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The zooplankton community in Egyptian Mediterranean waters: A Review

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The zooplankton community in Egyptian Mediterranean waters is reviewed in light of recent and historic data. Results indicate that the average annual standing crop of zooplankton sharply dropped from 28750 individuals/m³ in 1962 to 3723 individuals/m³ in 1966, 1685 individuals/m³ in 1970-71, and a minimum of 1206 individuals/m³ in 1984-85. The drop is a result of decreased fertility in the area after construction of the Aswan High Dam. In the present study, 184 Copepoda species, 20 Appendicularia species, 25 Siphonophora species, 21 Hydromedusa species, fifteen Amphipoda species, and seven Chaetognatha species were recorded in Egyptian Mediterranean waters, some of which immigrated to the Mediterranean through the Suez Canal.

Key words: Zooplankton, Eastern Mediterranean, Egyptian waters, standing crop, community composition

INTRODUCTION

The marine environment of the Egyptian Mediterranean coast has been considerably impacted by two man-made changes: the creation of a waterway between the Red and Mediterranean Seas (the Suez Canal) and the construction of the Aswan High Dam (HALIM, 1990). As a consequence, the biodiversity and productivity of the southeast Levantine basin and Egyptian waters in particular have dramatically changed. Most investigations on zooplankton populations in Egyptian Mediterranean waters concerned numerical abundance, seasonal distribution, and species composition in coastal waters. The construction of the Aswan High Dam and subsequent abrupt curtailment of the seasonal outflow of nutrient-rich Nile water into the sea also caused dramatic changes in the biological and physico-chemical characteristics of the southeast Mediterranean environment off the Egyptian coast.

Data on the pre-Aswan Dam zooplankton community were published by EL-MAGHRABY & HALIM (1965), GUERGUES (1969), DOWIDAR & EL-MAGHRABY (1970ab), GUERGUES & HALIM (1973), and HALIM & GUERGUES (1973). Changes in the community were detected soon after construction of the dam, in 1969-70 by ABOUL-EZZ (1975) and in 1970/1 by HUSSEIN (1977) and DOWIDAR (1981). During the last twenty years, quantitative and qualitative studies on zooplankton in

the Egyptian Mediterranean were carried out by NOUR EL-DIN (1987) and ZAKARIA (1992, 2004), who provided basic information on the ecology and distribution of the zooplankton community in waters overlying the continental shelf of the Egyptian coast.

The aim of the present work is to compare the pre and post Aswan High Dam zooplankton community in Egyptian Mediterranean waters on the basis of data collected during expeditions carried out by Egypt and other countries in the last forty years. The immigration of Red Sea species to the Mediterranean is also discussed.

MATERIALS AND METHODS

Study area

The study area lies between longitudes 25°30'E and 34°E, extending northward to latitude 33°N. The bathymetry of the area was obtained from Admiralty Charts (Fig. 1). Two distinct segments, east and west, differ in bathymetry and productivity. In the west, the 200 m isobath is 5-10 km from the coast and the continental shelf is very narrow. In the east, in front of the Nile Delta, the 200 m isobath is 90 km from the coast and the continental shelf is much wider.

The Egyptian waters are characterized by the presence of different water masses which converge and mix: the surface water mass of minimum salinity (38.6-38.8 ppt) and maximum oxygen concentration (>5.2 ml/l) which is of Atlantic origin and extends 50-150 m in depth; the intermediate water mass of maximum salinity (38.9-39.1 ppt) which extends below 150 m to about 300-400 m depth; and the deep waters which are of eastern Mediterranean origin (SAID & EID, 1994). The surface water temperature of the study area varies 16.3-17.9°C in winter and 22.0-27.8°C in summer. Salinity values of the surface water range over 39.0-39.2 ppt throughout the year (SAID & RAJKOVIC, 1996).

Sampling methods

Data were taken from expeditions carried out by Egypt and other countries during the last forty years (Fig 2). During the 1966 and 1970 expeditions, zooplankton were collected by vertical hauls (from the bottom to the surface) using a standard zooplankton net (Juday net) of 145 μm mesh. In 1984-85, a Nansen closing net of 220 μm mesh was used. Siphonophora, Hydromedusa, Amphiopda, and Thaliacea were sampled from neuston and oblique tows during the 1984-85 survey using an ichthyoplankton net with a ring diameter of 100 cm, filtering cone of 300 cm length, and mesh of 0.5 mm. A calibrated digital Rigosha flow meter was mounted on the mouth of the net to provide data on the volume of water filtered during each tow. Standard plankton net of 55 μm mesh was used for sampling during the 2000-01 survey.

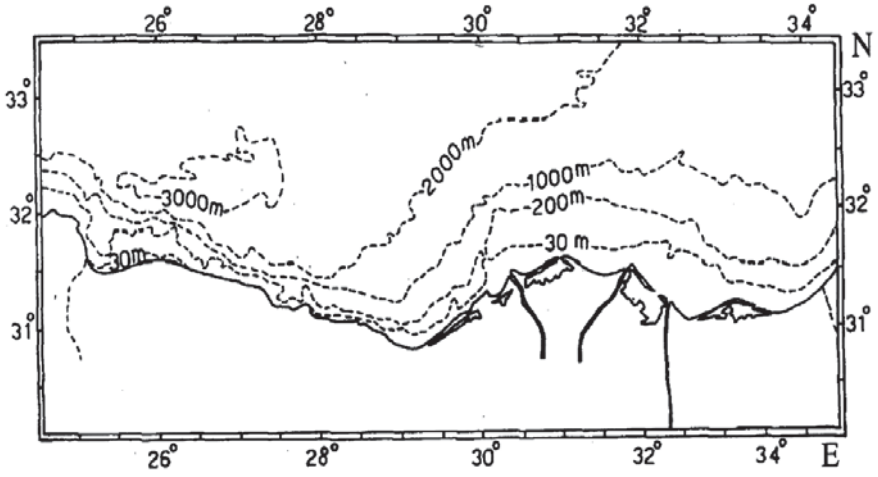

Fig. 1. The bathymetry of the study area in the Egyptian Mediterranean

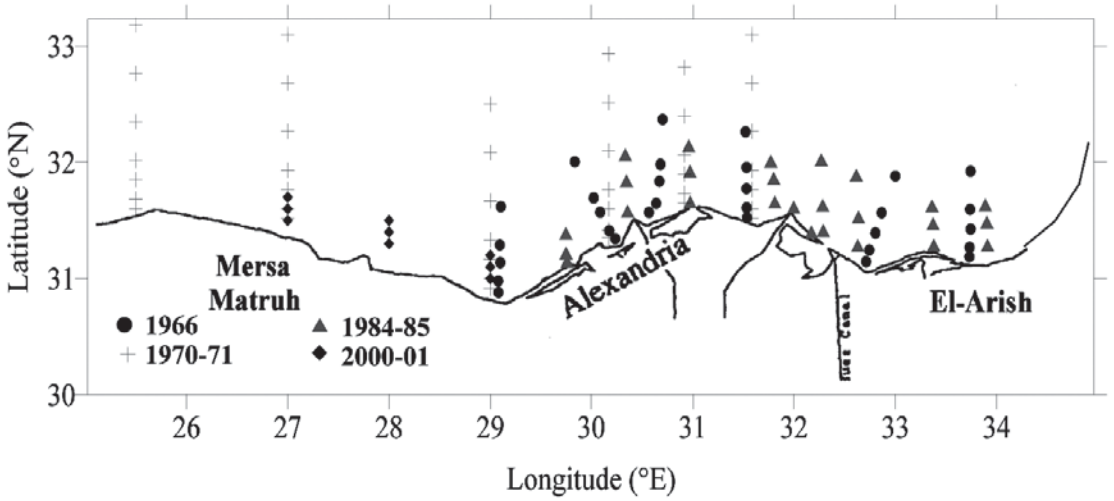

Fig. 2. Locations of sampling stations during expeditions carried out by Egypt and other countries

RESULTS AND DISCUSSION

Zooplankton community

During 1962, in the pre-dam period, zooplankton density was exceedingly high during the flood period, culminating in an outstanding peak of 85100 individuals m^{-3} during autumn (September-October; Fig. 3). The peak was associated with immense simultaneously-developed phytoplankton blooms (DOWIDAR, 1965). In 1966, shortly after construction of the dam, average annual zooplankton density sharply decreased to 7450 individuals m^{-3}, compared to 1962 (28750 individuals m^{-3}). The drop, which was recorded in all seasons, was more dramatic in autumn when the standing crop dropped to about 10% of the corresponding value in 1962. The average annual standing stock in the inshore zone was much lower in 1970-71 (3699 individuals m^{-3}) and 1984-85 (2013 individuals m^{-3}). The ratio between the annual averages in 1962, 1966, 1970-71, and 1984-85 was roughly 14.3 to 3.7 to 1.8 to 1 (NOUR EL-DIN, 1987).

The average annual standing crop also decreased in the offshore zone, from 1174 individuals m^{-3} in 1966 to 618 individuals m^{-3} in 1970-71, reaching a minimum in 1984-84 (370 individuals/m^3). The ratio during years 1966, 1970-71, and 1984-85 was 3.2 to 1.7 to 1.

The decline in zooplankton was accompanied by corresponding decreases in phytoplankton production and fish landings. Phytoplankton production in 1984 was about 33% of that in 1966 and fish landings dropped by nearly the same percentage (DOWIDAR, 1988).

Not only was the density of the zooplankton community greatly reduced, but the seasonality of the annual peak was also changed. Before construction of the dam, the annual cycle of zooplankton was bimodal with peaks in spring and autumn. In 1966, the cycle was similar to that in 1962 but the density of the autumn peak was greatly reduced. This picture completely changed in 1970-71 when the minimum zooplankton density occurred in autumn. During 1984-85, the seasonal cycle became unimodal with the only conspicuous peak occurring in winter (NOUR EL-DIN, 1987).

The major holoplanktonic zooplankton groups were Protozoa, Hydromedusa, Siphonophora, Copepoda, Cladocera, Pteropoda, Chaetognatha, Appendicularia, and Thaliacea. Meroplanktonic zooplankton groups include Polychaeta larvae, Decapoda larvae, nauplii and cypris larvae of Cirripedia, Gastropoda and lamellibranchiata veligers, Echinodermata larvae, and fish eggs and larvae. Five groups were more comprehensively studied: Copepoda,

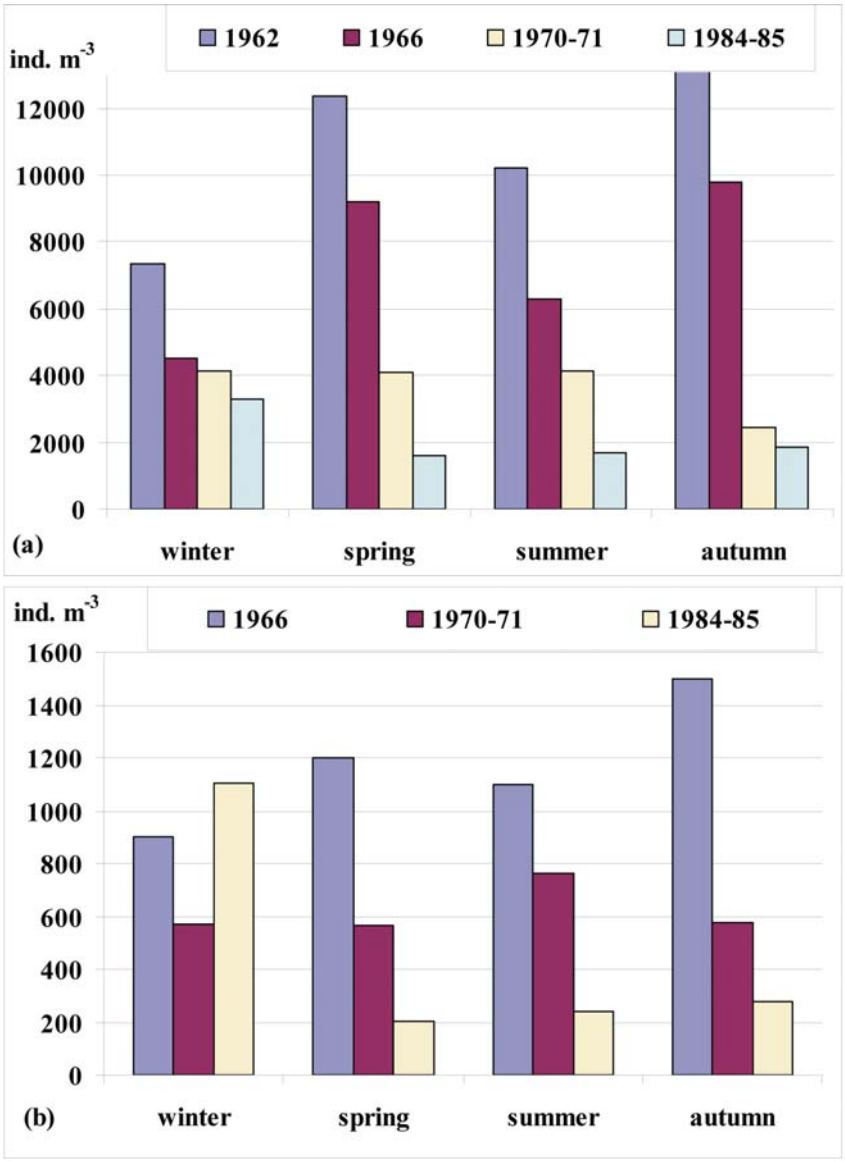

Fig.3. Seasonal variations of the zooplankton standing crop (individuals m^{-3}) in (a) inshore and (b) offshore Egyptian Mediterranean waters

pelagic tunicates, pelagic coelenterates, pelagic amphipods, and Chaetognatha.

Copepoda

Pelagic Copepoda are the dominant component of the zooplankton community, constituting approximately 87% of the total (NOUR EL-DIN, 1987). The effect of the construction of the Aswan High Dam was obvious in the reduction of the standing crop and alternation of the seasonal cycle. The high density of Copepoda in the coastal zone is due mostly to the high fertility of that zone resulting from land drainage, particularly in the region between Damietta and Port Said. Copepoda density decreased towards offshore waters. The annual cycle became distinctly unimodal with only one peak in winter (NOUR EL-DIN, 1987).

The highest density was recorded in the inshore zone and was dominated by a limited

number of species. In contrast, the offshore zone had the lowest population density and highest species diversity with the presence of a large number of oceanic species. Variations in ambient temperature and phytoplankton biomass were the most important factors controlling the density of the standing Copepoda crop (NOUR EL-DIN, 1987).

Along the coast, 184 Copepoda species were recorded. EL-MAGHRABY (1965) recorded 75 species from samples collected in March 1959. DOWIDAR (1965) observed 83 species off Alexandria during 1961-63. DOWIDAR & EL-MAGHRABY (1973) reported 168 in 1966 and HUSSIEN (1977) identified 116 species in 1970-71. NOUR EL-DIN (1987) recorded 126 copepod species during 1984-85, nearly all belonging to Mediterranean Atlantic fauna. Among them, ten are considered biomass builders: *Oithona nana, Euterpina acutifrons, Paracalanus parvus, Oithona plumifera, Clausocalanus furcatus, Temora stylifera, Calocalanus styliremis, Clausocalanus arcuicornis, Farranula rostrat*, and *Acartia negligens*.

A few species, such as *Acartia latisetosa, Centropages kryeri, Euterpina acutifrons*, and *Oithona nana*, are strictly coastal, lacking, or extremely rare in offshore zones but dominant in neritic waters. In contrast, there was wide species diversity in offshore zones with *Candacia varicans, Ctenocalanus vanus, Eucalanus attenuatus, Euchaeta* spp., *Neocalanus gracilis, N. tenuicornis, N. robustior, Haloptilus longicornis, Heterorhabdus papilliger,* and *Euaetideius giesbechti* as important species.

Pelagic tunicates

Appendicularia

Appendicularia was the second most important group after Copepoda, constituting about 3% of the total zooplankton community (NOUR EL-DIN, 1987). The average standing crop in 1966 of 145 individuals/m^3 (DOWIDAR & EL-MAGHRABY, 1973) decreased in 1970-71 to 102 individuals m^{-3} (HUSSIEN, 1977) and reached a minimum of 38 individuals m^{-3} in 1984-1985 (ZAKARIA, 1992). In 1984-85, the annual cycle consisted of one peak in winter (107 individuals m^{-3}) with a minimum in summer (15 individuals m^{-3}). Twenty Appendicularia species were recorded (Table 1) with *Appendicularia sicula, Oikopleura longicauda, O. dioica, O. parva*, and *Fritilaria borealis* dominating. *Oikopleura dioica* dominated in the eastern part of the area, while *Oikopleura longicauda* was abundant in the west. *Appendicularia sicula,* a rare species in the western Mediterranean, was characteristic of the southeast region of the Levantine basin (ABOUL-EZZ, 1975).

Based on the data collected during 1984-1985, ZAKARIA (1992) recorded only 16 Appendicularia species. The inshore zone was characterized by a high density of Appendencularia and low species diversity. A limited number of neritic species (*Oikopleura longicauda, O. dioica, O. parva*, and *Appendicularia sicula*) contributed the greater bulk of the coastal community. The offshore zone had wide species diversity with large numbers of oceanic species. The most important were *Fritillaria borealis, F. intermedia, F. formica, F. pellucida, F. megachile*, and *F. haplostoma*, which are almost strictly oceanic, lacking, or extremely rare in inshore areas.

Thaliacea

Few studies were carried out on Thaliacea in Egyptian Mediterranean waters. HUSSEIN (1977) reported that Thaliacea were recorded only in offshore and oceanic waters, particularly off the Nile Delta. This conclusion was confirmed by ZAKARIA (1992) who found an annual average of 109 individuals 100 m^{-3} offshore from the Nile Delta, but none in inshore waters. Four species were recorded: *Doliolium denticulatum*, *Thalia democratica, Salpa fusiformis*, and *Salpa maxima. Thalia democratica* was the most common species, constituting about 88% of the total Thaliacea community. It occurred in all seasons and was particularly common during spring and autumn (ZAKARIA, 1992).

Table 1. Zooplankton in Egyptian Mediterranean waters during 1961-2001

	1961/3	1966	1969/70	1984/5	2000/1
APPENDICULARIA					
Oikopleura longicauda Vogt, 1854	+	+	+	+	
Oikopleura dioica Fol, 1872	+	+	+	+	
Oikopleura albicans Leuckart, 1853	+	+	+	+	
Oikopleura cophocerca Gegenbaur, 1855	+	+	+	+	
Oikopleura parva Lohmann, 1896			+	+	
Oikopleura fusiformis Fol, 1872			+	+	
Oikopleura intermedia Lohmann, H.1896			+	+	
Oikopleura rufescens Fol, 1872			+	+	
Oikopleura magnum Langerhans, 1880	+	+	+	+	
Pegalopleura haranti Vernieres	+	+			
Appendicularia sicula Fol, 1874	+	+	+	+	
Fritillaria borealis f.intermedia Lohmann,1905			+	+	
Fritillaria borealis f. sargassi Lohmann, 1896			+	+	
Fritillaria formica Fol, 1872	+		+	+	
Fritillaria pellucida Busch, 1851	+		+	+	
Fritillaria aequatorialis Lohmann, 1896	+		+		
Fritillaria fraudax Lohmann, 1896	+				
Fritillaria haplostoma Fol, 1872		+	+	+	
Fritillaria megachile Fol, 1872		+	+	+	
Folia gracilis Lohmann, 1892		+	+		
Kowalevskia tenuis Fol			+	+	
SIPHONOPHORA					
Sphaeronectes gracilis Claus, 1873			+	+	+
Hippopodius hippopus Forsskal, 1776			+	+	+
Rosacea cymbiformis Delle Chiaje, 1822			+		
Rosacea plicata Quoy & Gaimard,1833				+	+
Abyla trigona Quoy & Gaimard,1827				+	
Abylopsis tetragona Otto, 1823		+	+	+	
Abylopsis eschscholtzi Huxley, 1859		+			
Bassia bassensis L.Agassiz, 1862		+	+	+	+
Sulculeolaria biloba M. Sars,1846			+	+	
Sulculeolaria chuni Lens & Riemsdijk,1908			+	+	+
Sulculeolaria quadrivalvis Blainville, 1834			+	+	
Sulculeolaria angusta Totton, 1954		+		+	
Chelophyes appendiculata Eschscholtz, 1829	+	+	+	+	+
Chelophyes contorta Lens & Riemsdijk,1908			+	+	
Diphyes dispar Chamisso & Eysenhardt,1821			+	+	
Eudoxoides spiralis H. B. Bigelow, 1911	+	+	+	+	+
Lensia campanella Moser, 1925			+	+	+
Lensia conoidea Keferstein & Ehlers, 1860			+		
Lensia subtilis Chun, 1886	+	+	+	+	+
Lensia subtiloides Lens & Riemsdijk, 1908			+	+	
Lensia multicristata Moser, 1925	+	+			
Muggiaea kocki Will, 1844		+	+		
Nanomia bijuga Delle Chiaje, 1841			+	+	+
Agalma elegans Sars, 1846				+	
Forskalia edwardsi Koelliker, 1853			+		

Table 1. Cont'd

HYDROMEDUSA					
Bougainvillia muscus Allman, 1863			+		
Lizzia gracilis Mayer,1900			+		
Ectopleura dumortieri Van Beneden, 1844			+	+	+
Turritopsis nutricula Mac Crady, 1859			+	+	+
Pandea conica Quoy & Gaimard, 1827	+				
Obelia spp.	+	+	+	+	
Laodicea undulata Forbes & Goodsir, 1851				+	
Clytia hemispherica Linnaeus, 1767	+	+			
Eutima gegenbauri Haeckel, 1864	+				
Gossea corynetes Gosse,1853	+				
Lovenella cirrata Haeckel,1879	+				
Olindias singularis Browne, 1905				+	+
Pantachogon haeckeli Maas,1893	+	+			
Geryonia proboscidalis Forskal, 1775				+	+
Liriope tetraphylla Chamisso & Eysenhardt, 1821	+	+	+	+	+
Rhopalonema velatum Gegenbaur, 1857		+	+	+	+
Rhopalonema spp	+				
Aglaura hemistoma Peron & Lesueur, 1810			+	+	+
Solmundella bitentaculata Quoy & Gaimard, 1833				+	+
Cunina peregrina Bigelow, 1909				+	
Cunina octonaria Mc Crady, 1857				+	+
AMIPHODA					
Scina crassicornis Fabrrich, 1775	+				
Vibilia viatrix Bovallius, 1887	+				
Phronima stebbingi Vosseler, 1901	+				
Phronima colletti Bovallius, 1887	+				
Phronima sedentaria Forskal, 1775			+		
Phronimella elongata Claus, 1871	+				
Euprimno macropus Guerin	+				
Hyperia latissima Bovallius, 1887	+		+		
Hyperia schizogeneios Stebbing, 1888			+		
Phrosina semilunata Risso, 1822	+				
Phronimopsis spinifera Claus, 1879			+		
Parathemisto oblivia Kroyer			+		
Euthemisto bispinosa Boeck, 1876			+		
Lycaea pulex Marion, 1874			+		
Rhabdosoma whitei Bate, 1862			+		

Pelagic Coelenterata

Siphonophora

Siphonophora constitute a permanent component of the holoplankton in the southeastern Mediterranean. According to NOUR EL-DIN (1987), they constitute about 1% of the average density of the total zooplankton. They were extremely rare in the coastal zone and their density increased in oceanic waters. The highest Siphonophora density was found in summer (about 40% of the total annual abundance of

Siphonophora; ZAKARIA, 1992). The high density recorded by DOWIDAR & EL-MAGHRABY (1973), based on samples collected during 1966, was found in winter and spring.

Along the Egyptian Mediterranean coast, 25 Siphonophora species were recorded. DOWIDAR & EL-MAGHRABY (1973) recorded nine Siphonophora species during 1966, while DOWIDAR (1981) identified 18 species in the same area during 1970-71. ZAKARIA (1992), during her work in the area between El-Agami and El-Arish in 1984-85, recorded 20 Siphonophora species. Eleven were recorded in the western part of the Egyptian Mediterranean coast during 2000-2001 (ZAKARIA, 2004), four of which were common during the 1966, 1970-71, 1984-85, and 2000-2001 surveys: *Chelophyes appendiculata, Eudoxoides spiralis, Bassia bassensis*, and *Lensia subtilis*. The majority of the recorded species (23) are present in the Atlantic Ocean (LELOUP, 1934; BIGELOW & SEARS, 1937; PATRITI 1965ab, 1966; BEAUDOUIN, 1971) and entered the Mediterranean through the Strait of Gibraltar. The other two species (*Abyla trigona* and *Sulculeolaria angusta*) belong to the Indian Ocean (BROWNE, 1926; PATRITI, 1970) and migrated from the Red Sea through the Suez Canal (ZAKARIA, 1992).

Hydromedusa

On average, Hydromedusa constituted 4.2% of the total number of pelagic Coelenterata. The standing stock of Hydromedusa in the eastern part of the study area peaked twice, with a pronounced peak in spring (April) and a lower peak in autumn (October). Minimum density occurred in winter. *Aglaura hemistoma* and *Olindias singularis* formed the spring peak, while *A. hemistoma* formed the autumn peak (ZAKARIA, 1992).

Twenty-one Hydromedusa species were recorded in the study area. DOWIDAR & EL-MAGHRABY (1973) recorded five during 1966, DOWIDAR (1981) identified eight during 1970-1971, and ZAKARIA (1992) recorded twelve during 1984-85. Only nine Hydromedusa species were recorded in the western part of the area during 2000-2001 (ZAKARIA, 2004). Species diversity was higher in summer (eight species) than winter (four species).

Among the Hydromedusa species listed by DOWIDAR & EL-MAGHRABY (1970a, 1973) and DOWIDAR (1981), eight species were not recorded by ZAKARIA (1992, 2004): *Bougainvillia muscus, Lizzia gracilis, Pandea conica, Clytia hemispherica, Eutima gegenbauri, Gossea corynetes, Lovenella cirrata*, and *Pantachogon haeckeli.* Three species, *Aglaura hemistoma, Olindias singularis,* and *Liriope tetraphylla*, constituted about 90% of the total hydromedusae community.

Olindias singularis, an Indian Ocean species (BROWNE, 1916; KRAMP 1965; VANNUCI & NAVAS 1973), is a new record in the Mediterranean, recorded for the first time by ZAKARIA (1992). Its occurrence in comparatively large numbers in the offshore waters east of Port Said may indicate enrichment from the Red Sea through the Suez Canal. This species was nearly absent from the inshore waters. Its highest density was found in El Arish offshore waters, probably carried there by the eastward current prevailing in the southeastern Mediterranean (ZAKARIA, 1992).

Pelagic Amphipoda

Amphipoda of the suborder Hyperiidae are often important components of pelagic communities and sometimes rank third in abundance among marine planktonic Crustacea (LORZ & PEARCY, 1975). Amphipods were very rare, however, in the samples from the Egyptian Mediterranean and of relatively little importance in the standing zooplankton crop except in summer (ABOUL-EZZ, 1975; HUSSEIN, 1977). During 1984-85, Amphipoda were more numerous in winter (average 124 individuals/100 m^3) and reached their lowest density in spring (average 6 individuals/100 m^3) and autumn (8 individuals/100 m^3). Inshore waters had low species diversity and were dominated mainly by benthic forms.

Fifteen Amphipoda species were recorded. Eight were recorded by DOWIDAR & EL-

MAGHRABY (1973) in samples collected during 1966 and by ZAKARIA (1992) in the 1984-85 studies. Only *Hyperia latissima* was recorded in both studies. The most common species recorded by ZAKARIA (1992) were *Phronimopsis spinifera, Parathemisto oblivia*, and *Hyperia schizogeneios*. *Rhabdosoma whitei* was recorded in the eastern Mediterranean for the first time. It was previously recorded in the western Mediterranean (TREGOUBOFF & ROSE, 1957), Indian Ocean, and Red Sea (BARNARD, 1937; FAGE, 1960; HALIM, 1969).

Chaetognatha

EL-MAGHRABY & HALIM (1965), GUERGUES (1969), GUERGUES & HALIM (1973), and HALIM & GUERGUES (1973) studied Chaetognatha in Egyptian Mediterranean waters. Seven species of *Sagitta* were recorded from October 1964 to April 1966. The most abundant was *Sagitta frederici,* comprising 76.96% of the total Chaetognatha population, followed by *S. serratodentata* (21.06%). Less common were *S. enflata, S. minima, S. bipunctata, S. hexaptera*, and *S. neglecta*. *Sagitta neglecta* is an Indo-Pacific immigrant from the Red Sea through the Suez Canal (GUERGUESS & HALIM, 1973). *Sagitta frederici* was abundant off the Nile Delta and is a plankton indicator of the Nile stream. Further investigations on Chaetognatha in the Egyptian waters are needed.

CONCLUSIONS

The zooplankton community in Egyptian Mediterranean waters was reviewed before and after the construction of the Aswan High Dam. Data used in the present study were collected from expeditions carried out by Egypt and other countries during 1966-2001. Results indicate that the average annual zooplankton standing crop sharply dropped from 28750 individuals m^{-3} in 1962 to 3723 individuals m^{-3} in 1966 to 1665 individuals m^{-3} in 1970-71 and to 1206 individuals m^{-3} in 1984-85. The decline in the zooplankton standing crop was paralleled by corresponding decreases in phytoplankton production and fish landings as a result of the decreased fertility of the area after the damming of the Nile (DOWIDAR, 1987).

Not only was the density of the zooplankton community greatly reduced but also the seasonality of its annual peaks was changed. In 1962, prior to the building of the dam, the annual zooplankton cycle was bimodal with main peaks in spring and autumn. In 1966, the cycle was similar but the density of the autumn peak was greatly reduced. The picture completely changed in 1970-71 when the zooplankton density minimum occurred in autumn. During 1984-85, the cycle became unimodal with the only conspicuous peak occurring in winter.

Pelagic Copepoda was the most dominant component of the zooplankton community. The construction of the dam clearly reduced the standing crop of pelagic Copepoda and altered the seasonal cycle. Of a total 184 species of Copepoda recorded in Egyptian Mediterranean waters, 75 species were recorded in 1959, 83 in 1961-63, 168 in 1966, 116 in 1970-71, and 126 in 1984-85.

Appendicularia was the second most important group of zooplankton. The average annual standing crop decreased from 145 individuals/m^3 in 1966 to 102 individuals/m^3 in 1970-71 and 38 individuals/m^3 in 1984-85. Twenty Appendicularia species were recorded in Egyptian Mediterranean waters during the study period.

Twenty-five Siphonophora and 21 Hydromedusa species were recorded during 1966-2001. Few studies were carried out on Thaliacea, Chaetognatha, and pelagic Amphipoda. Only four species of Thaliacea, seven of Chaetognatha, and 15 of Amphipoda were recorded during the study period.

The biodiversity of Egyptian waters greatly increased after construction of the Aswan High Dam. Five Indo-Pacific species immigrated to the Mediterranean through the Suez Canal and were recorded in the study area: *Abyla trigona* (ZAKARIA, 1992), *Sulculeolaria angusta* (ZAKARIA, 1992), *Olindias singularis* (ZAKARIA,

1992), *Rhabdosoma whitei* (ZAKARIA, 1992), and *Sagitta neglecta* (GUERGUESS & HALIM, 1973).

Further studies on the zooplankton community in Egyptian Mediterranean waters are needed to investigate the fundamental changes that have taken place in the area.

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Zooplanktonska zajednica u egipatskom dijelu Mediteranskog mora: Pregledni rad

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SAŽETAK

Zajednica zooplanktona u egipatskom dijelu Sredozemnog mora se prikazuje prema novijim i povijesnim podatcima. Rezultati ukazuju na prosječnu godišnju gustoću populacije zooplanktona koji je naglo pao na 28750 jedinki m^{-3} u 1962-oj godini; 3723 jednike m^{-3} u 1966-oj godini; 1685 jedniki m^{-3} u 1970-71-oj godini, te na minimum od 1206 jedniki m^{-3} u 1984-85-oj godini.

Pad je rezultat smanjenog fertiliteta na području Asuanske brane nakon gradnje. U ovom radu iznose se podatci o slijedećim vrstama: 184 Copepoda, 20 Appendicularia, 25 Siphonophora, 21 Hydromedusa, 15 Amphipoda i 7 Chaetognatha koje su zabilježene u egipatskim sredozemnim vodama, a od kojih su pojedine ušle u Sredozemlje preko Sueskog kanala.

Ključne riječi: Zooplankton, istočno Sredozemlje, egipatske vode, gustoća populacije, zajednica, sastav