PELAGIC COPEPOD DIVERSITY IN THE GULF OF AQABA (RED SEA)

Tariq Al-Najjar
Marine Science Station, P. O. Box. 195, Aqaba, Jordan
tnajjar65@hotmail.com

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ABSTRACT

From 43 zooplankton samples collected in the Gulf of Aqaba Jordan during the period from May 1998 to April 1999, 55 species of Copepoda were identified belonging to 30 genera and 24 families. Bathymetric distribution, biogeographic and ecological are discussed in the light of available information from the region.

Keywords: copepods, Gulf of Aqaba, Red Sea

INTRODUCTION

Copepods are an important link between pelagic primary productivity and fish-production. Traditionally, many copepods, particularly the calanoid species, have been considered herbivores feeding directly on phytoplankton. This view has become revised, especially for oligotrophic oceans where the dominant primary producers are too small (picoplankton) for copepod consumption, but seem to feed on Protozoa. Nevertheless, their importance as a link between the unicellular components of the food web and the fish is beyond doubt.

The distribution of Copepoda in the Gulf of Aqaba was first described by Schmidt (1973) who provided preliminary data on the displacement volume and numerical abundance of the total copepod assemblage in one station in the Northern part of the Gulf. Por (1979) reported eighteen species of Copepoda in the coast of the Gulf of Aqaba. Kahan and Bar-El (1982) identified new species of Harpacticoida in the Gulf of Aqaba. The first counts of calanoid Copepoda were reported by Almeida Prado-Por & Por (1981). Vaissiere and Seguin (1984) published preliminary studies of the zooplankton groups from the coral reef and the open sea areas in the Gulf of Aqaba. Almeida Prado-Por (1983, 1985, 1990) studied the diversity, dynamics and a daily cycle of vertical distribution of the Calanoida (Copepoda) in the North Gulf of Aqaba. Echelman and Fishelson (1990) listed surface zooplankton in the Northern part of the Gulf. The objective of this paper is to provide a species list of Copepoda in the Gulf of Aqaba, together with information on their biogeographic and depth distribution.

MATERIALS AND METHODS

Sampling site

Plankton samples were collected at an offshore station A (2927.362N-3457.238E, located offhore the Marine Science Station in the northern tip of the Gulf of Aqaba Jordan, (Figure 1). At this station water depth is 550m, it is oceanic in nature originating from the open Red Sea.

Figure 1. Sampling stations.

Sample collection

Vertical zooplankton hauls were taken by an opening plankton net of 150 µm-mesh size with a mouth diameter of 70 cm and a total length of 3 m during the period from May 1998 to April 1999. The net was hauled vertically from 100 m to the surface.

The zooplankton organisms retained in the net were then transferred carefully into plastic bottles and immediately fixed with 4% neutralized formalin after measuring the displacement volume. After each haul the net was washed thoroughly with seawater and the water used was added to the sample to prevent any loss of the caught organisms.

Species identification

In the laboratory, the samples were examined in a large Petri dish. Subsamples of 5ml were then transferred into a counting chamber and each copepod species was counted separately using an inverted microscope. For each sample, 3 sub-samples were estimated. The accurate identification of copepods was done by dissecting each copepod by using fine needles on a glass slide using a mixture of glycerin, alcohol, and water in the proportions 1: 1:2.

Species were identified following Giesbrecht (1892), Tregouboff & Rose (1957), Newell (1963), Mori (1964), Gonzalez & Bowman (1965), Williamson (1967), Bradford-Grieve (1972, 1994), Bradford-Grieve & Jillett (1980), Bradford-Grieve *et al.* (1983), Heron & Bradford-Grieve (1995).

RESULTS AND DISCUSSION

In total 55 copepod species belonging to 30 genera within 24 families in four orders were identified: Calanoida (34 species); Cyclopoida (3 species); Poecilostomatoida (14 species) and Harpacticoida (4 species) .

Only 3 species formed the main bulk of calanoid copepod individuals namely: *Mecynocera clausi, Clausocalanus furcatus* and *Ctenocalanus vanus*. Also species of the genera *Oithona*, *Oncaea* and *Farranula* formed the main bulk of the orders Cyclopoida and Pocilostomatoida, respectively, while the others were found as infrequent or rare forms. Most species (36 species) are classified as oceanic, while 10 species as neritic – oceanic, 8 species as neritic and 2 species as coastal neritic. Six species were observed as new geographical record for the Gulf of Aqaba.

Previous information about the geographic distribution of the studied species in the Rea Sea is included in Table 1.

As shown in the Table 1, most copepod species are classified as epipelagic. This means that the function of the epipelagic zone as the feeding and nursery ground of Copepoda is particularly pronounced in the Gulf of Aqaba. Seven species (*Paracalanus indicus, Phaenna spinifera, Clausocalanus farrani, Calanus robstior, Euchirella messinensis, Candacia tenuimana*, and *Corycaeus subullatus)* are not found in other parts of the Red Sea. Two of them, *Euchirella messinensis* and *Corycaeus subullatus,* were recorded for the first time in the Gulf of Aqaba during this investigation.

In comparison with the previous work in the region, there is a marked and progressive decline in the species diversity from the Arabian Sea - 300 bathypelagic calanoid species (Grice & Hülseman, 1967); through the open Red Sea - 107 copepod species (Delalo, 1966); into the Gulf of Suez - 65 copepod species (Halim, 1969); the Gulf of Aqaba - 55 species (present study) and finally the Suez canal - 23 copepod species (Abdelrahman, 1997).

TABLE 1
Species List of Pelagic Copepods in the Gulf of Aqaba with Distribution Information Derived from Literature. GA: Gulf of Aqaba, SC: Suez Canal, GC: Gulf of Suez, NRS: North Red Sea, CRS: Central Red Sea, SRS: South Red Sea

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This decline in species diversity could be due to differences in water temperature and salinity, factors that were considered to be important in controlling the abundance of zooplankton by early authors such as Ortton (1920), Sverdrupt *et al*. (1942), Sewel (1948), Deevey (1960), Goldman and Horne (1983), who mention that water temperature and salinity are the chief factors regulating the distribution of copepods as well as most of other organisms in sea water. Also, Elster (1954), Eichhorn (1957, Heinle (1969), Patalas (1972) mention that, when excess food is available for zooplankton, its abundance depends mainly on temperature.

However, the view of temperature as a controlling factor has mainly been developed for temperate environments where seasonal fluctuations by far exceed the amplitude recorded for the Gulf of Aqaba (<5^{o}C temperature amplitude, <0.25‰ salinity amplitude). Here, the importance of temperature and salinity seem to lie in their impact on the seasonal cycle of vertivcal stratification (during summer) and mixing (during winter) (Al-Najjar, 2000).

The waters of the Gulf of Aqaba, Red Sea, undergo stronger seasonal fluctuations than do other subtropical seas. During summer, the water column is stratified and the surface layers are depleted of nutrients (Riess and Hottinger, 1984). However, in winter the thermocline deepens and deep convective mixing persists for several months, often reaching 600m or more (Lindell and Post, 1995). This seasonal pattern of mixing and stratification has indirect influnce on copepods *via* controlling the nutrient and light regime for phytoplankton.

The production of copepods in any natural water mass is often considered equivalent to the secondary producers as most of them, particularly their larval and copepodite stages feed directly on phytoplankton. They usually outnumber other planktonic groups both individually and in number of species. Copepoda, including the calanoids, in turn contribute considerably to the food chain of many carnivores

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