body more slender; exopods of fifth legs ending in long stylet-shaped processes. Characterized by the pointed process on the forehead, by the asymmetry of the genital segment in the female, and by the form of the fifth legs in the male. It frequents tropical and temperate regions.

Fam. *Centropagidae*

gen. *Centropages* KROYER, 1848.

Centropages typicus KROYER. SARS (1903), Crustacea of Norway, Vol. 4, p. 75, Pls. 49-51. Female : metasome flattened; genital segment asymmetrical, with four stiff spines. Total length 0.8 mm. Male : body more slender; chela of right fifth leg very powerful and overlapping the caudal rami and both rami sharply pointed and curved inward towards each other at the tip. Recognized by the rostral spikes, the urosome in the female and by the conspicuous dentiform projections on the anterior antennae.

Fam. *Diaptomidae*

gen *Diaptomus* WESTWOOD. 1836.

Diaptomus salinus DADAY. DADAY (1909), p. 13 : SARS (1903), Crustacea of of Norway, p. 208, pl. 13, Figs. 2, a-f. The first abdominal segment is very short and slightly asymmetrical, the spine on the left side being longer than that on the right. Fairly well distributed in lake Karoun.

gen. *Thermodiaptomus* KIEFER, 1934.

Thermodiaptomus syngenes KIEFER. KIEFER (1934), p. 150, Figs. 59-94. Confined mainly to the freshwater habitats and sparsely recorded from the Delta-Lakes.

Fam. *Temorida*

gen. *Temora* BAIRD, 1885.

Temora stylifera DANA. GIESBRECHT (1892). Fauna und Flora des Golfes von Heapel, Vol. 19, p. 328, pls. 5, 17, 38. Female : the inner spine of the end segment of the fifth legs is much longer than the two apical spines,which are about equal in size. Male : spines at posterior corners of fifth segment straight and reaching eqhind the posterior margin of the genital segment. Total length about 0.8 mm. The sharp-pointed triangular process at the corners of the fifth segment, combined with the elongate and slender caudal rami, are the distinguishing characters of this species.

Fam. *Metridiidae*

gen. *Metridia* BOECK, 1864.

Metridia lucens BOECK. SARS (1903), Crustacea of Norway, Vol. 4, p. 113, pl. 77. Female : posterior corners of fifth segment angular, but without spines; end segment of fifth legs with three apical setae and a small spine on the outer margin; the inner apical setae is longest and the outer one shortest, all sparesely plumose. Male : left fifth leg a little shorter than the right five-segmented, the second segment with an inner fringe of hairs, spiniform process on inner margin of third segment of right fifth leg denticulate distally. Total length 0.8 mm. Limited in distribution.

Fam. *Pontellidae*

gen. *Labidocera* LUBBOCK, 1853.

Labidocera acutifrons DANA. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 445, pls. 33-41. Female: forehead with a crest; right fifth leg larger than left, endopods stout conical spines, exopods three times as long as endopods, each ending in three stout divergent spines. Total lenght about 0.9 mm. Male : body longer and more slender; left fifth leg with a one-segmented endopod half as long as the two-segmented exopod and tipped with a curved filament; chela of right leg much swollen at the knuckle, the finger with a wide and angular flap on its inner surface. The extraordinary asymmetry of the female and the details of the fifth legs in both sexes are distinguishing characters.

gen. *Pontellina* DANA, 1853.

Pontellina plumata Dana. Giesbrecht (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 497, Pls . 25–40. Female: endopod of fifth legs less than half as long as exopod and ending in two acute aqual processes. Total length about 0.86 mm. Male : fifth legs each four-segmented, the left one tipped with four slender spines of equal length. Recognized by the comparative width of the body, the symmetry of the fifth segment and the urosome, and the details of the fifth legs in both sexes.

Fam. *Acartiidae*

gen. *Acartia Dana*, 1846.

Acartia latisetosa Kricz. Sars (1903), Crustacea of Norway, Vol. 4, p. 150, Pl. 99. Female: body oblong fusiform, last pair of legs with the terminal joint exserted to a slender setiform point and curved in the middle. Total length about 0.6 mm. Male: smaller, recognized by the structure of the anterior antennae and urosome; last pair of legs, 2nd and 3rd joints of right leg each expanded inside into a rounded lamellar projection. Occasionally quite frequent.

Acartia claussii Giesbrecht . Sars (1903), Crustacea of Norway, Vol. 4, p. 150, Pl. 101. Female: end segment of fifth legs short and stout, swollen at its base and acute distally, where it is armed with a fringe of short hairs along the outer margin, but without teeth. Total length around one millimetre. Male: body shorter and narrower; end segment of right fifth leg narrow, strongly curved and armed with three or four small spines along its outer margin. This form shows ability for adaptation to differing degrees of salinity and occurs in brackish water habitats.

Acartia longiremis Lilljeborg. Lilljeborg (1853), De Crustaceis ex-ordinis tribus; Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 181, Pl. 24, Figs. 1–15; *Sars* (1903), Crustacea of Norway, Vol. 4, p. 149, Pls. 99, 100. This species is not confined to the Mediterranean but occured occasionally from the Delta-Lakes.

Sub-order *Harpacticoida*

Fam. *Longipediidae*

gen. *Longipedia Claus*, 1863.

Longipedia coronata CLAUS SARS (1903), Crustacea of Norway, Vol. 5, p. 10, Pls. 3, 4. Female: distal segment of fifth legs with transverse rows of slender spinules on the anterior surface near its base. Total length about 0.8 mm. Male: smaller; distal segment of fifth legs armed with seven slender setae, without the terminal spine. Recognized by the elongated second endopods and the peculiar form of the fifth legs.

gen. *Canuella Scott*, 1893.

Canuella perflexa Scott (1903), Crustacea of Norway, Vol. 5, p. 17, Pls. 8, 9. Female: body uniform width throughout, last pair of legs extremely minute, each forming a thin plate edged with four setae, distinctly plumous. Total length about 0.4 mm. Limited in distribution.

Fam. *Ectinosomidae*

gen. *Ectinosoma Boeck*, 1864.

Ectinosoma melaniceps BOECK SARS (1904), Crustacea of Norway, Vol. 5, p. 34, Pl. 21, Fig. 1. Female: body fusiform; last pair of legs of moderate size,

distal joint with the apical spines slender, setiform. Total length about 0.2 mm. Characterized by the last pair of legs, exhibit several structural peculiarities. Fairly well distributed among the brackish water habitats.

gen. *Microsetella* BRADY and ROBERTSON, 1873.

Microsetella norvegica BOECK. SARS (1904), Crustacea of Norway, Vol. 5, p. 44, pl. 24. Female: body almost linear and strongly compressed. Inner expansion of basal segment of fifth leg reaching tip of distal segment, its outer seta twice the length of the inner one. Male: smaller; fifth legs like those of the female. Total length about 0.2 mm. Distinguished by its minute size and the laterally compressed body. Moderately abundant.

Fam. *Harpacticidae*

gen. *Harpacticus* EDWARDS, 1838.

Harpacticus gracilis CLAUS. SARS (1904), Crustacea of Norway, Vol. 5, p. 52, Pl. 30, Fig. 1. Female: body somewhat depressed; inner expansion of basal segment of fifth legs with four denticulate setae, the inner one not reduced in size, distal segment oblong, its outer margin with a continuous fring of cilia, its inner margin with scattered hairs. Total length about 0.3 mm. Male: slightly longer; fifth legs very small, distal segment club-shaped, the three outer setae spiniform. Common in brackish and saltwater habitats.

gen. *Microthalestris* SARS, 1905.

Microthalestris forficula CLAUS. SARS (1905), Crustacea of Norway, Vol. 5, p. 123, Pl. 76. Female: body narrow and elongated; inner expansion of fifth legs scarcely reaching the basal quarter of the distal segment, with five setae closely juxtaposed. Total length about 0.2 mm. Male: smaller; fifth legs much reduced in size, inner expansion of basal segment narrow-triangular, with two small setae. Characterized by its small size, by the very long and slender two-segmented endopod of the first leg. Limited in distribution.

Fam. *Macrosetellidae*

gen. *Macrosetella* SCOTT, 1909.

Macrosetella gracilis DANA. GIESBRECHT (1892), Fauna und Elora des Golfes von Neapel, Vol. 19, p. 559, Pls. 1, 45. Female: first antennae very strong reaching the genital segment; basal expansion of fifth legs with four apical setae, the second inner one plumose and more than twice the length of the others, which are smooth. Total length about 0.7 mm. Male: basal expansion of fifth legs very short and tipped with two setae. Recognized by the very long first antennae and apical caudal setae, the latter longer than the body itself. Moderately abundant along the Mediterranean coast.

Fam. *Tachidiidae*

gen. *Tachidius* LILLJEBORG, 1853.

Tachidius littoralis POPPE (1881), Abh. Nat. Ver. Bremen, Vol. 7, pt. 2, p. 149, Pl. 6 ; WILSON (1932), p. 294, Fig. 180. Female: body slender; fifth leg a one-segmented lamina, curved inward at its tip, and armed with four plumose setae, the outer one the longest. Total length about 0.5 mm. Male: slightly smaller; fifth legs each reduced to a short lamina fused with the ventral surface of the fifth segment. Brackishwater species living close to the shore and in the brackish water lakes; characterized by the deep cut in the basal segment of the first antennae and the structure of the fifth legs.

Fam. *Metidae*

gen. *Metis* PHILLIPI, 1843.

Metis jousseaumei RICHARD. RICHARD. (1892), Bull. Soc. Zool. France, Vol. 17, p. 69. Female: cephalic segment about half the length of the body; fifth legs fused across the midline into a single lamina, with a shallow median apical sinus. Total length about 0.2 mm. Male : smaller and less swollen; the fifth legs are fused into a lamina shaped like the letter U., each branch tipped with two stout and short spines, curved outward. Able to adapt itself to any salinity (WILSON 1932).

Sub-order *Cyclopoida*

Fam. *Oithonidae*

gen. *Oithona* BAIRD, 1843.

Oithona plumifera BAIRD. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 537., Pls. 3, 34, 44. Female: rostrum turned downward, the setae on the sides of the fifth metasome segment, project at right angles to the body axis. Total length 0.5 mm. Male: rostrum lacking; end segment of first and fourth exopods with two spines. Recognized by the long plumose setae; chiefly tropical.

Oithona similis CLAUS. SARS (1913), Crustacea of Norway, Vol. 6, pp. 8, 207, Pl. 3. Female: body moderately slender, rostrum turned dounwards. Total length about 0.6 mm. Male: rostrum entirely lacking ; end segments of the first four exopodes each with two outer margin spines. Distinguished by the number and arrangement of the outer spines on the swimming legs and by the ovisacs in the female. Littoral, and in tidal pools and salt marsh lakes.

gen. *Oithonina* SARS, 1913.

Oithonina nana GIESBRECHT. SARS (1913), Crustacea of Norway, Vol. 6, p. 5. Female: body rather short and stout; fifth leg with a single apical setae and none on the side of the fifth segment. Total length 0.2 mm. Male : body shorter and stouter; groove between the first and second thorasic segment with a median dorsal sinus. Recognised by the squarely truncated forehead and the absence of a rostrum. Furthermore, the first antennae are shorter than in any of the other species.

Fam. *Cyclopidae*

gen. *Halicyclops* NORMAN, 1903.

Halicyclops magniceps LILLJEBORG. SARS (1913), Crustacea of Norway, Vol. 6, p. 29, pl. 15. Female: cephalic segment considerably large ; second inner seta on distal segment of fifth legs filiform, the others plumose. Total length about 0.4 mm. Male : much smaller; in the fifth legs, the basal segment is more distinctly defined and the terminal segment is narrower, with longer and more slender setae. Brackishwater species.

gen. *Cyclops* (*Microcyclops* CLAUS, 1893) *Muller*

Cyclops (*Microcyclops*) *varicans* SAR. KIEFER (1928), Das Tierreich, Lief. 53, p. 86; KIEFER (1934), p. 162, Figs. 104, 105. Female: metasome oval; basal segment of fifth leg fused with the fifth metasome segment, its presence indicated by a plumose setae. Total length about 0.5 mm. Male : body much more slender; basal segment of fifth leg always fused with the body. Recognized by the combination of twelve-segmented first antennae and two-segmented rami of the swimming legs. Brackishwater form.

gen. *Mesocyclops* (*Thermocyclops* KIEFER) SARS.

Mesocyclops (*Thermocyclops*) *emini* MRAZEK. KIEFER (1934), p. 171, Fig. 136. Confined to the freshwates habitats and recorded in limited numbers including both sexes.

Fam. *Oncaeidae*

gen. *Oncaea* PHILIPPI, 1843.

Oncaea conifera GIESBRECHT. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 591, Pls. 2, 47. Female: metasome elliptical; fifth leg cylindrical, its inner setae twice as long as the outer one. Total length about 0.5 mm. Male: smaller; fifth leg not articulated with the body segment, its apical setae very unequal. The great inequality of the apical setae of the fifth legs is the best single character of this species. The species is evidently not much influenced in its distribution by temperature and has been reported from both the Arctic (MRAZEK 1902, p. 517) and Antarctic (WOLFENDEN 1911, p. 382; FARREN 1929, p. 285).

Oncaea minuta Giesbrecht. Giesbrecht (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 591, Pl. 47. Female: metasome slender and fusiform; fifth leg as wide as long, the inner apical seta twice as long as the outer. Total length about 0.2 mm. Characterized by its minute size with widest head across its posterior margin. Mainly found in limited numbers along the Mediterranean coast.

Fam. *Corycaeidae*

gen. *Corycaeus* DANA, 1845.

Corycaeus obtusus DANA. GIESBRECHT (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 659, Pls. 4, 51. Female: head separated from first segment;

endopod of fourth leg an elongate knob, with a single apical seta. Total length about 0.6 mm. Male: body considerably slender. Common.

Corycaeus danae Giesbrecht. *Giesbrecht* (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 660, Pl. 51. Female: head separated from first segment, third and fourth segments fused. Total length 0.6 mm. Male: body narrower, head fused with first segment. Occasionally quite frequent.

Corycaeus ovalis Claus. *Giesbrecht* (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 629, Pls. 49–51. Female: head indistinctly separated from first segment. Total length about 0.5 mm. Male: body much narrower. The exceptional width of the lappets of the fourth segment is one of the best characters for recognition of this species. *Dahl* (1912, p. 96) claimed it as a typical Mediterranean form.

gen. *Sapphirina Thompson*, 1829.

Sapphirina angusta Dana. *Giesbrecht* (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 619, Pls. 52, 53, 54. Female: head one-half longer than wide, narrowed anteriorly, third and fourth segments of second antenna shorter than the second segment. Total length one millimetre. Male : first four free segments each wider than the head, the second segment the widest. Easily recognized by its exceptional length in comparison with its breadth and by the broad process at the inner corner of the caudeal ramus.

Sapphirina gemma Dana. *Giesbrecht* (1892), Fauna und Flora des Golfes von Neapel, Vol. 19, p. 618, Pls. 3, 52–54. Female: head a little wider. Total length about 0.9 mm. Male: terminal segment of second endopod with three large lanceolate flanged spines, three setae and four small spines around the apex. Fairly well distributed.

gen. *Copilia Dana*, 1849.

Copilia mirabilis Dana. *Brady* (1883), voyage of H.M.S. Challenger, Vol. 8, Pt. 23, Copepoda, p. 117, Pl. 53. Female: head quadrangular, widened posteriorly; fith legs two small knobs, each with a single apical seta. Total length about 0.9 mm. Male: head separated from first segment; posterior margin of fourth segment with a median knob. Confined to the marine water habitats and moderately abundant.

III.—SUMMARY AND CONCLUSIONS

The species composition of the plankton of Egypt has peen reported, mainly the free-swimming forms. The data are based upon a series of samples collected at intervals during the years 1964–1965, from the diverse habitats viz.: Mediterranean Sea; Suez Canal; Bitter Lakes; Gulf of Suez; Red Sea; Delta Lakes; Lake Karoun; Nile River.

The taxonomic analysis is noted. The remarkable feature of the present investigation is the large number of species. Altogether 151 species belonging to 85 genera are listed. Indeed, this constitutes the first record of the species covering nearly the entire habitats. However, the diatoms constitute quite the largest portion among the total crop both in numbers of species and individuals. Further more, the *Dinophycean*, particularly *Peridinium* and *Dinophysis* are also of importance. The following are the pricipal genera of the Bacillariophycease: *Chaetoceros*; *Biddluphia*; *Rhizosolenia*; *Nitzschia*; *Melosira*; *Rhabdonema*; *Amphora*; *Cyclotella*. These are roughly arranged in order of their important.

Forty-two species of Copepoda representing twenty-one families and thirty-four genera have been listed. *Paracalanus*; *Diaptomus*; *Temora*; *Longipedia*; *Oithonina*; *Mesocyclops*; *Oncaea*; *Corycaeus*; *Sapphirina* are the chief components of the plankton. The Cladocerans are dominated chiefly by *Diaphanosoma excisum Sars*; *Ceriodaphnia dubia Richard*; *Moina dubia Guerne* and *Richard*; *Bosmina longirostris Muller*.

Moreover, the present investigation has peen already added many new and interesting plankton species mainly detected from Lake Karoun and the Bitter Lakes (under publication 1967 ; 1968 ; 1969).

On the average, the Mediterranean shore and the Delta lakes are comparatively very rich and more productive, on account of their eutrophication through the freshwater supplies. The relative poverty of the plankton in the Red Sea is also evident. The diatom group is the most important and widespread. Small sizes of the specimens are a striking character of the fauna and the flora. Qualitatively, the population is evidently influenced by the topographic and the hydrographic conditions prevailing on the spot.

In conclusion, the local habitats comprise a rich stock of plankton recruited from various localities. These forms can be classified into three distinct categories as follows (c.f. Tables).

1.—Freshwater forms which are abundant in the Nile, and are rather less common along the Mediterranean.

2.—Brackishwater forms with a wide range of distribution. These are very abundant and most common.

3. —Marine forms which are capable of surviving a certain amount of changes in the external medium.

IV.—ACKNOWLEDGEMENTS

This work was carried out during the study trip of Dr. M. Salah in Hungary in collaboration with Dr. G. Tamas. The authors express their gartitude for the helpful assistance of the directors and collectives of the Natural-History Museum (Budapest) and the Biological Mesearch Institute of the Hungarian Academy of Sciences (Tihany).

Special cordial thanks are due to the Egyptian and to the Hungarian Goverments for the kind permission to undertake these researches. The authors are also indebted to the Hungarian Academy of Sciences and to the Institute of Cultural Relations, Budapest, for the facilities afforded at their disposal.

VI.—TABLES OF DISTRIBUTION OF THE SPECIES

Species	Mediterranean Sea	Suez Canal	Bitter Lakes	Gulf of Suez	Red Sea	Delta Lakes	Lake Karoun	Nile River
Flagellates								
Dinophysis tripos	+					+		
Dinophysis caudata	+					+		
Peridinium cerasus	+	+	+	+	+	+		
Peridinium cinctum	+	+			+	+		
Ceratium macroceros				+	+			
Ceratium furca	+	+	+	+	+	+		
Ceratium massilense	+	+	+	+	+	+		
Ceratium fusus	+							
Ceratium tripos	+	+	+	+	+	+		
Gymnodinium lohmanni	+		+					
Bacillariophyceae								
Melosira granulata var. angustissima						+		+
Melosira crucipunctata	+					+		+
Melosira jurgensii	+	+				+	+	
Podosira montagnei	+					+		
Cyclotella meneghiniana	+	+				+	+	+
Coscinodiscus excentricus	+	+			+	+	+	
Coscinodiscus granii	+							
Coscinodiscus gigas	+							
Actinoptychus vulgaris	+					+		
Skeletonema costatum	+					+		
Guinardia flaccida	+	+		+				
Dactyliosolen mediterraneus	+							
Rhizosolenia hebetata	+	+						
Rhizosolenia alata f. semispina	+	+	+	+	+	+		
Rhizosolenia shrubsolei	+	+		+				
Rhizosolenia stolterfothii	+	+	+					
Rhizosolenia calcar avis	+	+	+	+	+	+		
Rhizosolenia fragillima	+							
Bacteriastrum hyalinum	+	+				+		

VI.—Tables of Distribution of the Species (*contd.*)

Species	Mediterranean Sea	Suez Canal	Bitter Lakes	Gulf of Suez	Red Sea	Delta Lakes	Lake Karoun	Nile River
Bacteriastrum delicatulum	+	+				+		
Chaetoceros affinis	+	+						
Chaetoceros didymus	+							
Chaetoceros curvisetus	+	+				+		
Chaetoceros decipiens	+	+	+		+	+		
Chaetoceros lauderi	+	+						
Climacodium biconcavum	+							
Hemiaulus heibergii	+	+		+		+		
Lithodesmium undulatum	+	+				+		
Ditylum brightwellii	+	+						
Ditylum intricatum	+	+						
Triceratium (Bidd.) alternans.,	+							
Biddulphia mobiliensis	+	+						
Biddulphia rhombus						+	+	
Biddulphia aurita	+	+				+		
Biddulphia favus	+							
Biddulphia obtusa	+					+		
Biddulphia vesiculosa	+					+		
Asterionella japonica	+							
Rhabdonema adriaticum	+					+		
Climacosphenia elongata	+					+		
Grammatophora marina	+	+				+	+	
Grammatophora angulosa	+	+				+	+	
Licmophora gracilis var. anglica	+		+	+		+	+	
Synedra ulna	+	+				+	+	+
Synedra tabulata	+					+	+	
Thalassionema nitzschioides	+	+	+		+	+	+	
Cocconeis placentula var. euglypta								
Rhoicosphenia curvata						+	+	+
Mastogloia braunii						+		
Mastogloia elliptica						+		
Mastogloia exigua						+		
Mastogloia pumila	+					+		
Diploneis pseudovalis	+					+		
Diploneis aestuarii	+					+		
Navicula cryptocephala var. intermedia	+					+		

VI.—Tables of Distribution of the Species (*contd.*)

Species	Mediterranean Sea	Suez Canal	Bitter Lakes	Gulf of Suez	Red Sea	Delta Lakes	Lake Karoun	Nile River
Navicula humerosa var. minor	+					+		
Navicula lyra var. altanica.	+							
Navicula pygmaea	+					+		
Gyrosigma Kutzingii						+	+	
Gyrosigma spencerii	+			+		+	+	
Gyrosigma distortum						+	+	
Pleurosigma minutum	+	+					+	
Pleurosigma aestuarii	+					+	+	
Amphiprora paludosa var. duplex	+					+		
Tropidoneis lepidoptera	+					+		
Amphora ovalis	+					+	+	+
Amphora coffeaeformis						+	+	
Amphora turgida	+						+	
Amphora elegans.	+							
Amphora marina	+							
Nitzschia tryblionella							+	
Nitzschia closterium	+					+		+
Nitzschia microcephala						+		+
Nitzschia sigma	+		+	+	+		+	+
Nitzschia flexa	+					+		
Nitzschia longissima	+	+	+					
Nitzschia seriata	+	+	+	+	+		+	
Nitzschia obtusa var. scalpelliformis						+	+	
Nitzschia bilobata var. minor	+						+	
Epithemia sorex						+	+	+
Cymatopleura solea								+
Surirella striatula								+
Surirella gemma	+					+		
Campylodiscus daemalianus						+		+
Campylodiscus parvulus	+							
Cladocera								
Diaphanosoma excisum						+		+
Daphnia longispina								+

VI.—Tables of Distribution of the Species (*contd.*)

Species	Mediterranean Sea	Suez Canal	Bitter Lakes	Gulf of Suez	Red Sea	Delta Lakes	Lake Karoun	Nile River
Daphnia barbata								+
Daphnia lumholtzii								+
Ceriodaphnia dubia								+
Ceriodaphnia cornuta								+
Ceriodaphnia rigaudi								+
Moina dubia						+	+	
Macrothrix spinosa						+		+
Bosmina longirostris						+		+
Copepoda								
Calanus minor	+	+	+	+	+			
Undinula vulgaris				+	+			
Eucalanus attenuatus	+		+		+			
Paracalanus parvus	+		+	+	+	+		
Calocalanus pavo	+		+	+	+			
Calocalanus plumosus	+			+	+			
Clausocalanus arcuicornis	+		+	+	+			
Pseudocalanus minutus	+	+	+	+				
Euchaeta marina	+		+	+	+			
Centropages typicus	+					+		
Diaptomus salinus						+	+	
Thermodiaptomus syngenes						+	+	+
Temora stylifera	+		+	+	+			
Metridia lucens			+	+				
Labidocera acutifrons	+					+		
Pontellina plumata	+		+	+				
Acartia latisetosa	+					+		
Acartia claussii	+					+		
Acartia longiremis	+					+		
Longipedia coronata	+		+	+	+			
Canuella perflexa						+		
Ectinosoma melaniceps						+		
Microsetella norvegica	+		+	+	+			
Harpacticus gracilis	+					+		

VI.—Tables of Distribution of the Species (*contd.*)

Species	Mediterranean Sea	Suez Canal	Bitter Lakes	Gulf of Suez	Red Sea	Delta Lakes	Lake Karoun	Nile River
Microthalestris forficula	+							
Macrosetella gracilis	+							
Tachidius littoralis			+	+				
Metis jousseaumei			+	+				
Oithona plumifera	+		+	+	+			
Oithona similis	+	+	+	+	+			
Oithonina nana	+	+	+	+	+	+		
Halicyclops magniceps						+	+	
Cyclops (Microcyclops) varicans						+	+	
Mesocyclops (Thermocyclops) emini								+
Oncaea conifera	+		+		+			
Oncaea minuta	+							
Corycaeus obtusus	+		+	+	+			
Corycaeus danae	+		+	+	+			
Corycaeus ovalis	+				+			
Sapphirina angusta	+							
Sapphirina gemma	+		+	+				
Copilia mirabilis	+		+	+	+			

REFERENCES

BACMMANN, H., 1936.—Phytoplankton from the Nile. Fisheries Research Directorate. Note and Memoires No. 22, Egypt.

BOYER, C.S., 1926–1927.—Synopsis of the North American Diatomaceae. Part I. Coscinodiscatae, Rhizosolenatae, Biddulphiatae. Part. II Naviculatae, Surirellatae. Proc. Acad. Nat. Sci. Philadelphia.

BRAARUD, T., 1935.—The Ost Expedition to the Denmark Strait 1929 II. The phytoplankton. and its conditions of growth. Hvalradets Skrifter, Oslo, Nr. 10, 1–173.

BRAARUD, T. AND RAPPAS, I, 1951.—Experimental studies of the Dinoflagellates; Pe·dinium Norske Vid. Akad. I. Mat.-Naturv. Klasse, Nr. 2.

BRAARUD, T.— GAARDER, K.K.— GRONTVED, J., 1953.—The phytoplankton of the North Sea and Adjacent waters. Cons. Perm. Int. Explor. de la Mer., Vol. CXXXIII.

BRADY, G.S., 1883.—Report on the Copepoda collected by H.M.S. Challenger during the years 1873–1876. Published in 1883, as Volume 8, Part 23 of the Report on the Expedition,

CLEVE, P.T., 1894-1895.—Synopsis of the Naviculoid Diatoms I. and II. K. Sv. Vet. — Akad. Handl. Amsterdam (N.S. 1965).

DADAY, E.V., 1909.—Ostra coden und Plankton. Beiträge zur Kenntnis der Fauna Turkestans. Sonder-Abdruck aus "Tra vaux de la Société Empériale des Naturalistes de St. Petersbourg" Bd. XXXIX, Heft 2.

DAHL, M., 1912.—Die Cope poden der Plankton-Expedition I. Die Coryacaeinen (mit berücksichtigung aller bekanten Arten). Ergebn. Plankton Exped. Humboldt Stiftung, II., F.I. IV, pp. 135.

FARRAN, G.P., 1929.—Crusta cea, Pt. 10, Copepoda. British Antarctic (Terra Nova). Expedition 1910. Nat. Hist. Rep. Zool. Vol. 8, Nr. 3.

FOGED, R. 1948.—Diatoms in water courses in Funen. Dansk Bot., Arkiv., Bind 12, Nr. 12.

GIESBRECHT, W., 1892.—Systematik und Faunistik der pelagischen Copepodn des Golfes von Neapel und der angrenzenden Meeresabschnitte. Fauna und Flora des Golfes von Neapel, monogr. 19, pp. 831, Pls 54. Berlin.

GIESBRECHT, W. AND SCHMEIL, O, 1898.—Copepoda. Gymnoplea in " Das Tierreich " Lief. 6, Crustacea, pp. 169, 31 text Figs.

GHAZZAWI, F.W., 1938.—Plankton of the Egyptian waters. Two Cladocera from the Plankron Inst. of Hydrobiology and Fisheries. Notes and Memoirs No. 31, Egypt.

GRAN, H.H., 1905.—Nordische Plankton XIX, Diatomeen. Kiel and Leipzig.

GRAN, H.H. AND BRAARUD, T., 1935.—A quantitative study of the phytoplankton in the Bay of Fundy and the Gulf of Maine. J. Biol. Brd. Canada. Vol. I (5), p. 279-467.

GREEN, J., 1961.—A Biology of Crustacea. London.

GREGORY, W., 1857.—On some new forms of marine Diatomacea found in the firth of Clyde and in Lake Fyne. Trans. Roy. Soc. Edn. 21, 473-543, Ednburgh.

GRONTVED, J., 1949.—Investigations on the phytoplankton in the Danish Waddensea. Medd. Komm. Danm. Fiskeri-og. Havundersog. Ser. Plankton, Bd. V., 2. Kobenhagen.

GRONTVED, J., 1952.—Investigations on the phytoplankton in the southern North Sea. Medd. Komm. Danm. Fiskeri-og Havundersog. Ser. Plankton 5, 5. Kobenhagen.

HENDEY, N.I., 1958.—Marine Diatoms from some West African Parts. J. Roy. Micr. Soc., London, Parts, I and II. Ser. III, Vol. LXXVII.

HEURCK, H. VAN , 1880-1885.—Synopsis, des Diatomées de Belgique. Anvers.

HUBER PESTALOZZI, G., 1938-1955.—Das Phytoplankton des Süsswassers. Die Binnengewässer I-IV. Stuttgart.

HUSTEDT, F., 1927-1959.—Die Kieselalgen Deutschlands, Osterreichs und der Schweize, Rabenhorst's Krytog. Flora 7, . 1-920., Leipzig.

HUSTEDT, F., 1930.—Bacillariophyta. Pascher. Süsswasserflora Mitteleuropas, A. 10. Jena.

HUSTEDT, F. , 1939.—Die Diatomeenflora des Kustengebiets der Nordsee von Dollart bis sur Elbemündung. I. Abh. Nat. Ver. Bremen 31, p. 572-677.

HUSTEDT, F., 1959-1962.—Rabenhorst Kryptogamenflora von Deutschland, Österreich und der Schweiz. Die Kieselalgen Deutschlands, Österreichs und der Schweiz unter Berucksichtigung der übrigen Länder Europas sowie der angrenzenden Meeresgebiete. Leipzig.

JORGENSEN, E., 1920.—Mediterranean Caratia. Report Danish Oceanogr. Exped., 1908-1910.

JORGENSEN, C.B., 1955.—Quantitative aspects of filter feeding invertebrates. Biol. Rev. 30.

KARSTEN, G., 1905.—Das phytoplankton des Antarktischen Meeres nach dem Material der Deutschen Tief. Ergebni. d. deutsch. " Valdivia " II. Jena.

KIEFER, F., 1928.—Beiträge zur Copepoden - Kunde IX. Zool. Anz. LXXVI.

KIEFER, F., 1934.—Die freilebenden Copepoden Südafrikas. Zool. Jb. (Systematik) Band 65, Heft 2, p. 99-208, Jena.

KOFOID, C.A. AND CAMPBELL, A.S., 1929.—A conspectus of the marine and fresh-water Cailiata. Univ. Calif. Publ. Zool. 34, p. 1-403.

KROYER, H., 1842.—Crustacés Copepoda in Atlas de Zoologie. Paris.

LEBOUR, M.V., 1925.—The dinoflagellates of northern seas. J. Mar. Biol. Lab. pp. 1-172, U.K. Plymouth.

LEBOUR, M.V., 1930.—The planktonic diatoms of Northern Seas. The Roy. Society., London.

LEYDIG, F., 1860.—Naturgeschichte der Daphniden (Crustacea - Cladocera), p. 252, Pls. 1-10.

LIEBMANN, E., 1935.—Some oceanographical observations on the Palestine Coast. Comm. Intern. Explor. Mer Mediterr., Rap. Proc. Verg. 9.

LILLJEBORG, W., 1853.—Die Crustacies ex. ordinibus tribus in Scania occurrentibus ; Cladocera, Ostracoda et Copepoda, in Scania occurrentibus., pp. 222, Pls. 27, Lun, Akademisk, Afhendling.

LOHMANN, H., 1908.—Untersuchungen zur Feststellung des vollstandigen gehaltes des Meeres am plankton. Wiss. Meeres. Untersuch., Kiel X.

LUCAS, C.E., 1941.—Continuous plankton records. Phytoplankton in the North Sea, 1938-1939. Hull. Bull. Mar. Ecol., No. 8, 11, pp. 19-46.

MRAZEK, A., 1902.—Arktische Copepoda. Fauna Arctica Vol. 2, Fasc. 3, pp. 501-528, Figs. 13, Pls. 4-6.

OCIOSZYNSKA - WOLSKA, 1935.—Uber die Cladocerenfauna von Agypten I. Die Gattung Daphnia. Annales Musei zoologici Polonici. Tom. XI, Warszawa, Nr. 8.

OSTENFELD, C.H., 1913.—On the distribution of Bacillariales in the plankton of the North European Waters. Bull. Trin. Cons. Int. Exp. Mer. Planktonique 3.

PAULSEN, O.V.E, 1908.—Nordisches Plankton XVIII. Peridiniales.

PAULSEN, O.V.E., 1912.—Peridiniales Centrae. Const. Permanent International pour l'Exploration de la Mer. Résumé Planktonique, 3 partie, Copenhagen,

PAVILLARD, J., 1905.—Research sur le flora pelagique de l'étange de Thau. Montpellier.

PAVILLARD, J., 1934.—Observations sur les Diatomées (4 ser.). Le genre Bactetriasrum. Bull. Soc. France, LXXI, pp. 1084-99.

PERAGALLO, H., 1890-1891.—Monographie du genre Pleurosigma et des genres allico. Le Diatomiste, Paris.

PERAGALLO, H. AND PERAGALLO, M., 1897-1908.—Diatomées Marine de France et des District Mari,times Voisins, I, II (text and plates). Paris and Grez sur-loing.

RICHARD, J. (1892).—Cladocéres nouveaux du Congo. Mém. Soc. Zool. France 5, pp. 213-226, 8, text-figs.

RICHARD, J., 1893.—Copépodes recueillis par M. le De. Th. Barrois en Egypt, en Syrie et en Palestine (Mars-Juin 1890). Revue biol. Nord. France 5, 400-405, 433-474.

ROSE, M, 1933.—Copépodes pelagiques. Fauna de France., No. 26.

ROUND, F.E. AND BROOK, A.J., 1959.—The phytoplankton of som Irish Loughs and an assessment of thier trophic status. Proc. Roy. Irish. Acad.— 60, 167-191

RYLOV, W.M., 1935).—Die Cladoceren. Die Binnengewàsser 15, 97-157.

SALAH, M.M., 1963.—Plankton Investigation of the Mediterraneon Coast I. Hydrobiol. Dept. Notes and Memoirs No. 68, Egypt.

SALAH, M. (1967).—Decription of New Planktonic Diatoms from Egypt. Annal. Biol. Tihany. 34, 179-189. Hungaria

SALAH, M.; & TAMAS, G. (1968).—Notes on New Planktonic Diatoms from Egypt. HYDROBIOLOGIA, 31, 2, 231-240, Den Hague.

SALAH, M., & TAMAS, G. (1969).—A New Surirella from Egypt. Acta Bot. Academiae Scientiarum Hungaricae, 14 (3-4), 369-371.

SARS, G.O., 1885.—On some Australian Gladocera, raised from dried mud. Vidensk-Selsk. Forth Christiania, No. 8, pp. 1-46, 8, Pls.

SARS, G.O., 1901.—Contributions to the knowledge of the freshwater Entomostraca of South America. Part. I. Cladocera. Arch. Math. Nat. Kristianai 23.

SARS, G.O., 1901-1903.—An account of theCr ustacea ofNorway, Vol. 4, Copepoda,· Calanoida. Pts. 1, 2,pp. 1-28,Pls. 1-16, 1901 ; Pts. 3-12, pp. 29-144, Pls. 17-96, 1902; Pts. 14, 13 pp; 145,-171, Pls. 97-102 and suppl. 1903 ; Pls. 1-6. Bergen.

SARS, G.O., 1903.—On the Crustaceans. Fauna of Central Asia., Part 3. Copepeda and Ostracoda. Ann. du Musée Zool. de l'Akad. Imp. des Sciences de St. Petersbourg. T. 8, pp. 145.

SARS, G.O., 1904.—Pacifische Plankton-Crustaceen. Zool. Jahrb. Syst. 19, pp. 629-646, Pls. 33-38.

SARS, G.O., 1905.—List preliminaire des Calanoideés recueillis pendant les campagnes de S.A.S. le prince Albert de Monaco, avec diagnoses des genres et des espèces nouvelles Pt. I, II. Bull. Mus. Oceanogr. Monaco, Nr. 26, 40.

SARS, G.O., 1903-1911.—An account of the Crustacea of Norway. Vol. 5, Copeoda, Harpacti-, coida. Pts. 1, 2, pp. 1-28, Pls. 1-16, 1903 ; Pts. 3-6, pp. 29-72, Pls. 17-48, 1904 ; Pts. 7-1,0 pp. 73-132, Pls. 49-80, 1905 ; Pts. 11-16, pp. 133-196, Pls. 81-128, 1906 ; Pts. 17-20, pp. 197 240, Pls. 129-160, 1907,; Pts. 21-24, pp. 241-274, Pls. 161-192, 1908 ; Pts. 25-28, pp. 277-336, Pls. 193-224, 1909 ; Pts.29-30, pp. 337-368, Pls. 225-230 and suppl, 1910 ; Pls. 1-10and suppl 1910; Pts. 31-36, pp. 369-443, Pls. 11-54. 11-54, 1911., Bergen.

SARS, G.O., 1916.—The fresh water Entomostraca of Cape Province. Cladocera. Ann. South. Africa Mus. Vol. 15, pp. 303-351.

SARS, G.O., 1913-1918.—An account of the Crustacea of Norway. Vol. 6. Copepoda, Cyclopoida. Pts. 1-4, pp. 1-56, Pls. 1-32, 1913; Pts. 5, 6, pp. 57-80, Pls. 33-48, 1914; Pts. 7-10, pp. 81-140, Pls. 49-80, 1915 ; Pts. 11, 12, pp. 141-172, Pls. 81-86, 1917 ; Pts. 13, 14, pp. 173-225, Pls. 97-118, 1918.

SARS, G.O., 1924-1925.—Copépodes particulierement bathypélagique. Published as fascicule 69 of the Résultats des campagnes Scientifiques accomplies sur son yacht parAlbert Ier Prince Souverain de Monaco. The Atlas of Plates appeared in October 1924, the text in December 1925.

SCHILLER, J., 1937.—Dinoflagellates (Peridinae) in monographischer Behandlung. Teil I. In Rabenhorst's Kryptogamen-Flora. Band 3, Abt. Leipzig.

SCHMIDT, A., 1874-1940.—Atlas der Diatomeenkunde, fortges. Von A. Schmidt, F. Fricke, O. Müller, H. Heiden und F. Hustedt. Aschersleben. Not concluded., Leipzig.

SCOTT, A., (1909).—The Copepoda of the Siboga Expedition in the Dutch East Indies during the years 1899 to 1900. Published in 1909 as monograph 29 a, part I. of the report on the Expedition. Free-swimming, littoral and semiparasitic Copepoda. 323, pp. 69, Pls. Leyden.

STEUER, A., 1935.—The fishery grounds near Alexandria. Preliminary Report. Fisheries Res. Directorate. Notes and Mémoirs No. 8, Cairo.

WELTNER, W., 1898.—Ostafrikanische Cladoceren gesammelt von Hern Stuhlmann 1888 und 1889, Mittheil, Naturhist. Mus. Hamburg, 15.

WILSON, C.B., 1932.—Copepods of the Woods Hole region Massachusetts. U.S. Nat. Mus. Bull. No. 158 pp. 1-635. Washington.

WOLFENDEN, R.N., 1911.—Die marinen Copepoden : 2, Die pelagischen Copepoden der Westwinddrift und des südlichen Eismeers. Mit Beschreibung mehrerer neuer Arten aus dem, atlantischen Ozean. Deutsche Süd-polar-Expedition 1901-1903 ; Vol. 12, Zoology, Vol. 4 Fasc. 4.

Prof. M. SALAH. Inst. of Ocenogr. & Fisheries ALEXANDRIA.