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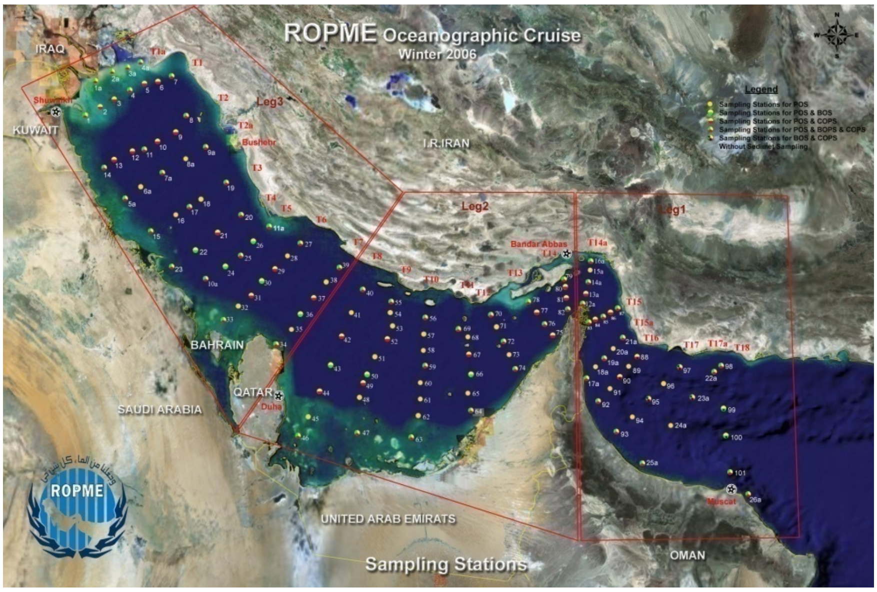
ROPME Oceanographic Cruise - Winter 2006



Technical Report Series

Technical Report : No. 6

Zooplankton in the ROPME Sea Area

December 2010

ROPME Oceanographic Cruise - Winter 2006
Technical Report Series:

1. Physical oceanography
2. Contaminants in Marine Sediments
3. Nutrients
4. Chlorophyll
5. Phytoplankton
6. Zooplankton
7. Ichthyoplankton
8. Meiobenthos
9. Macrobenthos

Disclaimer

This Report has been prepared by the Department of Oceanography of Alexandria University, as the principal Investigator on 'Zooplankton' under a contract with ROPME. The report is being separately subjected to peer review and linking with other relevant data and information, in order to develop an integrated understanding of the ROPME Sea Area. Meanwhile, in order to bestow the benefit of viewing the results in their preliminary form and promote a general level of understanding of the marine environment of the Region, not withstanding the possible delay by peer review, this document is being brought out as part of a special Technical Report Series in the very form in which it was submitted by the Principal Investigator. Owing to this reason, ROPME shall not accept responsibility on the accuracy of data or interpretations contained in this Report.

Preface:

In recognition of the importance of the oceanographic Cruises in ROPME Sea Area to understand the state of the marine environment, ROPME Council has assign high priority to the scientific Cruises. In pursuance of the Council Decision CM12/7, ROPME had the responsibility to coordinate a comprehensive oceanographic Cruise in winter 2006. The Cruise was planned in such a way that the results and reports of the studies can find their way into the synthesis of ROPME State of the Marine Environment Report.

As a result of sustained efforts, cooperation of Member States, guidance of the designated scientific committee for the Cruise, encouragements from the Executive Committee of ROPME and the generous provision made by the Council, the historic Winter Cruise was carried out successfully on board of M/V Ghods of I. R.Iran during 1st February and 11 March 2006.

Totally, 115 stations covering the RSA have been surveyed and 97 experts from ROPME Member States participated in the Cruise. The survey covered most of the main oceanographic disciplines.
The collected samples during the Cruise were distributed on a competitive basis to the competent laboratories in the Region and elsewhere for detailed analyses while sub-sample sets were kept in ROPME Marine Sample Bank to enable repetitive analyses in future, when required.

To enhance benefits from the reproduced results from the Cruise among Regional scientific community towards a better understanding of the marine environment in the RSA and to enable higher marine research, ROPME Secretariat decided on the publication of the results in a series of Technical Reports as follows:

1. Physical oceanography
2. Contaminants in Marine Sediments
3. Nutrients
4. Chlorophyll
5. Phytoplankton
6. Zooplankton
7. Ichthyoplankton
8. Meiobenthos
9. Macrobenthos

The present Technical Report is devoted to the status of zooplankton in the RSA. The analyses of samples and reporting have been conducted by Prof. M.M Dorgham of Department of Oceanography, Alexandria University, as the principal Investigator on 'Zooplankton' under a contract with ROPME.

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Executive summary

The zooplankton community indicates highly diversified in the ROPME Sea Area, comprising 231 species, distributed among numerous taxonomic phyla of the animal kingdom, beside planktonic larvae of several benthic animals (meroplankton). The crustacean copepods were the most diversified group (94 species), followed by cnidarians (18 hydromedusae and 16 siphonophores), and protozoan tintinnids (24 species). The rest zooplankton species belong to planktonic annelids (11 species), thaliaceans (11 species), planktonic mollusks (10 species), larvaceans (9 species) and Chaetognaths (8 species), and other small groups like Ostracoda, Cladocera, Mysidacea, Euphausiacea and the protozoan Radiolaria and Foraminifera**.** All zooplankton genera of the different groups were represented by 1-3 species, except the copepods *Corycaeus* (12 species), *Sapphirina* (7 species), *Oncea* (7 species), *Oithona* (6 species), *Acartia* (5 species), *Candacia* (5 species), *Centropages* (5 species), *Labidocera* (5 species), *Temora* (4 species), the chaetognath *Sagitta* (7 species) and the larvaceans *Oikopleura* (5 species).

Despite the high diversity of winter zooplankton in the study area, the number of species showed considerable variability among the sampled stations between a minimum of 17 species at station 36 and a maximum of 69 species at station 50. However, most of stations harboured 45-55 species.

The zooplankton community in the inner RSA appeared to be highly diversified (210 species) than (144 species) in the Strait of Hormuz and Sea of Oman . But the recorded species could be divided into three groups, whereas 89 species, usually restricted to the inner RSA, 24 species in the Strait of Hormuz and Sea of Oman , and 120 species were found either sporadically or widespread over the whole ROPME Sea Area. On the other hand, of the total recorded species during the present study, 116 species appeared to be new to the ROPME Sea Area, particularly in the inner RSA. This indicates that some of these species were occurring in the area but they have never been identified earlier, or they were recently transferred with low salinity surface current water from the Sea of Oman .

The majority of zooplankton species were occasionally observed throughout the study area. (at 1 - 6 stations). However, 20 species appeared to be widespread over the whole inner RSA and 17 species in the Strait of Hormuz and Sea of Oman . On the other hand, several species occurred at the most station of the whole ROPME Sea Area, like the siphonophore *Lensia conoidea*, the mollusk *Creseis acicula* , the cladoceran *Penilia avirostris*, the copepods *Centropages furcatus*, *Clausocalanus minor*, *Eucalanus crassus*, *Nannocalanus minor*, *Paracalanus aculeatus*, *Paracalanus parvus*, *Temora turbinata*, *Corycaeus rostratus*, *Corycaeus speciosus*, *Oithona nana*, , *Oithona plumifera*, *Oncaea conifera*, *Oncaea venusta*, *Euterpina acutifrons* and *Microsetella rosea*, the chaetognath *Sagitta enflata*, the larvacean *Oikopleura dioica*, and the thaliacean *Doliolum denticulatum.*

The zooplankton abundance in the ROPME Sea Area reflects high secondary production during winter, but it demonstrated pronouncedly wide variations among the sampled stations between 1 x 10^3 organisms/m^3 and 71.7x10^3 organisms/m^3. In the inner RSA, the standing crop was less than 5 x 10^3 organisms/m^3 at several stations, increased to 10 x 10^3 organisms/m^3 at other stations in the northern and central parts, reaching 43 x 10^3 organisms/m^3 at a few stations in the southern part, while the maximum value (71.7x10^3 organisms/m^3) was reported at station 15 in the northern inner RSA. In the Strait of Hormuz and Sea of Oman , zooplankton count varied between 15 x 10^3 – 35 x 10^3 organisms/m^3 at most stations, increased to 43 x 10^3 organisms/m^3 at a few stations. It accordingly seems that, the inner RSA is pronouncedly less productive in zooplankton (total average: 14.1 x10^3 organisms/m^3) than the Sea of Oman (23.3 x10^3 organisms/m^3). In the meantime, the different groups displayed variable contributions to the total zooplankton crop in both regions of the ROPME Sea Area.

The protozoan Foraminifera and Radiolaria were found at sporadic stations, usually in very low counts, except a maximum of 23 organisms/m^3 for Foraminifera and of 297 organisms/m^3 for Radiolaria.

The protozoan ciliates (Tintinnids) were missed over great part of the inner RSA, but they showed high counts (343- 5726 organism/m^3) at some stations on Iranian Coast, and (862 - 8954 organisms/m^3) at other stations in the Sea of Oman . *Tintinnopsis radix*, *Codonellopsis morchella*, *Favella azorica*, *Salpingella attenuata* and *Eutintinnus fraknoii* were the most abundant species only at a few stations. The total tintinnids played limited role (average: 1.8 %) of total zooplankton in the ROPME Sea Area, but they were among the dominant components (25.7%) at one station only

The hydrozomedusae include Anthomedusae, Leptomedusae, Limnomedusae, Narcomedusae, and Trachymedusae. They usually appeared in low counts, (< 10 organisms/ m^3), and had very limited role in total zooplankton count (mostly < 0.1%), except *Solmundella bitentaculata* and *Aglaura hemistoma*, which sustained relatively high counts (up to 50 & 70 organisms/m^3 respectively) in the inner RSA, forming 3.9 % of total zooplankton at one station.

Siphonophores amounted collectively to < 20 organisms/m^3 at most stations, except a maximum of 369 organisms/m^3. They showed markedly low contribution to zooplankton count (<1%) and different spatial distribution. Some of them were confined to the inner RSA, others to the Sea of Oman and few species were widely distributed throughout the whole ROPME Sea Area, attaining relatively high counts at some stations, like *Lensia conoidea*, S*ulculeolaria biloba* and *Diphyes sp.*

The planktonic annelids reported very small role (mostly < 0.2% of zooplankton count) and sustained counts < 20 organisms/m^3, except those (123 - 347.5 organisms/m^3) at some stations. The majority of planktonic annelid species occurred in both the inner RSA and Sea of Oman , with wide distribution of *Pelagobia longicerrata*, *Rhynchonerella* sp. and *Tomopteris* sp.

The planktonic adult molluscs had counts 10- 1830 organisms/m^3, forming 0.1 – 17.7% (average 1.1%) of total zooplankton throughout the ROPME Sea Area. Three species appeared to be widely distributed in the study area and attained high counts at some stations, namely *Creseis acicula*, *Limacina inflata* and *Euclio* sp. On the other hand, *Diacria trispinosa* was found in high counts at few stations in both the inner RSA and Sea of Oman .

The winter planktonic crustacea in the ROPME Sea Area was represented by six groups, Cladocera, Copepoda, Ostracoda, Amphipoda, Euphausiacea and Mysidacea. Copepods were the most diversified and abundant group, while the other five groups comprised small number of species and displayed low abundance at most stations.

The count of cladocerans fluctuated between 3 - 5125 organisms/m^3, and constituted 1.8% of total zooplankton, increased to 28.9% at some stations in the inner RSA. *Penilia avirostris*, *Evadne tergestina* and *Podon polyphemoides* were well represented throughout the whole ROPME Sea Area, but mainly in the inner RSA. *P. avirostris* appeared as the main component of cladocerans at several stations, while *E. tergestina* predominated cladocerans (69%, 91.3%) at two stations only.

Copepods overcome all other zooplankton groups in the term of the standing crop in the whole ROPME Sea Area, varying from 0.6 x 10^3 – 62.7 x 10^3 organisms/m^3. In the inner RSA, they sustained pronouncedly less counts than in the Sea of Oman , although their maximum count observed at station 15, in addition to high counts (20 x 10^3 – 30x 10^3 organisms/m^3) at some stations in the inner RSA. In general, copepods formed 49.7 – 96.9% of the total zooplankton in the study area, but at the majority of stations they formed 70-80%.

The nauplii and copepodides displayed pronouncedly variable contribution to copepods in the ROPME Sea area. The nauplii demonstrated similar spatial distribution to those of total copepods, possing higher counts in the Sea of Oman than in the inner RSA. However, the relative abundance of nauplii reflected variable role in the total copepod populations over the whole area..

In contrast, the copepodides showed lower count in the Sea of Oman than in the inner RSA. They exhibited pronouncedly big roles in the total copepods throughout the inner RSA, while in the Sea of Oman their role was clearly small, being less than 10% at most stations.

In addition to nauplii and copeodides, several adult copepods species were common in the ROPME Sea Area and played crucial roles in zooplankton standing crop, namely. *Paracalanus parvus*, *Paracalanus aculeatus*,, *Eucalanus crassus, Nannocalanus minor, Clausocalanus minor, Temora stylifera*, *Temora turbinata*, *Paracalanus crassirostris, Oithona nana*, *Oithona plumifera*, *Oncaea venusta*, *Oncaea conifera*, *Corycaeus speciosus*, *Corycaeus rostratus*, *Euterpina acutifrons*, *Microsetella rosea*

Ostracods displayed limited role (0.8%) in the total zooplankton count of the ROPME Sea Area, but they were more distributed in the inner RSA than in the Sea of Oman , sustaining low count in the whole area (< 200 organisms/m^3), except those (1081 - 2588 organisms/m^3) at some stations in the inner RSA.

Amphipods and euphausiaceans were among the minor zooplankton groups, having a maximum of 12 and 92 organisms/m^3 respectively. Mysidacea was also a minor crustacean group, occurred usually in low counts, except that (298 - 414 organisms/m^3) at some stations in the inner RSA.

Chaetognatha was dominated by several *Sagitta* species in addition to *Krohnitta subtilis,* which altogether counted < 400 organisms/m^3at most stations, while reported high counts (1280 and 1294 organisms/m^3) at two stations in the inner RSA. The spatial distribution of different Chaetognaths species was clearly different. *Sagitta serratodentata,* appeared to be common mostly in the northern inner RSA, *Krohnitta subtilis* and *Sagitta ferox* in the northern and central parts, while *Sagitta neglecta* was restricted to the Sea of Oman . In the mean time, *Sagitta enflata* was the most widespread chaetognath throughout the ROPME Sea Area and could be considered among the key species in the study area. The numerical abundance of chaetognaths in the inner RSA (174 oragnisms/m^3) was higher than that in the Sea of Oman (118 oragnisms/m^3), forming 0.01 – 5.9% of the total zooplankton over the ROPME Sea Area.

The larvaceans count experienced wide variation in the study area (6 - 8033 organisms/m^3), with richer population in the Sea of Oman (mostly < 2000 organisms/m^3) than in the inner RSA (mostly <500 organisms/m^3). High counts (up to8033 and 3230 organisms/m^3) were observed in the inner RSA and Sea of Oman respectively. Larvaceans displayed pronouncedly variable role in the total zooplankton count over the whole area (0.4 % - 25.6%). Although three species were the most common larvaceans, they demonstrated variable spatial distribution. *Oikopleura dioica* appeared as the persistent and widely distributed species, while *Oikopleura longicauda* and *Oikopleura parva* were mostly found in the Strait of Hormuz and Sea of Oman .

The winter thaliacians usually displayed small role (1.5%) in the total zooplankton count, but at some stations they displayed active contribution (up to 33.6%), particularly in the central inner RSA. They attained high counts (1393 - 6163 organisms/m^3) at some stations in the Strait of Hormuz. *Thalia democratica* and *Doliolum denticulatum* were the predominant species, showing different abundances over the ROPME Sea Area.

The planktonic larvae of benthic animals displayed relatively low contribution (6.8%) to total zooplankton, but it showed pronouncedly big role (up to 35.3%) in the inner RSA and less (up to 22%) in the Sea of Oman . The mollusks larvae were the predominant component, particularly lamellibranch veligers, which dominated (up to 95% of meroplankton) at the greatest majority of the sampled stations. Polychaetes larvae demonstrated variable contribution to the meroplankton (5.5%), with more effective role (average: 9.4%) in the inner RSA than (average: 1.6%) in the Sea of Oman . However, this role increased to 71.2% in the northern inner RSA and 26.3% in the Sea of Oman . Decapods larvae were represented mainly by crabs and prawns larvae, forming together 26% of total meroplankton, but prawns larvae showed markedly active contribution (22.2%) than crab larvae (3.7%). However, prawns larvae were abundant in the southern inner RSA and in the Sea of Oman , constituting up to 100% of total meroplankton at some stations. In the meantime, the larvae of crabs attained the highest contribution (up to 80%) at stations scattered mainly in the inner RSA. The other meroplankton representatives such as cirripedes larvae, crustacean eggs, fish larvae and eggs were almost found in low counts, except at a few stations.

1. Introduction

The ROPME Sea Area comprised the inner RSA and a part of the Sea of Oman . The inner RSA, the main part of ROPME Sea Area, is a shallow marginal semiclosed sea with about 1000 km long and 200-300 km width. Its depth varies between 20-40m in the western side and 40-80m in the eastern side with an average of 35m. The inner RSA lies between the latitudes 24°-30.3 N in an arid subtropical area, which is characterized by continental climate. It is connected at its southern end to the Sea of Oman by a narrow entrance of 60 km width "Strait of Hormuz", the eastern part of which is dammed by Masandam Peninsula. The northern end of the inner RSA is terminated by Shat Al-Arab, while the eastern side is exposed to numerous smaller streams draining from the Zagros mountain area.

The inner RSA is characterized by unique ecological and biological properties, mainly due to the effects of low salinity water discharged from the Sea of Oman at the southern end and the fresh water inflow from Shatt Al-Arab at the northern end.

The physico-chemical conditions appeared to be pronouncedly different throughout the inner RSA. The imbalance between the evaporation and precipitation and partial isolation from the low saline Indian Ocean provoke the increase of salinity in significant part of the inner RSA basin. The surface current flows from Sea of Oman , moving anticlockwise along the Iranian Coast (Hartman *et al.*, 1971), play an important role in the distribution of salinity, temperature and nutrients throughout the inner RSA. Waves and surface currents of several weeks duration produced by 'Shamal' winds together with tidal currents tend to homogenize the surface waters to a depth of about 30m (Purser and Seibold, 1973), or may twice this depth in the axial parts (Sarnthein, 1970). The water transparency may exceed 30m in the axial part, but it decreases in the shallow parts due to the high turbidity (Clarke and Keij, 1973).

The salinity configuration in the inner RSA varies between 27-70 ‰, with clear spatial differences. In the central part, along the Iranian Coast, the surface salinity increases gradually northwards from 37 to 40‰, while the shallow waters of Qatar and UAE sustained higher salinities (41 - 43‰), reaching to 50-70‰ in remote lagoons and coastal embayments such as Gulf of Salwa (Purser and Seibold, 1973).

The surface water temperature is often variable even within a day because of the wind system in the inner RSA, demonstrating a northward decrease in winter against increase in summer. The minimum winter temperature dropped to 14°C in the isolated lagoons and shallow coastal waters and 22°C in the offshore waters, while the maximum summer temperature rised to 40-42°C in the coastal waters and 32.5°C in the central part. The vertical profile showed more or less homothermal water layers in winter and clear stratification in summer, particularly in the central area (EL-Samra and EL-Gindy, 1990).

The inner RSA is characterized by relatively low contents of nutrient salts, but the offshore waters are generally more fertile than the inshore. However, detectable high nutrient levels were recorded in Kuwaiti waters and near Hormuz Strait, reflecting the effect of high nutrient content in the waters discharged from Shatt Al-Arab and the Sea of Oman respectively. In addition, the southern part of Qatari waters receives allochthonous supply of nitrate and phosphate from fertilizers industry (EL-Samra, 1988).

Numerous studies have been conducted on plankton of The ROPME Sea Area (Frontier, 1963a,b; Sarnthein, 1967; Furnestin and Codaccioni, 1968; Martini, 1969; Fenoux, 1973; Kimor, 1973; Ahmed, 1974; Yamazi, 1974; Grasshoff, 1976; Basson *et al*., 1977; Grice and Gibson, 1978; Jacob, 1978; Jacob and Zarba, 1979; Jacob *et al*., 1979; Gibson *et al.* 1980; Michel, 1980; 1983; 1995; Michel, *et al*., 1981; 1982; 1986a,b; Halim, 1984; Fahmi *et al*., 1987; Al-Yamani, 1989; 1993; Salman *et al*., 1990; Grabe and Lees, 1992; Hussein, 1992; Al-Yamani *et al.*, 1993; 1994a; 1998; 2004; 2006; AL-Aidaroos, 1993; Ghobashy *et al.*, 1994; Cherif *et al.*, 1997; Dorgham and Hussein, 1997; Sharaf and Al-Ghais, 1997; AL-Khabbaz and Fahmi, 1998; El-Serehy, 1998; 2004; Nour EL-Din and Ghobashy, 1999; Nour EL-Din and Abdel-Moati, 2001; Nour EL-Din and AL-Khayat, 2001; 2006; Abdul-Aziz *et al*., 2003; Baker and Hosny, 2005; Batang *et al*., 2007; Haghi *et al.*, 2007; Skryabin and AL-Yamani, 2007). The majority of these studies based on one time or seasonal collection of zooplankton samples from limited parts of the ROPME Sea Area, while some of them based on samples collected once at numerous stations over the whole area. The present strudy seems to be one of the most comprehensive one, since it based on large number of sampling stations and represent a part of integrated study of all abiotic and biotic characteristics of the ROPME Sea Area.

This part of the present study aims at following the species composition and numerical density of zooplankton community throughout the whole ROPME Sea Area during winter 2006, relative to the surrounding environmental conditions.

2. Material and Methods

A total of 59 zooplankton samples were provided by ROPME to AUDO for complete analysis of species composition and estimation of standing crop of zooplankton. The Oceanographic onboard zooplankton data sheet given by ROPME indicate that the concerned samples were collected by coarse plankton net of 110 µm and mouth diameter of 60cm, and fitted by a flow meter.

The net hauls were carried out obliquely at variable depths (6-14 m) and variable angles (20^o - 50^o) at the different sampling stations. The time of net towing varied from 1 to 4 minutes at Research Vessel speed of 2 knots/hr at most stations and 1-2 knots/hr at some stations. As shown in figure 1, the sampling stations were chosen to cover all parts of the the inner RSA, Straits of Hormuz and the northern part of the Sea of Oman .

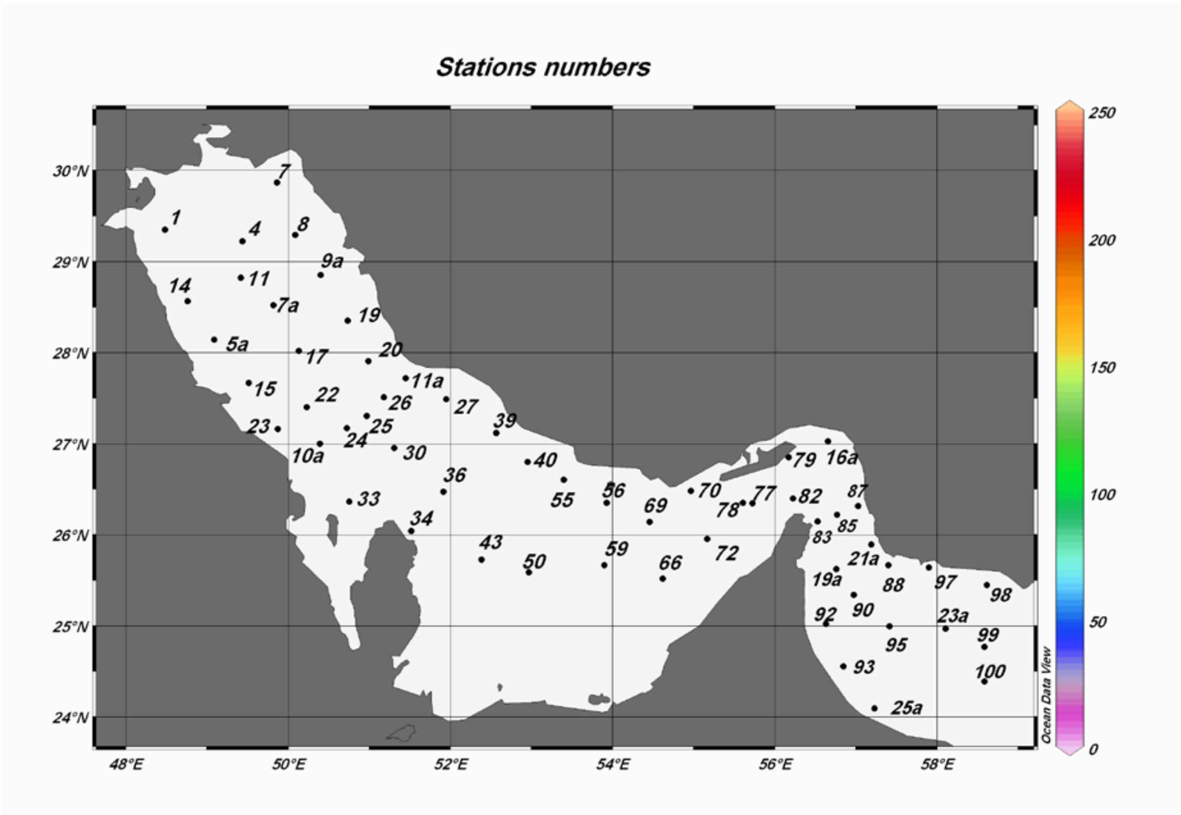

Fig.1- Map of the ROPME Sea Area, including positions of the sampling stations.

Each zooplankton sample was examined carfully carefully under the microscope and all taxa were identified to the species level, following Giesbrecht (1891; 1892; 1897), Cleve (1903), Thompson and Scott (1903), Burfield (1927), Kofoid and Campbell (1929; 1939), Hada (1932; 1937), Lohmann (1931), Rose (1933), Sewell (1948), Tregouboff and Rose (1957), Marshall (1969) and Paulmier (1997).

For estimation of the standing crop, the samples were well gently shacked to make homogenous distribution of different zooplankton components inside the sample, sub-sample of 5 ml was transferred into a counting chamber (Bogorov chamber) using a plunger pipette.

All zooplankton organisms in the sub-sample were counted to the species level and the counting was repeated in three replicates. The mean value of the three counts was used to determine the total count of zooplankton in the whole volume of the sample concentrated by the net.

The number of zooplankton organisms in the concentrated sample at each station is equal to their number in the volume of filtered seawater. To estimate the standing crop of zooplankton at each station its count in the whole concentrated sample was divided by the volume of the filtered seawater at the same station and the standing crop was expressed as number of organisms/m^3.

The volume of filtered seawater was calculated by two methods:

The first method depends upon measuring the length of the water column entered the plankton net during the towing time, using the vessel speed. This length is equal to the distance to which the plankton net was towed, and can be calculated applying the following formula:

$$V = \Pi \, r^2 \, d$$

Where v = volume of the filtered seawater (in m^3), r = radius of the net mouth (in meter), d = distance of net tow during one minute, d = distance to which the plankton net was towed, and can be found as follow:

$$d = \frac{\text{Speed of the Research Vessel (2x1852) X Towing time}}{\text{60 minutes}}$$

The second method is based on the reading of the flow meter (number of revolutions), and the volume of filtered seawater can be calculated according to the following formula:

$$V = \text{number of revolutions} \times 0.3 \times \Pi r^2$$

Where V = volume of the filtered seawater (in m^3), 0.3 (in meter) is the pitch of the impeller per a revolution of the flow meter, r = radius of the net mouth (in meter).

It is to be noted that the estimation of the volume of filtered seawater at all examined stations in this report based upon the flow meter readings, except that at stations 56 and 98, the sheet data of which lack the end flow meter reading. Therefore, the volumes of filtered seawater at these stations were calculated from the ship speed.

3. Results

The present report includes the results of qualitative and quantitative analysis of 59 zooplankton samples collected throughout the ROPME Sea Area during February-March 2006.

3.1 Species composition:

The results showed that the zooplankton community in the ROPME Sea Area appeared to be highly diversified, comprising 230 species, distributed among numerous taxonomic phyla of the animal kingdom (Table 1). The crustacean copepods were represented by the highest number of species (94 species) and included calanaoids (56 species), cyclopoids (35 species) and harpacticoids (5 species). The planktonic cnidarian formed 15% of total number of zooplankton species, represented by 18 species of hydrozoan medusae and 17 species of siphonophores. The protozoan tintinnids (24 species) constituted 10%. The other zooplankton groups were represented by low number of species (Table 2). All zooplankton genera of the different groups were represented by one, two or three species, except the copepods *Corycaeus* (12 species), *Sapphirina* (8 species), *Oncea* (7 species), *Oithona* (6 species), *Acartia* (5 species), *Candacia* (5 species), Centropages (5 species), , Labidocera (5 species), *Temora* (4 species), the chaetognath *Sagitta* (7 species) and the larvaceans *Oikopleura* (5 species).

Table 1- Zooplankton species in the ROPME Sea Area during winter 2006.

Foraminifera (4 spp.)	*Phialidium hemisphericum*	*Tomopteris* sp.
Globigerina bulloides	*Phialidium* sp.	*Sagitella* sp.
Golobigerina sp.	**Limnomedusae**	**Mollusca (10 spp.)**
Globorotalia sp.	*Olindias singularis*	*Atlanta* sp.
Globigerinoid sp.	**Trachymedusae**	*Atlanta inflata*
Radiolaria (3 spp.)	*Aglaura hemistoma*	*Cavolinia* sp.
Acanthometron sp.	*Liriope* sp.	*Clione* sp.
Heliosphaera sp.	*Rhopalonema* sp.	*Creseis acicula*
Stauracantha sp.	**Narcomedusae**	*Diacria trispinosa*
Tintinnida (24 spp.)	*Cunina* sp.	*Euclio* sp.
Amphorides quadrilineata	*Solmaris* sp.	*Limacina bulloides*
Codonellopsis americana	*Solmundella bitentaculata*	*Limacina inflata*
Codonellopsis longa	*Solmundella* sp.	*Limacina trochiformis*
Codonellopsis morchella	**Siphonophora (16 spp.)**	**Cladocera (4 spp.)**
Codonellopsis orthoceras	*Abylopsis escholtzii*	*Evadne tergestina*
Dictyocysta reticulata	*Abylopsis tetragona*	*Penilia avirostris*
Epiplocylis brandti	*Agalma elegans*	*Podon polyphemoides*
Eutintinnus fraknoii	*Bassia bessensis*	Podon schmackeri
Eutintinnus lusus-undae	*Chelophyes appendiculata*	**Ostracoda (7 spp.)**
Eutintinnus macilentus	*Diphyes* sp.	*Conchoecia elegans*
Eutintinnus stramentus	*Eudoxoides spiralis*	*Conchoecia obtusata*
Favella azorica	*Forskalia spp.*	*Conchoecia* sp1?
Helicostomella subulata	*Lensia conoidea*	*Conchoecia* sp.
Leptotintinnus botnicus	*Lensia subtilis*	*Cypridina* sp.
Leptotintinnus nordgvisiti	*Lensia subtiloides*	*Euconchoecia chierchiae*
Parafavella gigantea	*Lensia sp.*	*Philomedes macandrei*
Petalotricha ampulla	*Muggiaea atlantica*	**Copepoda (94 spp.)**
Salpingella attenuata	*Muggiaea kockii*	**Calanoids (55 spp.)**
Steenomella nivalis	*Sulculeolaria biloba*	*Acartia amboinesis*
Tintinnopsis beroidea	*Sulculeolaria quadrivalves*	*Acartia clausi*
Tintinnopsis lobiancoi	**Scyphozoa (1 sp.)**	*Acartia danae*
Tintinnidum mucicola	Pelagia spp.	*Acartia erythraea*
Tintinnopsis radix	**Ctenophora (1 sp.)**	*Acartia negligens*
Xystonella treforti	**Beroe ovate**	*Acrocalanus gibber*
Medusa (18 spp.)	**Annelida (11 spp.)**	*Aetideus armatus*
Anthomedusae	*Alciopa* sp.	*Anomalocera patersoni*
Amphinema sp.	*Callizonella* sp.	*Bathycalanus maximus*
Ectopleura dumortieri	*Eunapteris euchaeta*	*Calanopia elliptica*
Steenstrupia sp.	*Magelona papillicornis*	*Calanopia minor*
Leptomeduase	*Pelagobia longicerrata*	*Calocalanus pavo*
Aequorea sp.	*Phalacrophorus uniformis*	*Candacia aethiopica*
Eirene sp.	*Prionospio* sp.	*Candacia armata*
Octocanna sp.	*Rhynchonella* sp.	*Candacia bradyi*
Obelia sp.	*Tomopetris elegans*	*Candacia longimana*

Table 1- Zooplankton species occurred in the whole ROPME Sea Area (Continued).

Copepods (Continued)	*Corycaeus andrewsi*	**Mysidacea (4 spp.)**
Candacia pachydactyla	*Corycaeus dahli*	*Leucifer acestra*
Canthocalanus pauper	*Corycaeus flaccus*	*Lucifer raynaudii*
Centropages furcatus	*Corycaeus lautus*	*Leucifer* sp.
Centropages kroyeri	*Corycaeus ovalis*	*Mysis* sp.
Centropages orsinii	*Corycaeus pacificus*	**Amphipoda (2 spp.)**
Centropages tenuiremis	*Corycaeus rostratus*	*Streetsia challengeri*
Centropages violaceus	*Corycaeus speciosus*	*Hyperia* sp.
Clausocalanus minor	*Corycaeus typicus*	**Chaetognatha (8 spp.)**
Clausocalanus furcatus	*Corycaeus venustus*	*Krohnitta subtilis*
Eucalanus crassus	*Corycaeus sp.*	*Sagitta enflata*
Eucalanus elongatus	*Oithona attenuate*	*Sagitta ferox*
Euchaeta concinna	*Oithona nana*	*Sagitta neglecta*
Euchaeta marina	*Oithona plumifera*	*Sagitta serratodentata*
Euchaeta spinosa	*Oithona setigera*	*Sagitta* sp1
Labidocera acutifrons	*Oithona similis*	*Sagitta* sp2
Labidocera acutum	*Oithona sp*	*Sagitta* sp3
Labidocera kroyeri	*Oncaea clevei*	**Larvacea (9 spp.)**
Labidocera minuta	*Oncaea conifer*	*Appendicularia sicula*
Labidocera pavo	*Oncaea media*	*Fritillaria borealis*
Lucicutia flavicornis	*Oncaea mediterranea*	*Fritillaria formica*
Nannocalanus minor	*Oncaea minuta*	*Oikopleura dioica*
Neocalanus tenuicornis	*Oncaea venusta*	*Oikopleura Intermedia*
Paracalanus aculeatus	*Oncaea sp.*	*Oikopleura longicauda*
Paracalanus crassirostris	*Sapphirina angusta*	*Oikopleura parva*
Paracalanus parvus	*Sapphirina gemma*	*Oikopleura rufescens*
Pleuromama abdominalis	*Sapphirina intestinata*	*Stegosoma magnum*
Pleuromama xiphias	*Sapphirina nigromaculata*	**Thaliacea (11 spp.)**
Pontella fera	*Sapphirina ovatolanceolata*	*Doliolum denticulatum*
Pontella karachiensis	*Sapphirina vorax*	*Doliolum gegenbouri*
Pontellina plumata	*Sapphirina sp2*	*Doliolum mulleri*
Pontellopsis krameri	**Harpacticoids (6 spp.)**	*Iasis zonaria*
Pseudodiaptomus arabicus	*Euterpina acutifrons*	*Ihlea sp.*
Rhincalanus cornutus	*Clytemnestra scutellata*	*Salpa cylinderica (1)*
Rhincalanus nasutus	*Macrosetella gracilis*	*Salpa fusiformis*
Temora discaudata	*Microsetella norvegica*	*Salpa maxima*
Temora longicornis	*Microsetella rosea*	*Thalia democratica*
Temora stylifera	Tigriopus spp.	*Thetys vagina*
Temora turbinata	**Euphausiacea (5 spp.)**	*Thalia sp.*
Tortanus sp.	*Euphausia* sp.	
Cyclopoids (33 spp.)	*Stylocheiron* sp.	
Copilia mirabilis	*Thysanopoda* sp.	
Corycaeus agilis	*Euphausia brevis*	
	Meganyctiphanes norvegica	

Table 2- The number of species in the different taxonomic zooplankton groups (Winter 2006).

Group	Sp. No.
Foraminifera	4
Radiolaria	3
Tintinnida	24
Hydromedusae	17
Siphonophora	16
Scyphozoa	1
Ctenophora	1
Polychaeta	11
Mollusca	10
Cladocera	4
Ostracoda	6
Copepoda	94
Euphausiacea	5
Amphipoda	2
Mysidaceae	4
Chaetognatha	8
Larvacea	9
Thaliaceae	11
Total species	230

Despite the high number of zooplankton species in the whole ROPME Sea Area during winter, the sampled stations harbored relatively low diversified communities, (Figure 2), whereas the total number of zooplankton species varied between a minimum of 17 species at station 36 and a maximum of 69 species at station 50. Stations 33, 14a, and 25 harbored small number of species (20 – 23 species) and stations 7a, 15, 23 & 69 harbored large number of species (61-63 species). Copepods were the most diversified group over the whole area (7 - 36 species) and they could be considered as keystone which affects the total number of zooplankton species over the whole area, as indicated from the significant correlation between the two variables ($r = 0.8634$, $n= 59$). However, some groups were represented by relatively high number of species at some stations. Tintinnids reported high number of species (14, 12, 9 & 7 species) at stations 27, 39, 40 and 88 respectively, while they were either missed or represented by 1 – 4 species at all the other stations. Hydromeduase occurred at most of stations, but usually 1-3 species, increased to 4-5 species at stations7a ,23 ,92 & 26a respectively, and similarly, siphonophores were mostly represented by 1-5 species, increased to 6-8 species at stations 17, 82 & 21a. The number of Planktonic polychaetes and mollusks species varied between 1 and 4 species, and increased to 6 species at stations 7a and 23 for polychaetes and at station 23 for mollusks. Chaetognatha was mostly represented by 2 species, while 6 species were observed at stations 50 and 69. Larvaceans comprised 1-3 species over the whole area, while at stations 77 and 21a there were 6 and 5 species respectively. One to three species of thaliaceans appeared at numerous stations, but 5 species were observed at station 22.

It is worth to mention that zooplankton community in the inner RSA appeared to be highly diversified (210 species) as compared to that (144 species) in the Sea of Oman . However, three groups of zooplankton species could be distinguished throughout the ROPME Sea Area during winter, the first one comprises 92 species (Table 3), which were restricted to the inner RSA, the second group include 18 species (Table 4) observed only in the Sea of Oman , and the third group was represented by 120 species (Table 5), which were found either sporadically or widespread over the whole ROPME Sea Area.

Table (3)- Zooplankton species restricted to the inner RSA (Winter 2006).

Foraminifera	*Tomopetris elegans*	**Cyclopoid copepods**
Golobigerina sp.	*Sagitella* sp.	*Oncaea clevei*
Globigerinoid sp.	**Mollusca**	*Oncaea spp.*
Radiolaria	*Atlanta* sp.	*Sapphirina angusta*
Acanthometron sp.	*Atlanta inflata*	*Sapphirina gemma*
Heliosphaera sp.	*Clione* sp.	*Sapphirina intestinata*
Stauracantha sp.	*Limacina trochiformis*	*Sapphirina vorax*
Tintinnida	**Cladocera**	*Sapphirina sp*
Codonellopsis americana	Podon schmackeri	**Harpacticoids**
Eutintinnus stramentus	**Ostracoda**	*Microsetella norvegica*
Favella azorica	*Conchoecia* sp1?	*Tigriopus* spp.
Leprotintinnus botnicus	**Calanoid copepods**	**Euphausiacea**
Parafavella gigantea	*Acartia amboinesis*	*Meganyctiphanes norvegica*
Petalotricha ampulla	*Acartia danae*	**Mysidacea**
Steenomella nivalis	*Calanopia minor*	*Lucifer reynaudii*
Tintinnidium mucicola	*Candacia bradyi*	**Chaetognatha**
Medusae	*Candacia longimana*	*Krohnitta subtilis*
Aequorea sp.	*Centropages orsinii*	*Sagitta ferox*
Eirene sp.	*Centropages tenuiremis*	*Sagitta* sp1
Octocannoides sp.	*Euchaeta concinna*	*Sagitta* sp2
Phialidium hemisphericum	Labidocera kroyeri	*Sagitta* sp3
Olindias singularis	*Labidocera pavo*	**Larvacea**
Liriope sp.	Lucicutia flavicornis	*Appendicularia sicula*
Rhopalonema sp.	*Neocalanus tenuicornis*	*Oikopleura rufescens*
Cunina sp.	*Paracalanus crassirostris*	**Thaliacea**
Solmaris sp.	*Pleuromama xiphias*	*Iasis zonaria*
Solmundella sp.	*Pontella karachiensis*	*Ihlea sp.*
Scyphozoa	*Pontellopsis krameri*	*Salpa cylinderica*
Pelagia spp.	*Pseudodiaptomus arabicus*	*Salpa fusiformis*
Siphonophora	*Temora longicornis*	*Thetys vagina*
Chelophyes appendiculata	**Cyclopoid copepods**	*Thalia sp.*
Diphyes sp.	*Corycaeus agilis*	
Eudoxoides spiralis	*Corycaeus andrewsi*	
Lensia subtilis	*Corycaeus dahli*	
Lensia subtiloides	*Corycaeus flaccus*	
Muggiaea kockii	*Corycaeus lautus*	
Annelida	*Corycaeus pacificus*	
Callizonella sp.	*Corycaeus sp.*	
Eunapteris euchaeta	*Oithona attenuata*	
Magelona papillicornis	*Oithona sp.*	

Table (4)- Zooplankton species restricted to the Sea of Oman (Winter 2006).

Foraminifera	**Siphonophora**
Globorotalia sp.	*Sulculeolaria quadrivalves*
Tintinnids	**Calanoid copepods**
Codonellopsis longa	*Aetideus armatus*
Dictyocysta reticulate	*Bathycalanus maximus*
Epiplocylis brandti	*Centropages violaceus*
Eutintinnus macilentus	*Tortanus sp.*
Tintinnopsis beroidea	**Euphausiacea**
Tintinnopsis lobiancoi	*Thysanopoda* sp.
Medusa	*Euphausia brevis*
Amphinema sp.	**Larvacea**
Steenstrupia sp.	*Fritillaria formica*
Obelia sp.	

Table 5- Zooplankton species reported in both the inner RSA and Sea of Oman (Winter 2006).

Foraminifera	**Ostracods**	**Cyclopoid copepods**
Globigerina bulloides	*Conchoecia elegans*	*Oithona nana*
Tintinnida	*Conchoecia obtusata*	*Oithona plumifera*
Amphorides quadrilineata	*Conchoecia* sp.	*Oithona setigera*
Codonellopsis morchella	*Cypridina* sp.	*Oithona similis*
Codonellopsis orthoceras	*Euconchoecia chierchiae*	*Oncaea conifera*
Eutintinnus fraknoii	*Philomedes macandrei*	*Oncaea media*
Eutintinnus lusus-undae	**Calanoid copepods**	*Oncaea mediterranea*
Helicostomella subulata	*Acartia clause*	*Oncaea minuta*
Leprotintinnus nordgvisiti	*Acartia erythraea*	*Oncaea venusta*
Salpingella attenuata	*Acartia negligens*	*Sapphirina nigromaculata*
Tintinnopsis radix	*Acrocalanus gibber*	*Sapphirina ovatolanceolata*
Xystonella treforti	*Anomalocera patersoni*	**Harpacticoid copepods**
Medusae	*Calanopia elliptica*	*Clytemnestra scutellata*
Ectopleura dumortieri	*Calocalanus pavo*	*Euterpina acutifrons*
Phialidium sp.	*Candacia aethiopica*	*Macrosetella gracilis*
Aglaura hemistoma	*Candacia armata*	*Microsetella rosea*
Solmundella bitentaculata	*Candacia pachydactyla*	**Euphausiacea**
Siphonophora	*Canthocalanus pauper*	*Euphausia* sp.
Abylopsis escholtzii	*Centropages furcatus*	*Stylocheiron* sp.
Abylopsis tetragona	*Centropages kroyeri*	**Mysidacea**
Agalma elegans	*Clausocalanus arcuicornis*	*Leucifer acestra*
Bassia bessensis	*Clausocalanus furcatus*	*Leucifer* sp.
Forskalia sp.	*Eucalanus crassus*	*Mysis* sp.
Lensia conoidea	*Eucalanus elongates*	**Amphipoda**
Lensia sp.	*Euchaeta marina*	*Streetsia challengeri*
Muggiaea atlantica	*Euchaeta spinosa*	*Hyperia* sp.
Sulculeolaria biloba	*Labidocera acutifrons*	**Chaetognatha**
Ctenophores	*Labidocera acuta*	*Sagitta enflata*
Beroe ovata	*Labidocera minuta*	*Sagitta neglecta*
Polychaetes	*Nannocalanus minor*	*Sagitta serratodentata*
Alciopa sp.	*Paracalanus aculeatus*	**Larvacea**
Pelagobia longicerrata	*Paracalanus parvus*	*Fritillaria borealis*
Phalacrophorus uniformis	*Pleuromama abdominalis*	*Oikopleura dioica*
Prionospio sp.	*Pontella fera*	*Oikopleura Intermedia*
Rhynchonerella sp.	*Pontellina plumata*	*Oikopleura longicauda*
Tomopteris sp.	*Rhincalanus cornutus*	*Oikopleura parva*
Molluscs	*Rhincalanus nasutus*	*Stegosoma magnum*
Cavolinia sp.	*Temora discaudata*	**Thaliacea**
Creseis acicula	*Temora stylifera*	*Doliolum denticulatum*
Diacria trispinosa	*Temora turbinate*	*Doliolum gegenbouri*
Euclio sp.	**Cyclopoid copepods**	*Doliolum mulleri*
Limacina bulloides	*Copilia mirabilis*	*Salpa maxima*
Limacina inflata	*Corycaeus ovalis*	*Thalia democratica*
Cladocerans	*Corycaeus rostratus*	
Evadne tergestina	*Corycaeus speciosus*	
Penilia avirostris	*Corycaeus typicus*	
Podon polyphemoides	*Corycaeus venustus*	

On the other hand, zooplankton species demonstrated variable spatial patterns (Table 6), whereas the majority of them (149 species) were recorded at 1 - 9 stations throughout the study area. Otherwise, in the inner RSA, 20 species were considered as widespread over the whole RSA, since they were reported at 24 – 38 stations, and 28 species were less wisdspread, being found at 13 – 23 stations (Fig. 2a). Meanwhile, in the Sea of Oman , 17 species occurred at 17 -21 stations, and 22 species were observed at 10 – 16 stations (Fig. 2b).

Table 6 – Frequent occurrence of zooplankton species over the ROPME Sea Area (Winter 2006).

No. of stations	No. of species
1-9	149
10-19	44
20-29	15
30-39	11
40-49	10
50-59	4

It is to be noted that, of the total number of zooplankton species identified during the present study 114 species have never been recorded before, and could be considred as new records to the ROPME Sea Area, particulalrly the inner RSA. Some of these species may already occurr in the area, but they were not identified while others recently pass from the Sea of Oman to the inner RSA. The new records belong to different zooplankton groups (Table, 7), and they will be mentioned in the next parts of this report.

Table 7- The number of new recorded species of different zooplankton groups.

Group	No. of species
Foraminifera	4
Radiolaria	3
Tintinnida	13
Hydromedusae	12
Siphonopohra	15
Polychaetea	9
Mollusca	7
Ostracoda	3
Copepoda	21
Euphausiacea	4
Mysidacea	4
Amphipoda	1
Chaetognatha	4
Larvacea	6
Thaliacea	7
Total	113

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Foraminifera (4 spp.)																																							
Globigerina bulloides																																			■		■		
Golobigerina sp.																																	■						
Globigerinoid sp.																																	■	■		■			
Radiolaria (3 spp.)																																							
Acanthometron sp.									■	■					■		■							■				■					■						
Heliosphaera sp.																								■				■						■					
Stauracantha sp.																	■			■								■						■					
Tintinnida (24 spp.)																																							
Amphorides quadrilineata						■																																	
Codonellopsis americana																							■	■			■												
Codonellopsis morchella																							■	■				■		■									
Codonellopsis orthoceras						■																																	
Eutintinnus fraknoii								■															■	■				■			■								■
Eutintinnus lusus-undae				■					■																													■	
Eutintinnus stramentus																							■					■		■	■								
Favella azorica																							■	■				■			■								
Helicostomella subulata																							■	■						■									
Leptotintinnus botnicus																							■	■															
Leptotintinnus nordgvisiti						■																																	
Parafavella gigantea																							■	■				■		■									
Petalotricha ampulla																							■	■															
Salpingella attenuata																							■	■				■		■									
Steenomella nivalis																							■																
Tintinnidum mucicola																							■	■				■		■									
Tintinnopsis radix												■											■	■			■	■											
Xystonella treforti																							■	■				■											

Fig. 2a- Occurrence of zooplankton species at different stations in the inner RSA Region.

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Anthomedusae																																							
Ectopleura dumortieri											■																												
Steenstrupia sp.																																							
Leptomeduase																																							
Aequorea sp.	■							■																															
Eirene sp.						■																						■					■						
Octocanna sp.					■																																		
Obelia sp.																																							
Phialidium hemisphericum								■	■																														
Phialidium sp.				■									■																										
Limnomedusae																																							
Olindias singularis													■																										
Trachymedusae																																							
Aglaura hemistoma					■			■	■		■	■	■	■					■	■				■			■		■	■		■	■	■		■	■		■
Liriope sp.																			■								■			■									
Rhopalonema sp.							■							■																									
Narcomedusae																																							
Cunina sp.						■																																	
Solmaris sp.													■																						■				
Solmundella bitentaculata					■			■	■				■	■																					■		■		■
Solmundella sp.																											■	■					■			■			
Class Scyphozoa							■							■																									
Pelagia spp.			■																																				
Siphonophora (16 spp.)																																							
Abylopsis escholtzii													■																								■		■
Abylopsis tetragona																																							■
Agalma elegans																																							■
Bassia bessensis																																					■		
Chelophyes appendiculata								■	■	■	■		■	■																					■			■	■
Diphyes sp.			■												■	■	■	■	■	■		■				■	■	■		■	■					■			

Fig. 2a- Occurrence of zooplankton species at different stations in the inner RSA Region (Continued).

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Siphonophora (Continued)																																							
Eudoxoides spiralis (Bigelow)		■				■		■	■		■	■	■	■																									
Forskalia spp.											■																								■		■	■	
Lensia conoidea		■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■	■		■				■	■	■	■	■	■	■		■	■	■	■	■	■
Lensia subtilis				■	■						■																												
Lensia subtiloides								■	■					■																									■
Lensia sp.											■																												
Muggiaea atlantica					■			■			■	■		■																									
Muggiaea kockii									■																														
Sulculeolaria biloba											■				■	■	■		■	■		■				■	■	■	■	■	■		■			■		■	
Ctenophora																																							
Beroe ovata																																							■
Polychaetes																																							
Alciopa sp.								■																															
Callizonella sp.												■	■																				■						
Eunapteris euchaeta																																							■
Magelona papillicornis								■					■																										
Pelagobia longicerrata				■	■			■	■	■	■	■	■																								■		■
Phalacrophorus uniformis									■		■																												
Prionospio sp.								■					■																										■
Rhynchonella sp.					■		■	■				■	■				■			■								■							■		■		■
Tomopetris elegans			■																											■			■	■		■			
Tomopteris sp.	■	■		■	■		■	■	■	■	■	■	■	■		■				■							■	■	■	■		■	■		■				
Sagitella sp.																						■					■			■				■		■			
Mollusca																																							
Atlanta sp.		■			■																																		
Atlanta inflata																										■		■		■									

Fig. 2a- Occurrence of zooplankton species at different stations in the inner RSA Region (Continued).

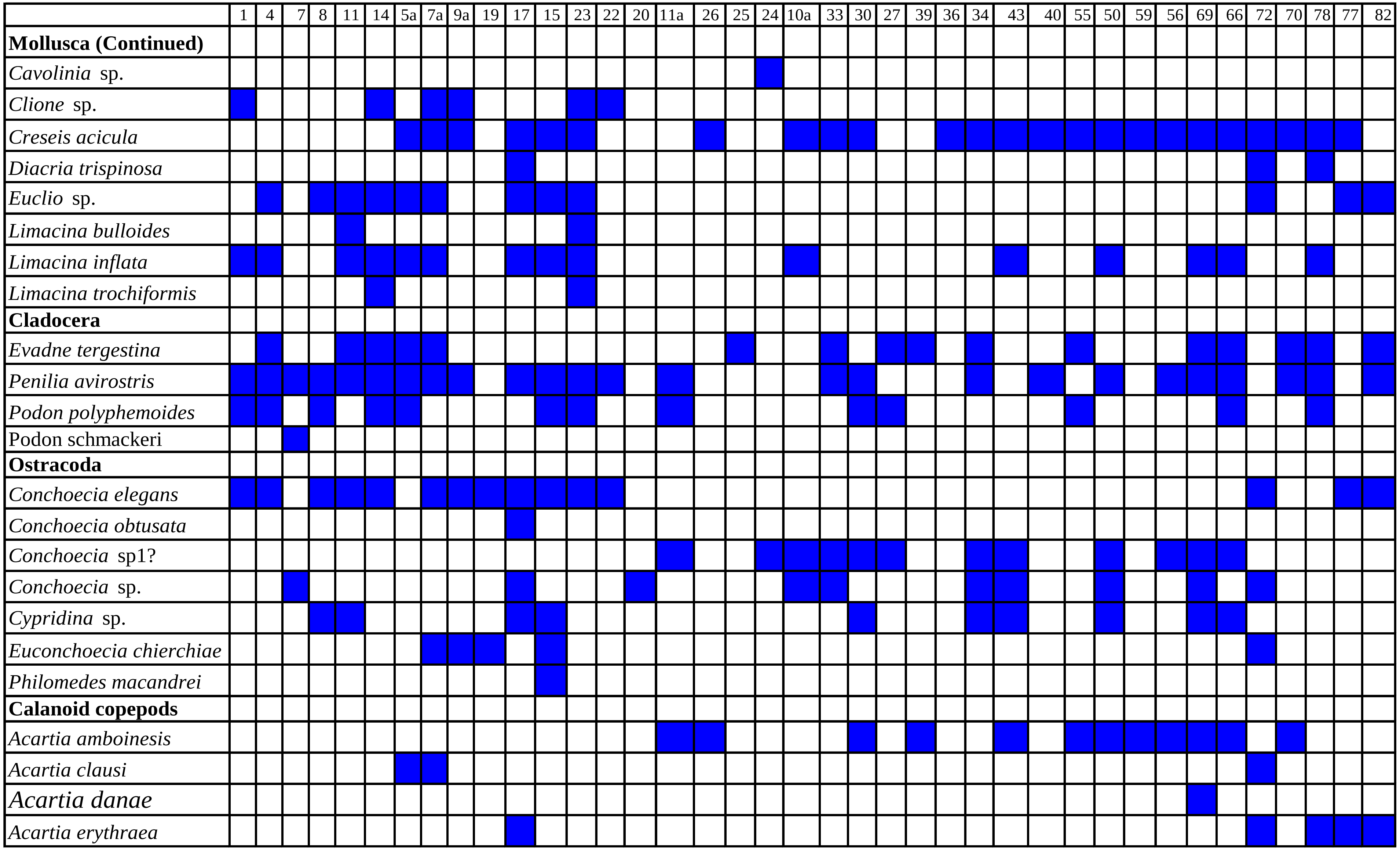

Fig. 2a- Occurrence of zooplankton species at different stations in the inner RSA (Continued)

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Calanoid copepods																																							
Acartia negligens	■						■	■																											■		■		
Acrocalanus gibber															■	■	■				■	■				■		■	■	■	■		■	■		■			
Anomalocera patersoni								■	■			■																											
Calanopia elliptica																										■								■				■	■
Calanopia minor																■										■													
Calocalanus pavo																																							■
Candacia aethiopica				■																																			
Candacia armata		■		■	■			■	■																														
Candacia bradyi			■																			■					■			■			■						
Candacia longimana		■		■					■		■																												
Candacia pachydactyla										■																													
Canthocalanus pauper			■									■	■			■				■	■					■			■	■			■	■		■			
Centropages furcatus		■			■		■	■	■			■	■			■	■			■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
Centropages kroyeri	■					■	■	■				■																											
Centropages orsinii																■								■		■			■	■	■		■	■					
Centropages tenuiremis			■												■						■	■																	
Clausocalanus minor (arcuicornis)	■	■	■	■	■	■	■	■	■	■	■	■	■		■					■		■				■	■		■				■		■	■	■	■	■
Clausocalanus furcatus		■		■	■				■			■	■												■														
Eucalanus crassus	■	■	■	■	■			■	■	■	■	■	■	■		■	■			■		■				■	■	■	■	■			■	■	■	■	■	■	■
Eucalanus elongatus	■			■								■	■																									■	■
Euchaeta concinna																				■		■				■	■			■			■						
Euchaeta marina												■	■																										
Euchaeta spinosa					■								■																									■	
Labidocera acutifrons								■																															■
Labidocera acutum		■			■																					■							■	■					
Labidocera kroyeri			■																																				

Fig. 2- Occurrence of zooplankton species at different stations in the inner RSA (Continued)

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Calanoid copepods																																							
Labidocera minuta		■	■	■	■		■	■	■	■	■	■	■			■	■			■		■		■	■	■		■	■	■	■		■	■					
Labidocera pavo		■																																					
Lucicutia flavicornis			■																																				
Nannocalanus minor	■	■		■	■	■		■	■	■	■	■	■																	■				■			■		■
Neocalanus tenuicornis								■																															
Paracalanus aculeatus										■					■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
Paracalanus crassirostris															■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Paracalanus parvus	■	■		■	■	■	■	■	■	■	■	■	■	■		■			■	■		■	■	■		■			■	■	■			■	■	■	■	■	■
Pleuromama abdominalis					■						■																												
Pleuromama xiphias										■																													
Pontella fera		■										■																											
Pontella karachiensis																																	■						
Pontellina plumata																																							■
Pontellopsis krameri		■		■								■	■																										
Pseudodiaptomus arabicus			■													■																							
Rhincalanus cornutus		■		■	■	■	■	■	■	■	■	■	■																						■		■		■
Rhincalanus nasutus																																							■
Temora discaudata		■	■	■	■			■	■	■	■	■	■			■		■	■	■		■				■	■	■	■	■		■	■	■	■	■			■
Temora longicornis																								■															
Temora stylifera		■		■	■	■	■	■	■		■	■	■																						■		■	■	■
Temora turbinata	■	■	■	■	■	■	■	■	■	■		■	■		■	■		■	■	■	■	■	■	■		■	■		■	■		■	■	■		■	■	■	■
Tigriopus spp.			■																																				
Cyclopoid copepods																																							
Copilia mirabilis		■		■	■			■	■	■	■	■	■							■		■					■		■	■		■			■	■			■
Corycaeus agilis																											■		■	■	■								
Corycaeus andrewsi																				■													■						

Fig. 2a - Occurrence of zooplankton species at different stations in the inner RSA (Continued).

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Cyclopoid copepods																																							
Corycaeus dahli			■												■	■	■	■	■	■	■	■		■	■	■	■	■				■	■			■			
Corycaeus flaccus																																				■			■
Corycaeus lautus																						■					■			■	■					■			
Corycaeus ovalis				■	■			■			■																										■	■	
Corycaeus pacificus			■														■			■		■		■		■	■		■	■	■					■			
Corycaeus rostratus	■	■		■	■	■	■	■	■	■	■	■	■																						■		■	■	
Corycaeus speciosus	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■			■				■		■	■		■	■	■				■	■	■	■	■
Corycaeus typicus				■							■	■								■															■		■		■
Corycaeus venustus		■		■	■		■			■																													■
Corycaeus spp.			■																	■			■	■		■	■	■	■	■						■			
Oithona attenuata																	■			■			■	■				■		■		■		■					
Oithona nana	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■		■	■		■		■	■	■	■		■	■	
Oithona plumifera	■	■		■	■	■	■	■	■	■	■	■	■			■				■		■					■	■	■	■		■	■	■	■		■	■	■
Oithona setigera												■																											■
Oithona similis		■										■																									■		
Oithona spp																		■	■		■	■					■		■	■	■	■	■	■		■			
Oncaea clevei			■	■	■	■					■	■			■	■	■	■	■	■	■	■				■	■		■	■		■	■	■		■			
Oncaea conifera	■			■	■	■	■	■	■	■	■	■	■																						■		■	■	
Oncaea media																																					■	■	■
Oncaea mediterranea		■									■	■																		■			■		■		■	■	
Oncaea minuta		■	■	■	■										■									■				■	■	■		■	■	■		■	■		
Oncaea venusta	■	■		■	■	■	■	■	■	■	■	■	■	■		■				■		■	■	■		■			■	■	■		■		■		■	■	■
Oncaea sp.																■	■	■	■			■	■	■	■		■	■		■		■				■			
Sapphirina angusta								■		■																													
Sapphirina gemma									■	■																													

Fig. 2a - Occurrence of zooplankton species at different stations in the inner RSA (Continued).

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Cyclopoid copepods (Continued)																																							
Sapphirina intestinata		■		■				■	■	■	■		■																										
Sapphirina nigromaculata										■	■								■	■				■		■	■	■	■	■	■		■	■	■	■			■
Sapphirina ovatolanceolata											■																								■				
Sapphirina vorax					■					■																													
Sapphirina sp2															■		■	■	■			■			■								■						
Harpacticoid copepods																																							
Euterpina acutifrons	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Clytemnestra scutellata				■	■			■	■				■			■											■	■	■	■			■	■		■	■		
Macrosetella gracilis		■	■	■	■				■		■	■					■			■				■		■	■		■	■		■	■	■		■			
Microsetella norvegica			■												■	■	■	■	■	■			■	■	■			■	■	■		■	■	■		■			
Microsetella rosea	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■			■		■	■	■				■	■	■				■	■		■	■	■
Copepod nauplii	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Copepodite stages	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Euphausiacea																																							
Euphausia sp.										■																												■	■
Stylocheiron sp.																																						■	■
Meganyctiphanes norvegica																																						■	
Mysidacea																																							
Leucifer acestra	■	■		■	■			■	■	■		■	■	■																					■		■	■	■
Lucifer raynaudii																	■																						
Lucifer sp1																■	■	■	■			■			■	■	■						■			■			
Lucifer sp2																■		■	■						■	■	■						■			■			
Leucifer sp.				■																■				■			■	■	■	■	■	■		■	■	■	■	■	
Mysis sp.				■						■	■	■																											
Amphipoda																																							
Streetsia challengeri			■							■	■																												
Hyperia sp.		■	■	■		■		■					■	■						■							■	■	■	■			■						

Fig. 2a - Occurrence of zooplankton species at different stations in the inner RSA (Continued).

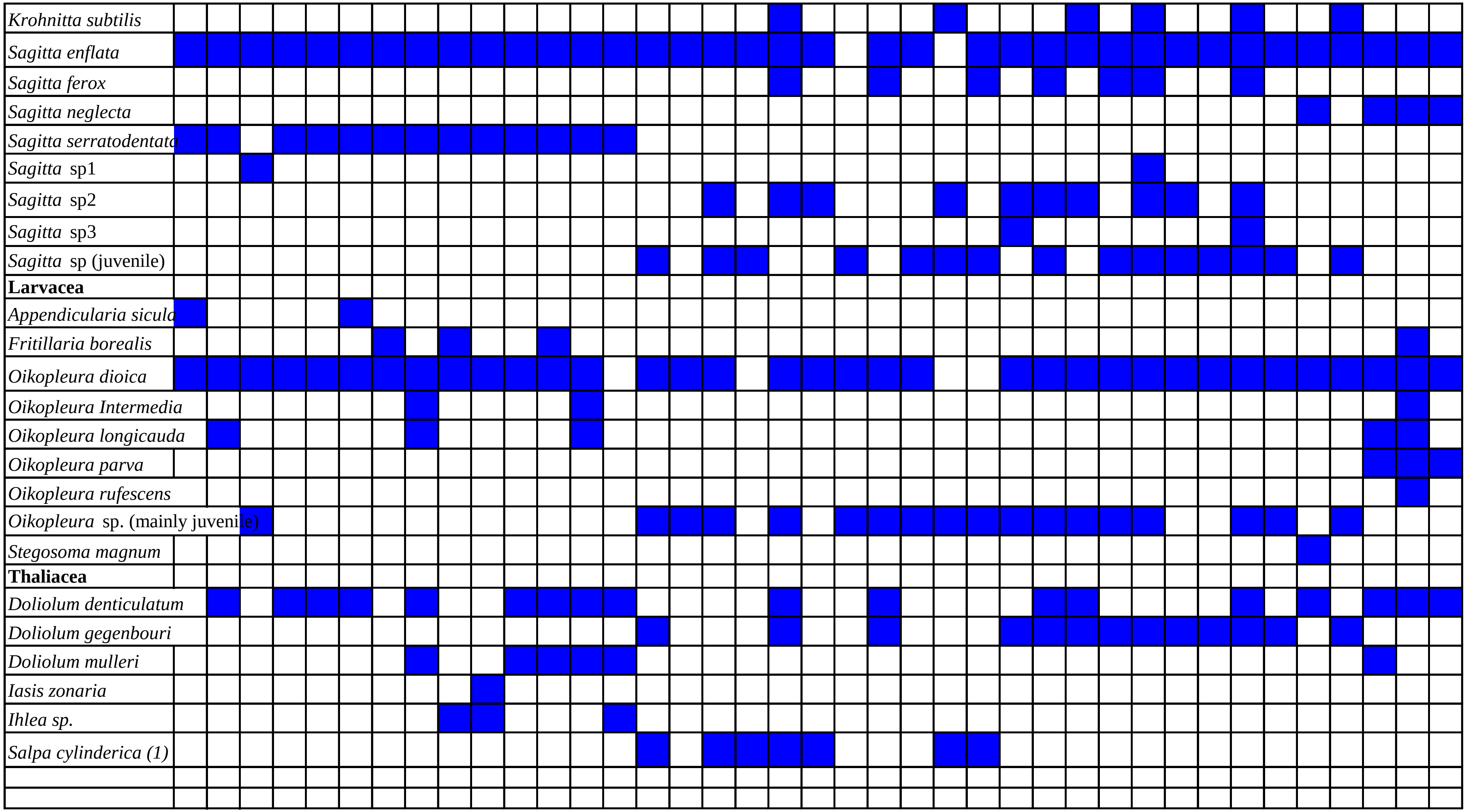

Fig. 2a - Occurrence of zooplankton species at different stations in the inner RSA (Continued).

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Thaliacea Continued)					■				■	■	■	■	■	■																									
Salpa fusiformis					■				■	■	■	■	■	■																									
Salpa maxima												■		■																					■				
Thalia democratica															■		■	■	■	■		■		■	■	■	■	■	■	■	■	■	■		■	■	■		■
Thetys vagina										■										■																			
Thalia sp.																																							■
Meroplanktonic larvae																																							
Polychaetes larvae																																							
Eulalia viridis (L)		■		■				■			■	■	■																								■		■
Sabellaria sp.(L.)				■		■			■																														
Spinoid larvae	■	■	■		■		■	■	■	■	■	■	■	■		■	■		■	■	■	■	■	■	■	■	■	■	■	■		■	■			■			■
Molluscs larvae																																							
Gastropod veligers			■	■				■			■	■	■		■	■	■			■	■	■		■		■	■	■	■		■	■	■	■		■			
Lamellibranch veligers	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■		■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■		■
Cirripedes larvae						■	■	■	■			■	■			■	■				■				■	■											■		■
Decapods larvae																																							
Calyptopis of Meganyctiphanes sp.																																					■	■	
Corystis crassivelanus(MZ)																																							
***Eriphia spiniferous* (MZ)**	■	■				■		■	■	■				■																					■				■
***Maia verrucosa* (Crab)(Z)**		■											■																										■
Megalopa larvae of crab(Metanauplius & Zoea)																																							■

Fig. 2a - Occurrence of zooplankton species and meroplanktonic larvae at different stations in the inner RSA

	1	4	7	8	11	14	5a	7a	9a	19	17	15	23	22	20	11a	26	25	24	10a	33	30	27	39	36	34	43	40	55	50	59	56	69	66	72	70	78	77	82
Decapods larvae (Continued)																																							
Mysis stages of Decapoda	■			■	■		■	■	■	■		■	■																						■		■	■	■
***Parapeneus* sp. (Prawn)(N)**											■	■																									■		
Porcellana longicornis (Crab) (MZ)												■	■																										
***Portunus* sp.(Crab) (Z)**					■							■	■																										
Sergestes sp.(L)																																							
***Sicyonia* sp.(L)**																																					■		■
Decapod larvae (Mohsen)																■				■			■	■			■	■	■	■	■	■	■	■		■			
Crab zoae (mainly Portunus sp) (Mohsen)																			■	■				■	■		■	■		■			■			■			
Procellain zoae (Crab) (Mohsen)			■																	■					■		■	■		■									
Penaeoid larvae (Prawn)(Mohsen)																	■			■		■	■	■	■		■	■		■	■			■					
Stomatopod larvae (Squilla)(Mohsen)																			■						■														
Echinoderms larvae					■	■		■			■		■	■						■								■		■	■	■	■	■	■				
Ascidiacean larvae												■																											
Branchiostoma sp. (L.)									■			■	■																										
Crustacean eggs											■	■																											
Fish larvae		■	■	■	■	■		■	■	■	■	■	■	■	■					■					■			■	■	■	■	■	■	■					
Fish eggs		■					■				■	■	■								■	■	■		■			■	■	■	■	■		■					

Fig. 2a- Occurrence of zooplankton species and meroplanktonic larvae at different stations in the inner RSA

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Foraminifera (4 spp.)																				
Globigerina bulloides									■											
***Globorotalia* sp.**					■															
Tintinnida (24 spp.)																				
Amphorides quadrilineata					■															
Codonellopsis longa														■						
Codonellopsis morchella									■		■	■		■		■		■		
Codonellopsis orthoceras																		■		
Dictyocysta reticulata								■												
Epiplocylis brandti																			■	
Eutintinnus fraknoii											■									
Eutintinnus lusus-undae							■			■	■					■				
Eutintinnus macilentus					■				■					■			■			
Helicostomella subulata							■					■				■	■			
Leptotintinnus nordgvisiti						■					■									
Salpingella attenuata											■			■						
Tintinnopsis beroidea												■								
Tintinnopsis lobiancoi											■									
Tintinnopsis radix								■		■	■	■			■					
Xystonella treforti								■						■	■		■			
Anthomedusae																				
***Amphinema* sp.**									■											
Ectopleura dumortieri									■	■	■						■	■		■
***Steenstrupia* sp.**												■								
Leptomeduase																				
***Phialidium* sp.**				■										■						
***Obelia* sp.**									■										■	■

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and inner RSA

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Narcomedusae																				
Solmundella bitentaculata				■	■		■		■				■					■		■
Trachymedusae																				
Aglaura hemistoma				■			■	■	■							■	■	■		■
Siphonophora																				
Abylopsis escholtzii							■				■					■	■	■		
Abylopsis tetragona													■							
Agalma elegans				■			■													
Bassia bessensis								■					■							
Forskalia spp.		■																		
Lensia conoidea	■			■			■	■	■				■			■	■	■	■	■
Lensia sp.							■			■						■	■			
Muggiaea atlantica							■						■			■			■	
Sulculeolaria biloba				■			■		■							■				■
Sulculeolaria quadrivalves							■										■			
Ctenophora																				
Beroe ovata																			■	
Polychaetes																				
Alciopa sp.												■								
Pelagobia longicerrata		■	■		■		■	■	■	■	■			■	■	■	■			
Phalacrophorus uniformis					■				■											
Prionospio sp.					■			■							■					
Rhynchonella sp.		■			■		■	■	■	■	■			■	■	■	■	■		
Tomopteris sp.	■	■		■		■			■				■	■	■					
Molluscs																				
Cavolinia sp.																		■		
Creseis acicula	■	■		■		■		■	■	■		■		■		■	■	■		
Diacria trispinosa					■					■		■		■	■	■				

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Molluscs (continued)																				
Euclio sp.	■						■		■		■		■				■			■
Limacina bulloides													■							
Limacina inflata	■	■	■		■			■			■	■	■	■		■		■		■
Cladoceras																				
Evadne tergestina	■	■		■		■			■	■				■	■	■				
Penilia avirostris	■	■		■	■				■			■	■		■	■	■	■		■
Podon polyphemoides	■																			
Ostracods																				
Conchoecia elegans					■								■				■	■		
Conchoecia obtusata								■												
Conchoecia sp.													■							
Cypridina sp.								■												
Euconchoecia chierchiae																		■		
Philomedes macandrei								■												
Calanoid copepods																				
Acartia clausi	■	■	■	■				■	■	■	■	■					■			■
Acartia erythraea	■	■	■	■	■	■				■	■		■			■				■
Acartia negligens	■				■											■				
Acrocalanus gibber																		■		
Aetideus armatus				■														■		
Anomalocera patersoni													■							
Bathycalanus maximus															■					
Calanopia elliptica		■					■								■	■		■		
Calocalanus pavo	■						■	■				■		■	■			■	■	
Candacia aethiopica				■														■		
Candacia armata	■				■		■									■	■		■	■
Candacia pachydactyla										■				■						

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Calanoid copepods (Continued)																				
Canthocalanus pauper				■				■								■				
Centropages furcatus	■	■	■			■		■	■		■	■				■	■			
Centropages kroyeri	■		■													■	■			
Centropages violaceus										■										
Clausocalanus minor (arcuicornis)	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■
Clausocalanus furcatus						■								■						
Eucalanus crassus	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■
Eucalanus elongatus	■			■	■	■	■	■						■	■	■	■		■	■
Euchaeta marina							■						■			■	■		■	■
Euchaeta spinosa								■					■	■	■	■	■	■	■	
Labidocera acutifrons	■	■			■			■		■	■		■		■	■				■
Labidocera acutum				■	■	■			■	■	■					■	■			
Labidocera minuta				■	■			■	■							■		■		
Nannocalanus minor	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Paracalanus aculeatus	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
Paracalanus parvus	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Pleuromama abdominalis	■																	■		
Pontella fera					■						■									■
Pontellina plumata								■		■						■	■			
Rhincalanus cornutus			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Rhincalanus nasutus	■						■		■				■	■		■	■	■	■	
Temora discaudata		■			■				■	■										
Temora stylifera	■	■		■	■	■		■	■	■	■	■			■	■	■			■
Temora turbinata	■	■		■	■	■			■	■						■	■			
Tortanus sp.	■								■			■				■		■		

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Cyclopoid copepods																				
Copilia mirabilis			■	■			■	■		■			■	■		■	■	■	■	■
Corycaeus typicus		■		■		■		■	■	■	■	■		■	■		■	■		■
Corycaeus ovalis				■						■	■						■	■		■
Corycaeus rostratus	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Corycaeus speciosus	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■
Corycaeus venustus				■		■			■	■		■		■	■					
Oithona nana	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Oithona plumifera	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Oithona setigera																	■			
Oithona similis		■			■				■		■			■	■	■				
Oncaea conifera	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
Oncaea media		■		■	■			■	■	■	■			■	■					
Oncaea mediterranea		■		■				■	■	■		■		■	■					
Oncaea minuta	■	■			■		■			■	■	■	■	■			■	■	■	■
Oncaea venusta		■		■	■			■	■	■	■	■		■	■	■	■	■		■
Sapphirina nigromaculata					■									■						
Sapphirina ovatolanceolata				■		■														
Harpacticoid copepods																				
Euterpina acutifrons	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■			■
Clytemnestra scutellata	■	■						■	■	■			■	■	■	■		■	■	
Macrosetella gracilis											■		■	■			■	■		
Microsetella rosea	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Copepod nauplii	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Copepodite stages	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Euphausiacea																				
Euphausia sp.				■											■					
Stylocheiron sp.					■															
Thysanopoda sp.										■										
Euphausia brevis		■	■				■													
Mysidacea																				
Leucifer acestra	■	■	■	■	■															
Leucifer sp.					■		■				■	■								
Mysis sp.														■						
Amphipoda (2 spp.)																				
Streetsia challengeri					■	■														
Hyperia sp.				■		■						■			■					
Chaetognatha (8 spp.)																				
Sagitta enflata	■	■		■	■		■	■	■	■	■	■	■	■	■	■		■	■	■
Sagitta neglecta	■	■		■	■	■	■	■	■	■		■	■	■	■	■	■		■	
Sagitta serratodentata							■				■	■						■		
Larvacea (9 spp.)																				
Fritillaria borealis						■					■			■						
Fritillaria formica							■		■								■			■
Oikopleura dioica	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Oikopleura Intermedia								■												
Oikopleura longicauda		■			■		■	■	■		■	■				■	■	■		■
Oikopleura parva				■	■		■	■			■		■		■		■	■		■
Stegosoma magnum							■													
Thaliacea																				
Doliolum denticulatum	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Doliolum gegenbouri					■															

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

	79	16a	14a	83	85	87	21a	19a	92	90	88	97	95	93	25a	23a	98	99	100	26a
Thaliacea (continued)																				
Doliolum mulleri				■			■					■	■				■			
Salpa maxima																				■
Thalia democratica		■		■	■	■														
Meroplanktonic larvae																				
Polychaetes																				
Eulalia viridis (L)	■		■	■			■		■	■	■			■					■	■
Sabellaria sp.(L.)		■				■		■	■	■		■		■	■		■			
Spinoid larvae	■				■		■		■			■			■		■	■		■
Molluscs																				
Gastropod veligers								■				■								
Lamellibranch veligers	■	■		■	■	■		■	■	■	■	■		■	■	■	■	■		■
Cirripedes larvae	■				■	■		■			■	■					■			■
Decapods larvae																				
Calyptopis of Meganyctiphanes sp.				■	■			■		■							■	■		■
***Eriphia spiniferous* (MZ)**															■					
***Maia verrucosa* (Crab)(Z)**		■																		
Mysis stages of Decapoda	■		■	■		■	■	■	■				■	■	■	■	■	■	■	
***Parapeneus* sp. (Prawn)(N)**	■		■	■	■		■	■	■	■		■	■	■	■		■			■
Sergestes sp.(L)																			■	
***Sicyonia* sp.(L)**	■			■	■	■	■	■	■	■	■	■	■	■		■	■			■
Total Echinoderms larvae																	■			
Crustacean eggs						■		■	■	■		■		■						
Fish larvae				■					■	■		■		■	■	■				
Fish eggs				■								■		■						

Fig. 2b - Occurrence of zooplankton species at different stations in the Strait of Hormuz and Sea of Oman

3.2 Standing crop

The zooplankton abundance in the ROPME Sea Area reflects high secondary production during winter. The numerical density of the total zooplankton over the whole area fluctuated widely between 1 x 10^3 organisms/m^3 at station 22 and 71.7x10^3 organisms/m^3 at station 15.

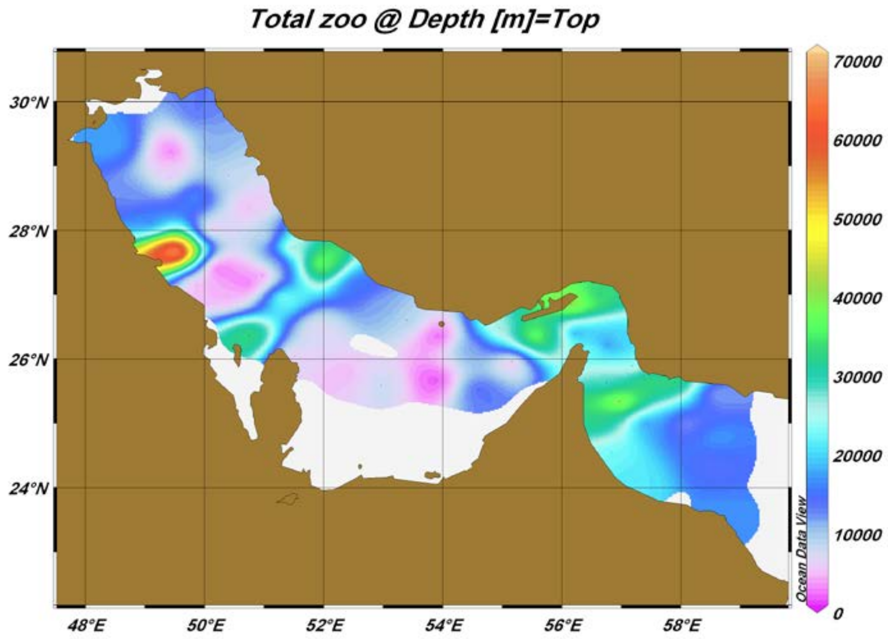

Fig. 3- Zooplankton count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

The horizontal distribution of the standing crop illustrates pronounced spatial differences throughout the study area. As shown in figure 3 the inner RSA harboured relatively low zooplankton count (< 15 x 10^3 organisms/m^3) at most of stations. Pronouncedly high count (>24.6 x 10^3 – 37.9 x 10^3 organisms/m^3) occurred at the eastern side of section T5 (Station 11a) and along section T6 at stations 27, 30 & 33 between Iran and Bahrain costs. The maximum zooplankton count was reported at staion 15 near Saudi Coast, amounting to 71.7 x 10^3 organisms/m^3. On the other hand, the area surrounding the Straits of Hormuz on both sides harboured clearly high zooplankton crop, amounting to 21 x10^3- 43 x10^3 organisms/m^3, with the highest counts (>30 x10^3 organisms/m^3) along Irani coast, particularly at stations 77, 78, 79, 16a, 88& 97. But, the part of the Sea of Oman , far from the Strait of Hormuz was inhabited by cmparatively low counts (10.8 x10^3 – 16.7 x10^3 organisms/m^3). In general, the population density of zooplankton in the inner RSA (total average: 14.1 x10^3 organisms/m^3) was pronuncedly lower than that in the Sea of Oman (23.3 x10^3 organisms/m^3). This was particularly due to the lower count of copepods, while several groups sustained higher counts in the inner RSA than in the Sea of Oman . The different groups displayed variable contributions to the total zooplankton crop in both the inner RSA and Sea of Oman . The numerical abundance as well as the role of the different zooplankton groups will be presented in the following parts.

3.2.1 Holoplankton

3.2.1.1 Protozoan groups

3.2.1.1.1 Foraminifera

These unicellular animals were scarcely found at sporadic stations throughout the whole study area during the present sampling and represented by four species only. Assemblages of this group occurred each at 1-3 stations only in the inner RSA (Fig. 2a) and at two stations in the Sea of Oman (Fig. 2b), with a maximum of 23 organisms/m^3 at station 69, mainly due to *Golobigerina* sp. Due to the lack of earlier records on Formainifera in ROPME Sea Area, it is difficult ot confirm whether the identified species during the present study are new to the area or no. Anyway, the four species of the present study (*Globigerina bulloides, Golobigerina sp., Globorotalia sp. and Globigerinoid* sp. are not mentioned in the available literature on the ROPME Sea Area.

3.2.1.1.2 Radiolaria

This group comprised 3 species, which were restricted to the inner RSA, mostly off Irani coast, with counts fluctuating from 1 – 297 organisms/m^3. *Acanthometron* sp. was reported at 7 stations, mostly < 14 organisms/m^3, increased to 33 and 173 organisms/m^3 at stations 20 and 39 respectively. *Heliosphaera* sp. appeared at stations 39, 40 and 66 with counts of 124, 52 and 14 organisms/m^3 respectively. *Stauracantha* sp. was observed at 3 stations in low counts (1-14 organisms/m^3). The three species have never been reported in the published works on the ROPME Sea Area, and they are considered as new records.

3.2.1.1.3 Tintinnida

The winter protozoan ciliates (Tintinnids) in the ROPME Sea Area appeared to be relatively low diversified, being represented by 24 species. As shown in figure 4, they were missed over great part of the ROPME Sea Area, and found in small counts at small number of stations (< 70 organism/m^3). High counts (5726, 1170 & 343 organism/m^3) were observed at stations 27, 39 and 40 respectively on Irani Coast of the inner RSA. In the mean time, tintinnids assemblages appeared at most stations in the Sea of Oman (mostly < 170 organism/m^3), but they displayed a markedly high count (8954 organisms/m^3) at station 88 and high counts (862 & 893 organisms/m^3) at stations 93 & 97 respectively. The high abundance of tintinnids at stations 27 and 88 constituted 15.1% and 25.7 % respectively of total zooplankton. *Tintinnopsis radix* (20.9%), *Codonellopsis morchella* (17.1%), *Favella azorica* (15.4%), *Salpingella attenuata* (14.6%) and *Eutintinnus fraknoii* (12.5%) were collectively responsible for the bulk of tintinnids at stations 27, while *Tintinnopsis radix* formed 97.3% of total tinnids at station 88.

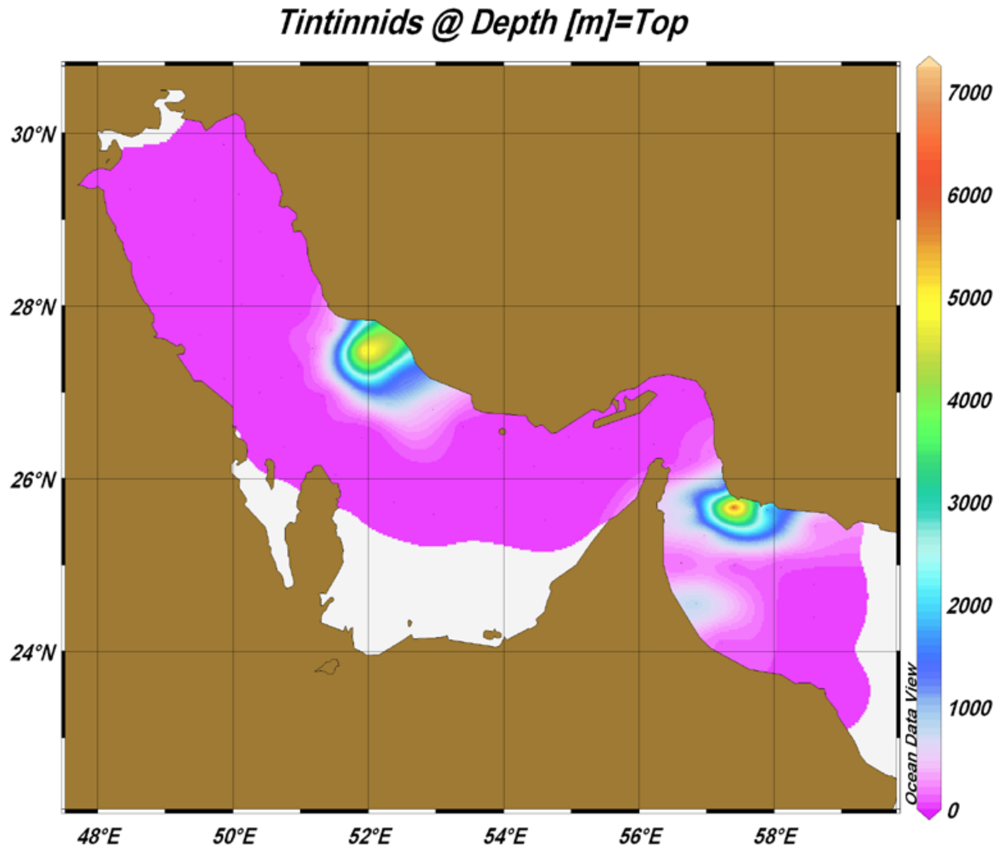

Fig. 4- Tintinnids count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

Codonellopsis morchella and *Tintinnopsis radix* were observed at 10 stations each, but *Tintinnopsis radix* seems to play more active role to the total tintinnids (20.9%, 26.7%, 84.3%, 97.3% and 67.1% particularly at stations 27, 39, 19a, 88 and 97 respectively. *Codonellopsis morchella* demonstrated smaller role (17.6%, 14.6%, 15.8%) at stations 27, 39 and 97 respectively. Some species were restricted to the Sea of Oman , like *Codonellopsis longa* at station (93) with relatively high counts (273 organism/m^3), *Dictyocysta reticulata, Epiplocylis brandti, Eutintinnus macilentus, Tintinnopsis beroidea, Tintinnopsis lobiancoi* and *Codonellopsis longa*. Other species appeared only in the inner RSA, such as *Eutintinnus stramentus, Favella azorica, Leptotintinnus botnicus, Parafavella gigantea, Petalotricha ampulla, Steenosemella nivalis, Tintinnidium mucicola* and *Codonellopsis americana*. Some of these species attained moderately high counts, like *Parafavella gigantean* (440, 107 & 108 organism/m^3) at stations 27, 39 and 40 respectively, *Eutintinnus fraknoii (718 & 241* organism/m^3) at stations 27 and 39, *Favella azorica* (879 organism/m^3) at station 27, *Helicostomella subulata* (141 organism/m^3) at station 97, *Leptotintinnus nordguistii* (165 & 196 organism/m^3) at stations 87 and 88, *Petalotricha ampulla* (127 organism/m^3) at station 27, *Salpingella attenuata* (835 & 124 organism/m^3) at stations 27 and 39, *Tintinnidium mucicola* (195 organism/m^3) at station 27 and *Xystonella treforti* (446 organism/m^3) at station 93. Thirteen tintinnid species were found to be new record to the ROPME Sea Area (Table 8**).**

Table 8 – New Tintinnids to the ROPME Sea Area.

Species	Max. count/m^3	Species	Max. count/m^3
Amphorides quadrilineata	4	*Helicostomella subulata*	141
Codonellopsis longa	277	*Leptotintinnus bottnicus*	20
Codonellopsis morchella	977	*Parafavella gigantea*	440
Codonellopsis orthoceras	6	*Petalotricha ampulla*	127
Dictyocysta reticulata	4	*Tintinnidum mucicola*	195
Epiplocylis brandti	4	*Xystonella treforti*	446
Eutintinnus stramentus	20		

3.2.1.2 Metazoan groups

3.2.1.2.1 Planktonic Cnidaria

3.2.1.2.1.1 Hydromedusae

The cnidarian hydrozomedusae in the ROPME Sea Area were represented by 17 species, comprising 3 Anthomedusae, 6 Leptomedusae, one Limnomedusae, 4 Narcomedusae, and 3 Trachymedusae (Table 1). All species belonging to Leptomedusae, Narcomedusae and Trachymedusae occurred at different scattered stations in the ROPME Sea Area, while the Limnomedusa species, *Olindias singularis,* appeared once only at station 23 in the inner RSA and Anthomedusae species were confined to the Sea of Oman . Each of the hydromedusae species was found at few stations (1-4 stations), but the Narcomedusa, *Solmundella bitentaculata* was reported at 15 stations and the Trachymedusa, *Aglaura hemistoma* at 27 stations (Fig. 2). The hydromedusae showed low population density over the whole ROPME Sea area, mostly < 10 organisms/m^3 (Fig. 5). However, *Solmundella bitentaculata* counted 45, 35, 50 and 20 organisms/m^3 at stations 7a, 22, 23 and 83 respectively, and *Aglaura hemistoma* counted 23, 65, 70, 19 organisms/m^3 at stations 39, 50, 66 and 70 respectively. The relative abundance of hydromedusae indicates their pronouncedly small role in zooplankton standing crop (usually < 1%), except at stations 23 and 22 near Saudi Coast (1.2 and 3.9% respectively). The average count of hydromedusae exhibited approximated values in both the inner RSA (9.4 organisms/m^3) and Sea of Oman (11.4 organisms/m^3).

Of the hydromedusae species (17 species) identified during the present study, only 5 species were reported earlier in the inner RSA, while other 12 other species were found for the first time mostly in the inner RSA, including two species found in both the inner RSA and Sea of Oman (Table 9).

Table 9- New Hydromedusae to the ROPME Sea Area.

Species	Max.count/m^3	Species	Max.count/m^3
Anthomedusae		**Trachymedusae**	
Ectopleura dumortieri	14	*Liriope* sp.	2
Amphinema sp.	6	*Rhopalonema* sp	1
Steenstrupia sp.	12	**Narcomedusae**.	
Leptomedusae		*Cunina* sp.	**1**
Aequorea sp.	1	*Solmaris* sp.	4
Octocanna sp.	**2**	*Solmundella* sp.	50
Phialidium sp.	7	**Scyphozoa**	
		Pelagia sp.	1

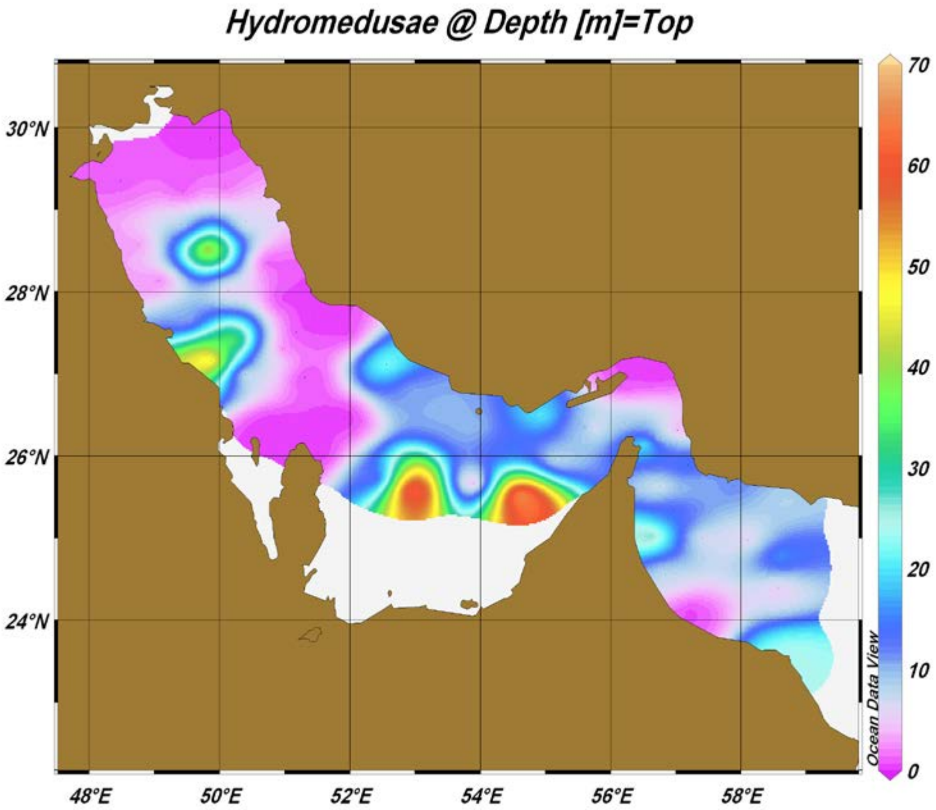

Fig. 5- Hydromedusae count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

3.2.1.2.1.2 Siphonophores

Sixteen cnidarian siphonophores were observed during winter in the ROPME Sea Area (Table 1), amounting collectively to 1 – 369 organisms/m^3 at the different stations (Fig. 6). The maximum count was reported at station 30 on the central line of the inner RSA off Bahrain, due to the dominance of *Lensia conoidea*, Sulculeolaria *biloba* and *Diphyes* sp.

Abylopsis escholtzii, *Abylopsis tetragona*, *Agalma elegans*, *Bassia bessensis*, *Lensia sp.*, *Sulculeolaria quadrivalves* appeared to be confined to the Sea of Oman , while *Chelophyes appendiculata, Diphyes dispar, Diphyes sp. Eudoxoides spiralis, Forskalia* sp., *Lensia subtilis, Lensia subtiloides, Muggiaea kockii,* were restricted to the inner RSA. Other species were widely distributed throughout the whole ROPME Area. For example, *Lensia conoidea* occurred at 42 stations, with the highest counts (86.3, 182.4 & 73.6 organisms/m^3) at stations 30, 66 and 70 respectively, S*ulculeolaria biloba* at 21 stations, with the highest counts (67.7, 164, 81.6 organisms/m^3) at stations 11a, 30, 69 respectively and *Diphyes sp.* at 14 stations, with the highest counts (92.4, 138 & 118 organisms/m^3) at stations 7, 20 and 30 respectively.

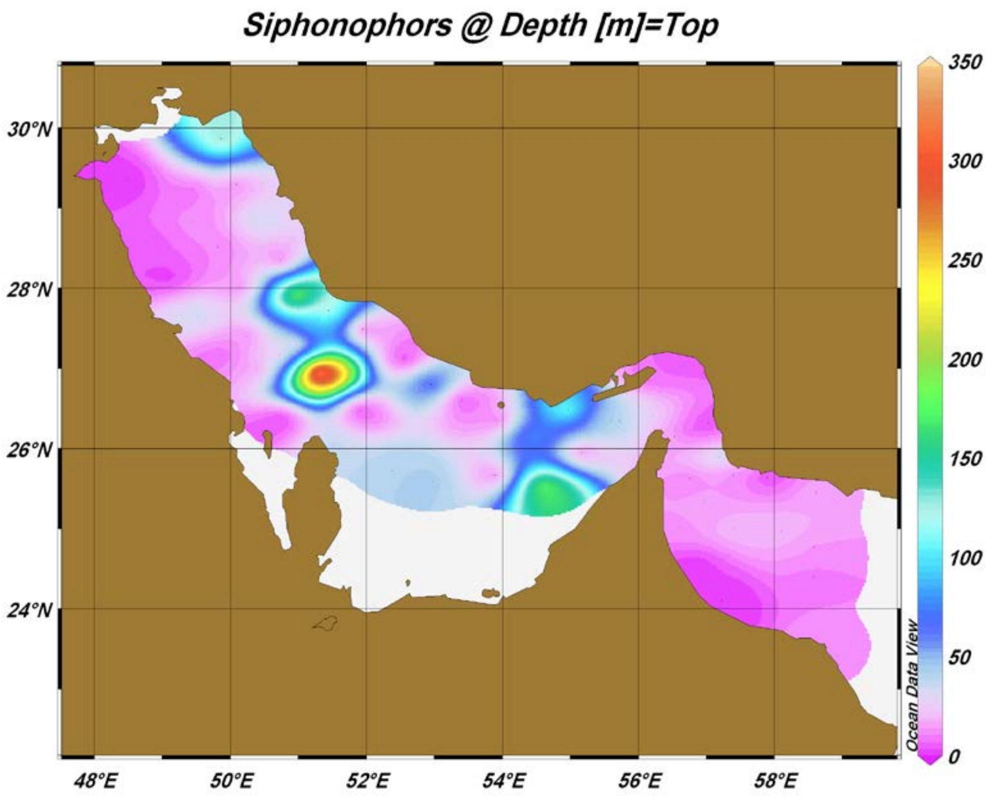

Fig. 6- Siphonophores count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

Siphonophores displayed limited contribution to the total zooplankton (<1%) at most stations, while they formed 2.5% and 1.5% at stations 20 and 30 respectively. The majority of the siphonophores of the present study have never been recorded earlier, and they found mostly in low count (Table 10).

Table 10- New siphonophores to the ROPME Sea Area.

Species	**Max. count/m^3**	**Species**	**Max. count/m^3**
Abylopsis escholtzii	9	*Lensia conoidea*	182
Abylopsis tetragona	5	*Lensia subtilis*	7
Agalma elegans	6	*Lensia subtiloides*	4
Bassia bessensis	7	*Muggiaea atlantica*	17
Chelophyes appendiculata	10	*Muggiaea kockii*	2
Diphyes sp.	138	*Sulculeolaria biloba*	164
Eudoxoides spiralis	9	*Sulculeolaria quadrivalvis*	6
Forskalia spp.	10		

3.2.1.3 Planktonic adult annelids

The planktonic annelids appeared as relatively diversified group in the study area, comprising 11 species. Several of these species occurred in both the inner RSA and Sea of Oman , but mostly at sporadic stations, while few were confined to the inner RSA, like *Eunapteris euchaeta, Magelona papillicornis, Tomopetris elegans* and *Sagitella* sp. Three species demonstrated wide distribution throughout the whole ROPME Sea Area (Fig 2), namely, *Pelagobia longicerrata*, *Rhynchonerella* sp. and *Tomopteris* sp. The count of planktonic annelids was generally lower than 20 organisms/m^3 (Fig. 7), while abnormally high count (347.5 organisms/m^3) was recorded at station 30 due to the absolute dominance of *Sagitella* sp., and station 93 (123 organisms/m^3) due to *Rhynchonerella* sp. On the other hand, the planktonic annelids displayed limited contribution to the zooplankton standing crop in the ROPME Sea Area, constituting at most stations less than 0.1% and reaching a maximum of 1.4% at station 30. Due to the scarcity of data in the literature on polychaetes of the ROPME Sea Area, it could be supposed that all planktonic addult species reported during the present study are not known to the area before (Table 11), except *Tomopteris* sp. and *Sagitella* sp. which were observed in the coastal water of the inner RSA off the United Arab Emirates (Gibreel, *et al*, 1997).

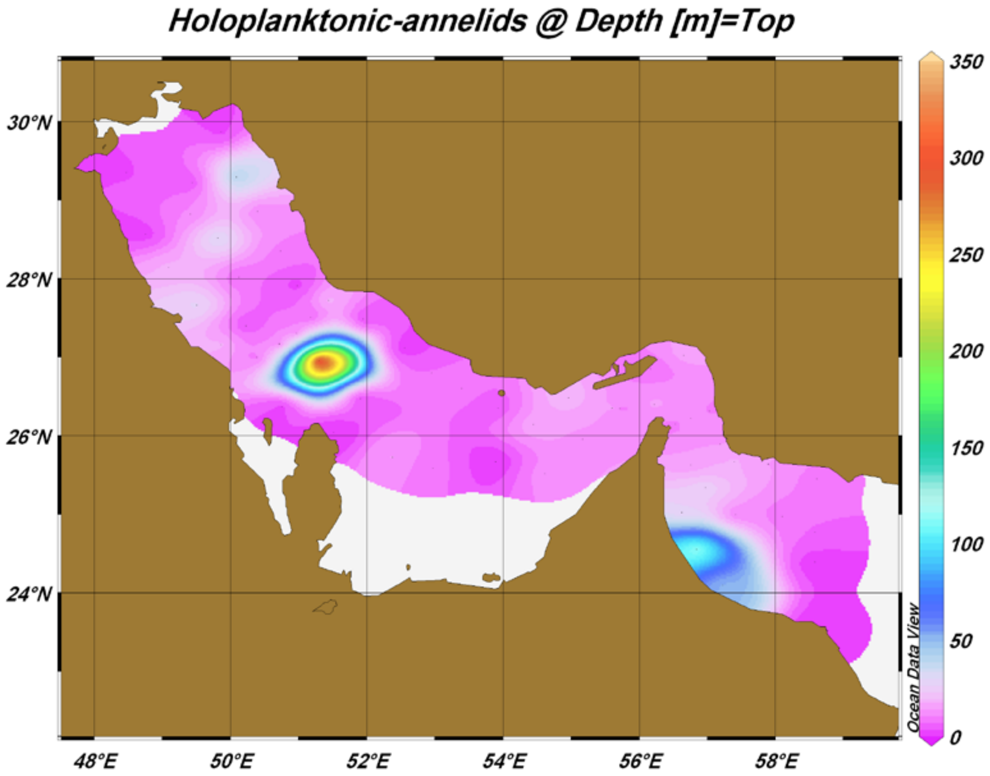

Fig. 7- Planktonic adult polychaetes count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

Table 11- New planktonic polychaetes to the ROPME Sea Area.

Species	**Max. count/m^3**	**Species**	**Max. count/m^3**
Alciopa sp.	12	*Phalacrophorus uniformis*	6
Enapteris euchaeta	4	*Prionospio* sp.	12
Callizonella sp.	1	*Rhynchonella* sp.	109
Magelona papillicornis	2	*Tomopetris elegans*	10
Pelagobia longicerrata	33		

3.2.1.4 Planktonic adult mollusks

The ROPME Sea Area harbored several planktonic adult mollusk species (10 species), amounting totally from 10- 1830 organisms/m^3 at the sampled stations. As shown in table 12, seven species are considered as new records to the area, but they occurred in at few stations and in low counts, except two species, *Euclio* sp. and *Diacria trispinosa*, *which attained pronouncedly high counts*. Four species appeared at 2-3 stations (Fig. 2a) in the inner RSA only (*Atlanta sp.*, *Atlanta inflate*, *Clione sp.* and *Limacina trochiformis*). Others like *Cavolinia sp.*, *Diacria trispinosa and Limacina bulloides*, were observed at few stations in both the inner RSA and Sea of Oman , while *Creseis acicula* was distributed at 36 stations, *Limacina inflata* at 27 stations and *Euclio* sp. at 19 stations over the whole area. *Creseis acicula* attained the highest counts (344, 400 & 624 organisms/m^3) at stations 34, 50 and 66 respectively, *Limacina inflata* (456 & 483 organisms/m^3) at stations 79 and 99 respectively and *Euclio* sp. (331 & 1070 organisms/m^3) at stations 7a and 15 respectively. On the spatial scale, station 90 in the Sea of Oman harbored the maximum count of planktonic mollusks (1830 organisms/m^3), due to the dominance (86%) of *Diacria trispinosa*, and station 15 on Saudi coast (inner RSA) harbored high counts (1438 organisms/m^3) caused mainly (74.5%) by *Euclio* sp. Relatively high counts (594 and 363 organisms/m^3) were also found at stations 25a and 23a due to *Diacria trispinosa* and (456 and 483 organisms/m^3) at stations 79 and 99 respectively caused by *Limacina inflata*. In spite of their relatively low count at most stations, the planktonic mollusks displayed active contribution to the total zooplankton count at some stations (Fig. 8), particularly station 4 (17.8%), station 17 (7.7%), station 23 (8.4%), station 34 (6.89%) and station 90 (4.3%). All other planktonic adult molluks are considered as new records to the inner RSA (Table 12), Except *Creseis acicula* and *Limacina inflate,which were* reported earlierly .

Table 12 – New planktonic adult mollusks to the ROPME Sea Area.

Species	Max. count/m^3	Species	Max. count/m^3
Atlanta inflate	22	*Diacria trispinosa*	1572
Cavolinia sp.	6	*Limacina bulloides*	5
Clione sp.	66	*Limacina trochiformis*	2
Euclio sp.	1070		

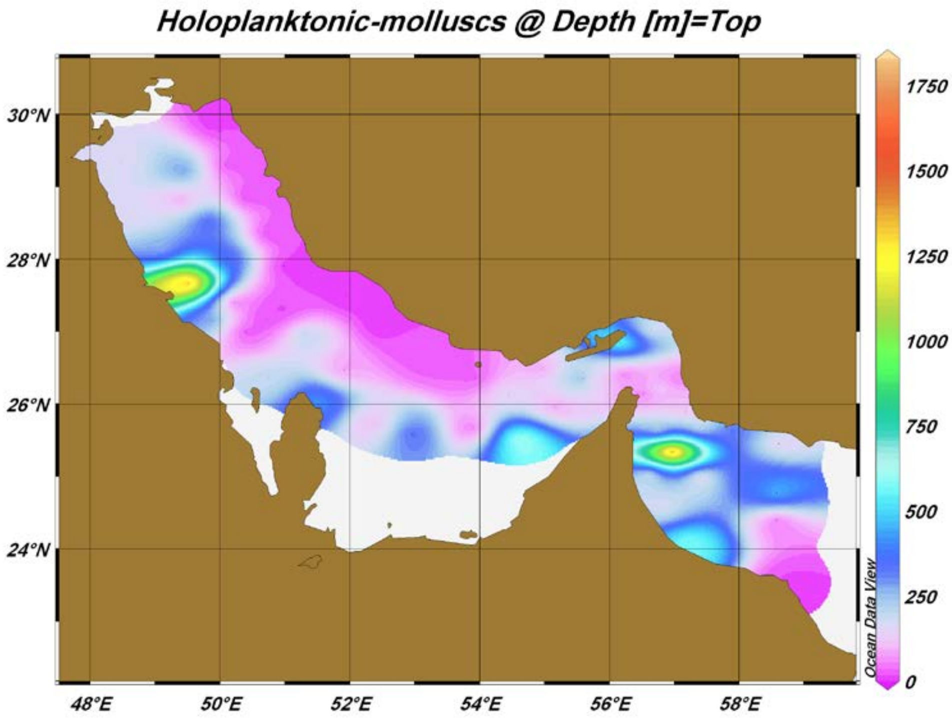

Fig. 8- Planktonic adult mollusks count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

3.2.1.5 Planktonic Crustacea

The winter planktonic crustacea was represented in the ROPME Sea Area by cladocera, copepoda and ostracoda, Euphausiacea, Mysidacea and Amphipoda. Copepods were the most diversified and abundant group, while the other groups comprised small number of species and showed poor population. However, cladocerans and ostracods displayed at some stations high counts and played crucial role in zooplankton standing crop.

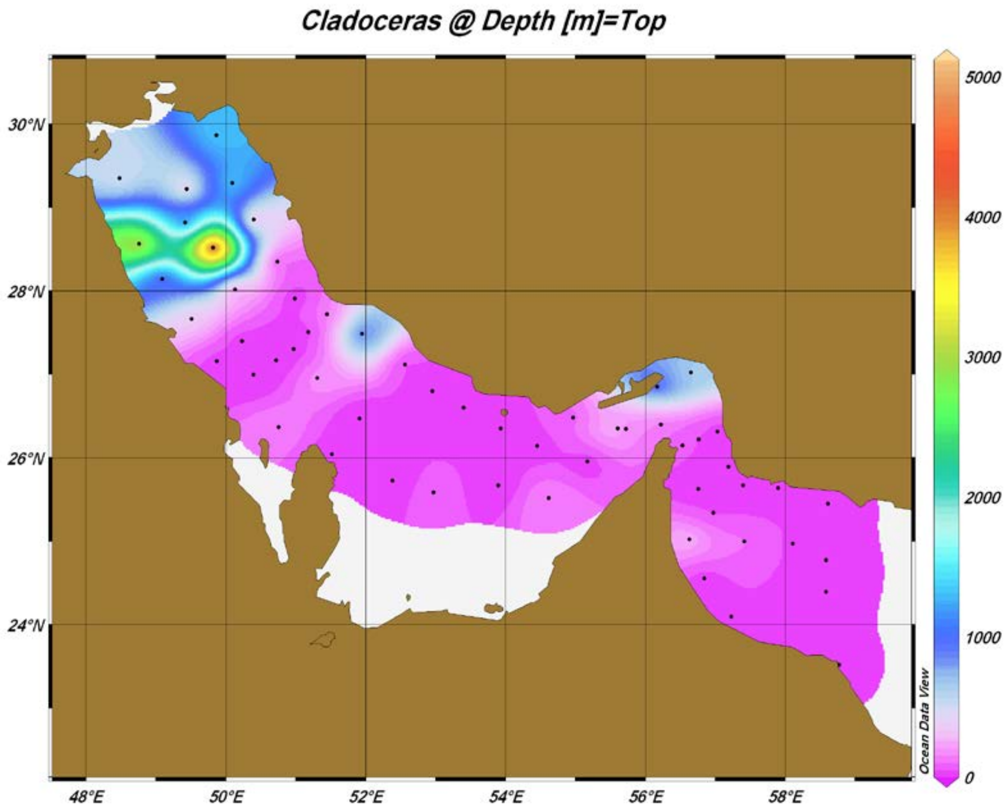

Fig. 9- Cladocerans count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

3.2.1.5.1 Cladocerans

Four Cladoceran species were identified in the study area, counting totally 3 - 5125 organisms/m^3, with wide variation among the sampled stations (Fig. 9). Three species were well represented throughout the whole ROPME Sea Area, whereas *Penilia avirostris* occurred at 37 stations, *Evadne tergestina* at 25 stations, and *Podon polyphemoides* at 14 stations, but mainly in the inner RSA. The four recorded species, showed different spatial distribution. Station 14 near Saudi coast and station 7a on the central line of the northern part of the inner RSA were characterized by markedly high counts (3295 and 5125 organisms/m^3 respectively) compared to all other stations. These values were attributed to the absolute dominance of *Penilia avirostris*, which constituted as the main component of cladocerans at several stations. However, *Evadne tergestina* appeared to play active roles (69%, 91.3%) in cladocerans count at stations 27 and 78 respectively. *Podon polyphemoides* formed high percent of total cladocerans (65.7%, 9.6%, 30.7%, 23.5%) at stations 1, 14, 27, 79, respectively. Despite it was reported at station 7 only, *Podon schmackeri*, appeared to be the major cladoceran species (96.6%) at this station. The role of cladocerans in zooplankton standing drop was usually <1% at most of stations throughout the wole ROPME Sea Area, however, it was pronouncedly large (5 – 28.9%) at the stations 4, 7, 8, 11, 14, 5a & 7a in the northern inner RSA (Fig. 10a,b).

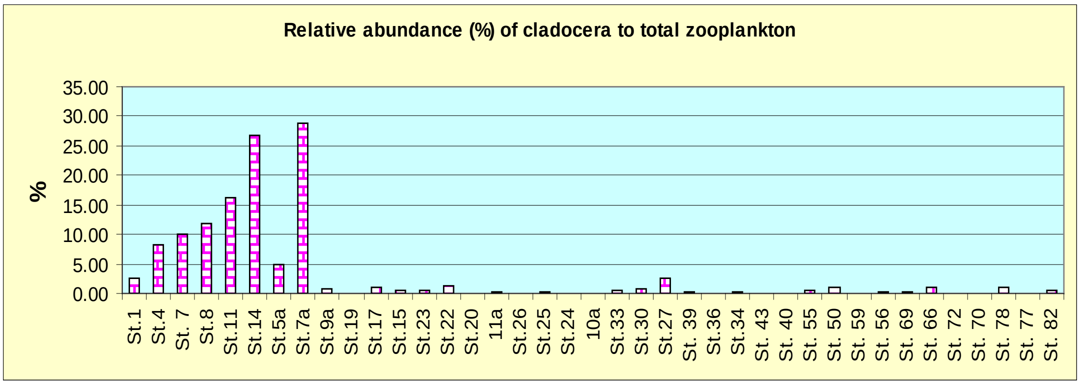

Fig. 10a- - Relative abundance (%) of cladocera to total zooplankton at the sampled stations in the inner RSA (Winter 2006)

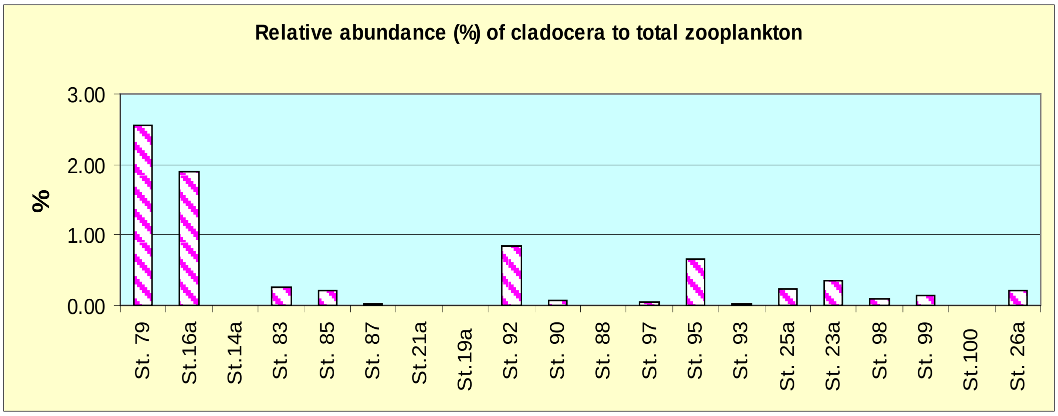

Fig. 10b- - Relative abundance (%) of cladocerans to total zooplankton at the sampled stations in the Sea of Oman (Winter 2006).

3.2.1.5.2 Copepods

Copepods were the predominant component of zooplankton by the number of species as well as the standing crop over the whole ROPME Sea. Their numerical abundance varied from 0.6 x 10^3 – 62.7 x 10^3 organisms/m^3. In the inner RSA, copepods counts were pronouncedly less than in the Sea of Oman . However, they attained the maximum count at station 15, in addition to high counts (20 x 10^3 – 30x 10^3 organisms/m^3) at stations 11a, 27, 30 and 33 in different parts of the inner RSA (Fig. 11). The role of copepods in the total zooplankton fluctuated between 49.7 – 96.9%, but at the majority of stations it falls within the range: 70- 80% (Fig. 12a,b).

Although the larval stages (nauplii and copepodides) usually occupied the bulk of copepods count everywhere in the marine habitat, they displayed pronouncedly variable and comparatively low contribution in the ROPME Sea area. The nauplii reported higher counts in the Sea of Oman than in the inner RSA, whereas their numerical density dropped to less than 2000 organisms/m^3 at most stations of the inner RSA, and sustained mostly more than 2000 organisms/m^3 in the Sea of Oman , increased to 8000 – 13485 organisms/m^3 at a few stations (Fig. 13). The relative abundance of copepod nauplii over the whole area reflects their variable role in the total copepod population. In the southern half of the inner RSA and in the Sea of Oman , they formed >20% - 50% of total copepods, while in the northern half of the inner RSA, constituted at most stations less than 10 % (Fig. 14a,b).

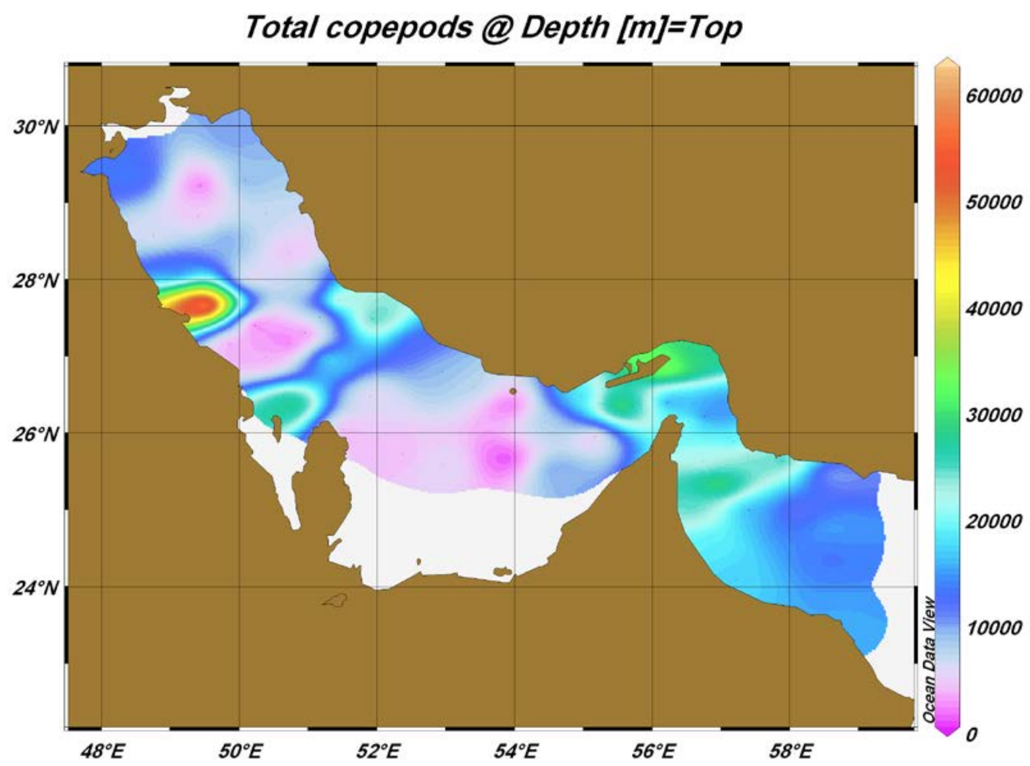

Fig. 11- Total copepods count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

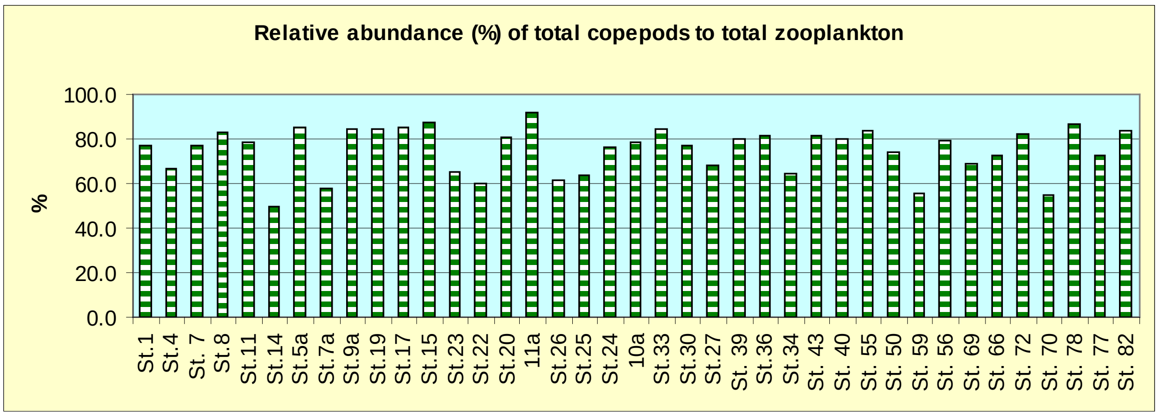

Fig. 12a- Relative abundance (%) of total copepods to total zooplankton at the sampled stations in the inner RSA (Feb. 2006).

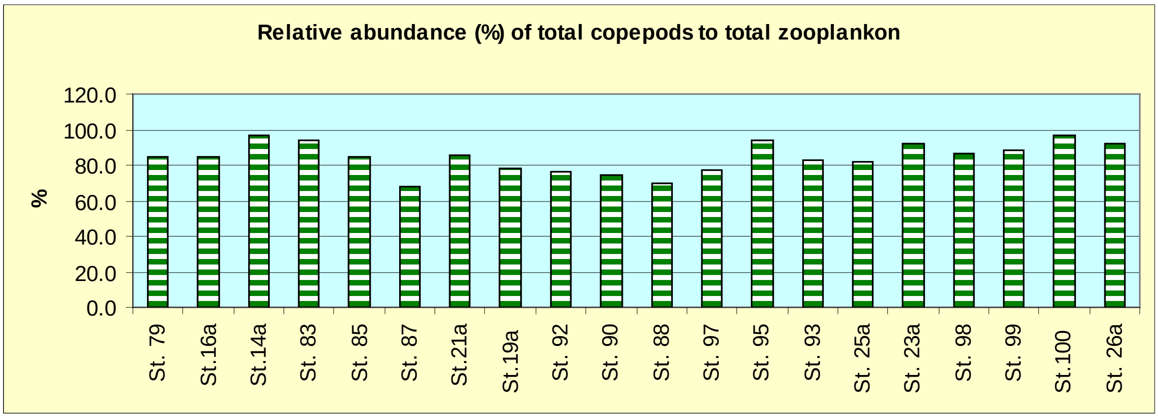

Fig. 12b- Relative abundance (%) of total copepods to total zooplankton at the sampled stations in the Sea of Oman .

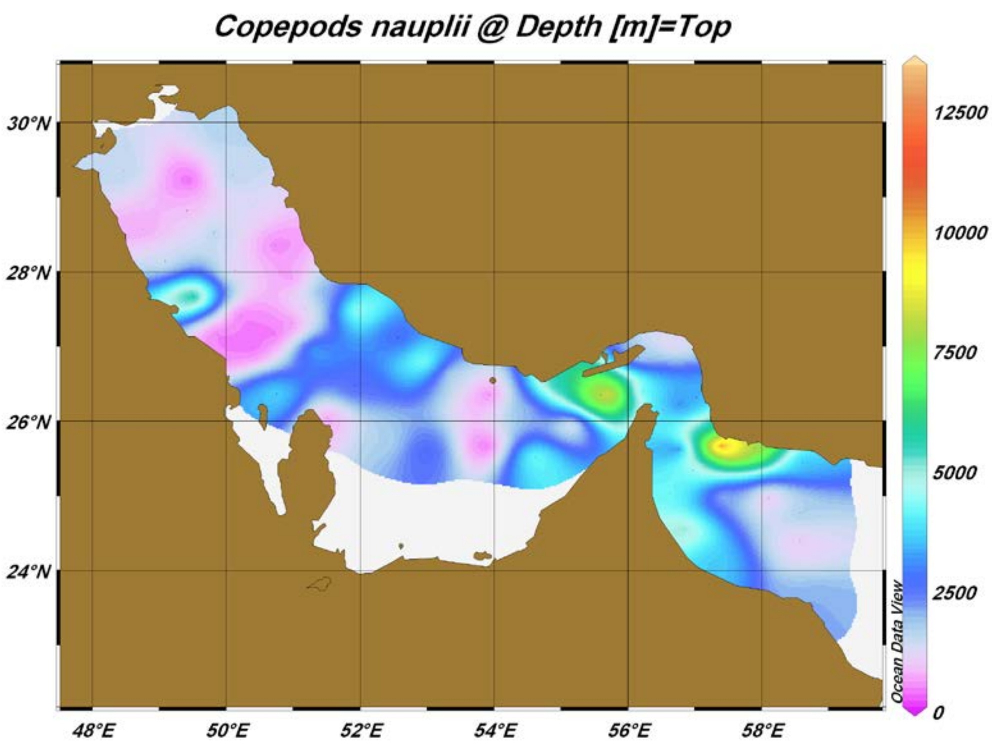

Fig. 13- Copepods nauplii count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

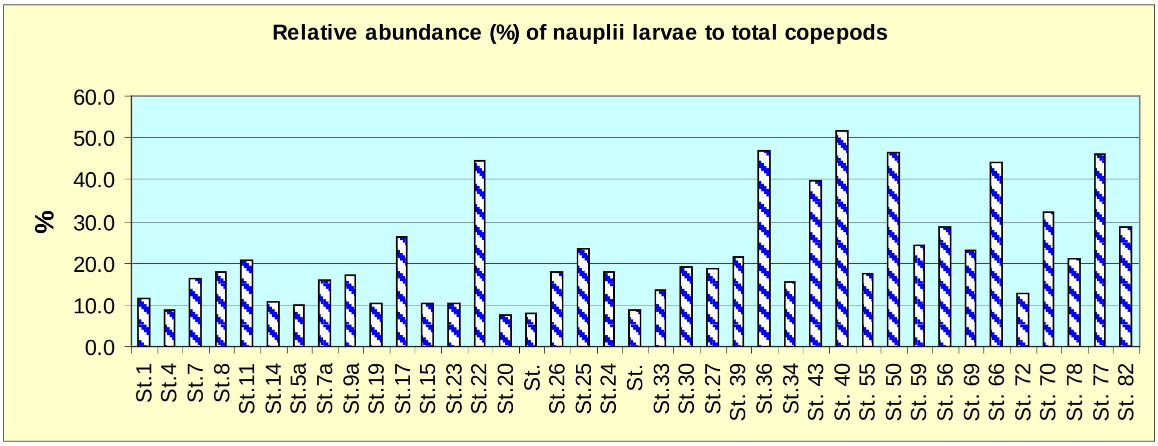

Fig. 14a- Relative abundance (%) of nauplii larvae to total copepods at the sampled stations in the inner RSA.

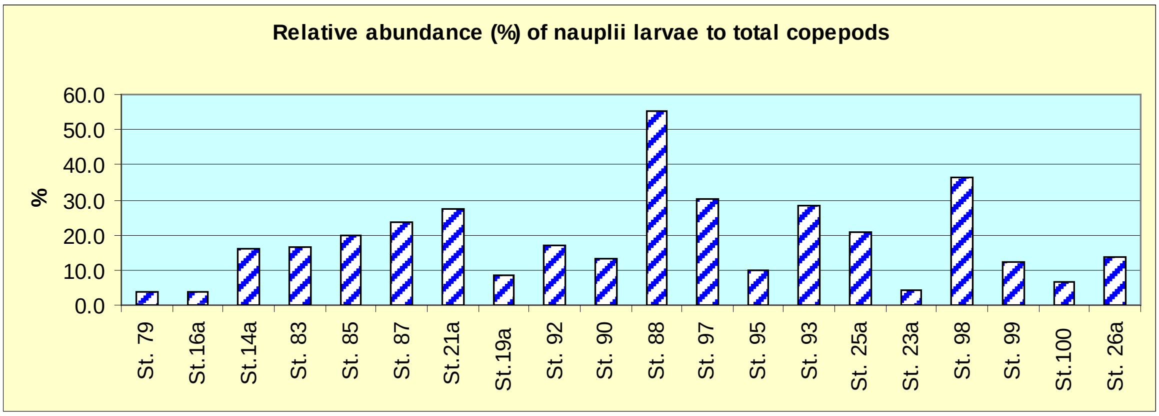

Fig. 14b- Relative abundance (%) of nauplii larvae to total copepods at the sampled stations in the Sea of Oman .

In contrast to nauplii, the copepodides amounted to less than 2000 organisms/m^3 at the majority of the stations in the Sea of Oman , and more than 2000 organisms/m^3 at numerous stations in the inner RSA, with maxima at stations 15, 11a, 27 and 33 (Fig. 15). They demonstrated pronouncedly larg role in the total copepods throughout the inner RSA, constituting at most stations >20% - >50% (Fig. 16a), while in the Sea of Oman their role was clearly small (< 10%) at most stations (Fig. 16b). It was noticed that the abundance of nauplii showed inverse relationship with that of copepodides at numerous stations throughout the whole ROPME Sea Area, whereas markedly high counts of nauplii coincided with pronouncedly low count of copepodides or vice versa at the same station. This phenomenon is clearly observed at stations 7, 11a, 27, 33, 39, 77, 78, 21a, 88 and 97.

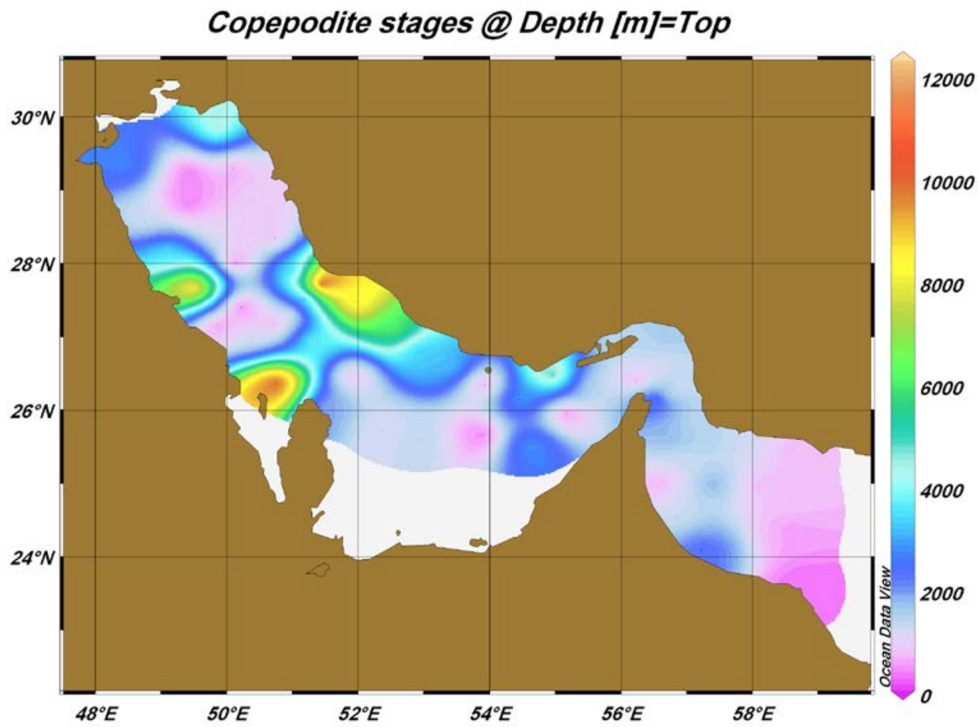

Fig. 15- Copepodides count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

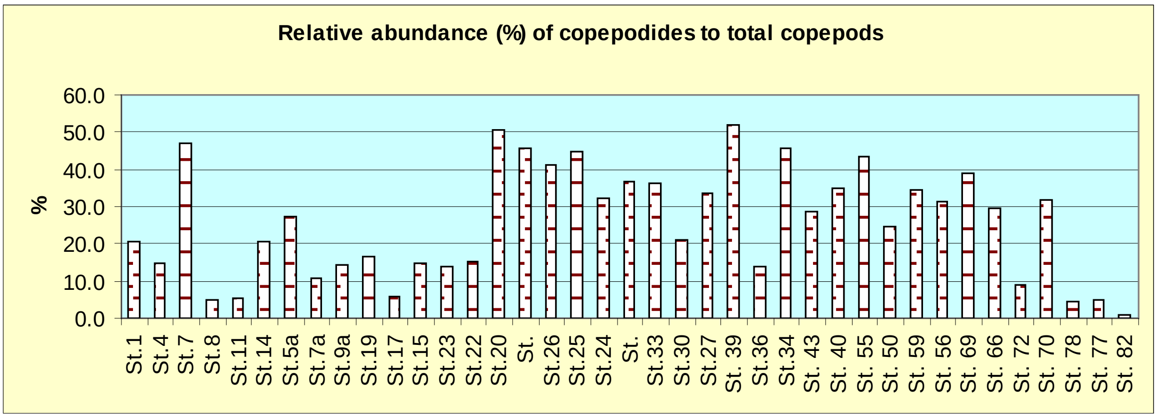

Fig. 16a- Relative abundance (%) of copepodides to total copepods at the sampled stations in the inner RSA.

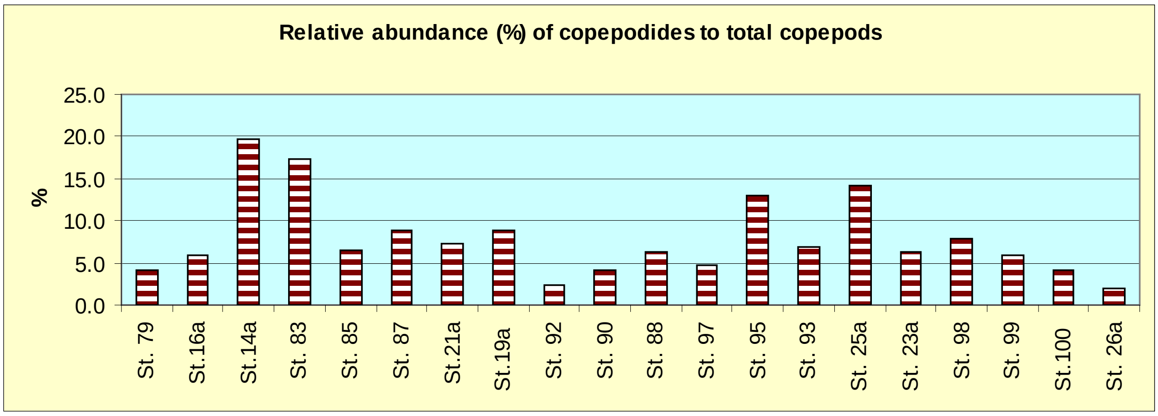

Fig. 16b- Relative abundance (%) of copepodides to total copepods at the sampled stations in the Sea of Oman .

In addition to nauplii and copeodides, several adult copepods species played pronouncedly active roles in the zooplankton standing crop. The count of total adult copepods fluctuated between a minimum of 242 organisms/m^3 at station 22 and a maximum of 47091 organisms/m^3 at station 15, with wide variability throughout the ROPME Sea Area (Fig. 17). These adults belong to the three major subgroups, namely calanoids, cyclopoids and harpacticoids. Calanoids were the most diversified subgroup, comprising in the whole area 55 species, followed by cyclopoids (33 species), while harpacticoids appeared as the lowest diversified one (6 species). The numerical abundance of the three subgroups followed the sequence: calanoids > cyclopoids > harpacticoids, but each subgroup demonstrated variable counts and different roles in the copepods counts among the sampled stations. Calanoids amounted to 56 -21485 organisms/m^3, cyclopoids: 120 – 21755 organisms/m^3 and harpacticoids: 54 – 8908 organisms/m^3. With the exception of some stations, the three copepods subgroups showed the same pattern of spatial distribution, whereas the high count of one subgroup was associated by high counts of the other two groups, such as at stations 15, 33, 79, 16a, 90 and 97 or vice versa. The highest count of both calanoids and cyclopoids were found at station 15, while that of harpacticoids occurred at station 90.

On the other hand, calanoids appeared as the major component (51.7 – 67.7%) of adult copepods at stations 1, 4, 5a, 23, 10a, 34, and 77 in the inner RSA, while they dominated (53.1 – 66%) at stations 14a, 19a, 95, 23a, 99 and 100 in Sea of Oman . Cyclopoids attained the highest percentage (50- 62.6 %) at stations 14, 7a, 17, 22, 25, 33, 30, 43, 40, 55 & 72 in the inner RSA (Fig. 18a) and predominanted (52.6 %) at station 97 in the Sea of Oman (Fig. 18b).

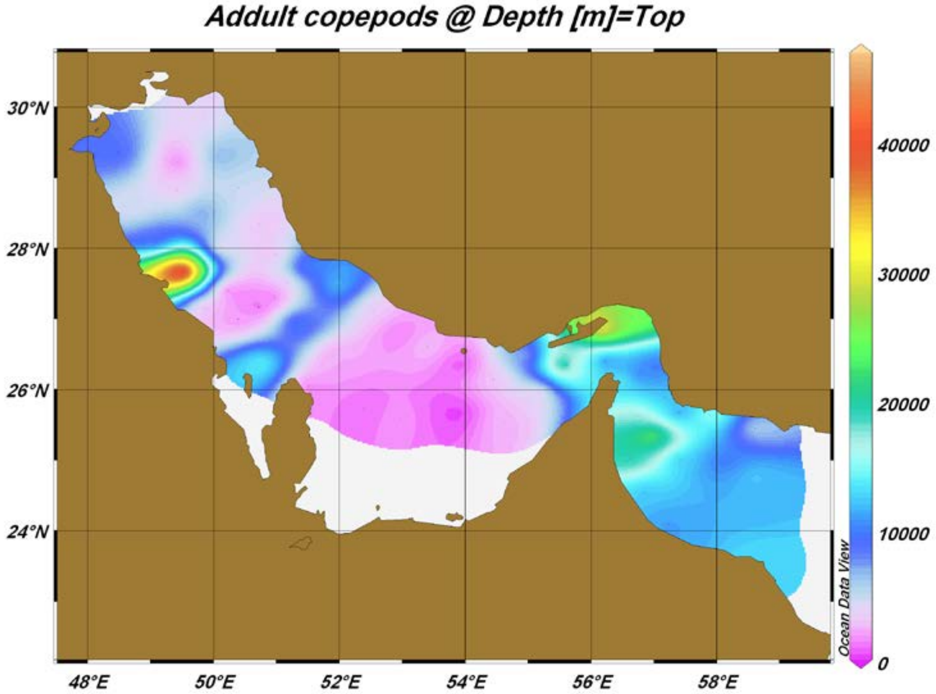

Fig. 17- Adult copepods count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

On the other hands, harpacticoids played the smallest role in the adult copepods count, forming mostly less than 40%. But they demonstrated active role (52.9 - 71.8%) at stations 26, 27, 36 and 70 in the inner RSA (Fig. 18a). These differences caused variable values of the ratio between the abundances of the three subgroups throughout the ROPME Sea Area. However, the average ration for the whole area was 2.1: 2.2: 1.

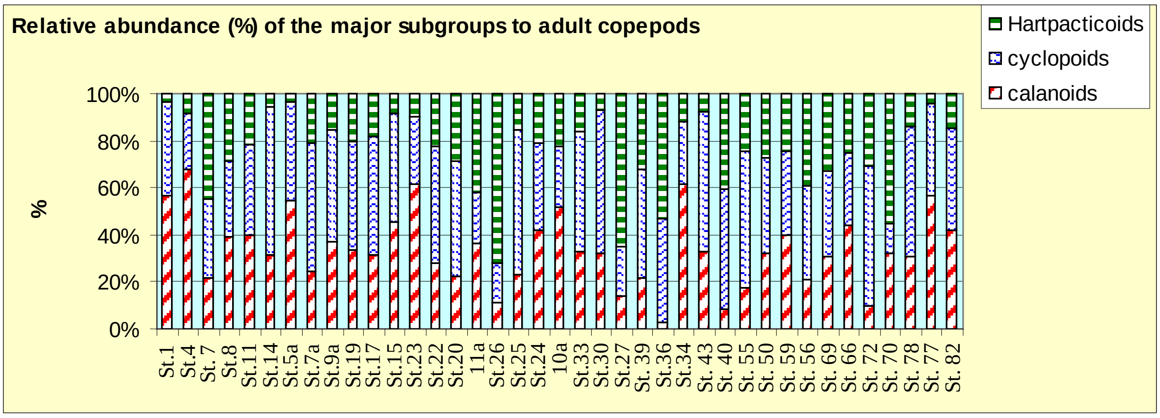

Fig. 18a- Relative abundance (%) of major subgroups to adult copepods at the Sampled stations in the inner RSA.

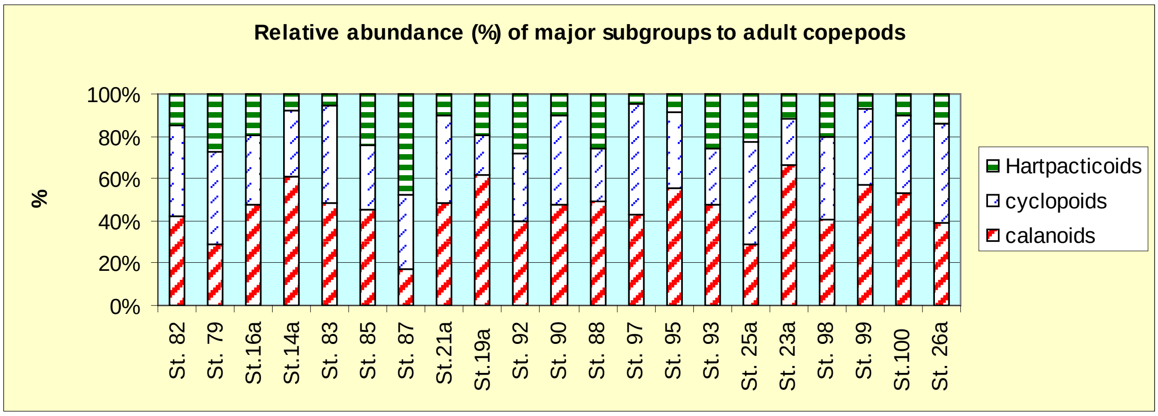

Fig. 18b- Relative abundance (%) of major subgroups to adult copepods at the Sampled stations in the Sea of Oman .

The present study added 21 copepod species (13 calanoids and 9 cyclopoids), to those previously observed in the inner RSA. The majority of these species occurred occasionally at a few stations in the inner RSA and/or Sea of Oman (Table 13), usually in low counts, such as *Acartia danae*, *Neocalanus tenuicornis*, *Pleuromama xiphias*, *Corycaeus lautus*, *Sapphirina gemma*, *Sapphirina intestinata*, *Sapphirina ovatolanceolata* and *Sapphirina vorax*. However, some species sattained high counts eithr in the inner RSA, Sea of Oman or in both, like *Calocalanus pavo*, *Nannocalanus minor*, *Pleuromama abdominalis*, *Oncaea mediterranea* and *Oncaea minuta*.

Table 13 – New copepods to the ROPME Sea Area.

Calanoida	Max.count/m^3	Cyclopoida	Maximum count
Acartia danae	3.8	*Pontellina plumata*	*14*
Anomalocera patersoni	9	*Tortanus* sp	12
Bathycalanus maximus	12	*Corycaeus lautus*	28
Calocalanus pavo	*205*	*Corycaeus typicus*	172
Candacia aethiopica	13	*Oncaea mediterranea*	688
Euchaeta spinosa	46	*Oncaea minuta*	957
Nannocalanus minor	2263	*Sapphirina gemma*	1
Neocalanus tenuicornis	*2*	*Sapphirina intestinata*	2
Pleuromama abdominalis	315	*Sapphirina ovatolanceolat a*	7
Pleuromama xiphias	1	*Sapphirina vorax*	2
Pontella fera	9		

3.2.1.5.3 Ostracods

This group was represented by 6 species, displaying together limited contribution to the total zooplankton in the ROPME Sea Area. They were more distributed in the inner RSA than in the Strait of Hormuz and Sea of Oman . Ostracods sustained low count in the whole area (< 200 organisms/m^3), except that (2588 organisms/m^3) at station 15 and (1081, 1167 organisms/m^3) at stations 66 and 69 respectively (Fig. 19). Despite of their weak contribution to the zooplankton crop at most stations (7.2%, 3.6%, 7.4%, 5.5%, 7.7% & 10.2%) they demonstrated active roles at stations 9a, 15, 19, 50, 60 & 69 respectively (Fig. 20). *Conchoecia elegans* was the absolute dominanant at station 15, while *Conchoecia sp.* predominated at station 66 and 69. In the meantime, *Conchoecia elegans, Conchoecia obtusata, Euconchoecia chierchiae* and *Philomedes macandrei* are considered as new records to the ROPME Sea Area and found in both the inner RSA and Sea of Oman . *Conchoecia elegans* was reported at 15 stations in the inner RSA with high counts (585, 368 & 2526 organisms/m^3) at stations 9a, 19 & 15 respectively, while it appeared at four stations only in the Sea of Oman , with a maximum count of 50 organisms/m^3 at station 95. In contrast, *Euconchoecia chierchiae* occurred at 5 stations in the inner RSA, with the highest count (44 organisms/m^3) at station 15, but it occurred at.station 99 with markedly higher count (644 organisms/m^3). Three of the ostracod species recorded during the present study are new to the ROPME Sea Area., namely: *Conchoecia elegans, Euconchoecia chierchiae* and *Philomedes macandrei.*

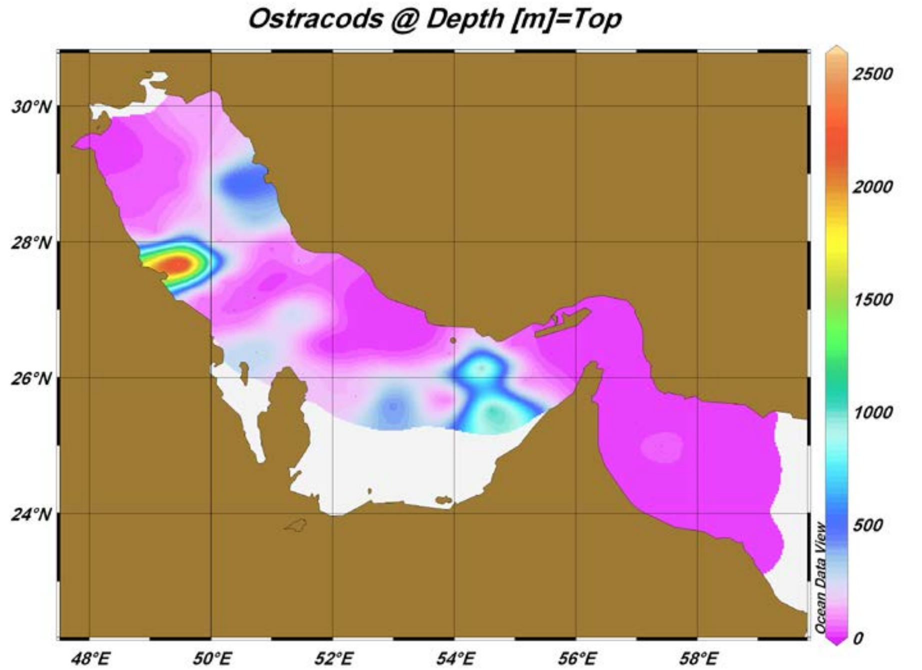

Fig. 19- Ostracods count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

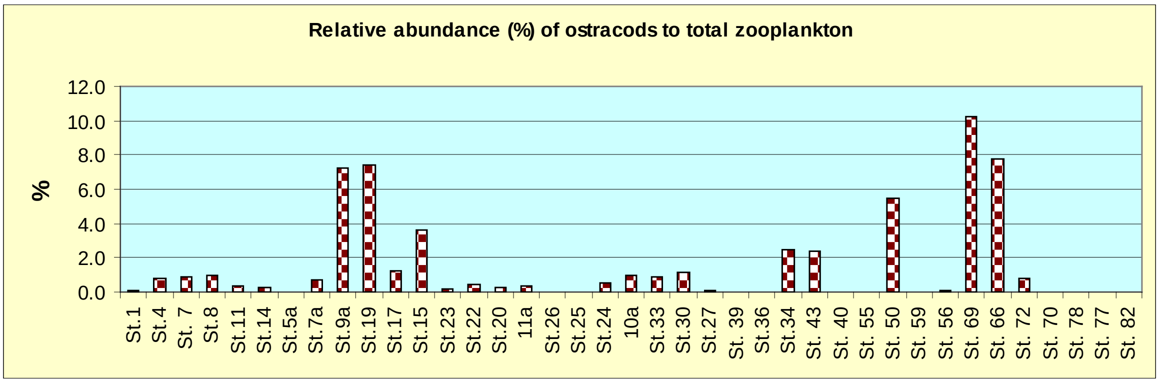

Fig. 20- Relative abundance (%) of ostracods to total zooplankton in at the sampled

stations in the inner RSA.

3.2.1.5.4 Amphipoda

Two species only of planktonic amphipods were observed sporadically throughout the whole ROPME Sea Area during winter 2006, namely, *Streetsia challengeri* and *Hyperia* sp. Both of them appeared at a few stations and had markedly low count (1 -12 organisms/m^3). *S. challengeri* is a new record during the present study, occurred at 5 stations 7, 17, 19 , 85 and 87, which are mostly near the Irani Caost. *Hyperia* sp. appeared to be more spread in the study area, being found at 17 ststions, distributed in the whole area (Fig. 2a,b).

3.2.1.5.5 Mysidacea

The winter zooplankton of the ROPME Sea Area comprised 6 planktonic mysidacean species, five of them belong to the genus *Leucifer* and one to the genus *Mysis*. The total count of mysidaceans varied over the whole area from 1 - 413 organisms/m^3 (Fig. 21). *Leucifer acestra* was the major component of mysidaceans in the northern inner RSA and in the Strait of Hormuz, with the highest count (361 organisms/m^3) at station 15. Unidentified *Leucifer* species were observed at different stations, mainly in the inner RSA, possessing relatively high count (414 organisms/m^3) at station 36 and (298 organisms/m^3) at station 30. *Mysis* sp appeared at 4 stations in the northern inner RSA, in both coastal and offshore waters, in addition to one station in the Sea of Oman (Fig. 2b), but usually in very low count. *Lucifer raynaudii* was reported once only at station 26 in the northern part of the inner RSA off Irani Coast. (Fig. 2a). Regardless of their low counts, mysidaceans appeared to play at some stations a role in the zooplankton crop, forming 1.9%, 1.8%, 1.2% and 6.1% at stations 24, 25, 30 and 36 respectively. *Lucifer acestra* and *Lucifer raynaudii*, *Lucifer* sp. and *Mysis* sp. have never been recorded earlier in the inner RSA and they are considered as new records to the ROPME Sea Area.

3.2.1.5.6 Euphausiacea

Of five planktonic Euphausiacean species found in ROPME Sea Area, four are new records, namely *Meganyctiphanes norvegica*, *Euphausia brevis, Stylocheiron* sp., and *Thysanopoda* sp. They showed different spatial distribution, whereas some of them were confined to the inner RSA (*Meganyctiphanes norvegica*), others to the Sea of Oman (*Euphausia brevis and Thysanopoda* sp.), or occurred in the whole study area (*Stylocheiron* sp.) (Fig. 2a,b). Euphausiacea sustained relatively low counts (up to 98 organism/m^3) in the inner RSA and (57 organism/m^3) in the Sea of Oman , with the predominance of *Euphausia* sp. in the inner RSA and *Euphausia brevis* in the Sea of Oman . The role of Euphausiacea in the total zooplankton was very limited over the whole ROPME Sea Area, since the highest percenatage was 0.7% of total zooplankton.

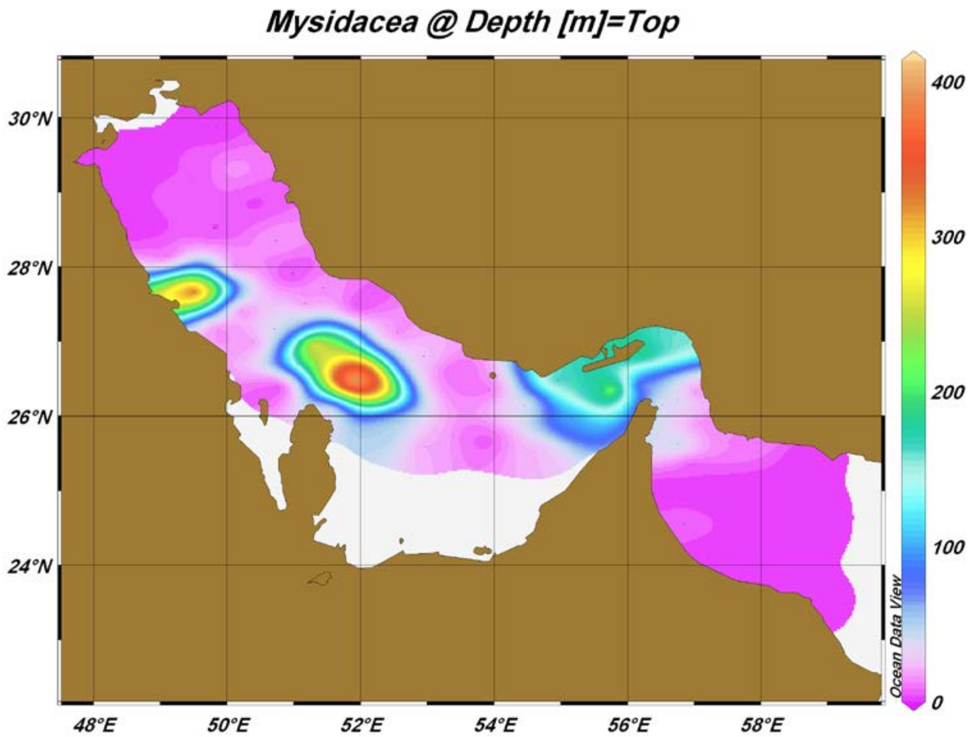

Fig. 21- Mycedaceans count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

3.2.1.6 Chaetognatha

The genus *Sagitta* was the predominant component of Chaetognatha in the ROPME Sea Area, cmprosing 7 species in addition to *Krohnitta subtilis*. The total count of chaetognaths over the whole area was usually lower than 400 organisms/m^3, except at stations 15 and 27 (1280 and 1294 organisms/m^3) (Fig. 22). *Krohnitta subtilis* occurred in the northern and central parts of the inner RSA, usually with low counts (2 – 20 organisms/m^3). Three unidentified *Sagitta* species showed different spatial distribution (Fig. 2a,b) as well as different numerical density throughout the study raea. *Sagitta ferox* occurred sporadically in the northern and central parts of the inner RSA with counts fall within 21 – 116 oragnisms/m^3. *Sagitta neglecta* was widely distributed in the area near Strait of Hormuz and in the Sea of Oman , amounting to 4 – 447 oragnisms/m^3, while it was missed totally from the inner RSA. Relatively high counts of this species (222, 167, 367, 447, 270 and 434 organisms/m^3) were recorded at stations 78, 82, 87, 90, 92 and 97 respectively. The contribution of *Sagitta neglecta* to total chaetognaths was very active (13.5% - 100%). With a few exceptions *Sagitta serratodentata*, appeared to be common in the northern part of the inner RSA (1 – 1254 oragnisms/m^3), with the highest count at station 15 off Saudi coast, while it accedently occurred in the Sea of Oman (6 – 12 oragnisms/m^3). *Sagitta enflata* appeared to be the most widespread chaetognath throughout the ROPME Sea Area, reported at 54 stations with pronouncedly variable counts (1 – 537 oragnisms/m^3), but in comparatively lower count than S. *neglecta*. Therefore *Sagitta enflata* could be considered among the key species in the study area. The maximum count was found at station 27, near Irani Coast, and relatively high counts (113 – 232 oragnisms/m^3) were observed near the eatsren entrance of the inner RSA at stations 66, 70, 77, and 79 respectively. Although the count of *S. enflata* was mostly <100 oragnisms/m^3 and played limited role in the total zooplankton over the whole area (<1%), it appeared to be the major component of chaetognatha, forming variable percentages at different stations, and decrease pronouncedly where there are another species of *Sagitta*. The role of chaetognaths in total zooplankton seems to be limited (<1%) at numerous stations, but they displayed active contribution (1-5.%) at several stations (Fig. 23a,b). *Sagitta serratodentata* was only the new recorded species among chaetognaths during the presentstudy.

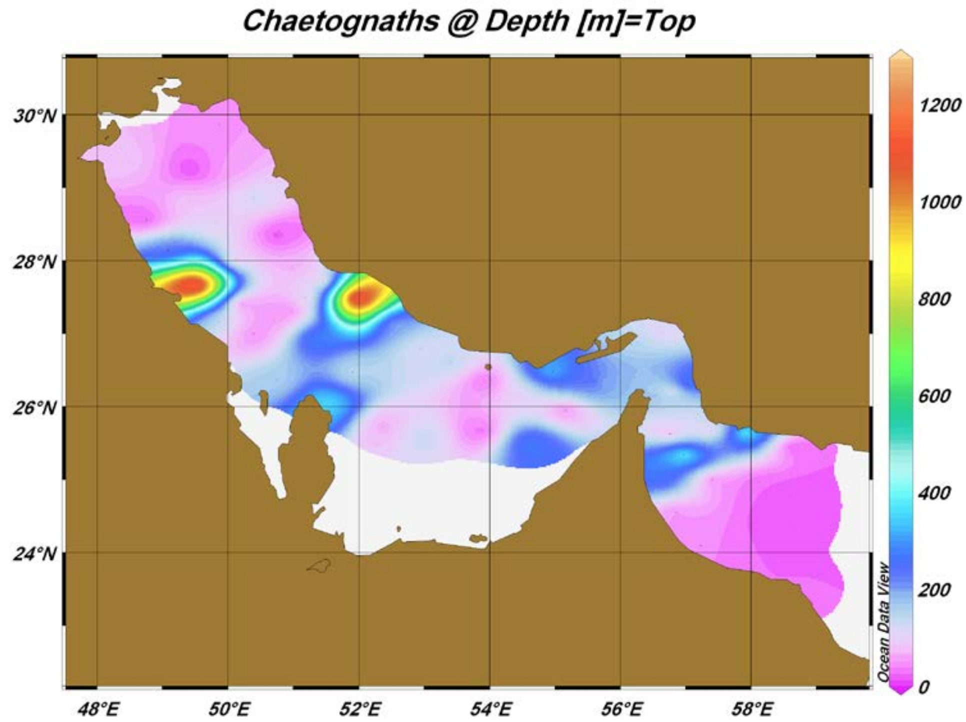

Fig. 22- Chaetognaths count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

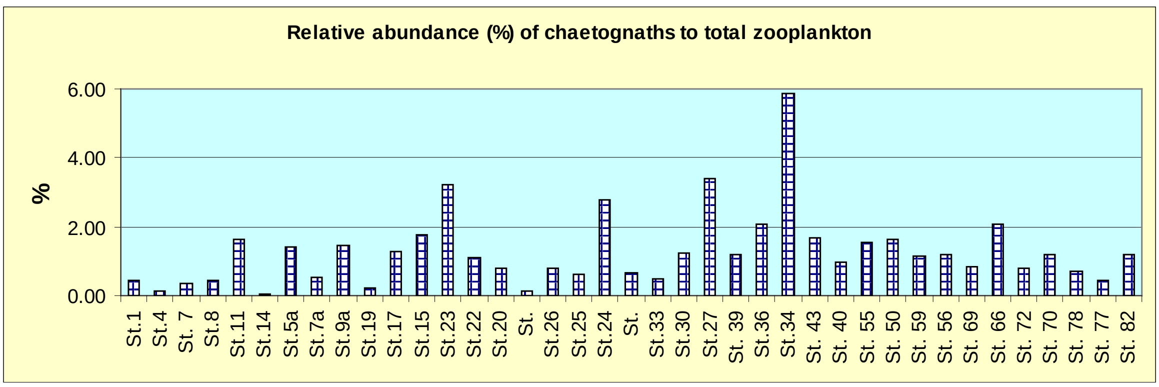

Fig. 23a- Relative abundance (%) of chaetognaths to total zooplankton at the sampled stations in the inner RSA.

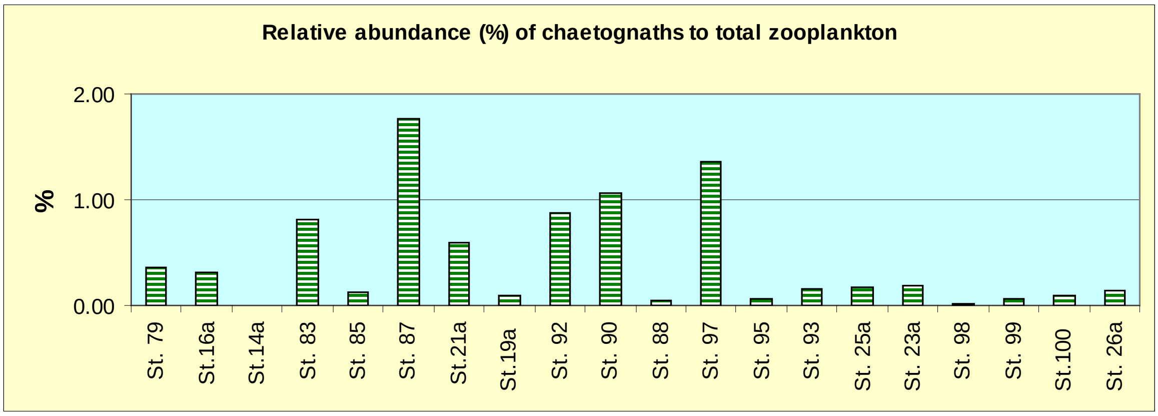

Fig. 23b- Relative abundance (%) of chaetognaths to total zooplankton at the sampled stations in the Sea of Oman .

3.2.1.7 Larvacea

The larvaceans in the ROPME Sea Area comprised 9 species, which totally had numerical abundance between 6 and 8033 organisms/m^3 (Fig. 24). They sustained higher count in the Sea of Oman (average: 1024 organisms/m^3) than in the inner RSA (average: 673 organisms/m^3) In the Sea of Oman , the count was mostly < 2000 organisms/m^3 but high counts (3230, 1990, 2697 and 2230 organisms/m^3) were observed at stations 19, 21a, 90, and 25a respectively. Meanwhile in the inner RSA, the larvaceans count was mostly <500 organisms/m^3, increased to 2274, 2373, 1404, 2052, 1576 , 1040, 8033 & 2727 organisms/m^3 at stations 1 ,14 ,15, 27 ,30, 33, 77 & 78 respectively. On the other hand, larvaceans displayed pronouncedly variable role in the total zooplankton count over the whole area (0.4 % - 25.6%) (Fig. 25 a&b).

The larvacean species demonstrated different spatial distribution over the ROPME Sea Area, whereas 4 species occurred on wide spatial scale (*Oikopleura dioica, Oikopleura longicauda, Oikopleura parva* & *Oikopleura* sp. (mainly juvenile) and 6 species were limited in their distribution to small number of stations (*Appendicularia sicula, Fritillaria borealis, Fritillaria formica, Oikopleura Intermedia, Oikopleura rufescens, Stegosoma magnum*). *Oikopleura dioica* appeared as the persistent and widely distributed larvacean in the whole ROPME Sea Area, and it will be discussed later on in the part delivered to the dominant species. *Oikopleura longicauda* was reported at 16 stations, mostly in the Strait of Hormuz and Sea of Oman , usually attained counts <200 organisms/m^3, increased to 350, 2185, 638 & 427 organisms/m^3 at stations 7, 77, 19a and 21a respectively, forming 27 – 75% of total larvaceans. *Oikopleura parva* was missed from the inner RSA, but it was represented in the Strait of Hormuz and Sea of Oman , with high counts (971, 271, 176, 226, 325, 201 organisms/m^3) at stations 77, 78, 83, 19a, 21a, and 95 respectively, constituting 7 – 61.5% of total larvaceans. Although other larvacean species appeared occasionally at a few stations, they attained high counts, at some stations. *Oikopleura rufescens* was found at station 77 only in the inner RSA, near the Strait of Hormuz, amounting to 152 organisms/m^3, *Oikopleura intermedia* appeared mainly at three stations in the inner RSA, with a maximum of 273 organisms/m^3 at station 77. *Appendicularia sicula* was confined to stations 1 & 14 in the northern end of inner RSA, having pronouncedly high counts (873 & 1862 organisms/m^3 respectively). *Fritillaria formica* appeared to be restricted to the Sea of Oman , mostly in very low count, except relatively high count (143 organisms/m^3) at station 21a. *Fritillaria* *borealis* and *Stegosoma magnum* appeared occasionally in very small numbers in the inner RSA and Sea of Oman . It is to be noticed that juveniles of *Oikopleura* species was widely distributed in the central and southern parts of the inner RSA, attaining high counts (195, 1221, 492, 803, 181 and 198 organisms/m^3) at stations 11a, 27, 30, 33, 34 & 39 respectively).

It is worth to mention that, 6 of the larvacean species during the present study have never been mentioned in the earlier studies, and they are new to the study area (Table 14).

Table 14- New larvaceans to the ROPME Sea Area.

Species	**Max. count/m^3**	**Species**	**Max. count/m^3**
Appendicularia sicula	1862	*Oikopleura parva*	971
Fritillaria formica	143	*Oikopleura rufescens*	152
Oikopleura intermedia	273	*Stegosoma magnum*	6

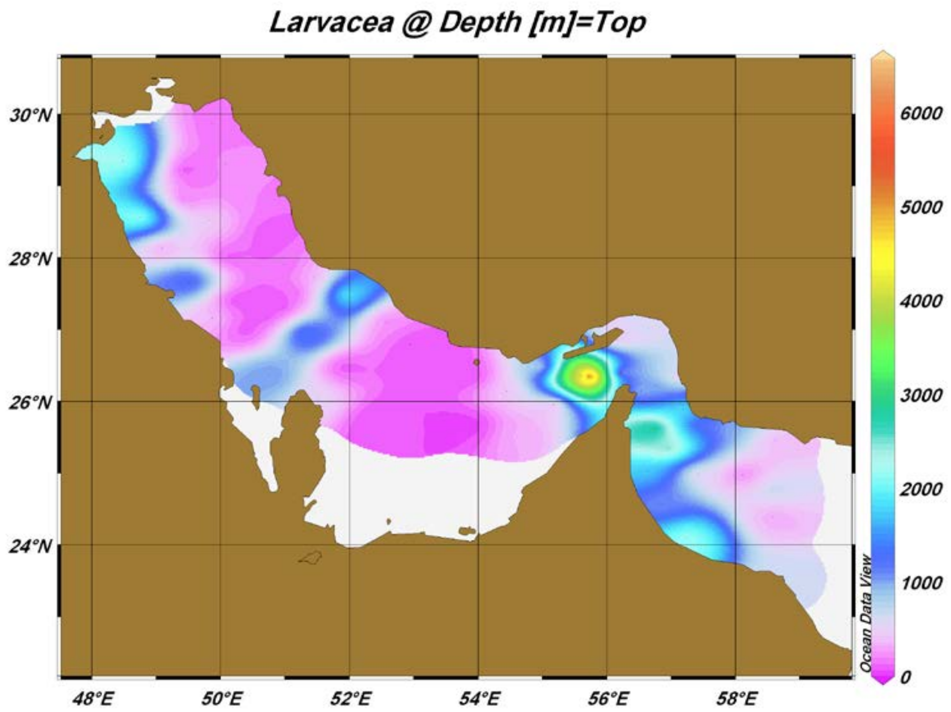

Fig. 24- Larvaceans count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

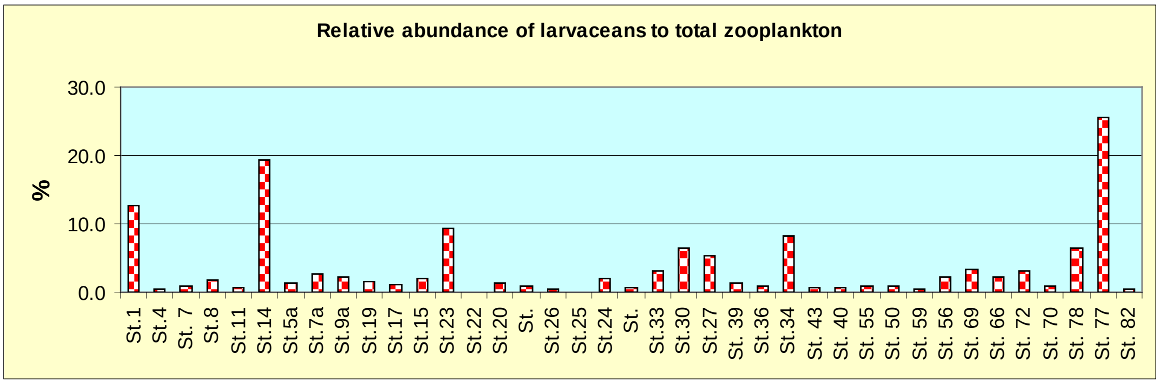

Fig. 25a- Relative abundance of larvaceans to total zooplankton at the sampled stations in the inner RSA (Feb. 2006).

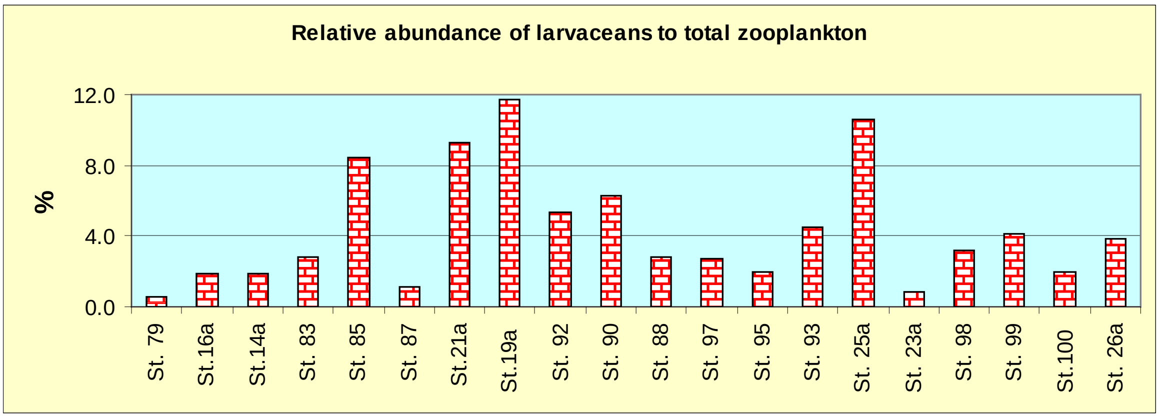

Fig 25b- Relative abundance of larvaceans to total zooplankton at the sampled stations in the Sea of Oman (Feb. 2006).

3.2.1.8 Thaliacea

The winter thaliacians were represented by eleven species over the ROPME Sea Area, usually in low count, except those (6163, 2487 and 1393 organisms/m^3) at stations 70, 79 and 87 respectively near and inside the Strait of Hormuz. Their average count in the inner RSA (270 organisms/m^3) was higher than in the Sea of Oman (232 organisms/m^3), whereas several stations in the inner RSA (20, 22, 25, 30, 36, 55, 59, 72) sustained relatively higher counts (627, 299, 626, 242, 342, 276, 434, 240, organisms/m^3 respectively (Fig. 26).

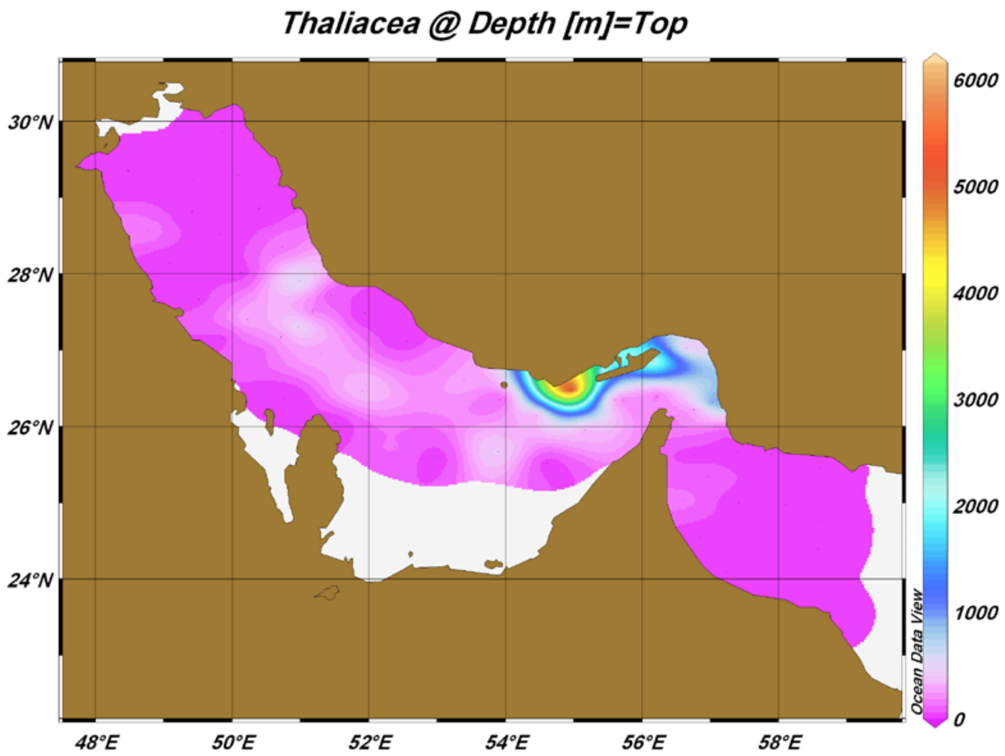

Fig. 26- Thaliaceans count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

On the other hand, the contribution of Thaliacea to the total zooplankton was higher in the inner RSA (mostly 1 – 33.6%) (Fig. 27a) than in the Sea of Oman (mostly <1%) (Fig. 27b). Of the thaliaceans found during the present study, seven species have never been recorded earlier, and they are considred as new records to the ROPME Sea Area (Table 15).

Table 15 – New thaliaceans to the ROPME Sea Area

Species	**Max. count/m^3**	**Species**	**Max. count/m^3**
Doliolum mulleri	12	*Salpa maxima*	23
Ihlea sp.	5	*Thalia* sp.	4
Iasis zonaria	2	*Thetys vagina*	14
Salpa fusiformis	270		

Doliolum denticulatum and *Thalia democratica* were the most widespread thaliacean species in the inner RSA and Sea of Oman . The former species sustained pronouncedly low counts over the whole area (< 62 organisms/m^3), except those (168, 2487, 135, 108 and 147 organisms/m^3) at stations 14, 79, 87, 90 and 92 respectively. It demonstrated markedly variable contribution to total thaliaceans (0.3% -100%) (Fig. 28a,b).

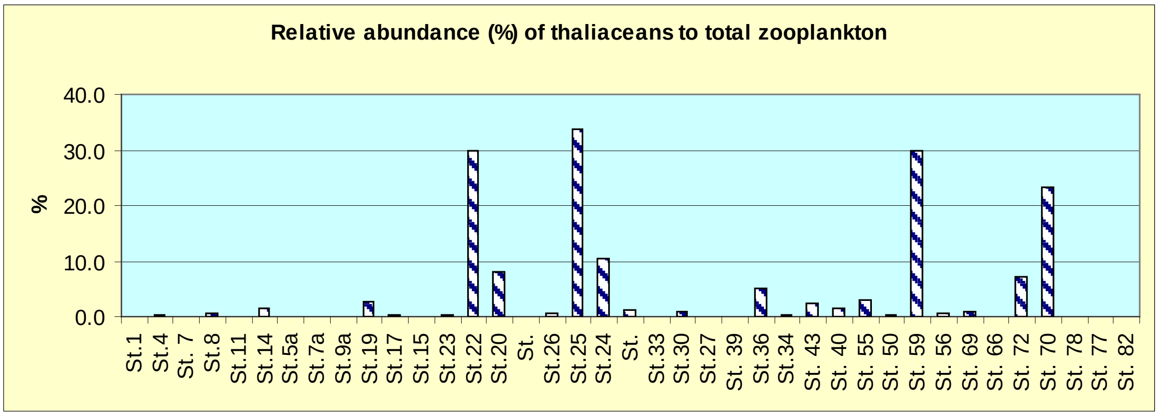

Fig. 27 a- Relative abundance (%) of thaliaceans to total zooplankton at the sampled stations in the inner RSA (Feb. 2006)..

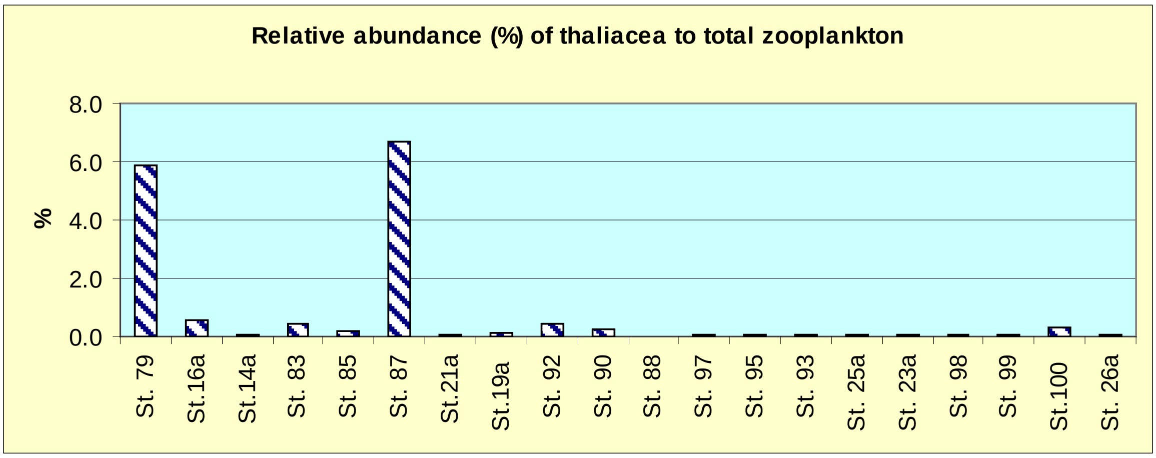

Fig 27b- Relative abundance (%) of thaliaceans to total zooplankton at the sampled stations in the Sea of Oman (Feb. 2006).

Thalia democratica was missed in the northern part of the inner RSA and the Sea of Oman , and was restricted to the central and southern part of the inner RSA. It attained markedly high counts (611, 512, 337, 274, 429, 6040, 234, 1258 organisms/m^3) at stations 20, 25, 36, 55, 59, 70, 72, 87 respectively, constituting 33 – 100% of total thaliaceans at several stations (Fig. 28a,b). *Doliolum gegenbouri* appeared only in the central and southern parts of the inner RSA, with relatively high counts (211 & 122 organisms/m^3) at stations 30 and 70 respctively, while *Salpa cylindrica* was restricted to the central area of the inner RSA, attaining a maximum count of 147 organisms/m^3 at station 25.. Of the new species, *Doliolum mulleri* was reported at 11 stations in both the inner RSA and Sea of Oman , in very low counts (1 -12 organisms/m^3). *Iasis zonaria* , *Ihlea sp.*, *Salpa maxima*, *Thetys vagina* and *Thalia* sp. were observed at 1-4 stations in the inner RSA and/or in the Sea of Oman , usually with few specimens each. However, *Salpa fusiformis* appeared only in the central inner RSA in very low counts, while at stations 19 and 22 it sustained 127 and 270 organisms/m^3 respectively.

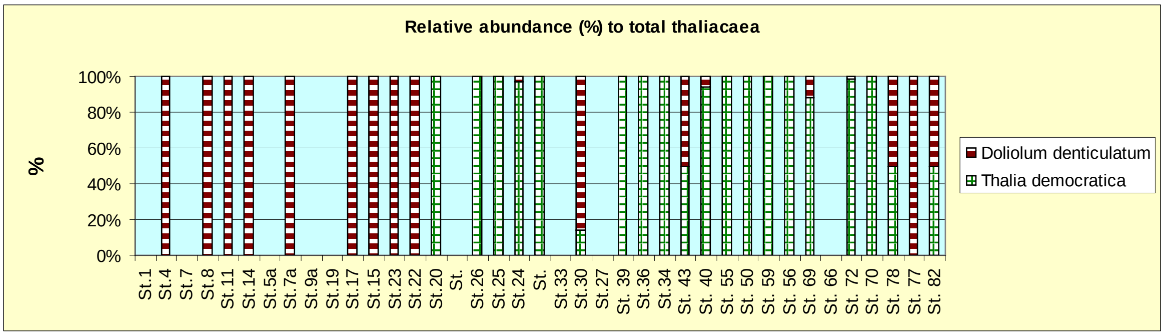

Fig. 28a- Relative abundance (%) of dominant thaliacean species tot total thaliaceans at the sampled stations in the inner RSA (Feb. 2006)

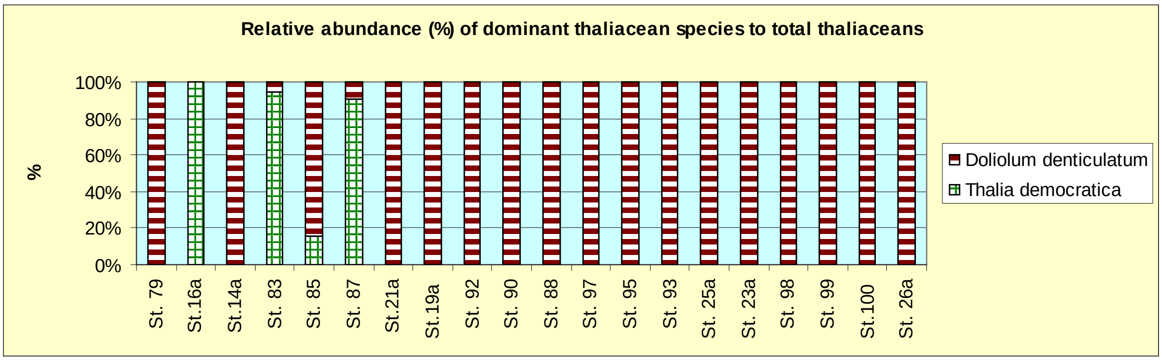

Fig 28b- Relative abundance (%) of dominant thaliacean species to total thaliaceans at the sampled stations in the Sea of Oman (Feb. 2006).

3.2.2 Dominant species

Two types of dominant species were reported in the ROPME Sea Area, the first one being widely distributed over the whole study area and dominated at numerous stations, and the second type included those species missed at several stations but displayed high counts and active contribution to the total zooplankton at some stations.

Numerous species of copepods appeared to be dominant, several of them belong to the sub group calanoid, namely *Paracalanus parvus, Paracalanus aculeatus, Clausocalanus minor, Temora stylifera, Temora turbinata, Eucalanus crassus, Rhinocalanus cornutus, Clausocalanus furcatus, Temora discaudata, Euchaeta marina.* Other species belong to the sub group cyclopoid, like *Oithona nana, Oithona plumifera, Oncaea conifera, Oncaea venusta, Oncaea mediterranea, Corycaeus speciosus, Corycaeus rostratus* and to the sub group harpacticoids, like *Euterpina acutifrons and Microsetella rosea,*

Other zooplankton representatives were also dominant, such as the cladoceran *Penilia avirostris*, the larvacean *Oikopleura dioica, Oikopleura longicauda*, and the thaliaceans *Thalia democratica* and *Doliolum denticulatum.*

3.2.2.1 Copepods

3.2.2.1.1 Calanoid copepods

Paracalanus parvus was the most dominant adult copepod species and widely distributed in the ROPME Sea Area, being found at 49 stations (Fig. 2a,b). It was well represented in the southern part of the inner RSA (238 – 8535 organisms/m^3), Strait of Hormuz and Sea of Oman (531 – 11003 organisms/m^3), while sustained relatively low counts (1-241 organisms/m^3) in the northern and central parts of the inner RSA (Fig. 29). It played active role (2.4 % and 34.2 %) in the total zooplankton and (10 – 47.9%) of the total addult copepods throughout the whole area (Fig. 30a,b).

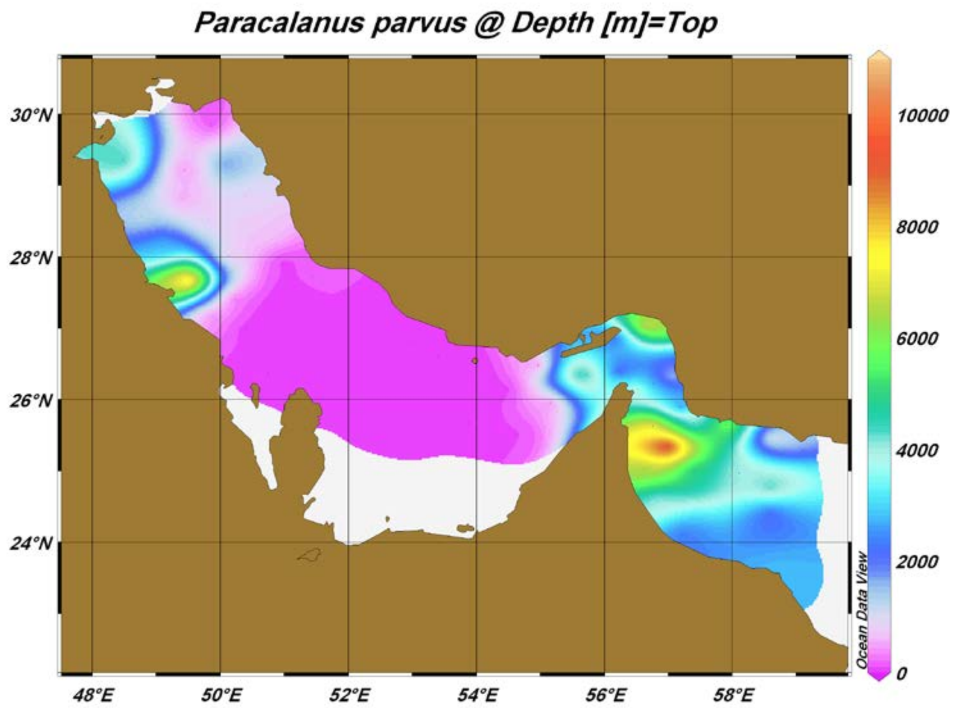

Fig. 29- *Paracalanus parvus* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

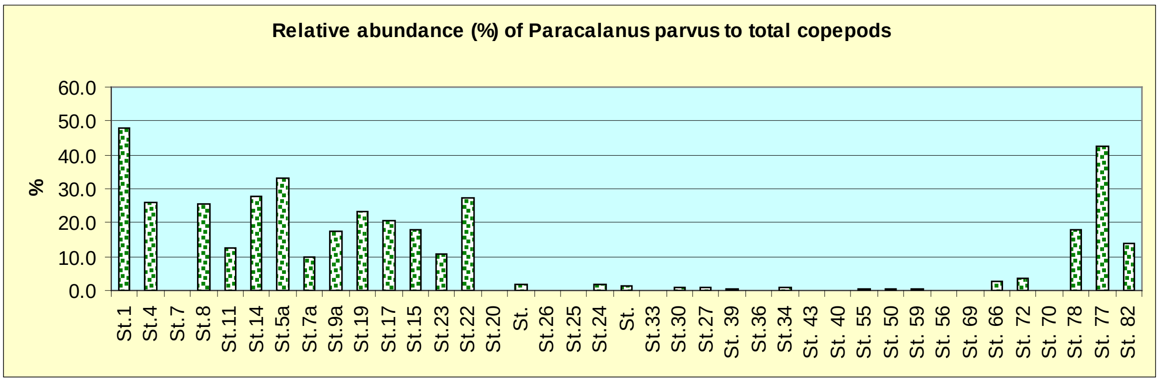

Fig. 30a- Relative abundance (%) of *Paracalanus parvus* to total copepods at the sampled stations in the inner RSA (Feb. 2006)

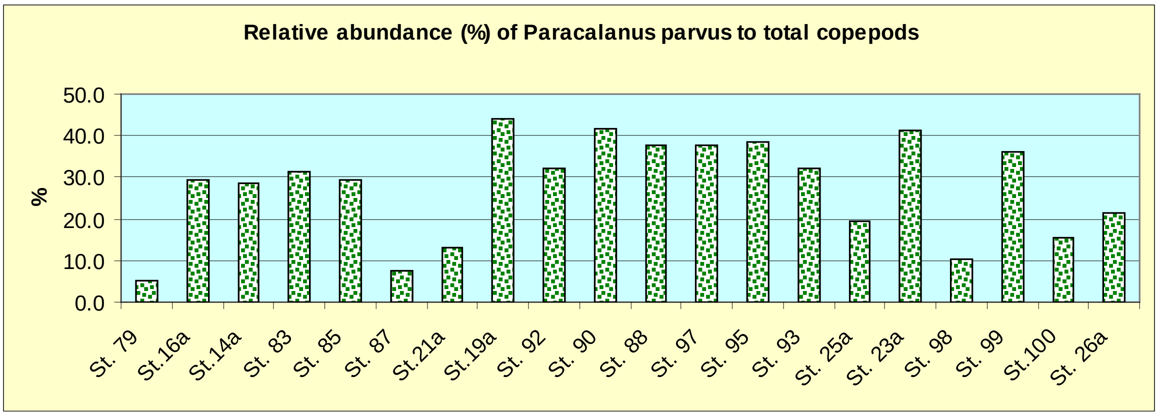

Fig. 30b- Relative abundance (%) of *Paracalanus parvus* to total copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Paracalanus aculeatus was completely missed from the southern inner RSA (Fig. 2a) and weakly represented in the other parts (mostly < 200 organisms/m^3), but it sutained high counts (2537, 870, 881 & 2006 organisms/m^3) at stations 11a, 27, 30 &33 respectively. In contrast, the species attained pronouncedly high counts (mostly >400 – 2600 organisms/m^3) in the Sea of Oman (Fig.31). The species demonstrated similar roles in the count of adult copepods in both in the inner RSA (7.0 – 24.9%) and the Sea of Oman (7.0 – 23.4%) (Fig.32a,b).

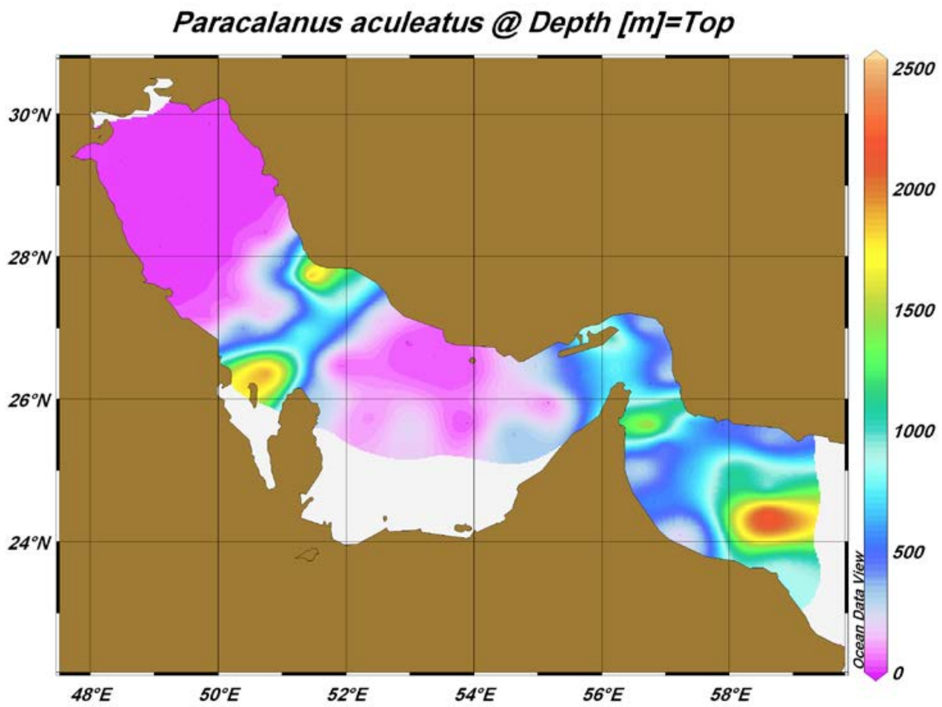

Fig. 31- *Paracalanus aculeatus* count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

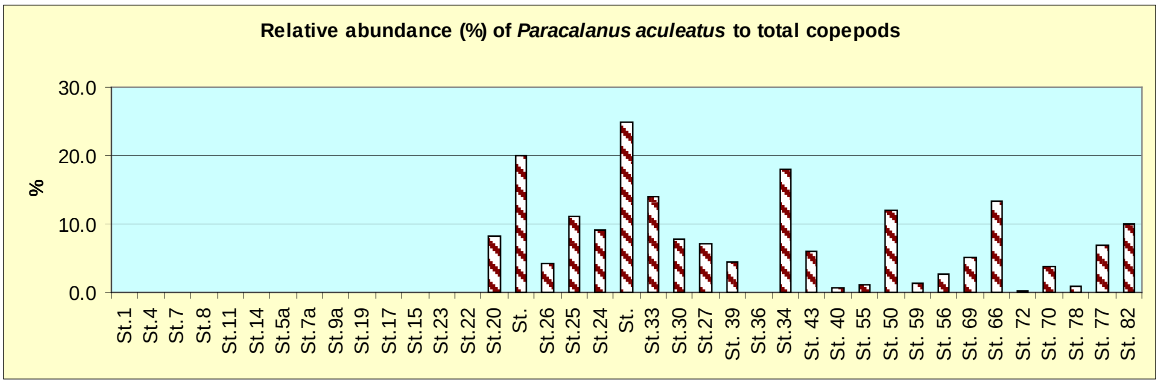

Fig. 32a- Relative abundance (%) of *Paracalanus aculeatus* to total copepods at the sampled stations in the inner RSA (Feb. 2006)

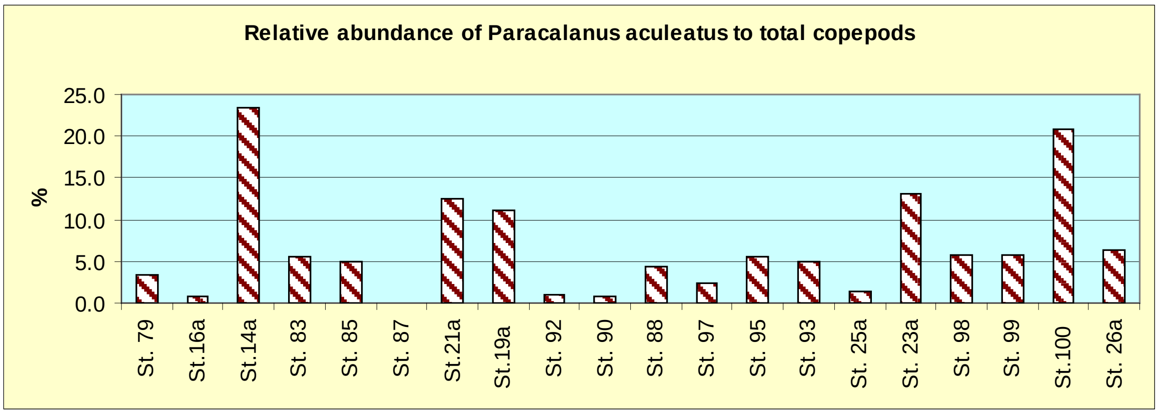

Fig. 32b- Relative abundance (%) of *Paracalanus aculeatus* to total copepodsn at the sampled stations in the Sea of Oman (Feb. 2006).

Eucalanus crassus appeared as a widely distributed calanoid copepod in the study area, being found at 47 stations (Fig. 2,ab), but it showed low counts at most of the sampled stations (< 200 organisms/m^3), particularly in the inner RSA, with the exception of station 15 (965 organisms/m^3). In the Strait of Hormuz and Sea of Oman , the counts *of E. crassus* individuals were pronouncedly high, amounting at several stations to 300 - 2416 organisms/m^3 (Fig. 33). The role of the species in total adult copepods was small throughout the inner RSA (mostly <1%), but increased in the Strait of Hormuz and Sea of Oman to >2% - 9.3% at several stations (Fig. 34a,b).

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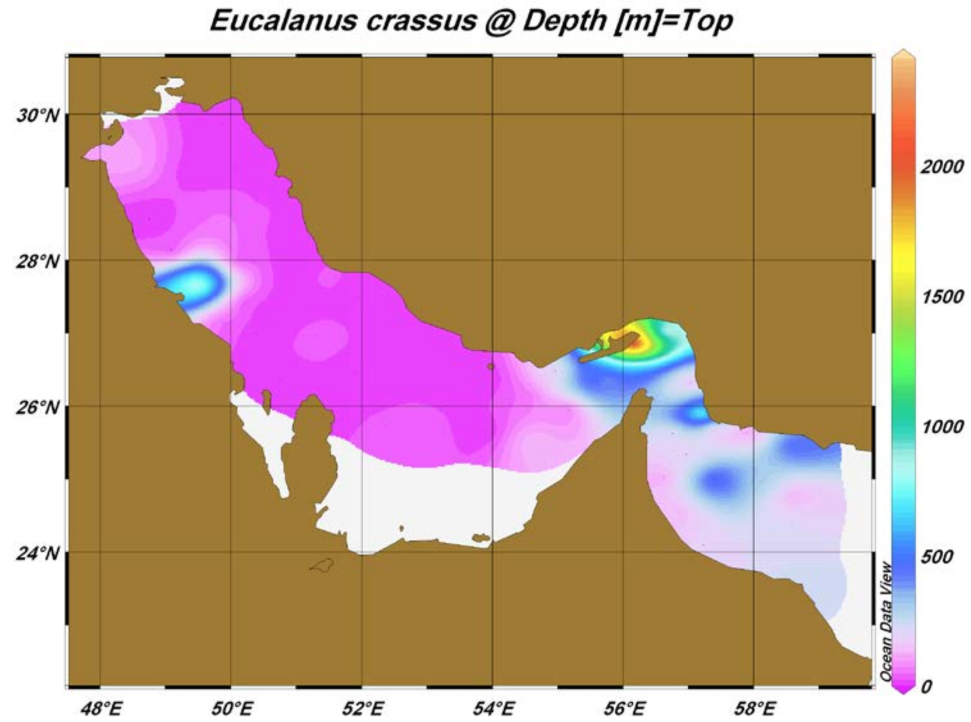

Fig. 33- *Eucalanus crassus* count (organism/m^3)in the ROPME Sea Area (Feb. 2006).

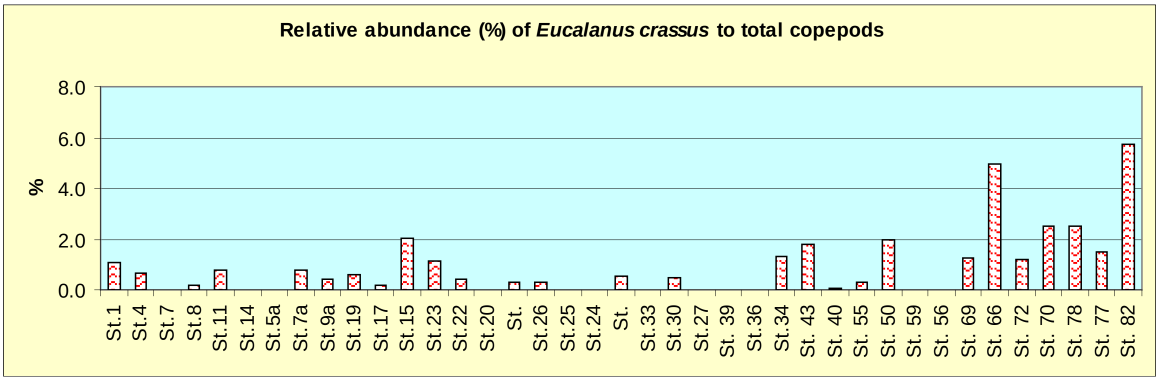

Fig. 34a- Relative abundance (%) of *Eucalanus crassus* to total copepods at the sampled stations in the inner RSA (Feb. 2006).

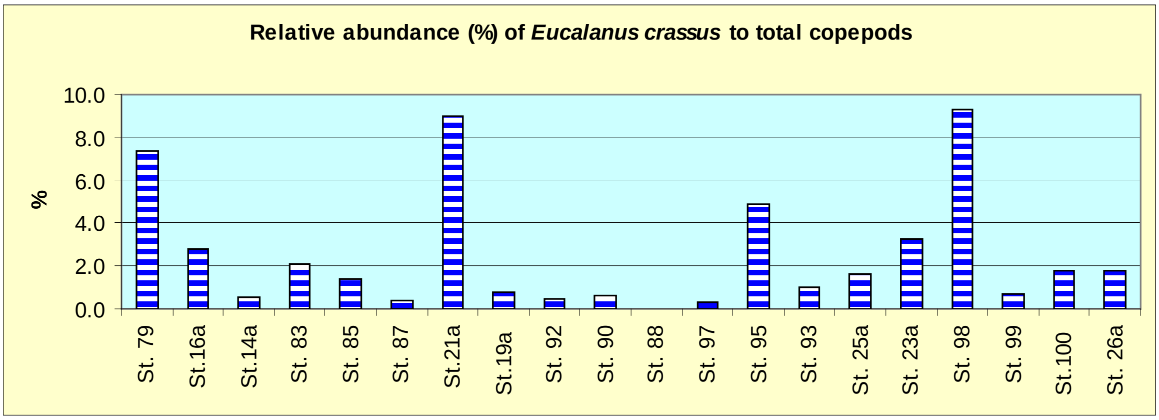

Fig. 34b- Relative abundance (%) of *Eucalanus crassus* to total copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Nannocalanus minor was missed in the central inner RSA and widespraed in the both extremes, and in the Strait of Hormuz (Fig. 2a,b). The species usually sustained relatively low counts over the whole area (< 300 organisms/m^3), with a few exceptions (2263, 661, 530, 428, 419 organisms/m^3) at stations 15, 79, 19a, 92 & 100 respectively (Fig. 35). The contribution of the species to the total adult copepods appeared to be limited at most stations, being less than 2%, reached to 3.0 % – 8.4% at 11 stations in the inner RSA (Fig. 36a,b).

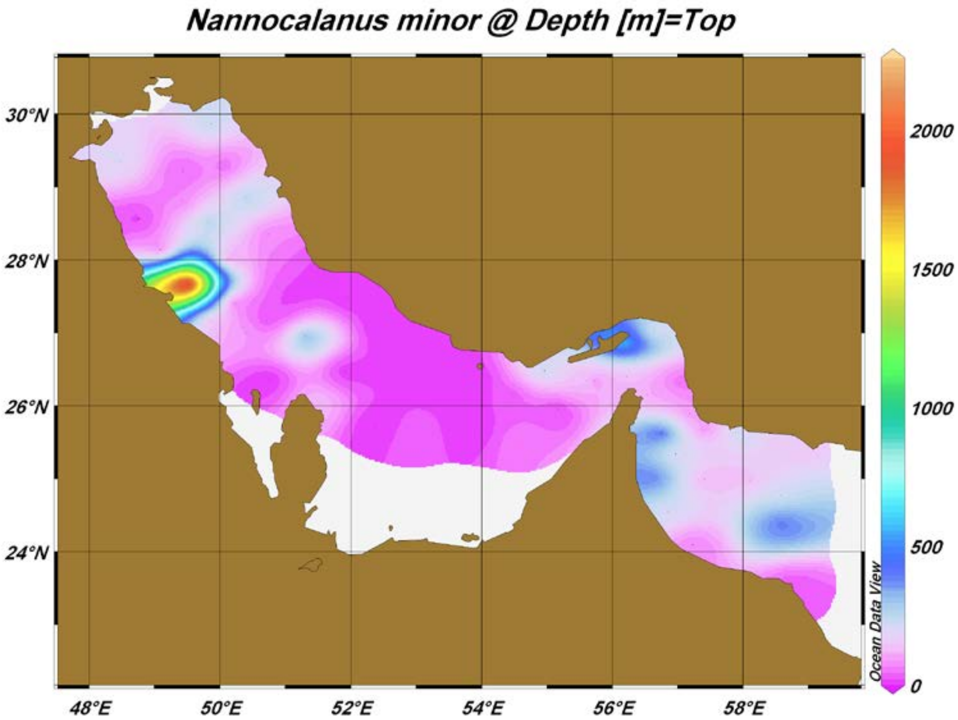

Fig. 35- *Nannocalanus minor* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

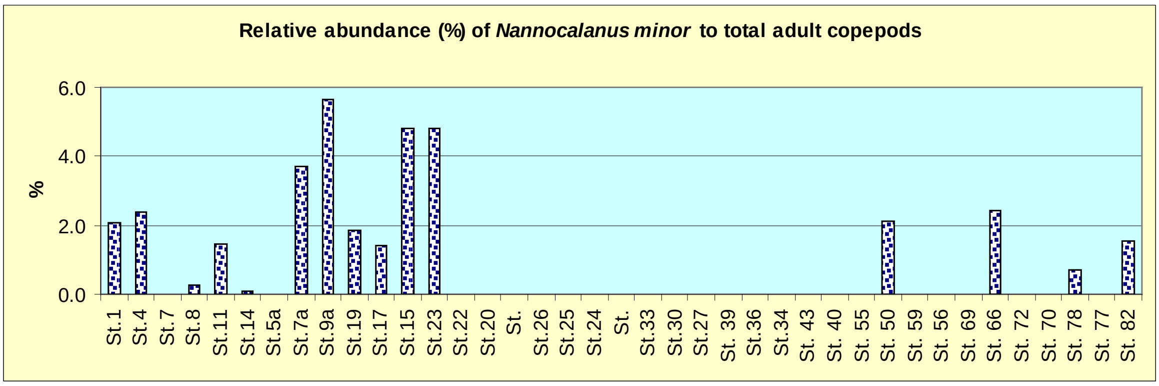

Fig. 36a- Relative abundance (%) of *Nannocalanus minor* to total copepods at the sampled stations in the inner RSA (Feb. 2006)

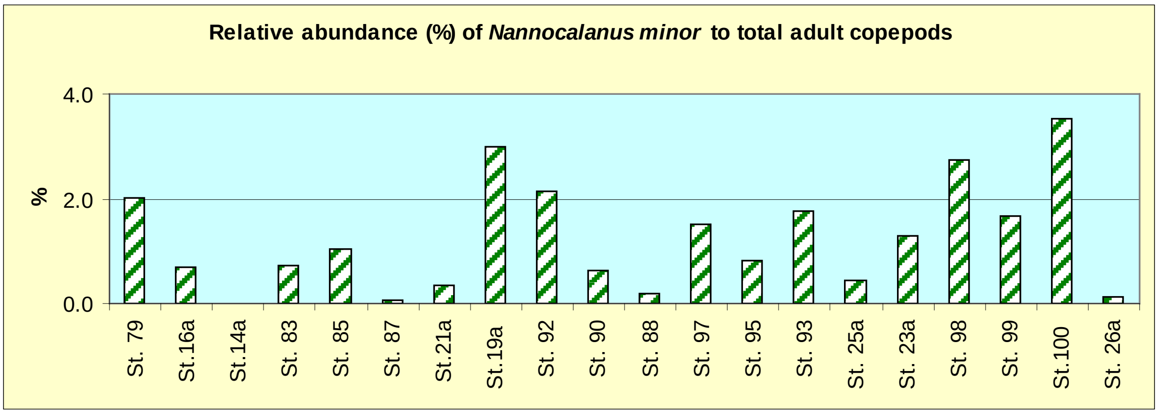

Fig. 36b- Relative abundance (%) of *Nannocalanus minor* to total copepods at the sampled stations in the Sea of Oman (Feb. 205).

Clausocalanus minor was missed from the northern and central parts of the inner RSA and found as persistent zooplankton component in the southern inner RSA, Strait of Hormuz and Sea of Oman (Fig. 2a,b). The numerical abundance of the species over the whole area varies between 25 - 1351 organisms/m^3. In the inner RSA, the majority of stations harbored <200 organisms/m^3, while stations 1, 4 & 15 harbored higher counts (286, 494, & 1351 organisms/m^3 respectively). The Strait of Hormuz and Sea of Oman seem to be comparatively richer in *C. minor*, whereas most of stations sustained counts > 200 with the highest values (1202 & 1032 organisms/m^3) at stations 21a & 99 respectively (Fig. 37). On the other hand, *C. arcuicornis* played more active role in the counts of adult copepods in the Strait of Hormuz and Sea of Oman rather than in the inner RSA (Fig. 38a,b).

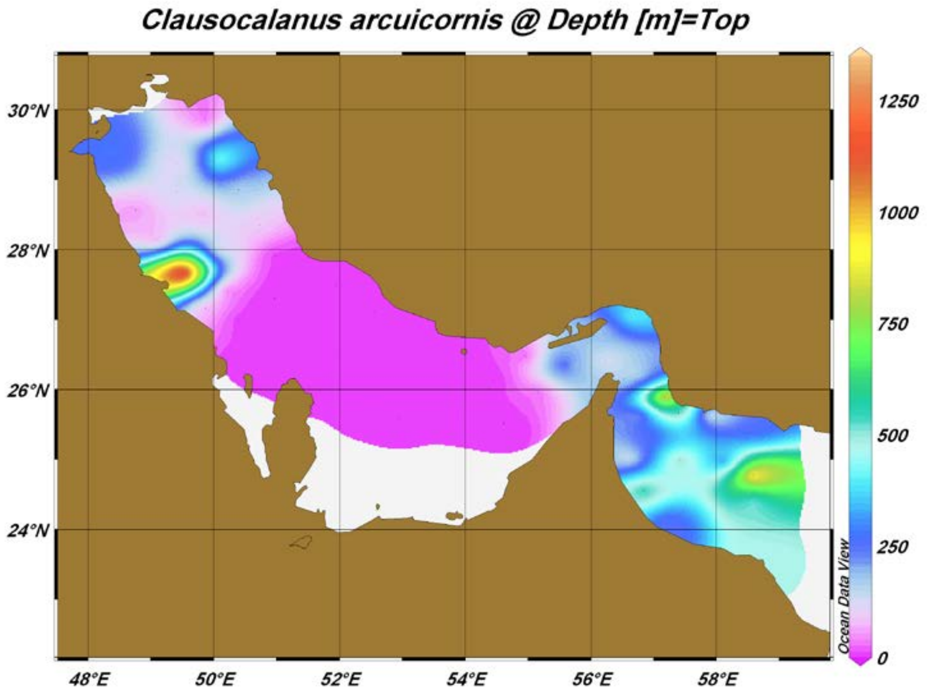

Fig. 37- *Clausocalanus arcuicornis* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

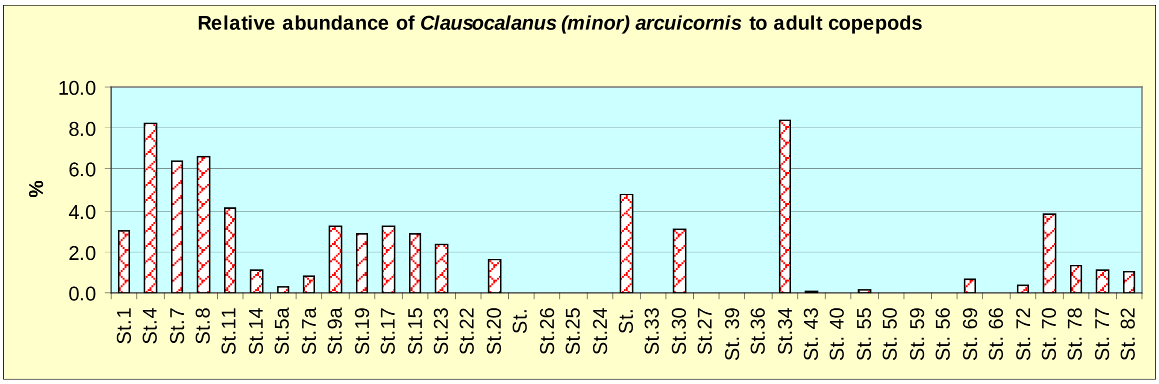

Fig. 38a- Relative abundance (%) of *Clausocalanus minor* to total copepods at the sampled stations in the inner RSA (Feb. 2006).

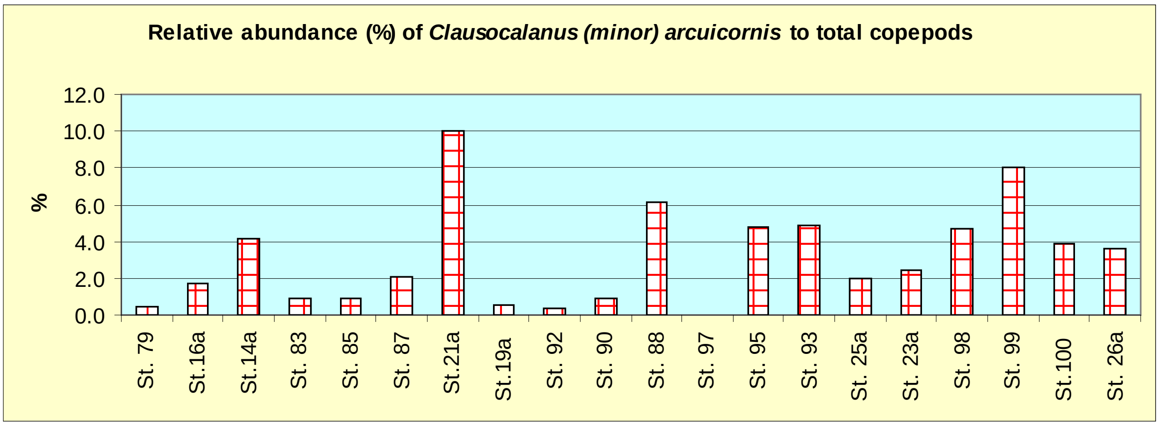

Fig. 38b- Relative abundance (%) of *Clausocalanus minor* to total copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Temora stylifera was observed at 28 stations sporadically distributed over the ROPME Sea Area (Fig. 2a,b), with counts fluctuating between 9 and 547 organisms/m^3 at most stations. Markedly high counts (3035 & 2203 organisms/m^3) were reported at stations 15 in the northern inner RSA and 16a in the Sea of Oman respectively (Fig. 39). In contrast, the relative abundance of the species to total adult copepods appeared to be more active in the southern inner RSA (mostly 2 – 14.6%) than in other parts of the ROPME Sea Area (< 1%) (Fig. 40a,b).

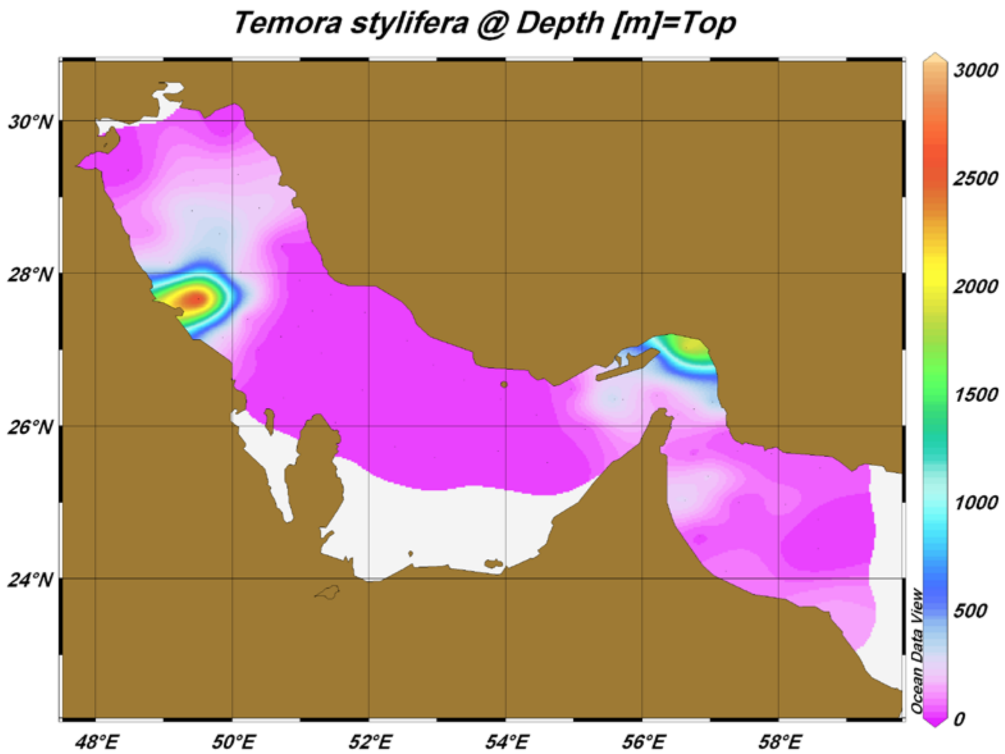

Fig. 39- *Temora stylifera* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

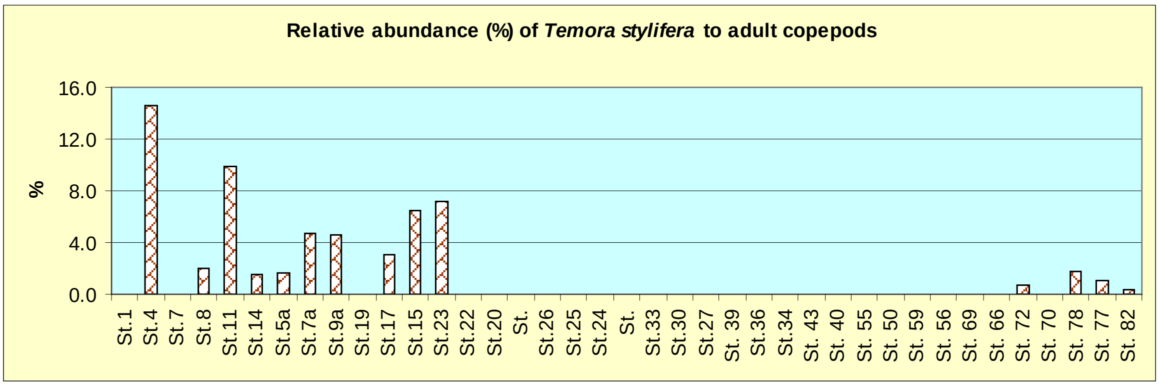

Fig. 40a- Relative abundance (%) of *Temora stylifera* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

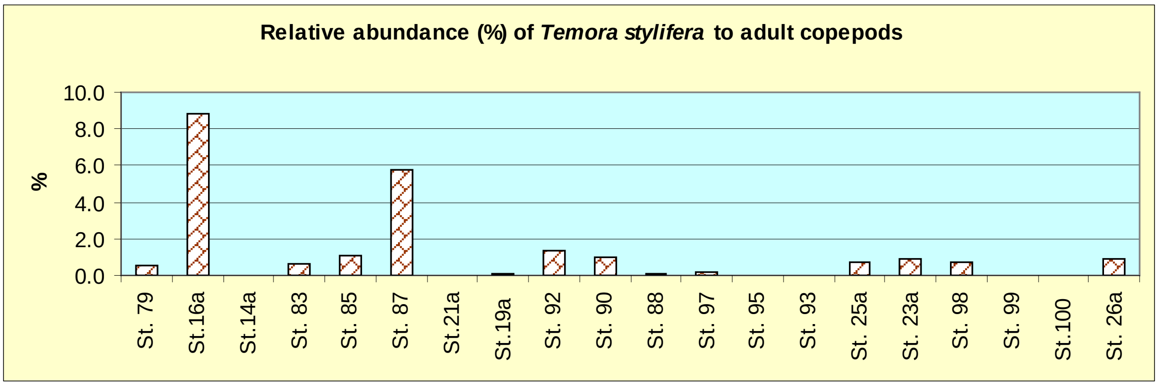

Fig. 40b- Relative abundance (%) of *Temora stylifera* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Temora turbinata was recorded among the widely distributed calanoid copepods throughout the ROPME Sea Area (Fig. 2a,b), with denser populations over the inner RSA and the Strait of Hormuz, than in the Sea of Oman . In the inner RSA, the individuals count fluctuated mostly from 6 – 336 organisms/m^3, increased to 1508, 2693, 523 organisms/m^3 at stations 5a, 15 & 23 respectively. In the Sea of Oman , *Temora turbinata* was missed at 10 stations, while it sustained high counts (895, 2036 and 559 organisms/m^3) at stations 78, 79 and 83 respectively in the area of the Strait of Hormuz, (Fig. 41). The role of the species in total adult copepods appeared to be active at numerous stations, reached 18.0% & 23.5% at stations 5a & 23 respectively. (Fig. 41a,b).

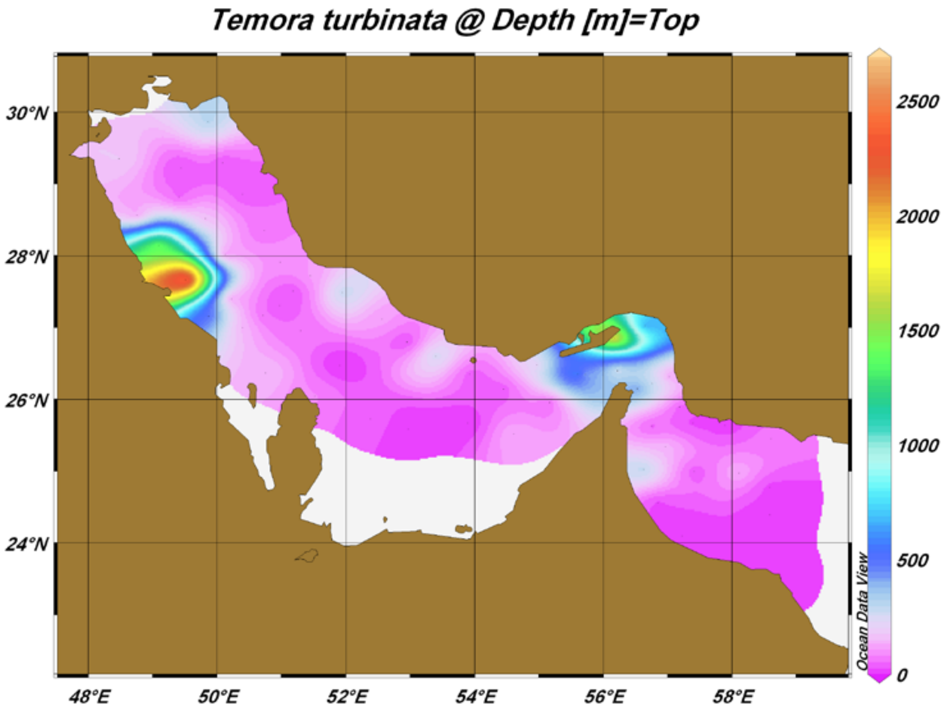

Fig. 41- *Temora turbinate* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

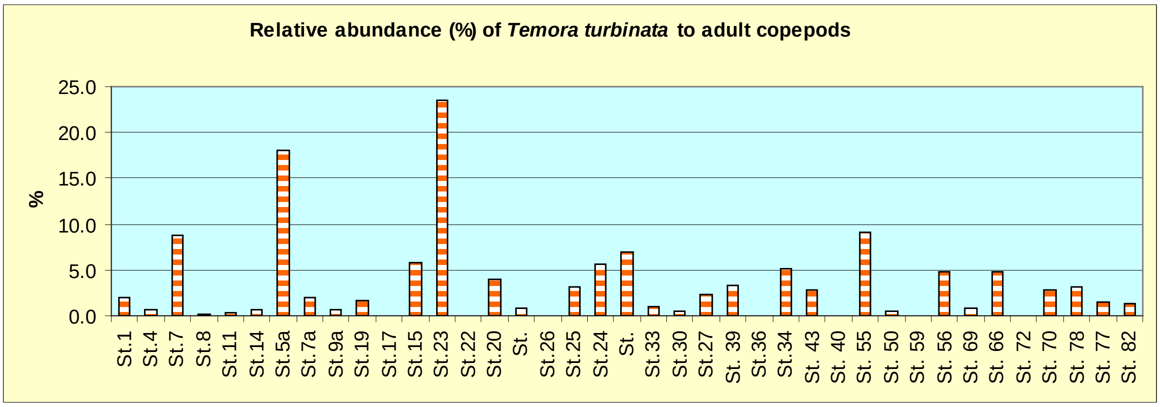

Fig. 42a- Relative abundance (%) of *Temora turbinata* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

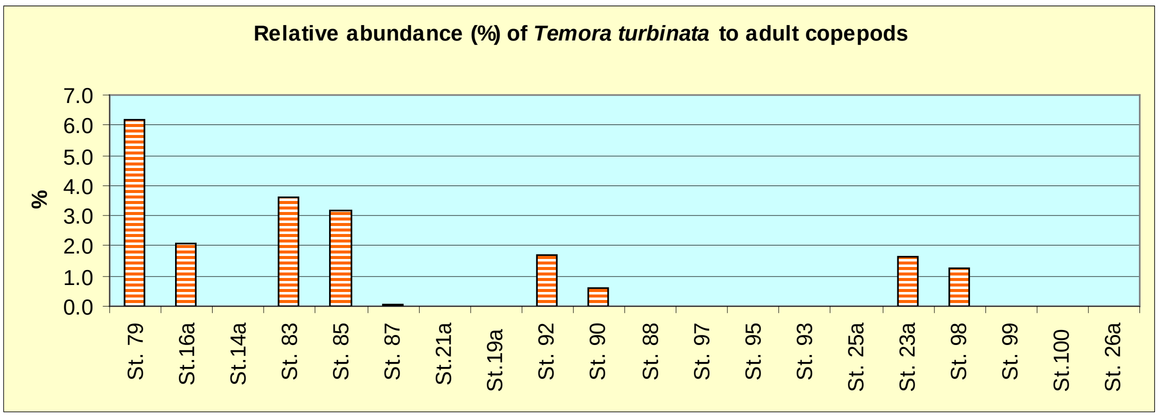

Fig. 42b- Relative abundance (%) of *Temora turbinata* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Paracalanus crassirostris was restricted to the central and southern inner RSA, while missed from the Sea of Oman , attaining numerical density mostly between 25 and 365 organisms/m^3. However, it reported high counts (1200, 1317, 2366 organisms/m^3) at stations 11a, 30 and 33 respectively (Fig. 43). The species displayed clear role in the total count of addult copepods mostly between 4% and 16.6%. (Fig. 44)

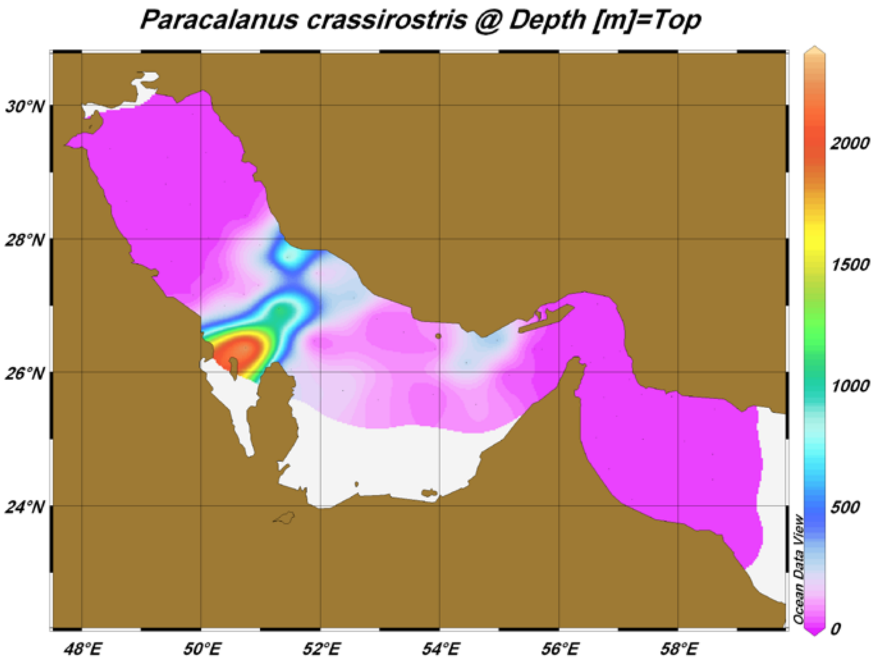

Fig. 43- *Paracalanus crassirostris* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

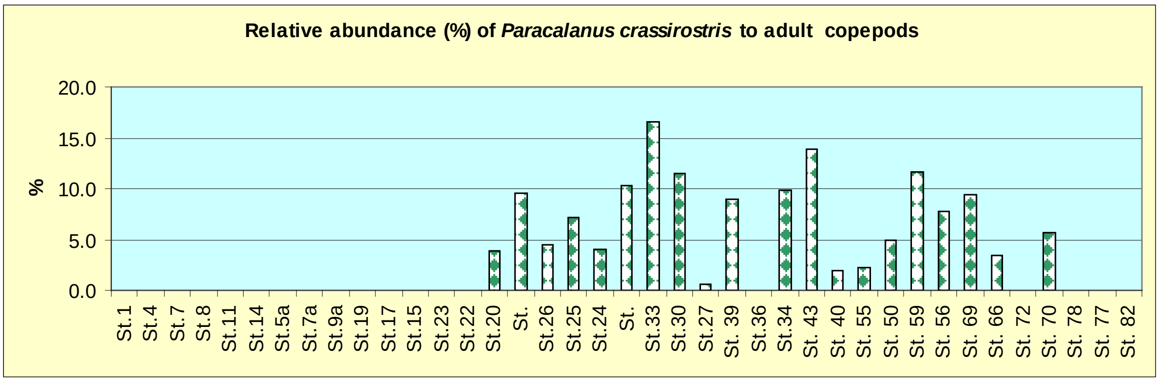

Fig.44- Relative abundance (%) of *Paracalanus crassirostris* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

3.2.2.1.2 Cyclopoid copepods:

Oithona nana was the most widespread cyclopoid copepod over the whole ROPME Sea Area, ocurring at 53 stations with greatly variable counts. Its high counts were reported in the southern inner RSA, Strait of Hormuz and Sea of Oman . In southern inner RSA, the counts varied between 200 and 6912 organisms/m^3, while in the northern and central parts the count was mostly < 200 organisms/m^3. In the Sea of Oman , it fluctuated between 728 and 9092 organisms/m^3 (Fig 45). The species contributed 0.1 - 23.8 % to total zooplankton count, and was the major components of adult copepods at numerous stations forming up to 37.2%. (Fig 46a,b)

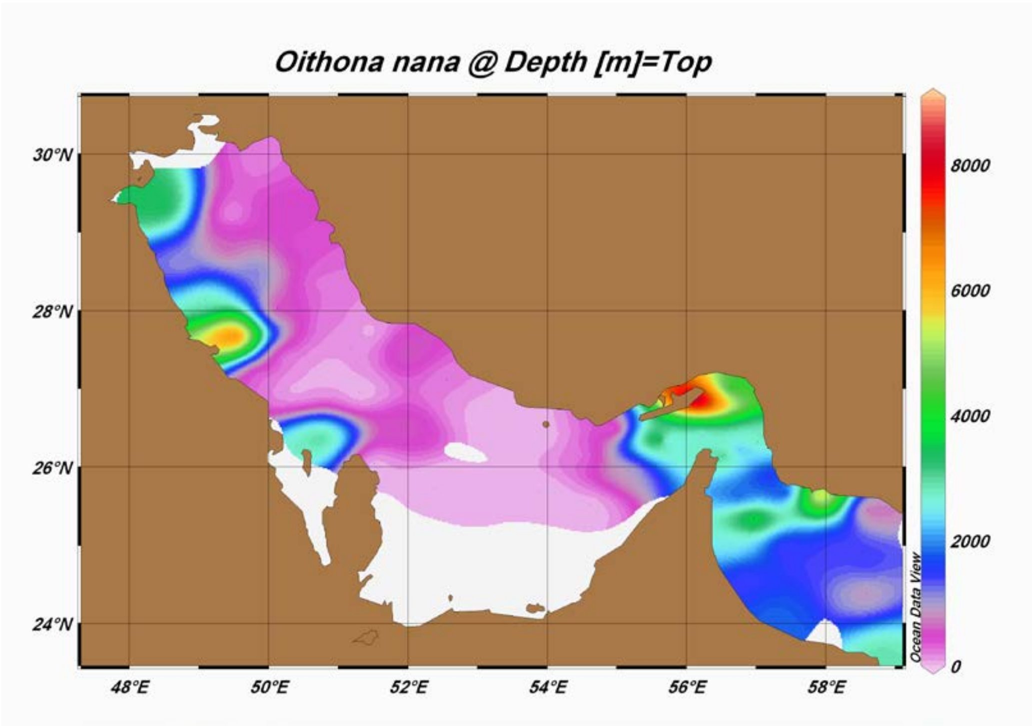

Fig. 45- *Oithona nana* count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

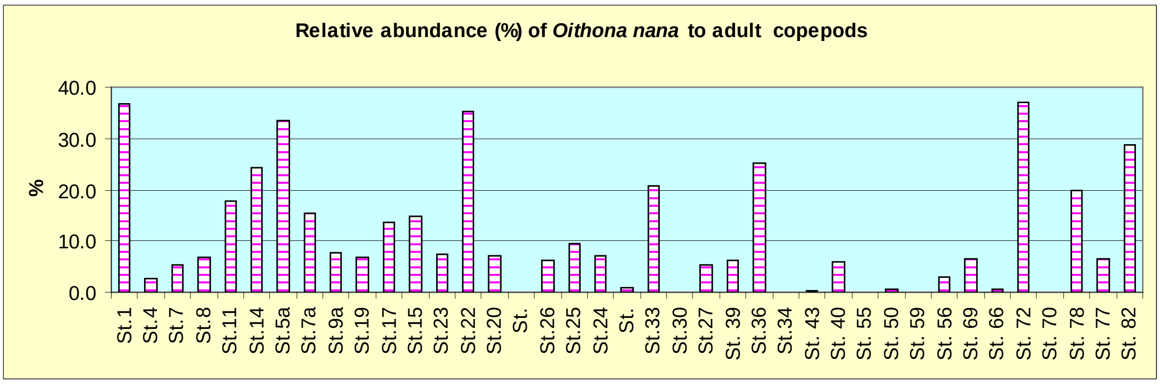

Fig. 46a - Relative abundance (%) of *Oithona nana* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

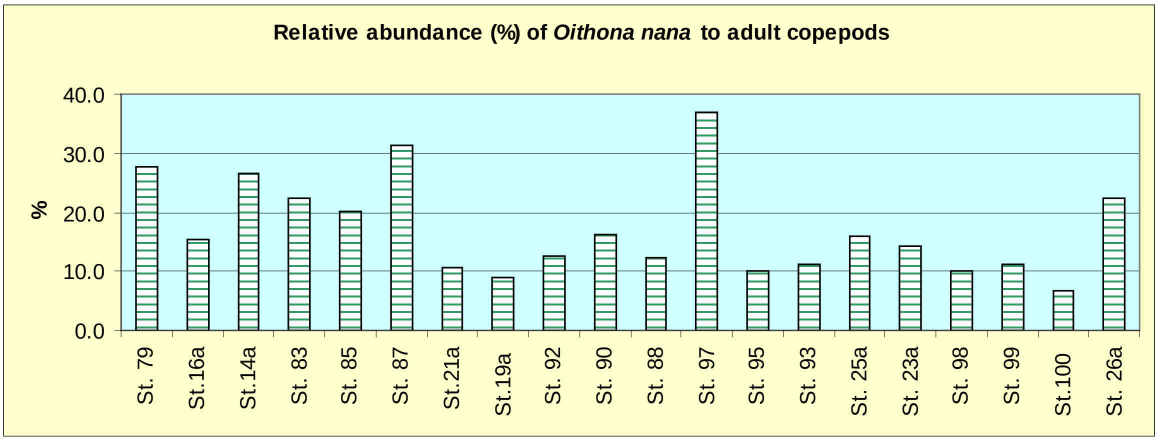

Fig. 46b - Relative abundance (%) of *Oithona nana* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Oithona plumifera appeared at 46 stations throughout the study area, with considerably variable numerical abundance. In the inner RSA, the species count fluctuated between 9- 3290 organisms/m^3), attaining high counts (562, 606 & 3290 organisms/m^3) at stations 8, 14 and 15 respectively in the northern part, 809 organisms/m^3 at station 11a in the central part and 2566 organisms/m^3 at station 78 near Strait of Hormuz. In the Sea of Oman , the counts were moderately high, varying between 100 and 692 organisms/m^3 (Fig 47). The species contributed 0.04% - 6% to total zooplankton count, being < 4% at most stations, while it showed different roles in total adult copepods, reached to 16% at station 55 (Fig 48a,b).

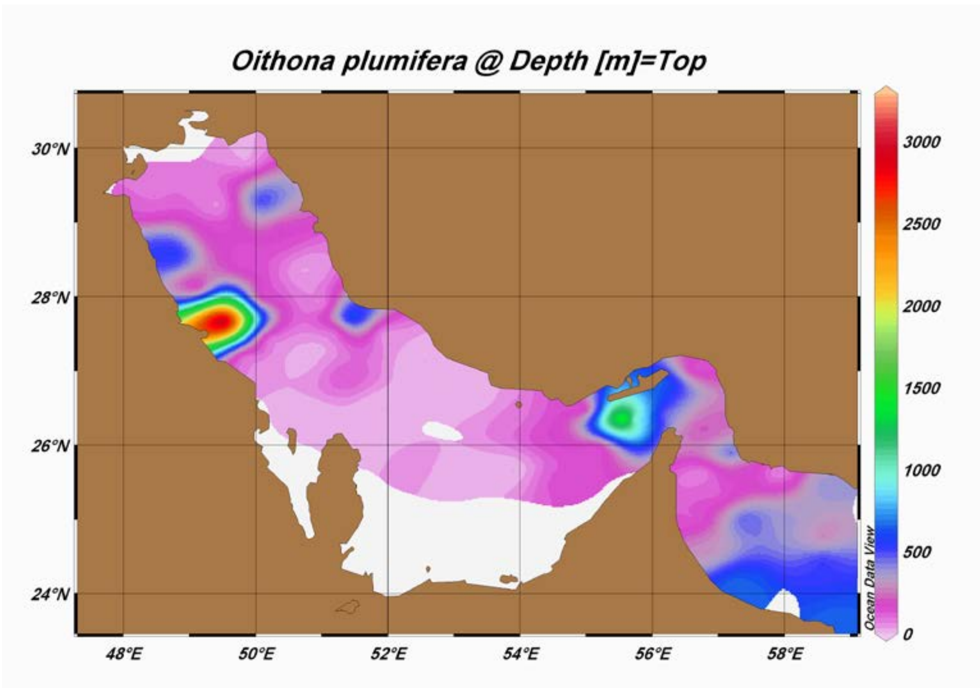

Fig. 47- *Oithona plumifera* count (organism/m^3) in the ROPME Sea Area

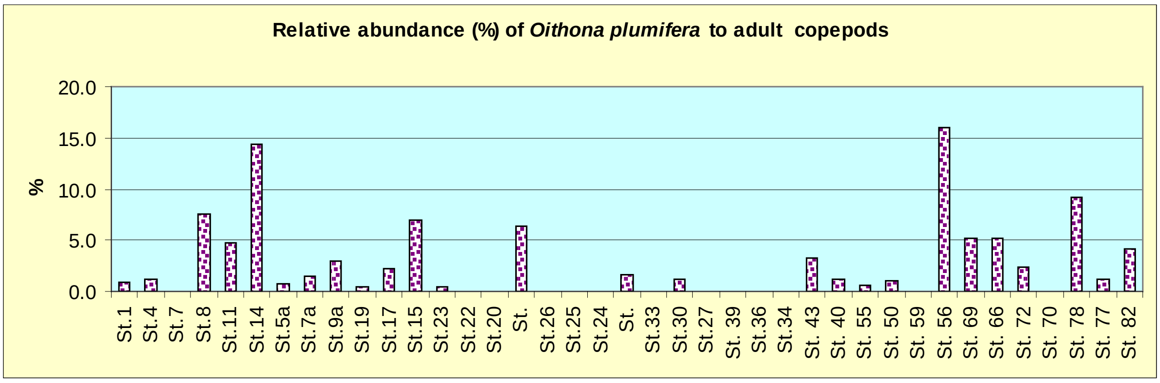

Fig. 48a - Relative abundance (%) of *Oithona plumifera* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

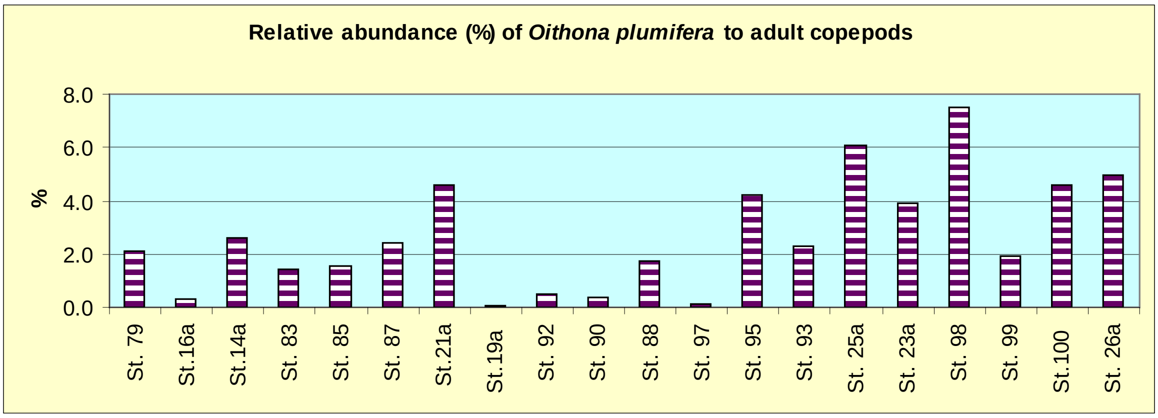

Fig. 48b - Relative abundance (%) of *Oithona plumifera* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Oncaea venusta was recorded at 40 stations, mainly in the northern inner RSA, the Strait of Hormuz and Sea of Oman (Fig. 2a,b). It sustained poor population density in the central and southern parts of the inner RSA (mostly < 100 organisms/m^3) and moderately high in the northern part (mostly 100 – 870 organisms/m^3). However, high counts (1788 & 4105 organisms/m^3) were observed at stations 7a and 15 respectively, and markedly high counts (2550 & 4203 organisms/m^3) at stations 77 & 78 respectively near the Strait of Hormuz, while it was missed from the Straits, except those (2448 and 2121 organisms/m^3) at stations 16a and 83 respectively. In the Sea of Oman , wide variability was reported in the couns of the species (118 – 5081 organisms/m^3), and the high counts (1082, 5081, 2553, 1127 & 2024 organisms/m^3) at stations 19a, 90, 92, 97 & 25a respectively (Fig 49). On the other hand, *O. venusta* displayed active contribution to total zooplankton at several stations, even at those with low counts, forming 4% - 11.8% at 8 stations and 1 - < 4% at other stations. This role was more active in the total adult copepods, being 17%, 23.9%, 18.2%, 16.1%, 23%, 19.2% & 18.1% at stations 14, 7a, 9a, 72, 77, 90 & 25a (Fig 50a,b).

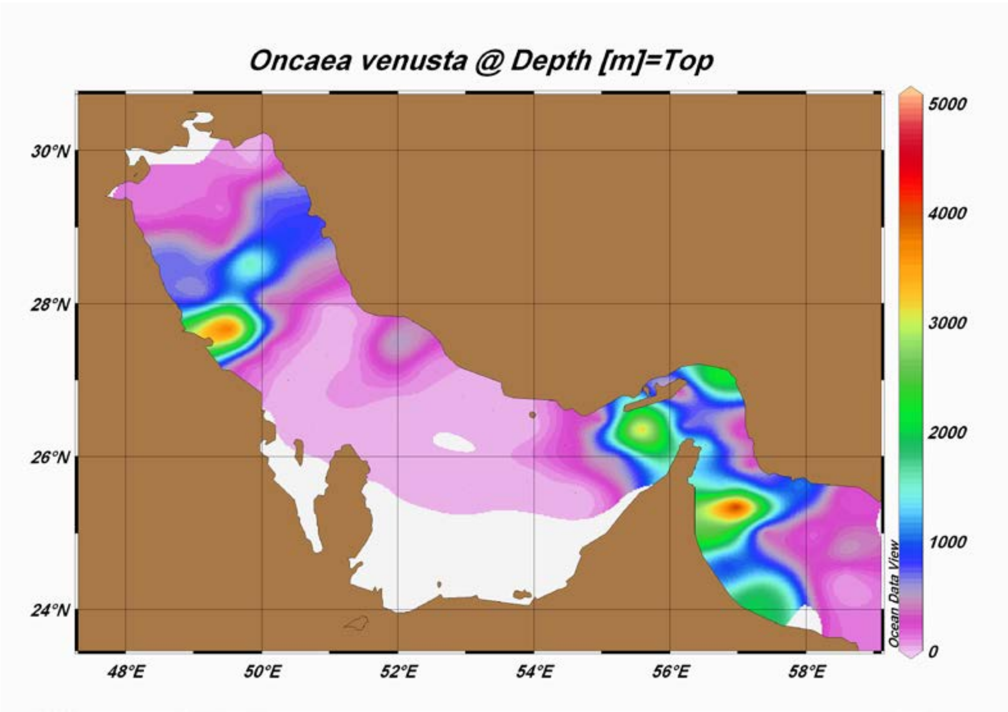

Fig. 49- *Oncaea venusta* count (organism/m^3) in the ROPME Sea Area (Feb. 2006)
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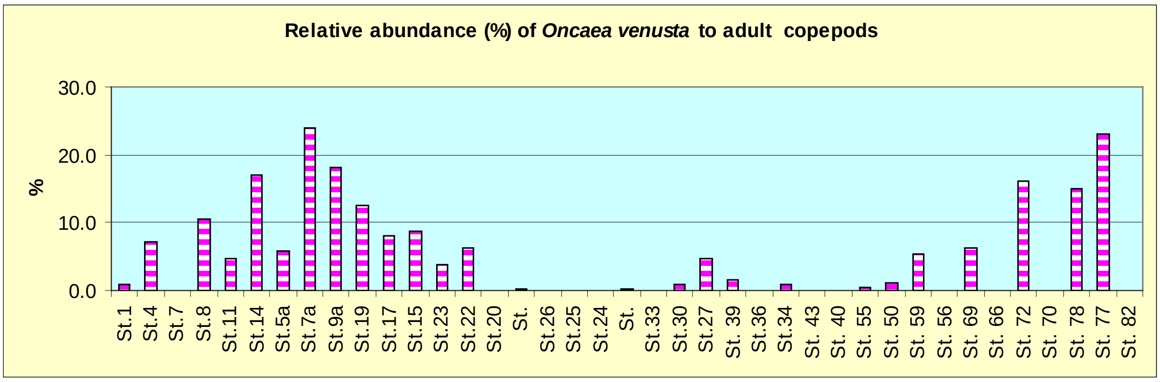

Fig. 50a - Relative abundance (%) of *Oncaea venusta* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

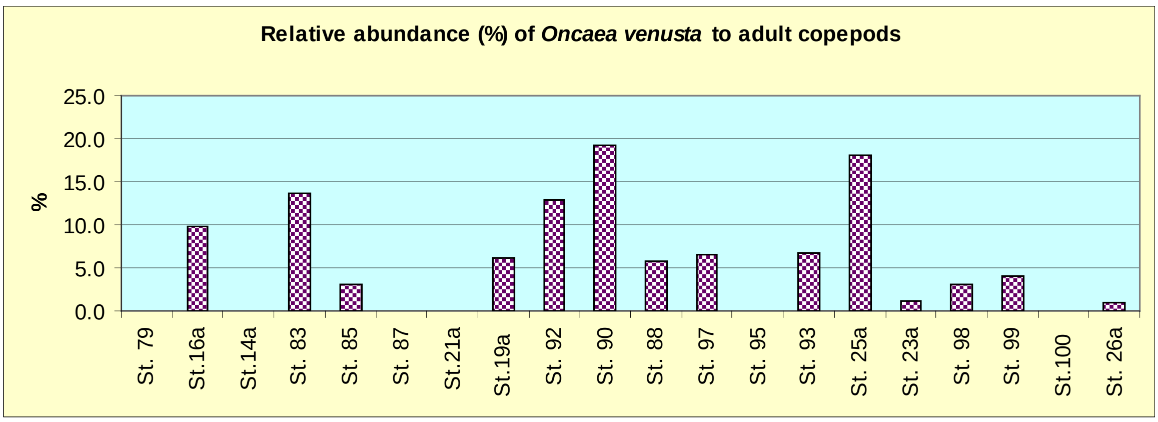

Fig. 50b - Relative abundance (%) of *Oncaea venusta* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Although *Oncaea conifera* disappeared from the central and southern parts of the inner RSA, it was well represented in the other parts of the ROPME Sea Area (Fig. 2a,b). In the southern inner RSA, the species counted 60 – 392 organisms/m^3, increased to (3328 organisms/m^3) at station 79 near the Strait of Hormuz. Other high count (1474 organisms/m^3) was found at station 15.in the northern inner RSA. In the Sea of Oman , the count varied between 80 and 2274 organisms/m^3, but the high counts (2091, 975, 1295, 1064, 2274 & 1821 organisms/m^3 appeared at stations 21a, 90, 95, 99, 100 & 26a respectively (Fig 51). The species formed less than 4 % of the total zooplankton over the whole study area, except at stations 79, 21a, 95, 100 & 26a, at which the species constituted 7.5% -16.5 % of zooplankton count and 10 – 19.2%.of adult copepods (Fig 52a,b).

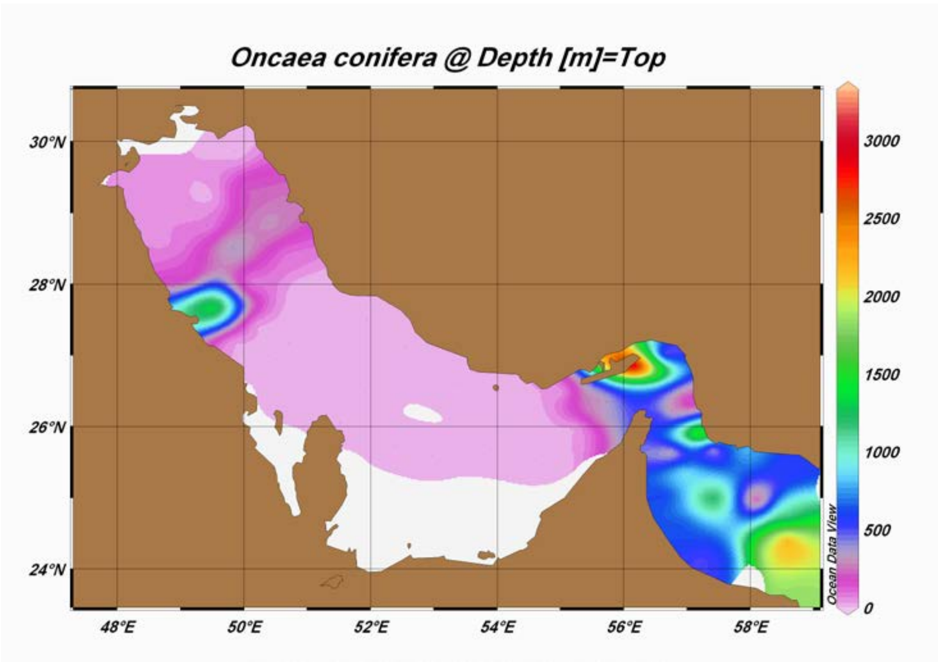

Fig. 51 *Oncaea conifera* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

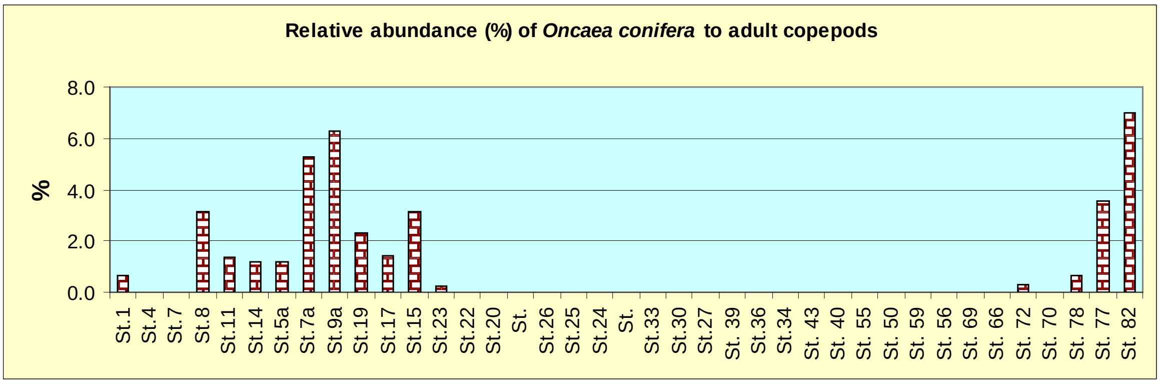

Fig. 52a Relative abundance (%) of *Oncaea conifera* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

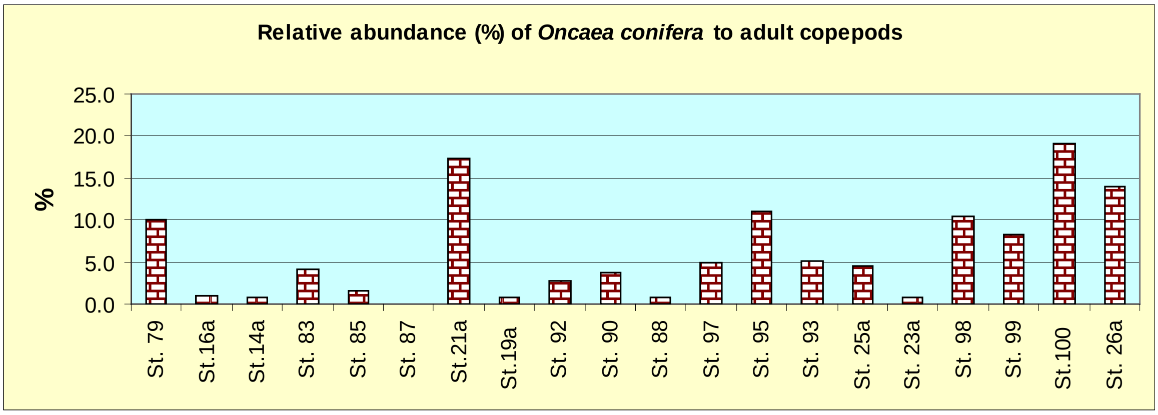

Fig. 52b - Relative abundance (%) of *Oncaea conifera* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

The cyclopoid copepod, *Corycaeus speciosus*, exhibited wide distribution in the whole study area, existing at 47 stations (Fig. 2a,b), but its count appeared to be generally low over great a part of the area, being < 100 organisms/m^3 at numerous stations, and 100 - >300 organisms/m^3 at 11 stations. However, high counts (551, 702 & 722 organisms/m^3 occurred at stations 7a, 19 & 78 respectively, and the maximum count (4333 organisms/m^3) appeared at station 15 (Fig 53). *Corycaeus speciosus* formed mostly <1%, increased to 5% - 8.9 % of zooplankton standing crop, and 9.9%, 9.2%, 15.2%, 22.6% & 11.6% the total adult copepods at stations 4, 15, 17, 19, 23 respectively in the inner RSA (Fig 54).

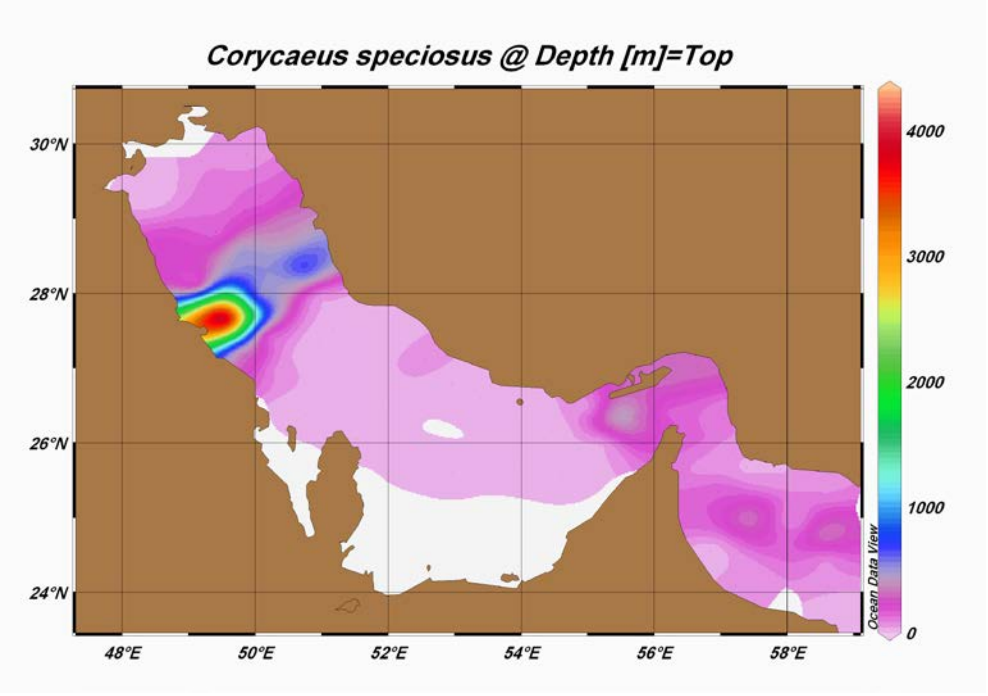

Fig. 53- *Corycaeus speciosus* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

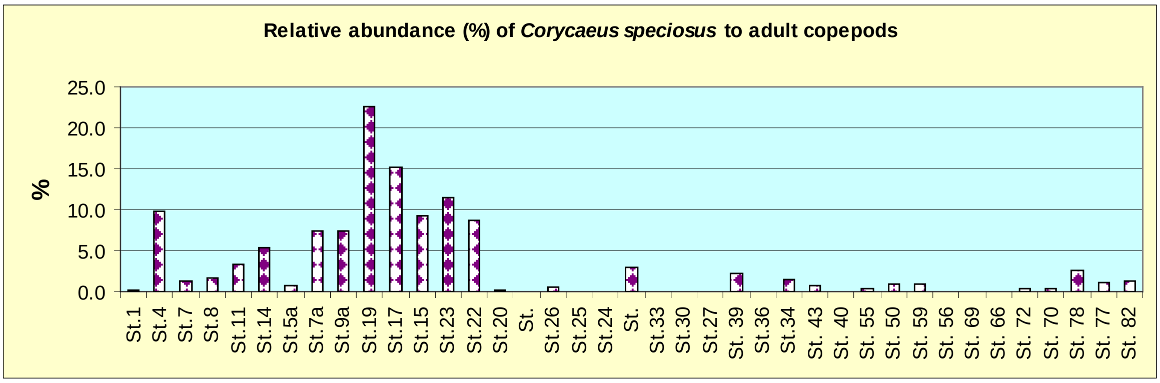

Fig 54- Relative abundance (%) of *Corycaeus speciosus* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

Corycaeus rostratus appeared as widely distributed cyclopoid in the northern inner RSA, Strait of Hormuz and Sea of Oman , but completely absent from other parts of the inner RSA (Fig2.a,b). At most of stations (25 stations), its numerical density dropped to < 200 organisms/m^3, slightly increased to 200 – 438 organisms/m^3 at some stations and reached the highest values (1097, 1061, 831 organisms/m^3) at stations 15, 78 & 79 respectively in the inner RSA (Fig 55). Although the count of the species appeared to be higher in the Strait of Hormuz and Sea of Oman , it displayed lower contribution to the total zooplankton (0.2 – 2.5%) as well as to the adult copepods (0.4 – 3.8%) as compared to those in the northern inner RSA (0.1 – 5%) and (0.3 – 8.6%) respectively. The highest contribution (5% & 8.6%) was found at station 17, which harbored comparatively low counts, while at stations 15, 78 and 79 the role of the species in zooplankton and adult copepods appeared to relatively small (1.5 – 2%) and (2.3 – 3.8%) respectively (Fig 56a,b).

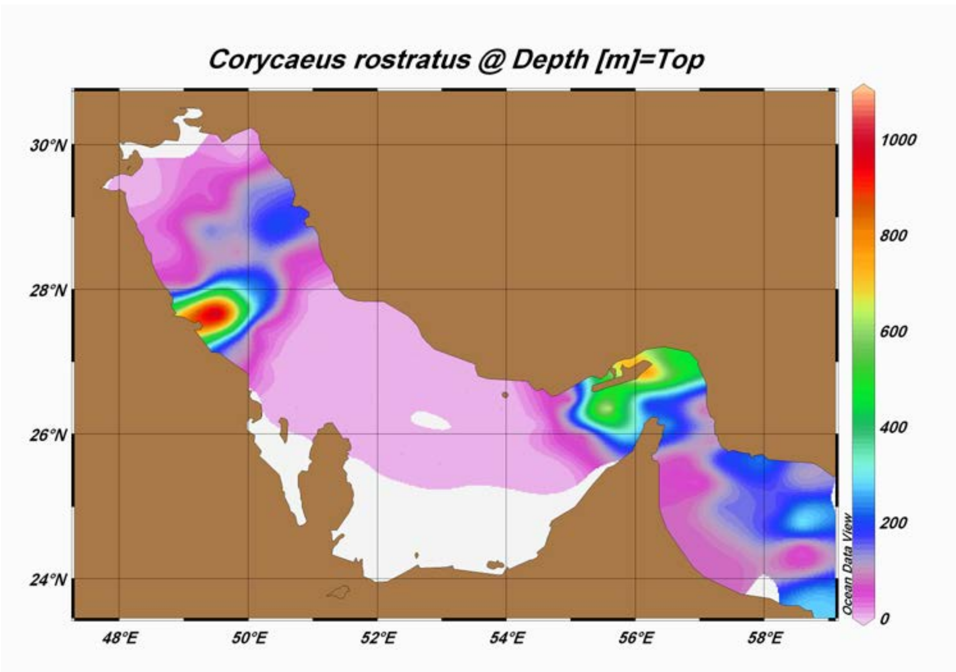

Fig. 55- *Corycaeus rostratus* count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

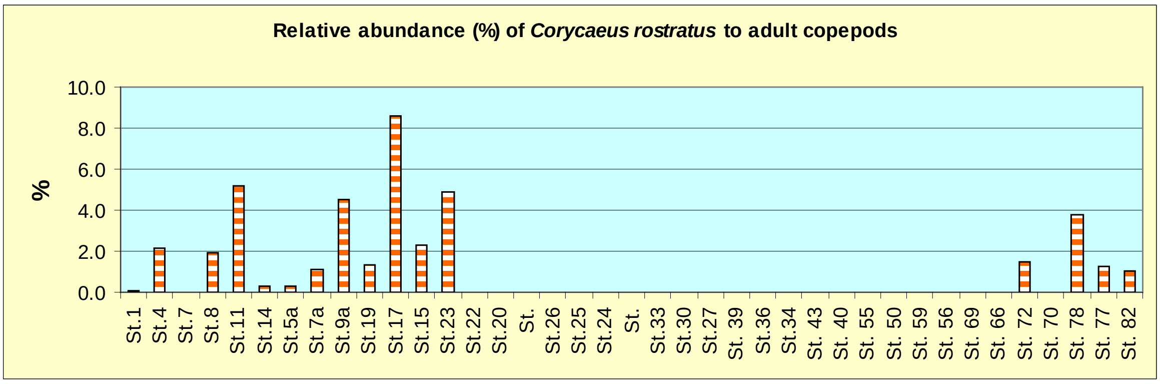

Fig 56a- Relative abundance (%) of *Corycaeus rostratus* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

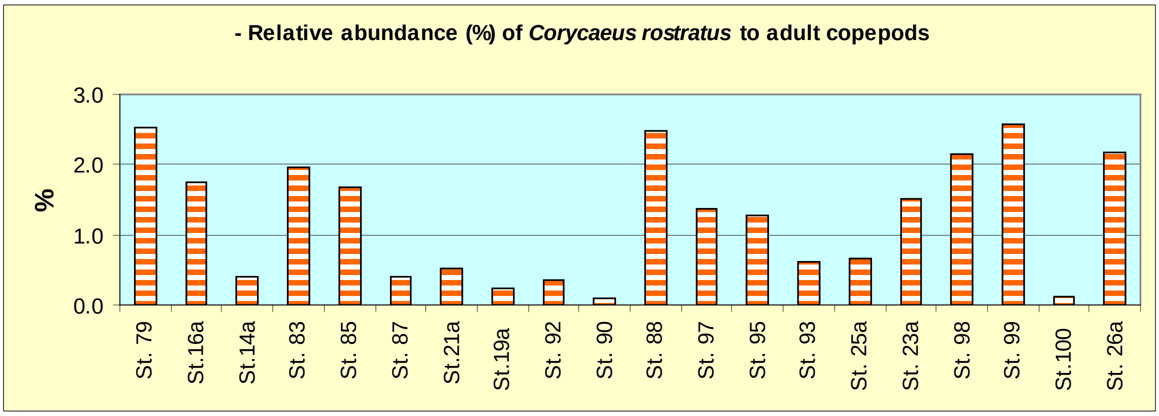

Fig 56b- Relative abundance (%) of *Corycaeus rostratus* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

An unidentified *Oithona* species was reported in the northern and central parts of the inner RSA, with numerical abundance between 25 and 4122 organisms/m^3, forming 1.1-16.3 % of the total zooplankton. The highest counts of the species (665, 4122 & 1511 organisms/m^3) were observed at stations 30, 33 & 55 respectively, however, the species was completely missed from the other parts of the ROPME Sea Area.

3.2.2.1.3 Harpacticoid copepods

Euterpina acutifrons was one of the most widely distributed copepods throughout the whole ROPME Sea Area, occurring at 56 stations (Fig. 2a,b). As shown in figure (Fig 57), the count was lower than 1000 organisms/m^3 at about 40 stations and exceeds 2000 organisms/m^3 at the rest number of stations, with less denser populations in the inner RSA (average: 1014 organisms/m^3) than in the Sea of Oman (average: 1260 organisms/m^3). The highest counts (3693, 4763, 7474, 8513 organisms/m^3) appeared at stations 15, 11a, 27& 79 respectively in the inner RSA and (3581, & 4038 organisms/m^3) at stations 16a & 87 respectively in the Sea of Oman . The species displayed pronouncedly active role in the total zooplankton (0.5 % and 20.1 %), but its role in the adult copepods appeared to be clearly greater, varying between 1.0% and 65.1%. Regardless of its numerical abundance the contribution of the species to the adult copepods exceeds 20% at numerous stations, appearing as predominant component (65.1%, 37%, 60.5%, 39.8% & 42.6%) at stations 26, 11a, 27, 36 & 87 respectively (Fig 58a,b).

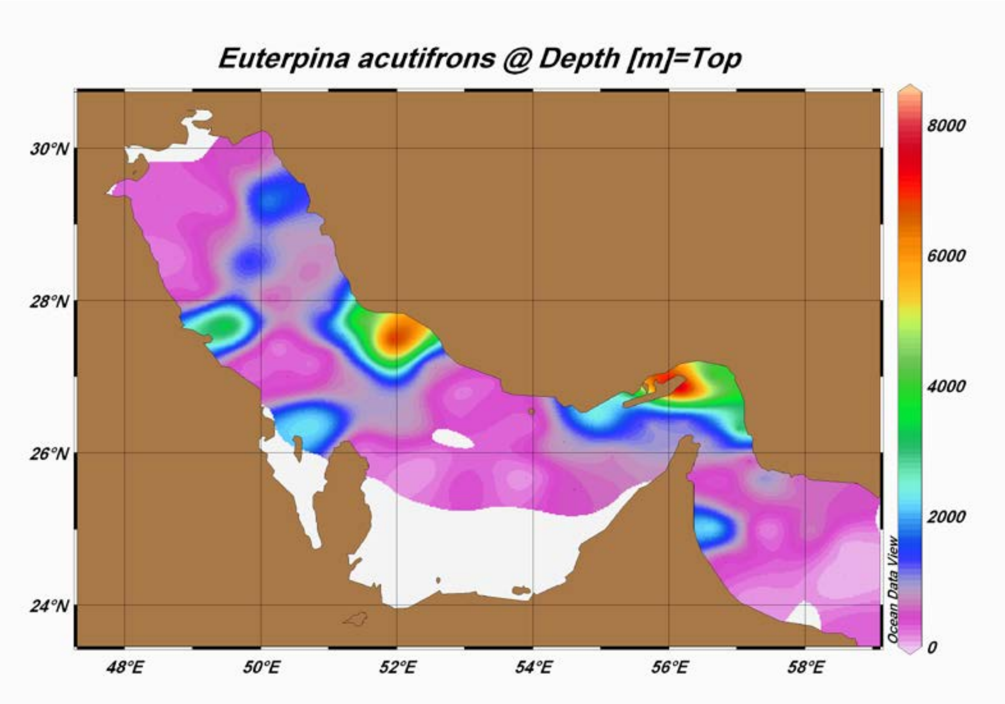

Fig. 57- *Euterpina acutifrons* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

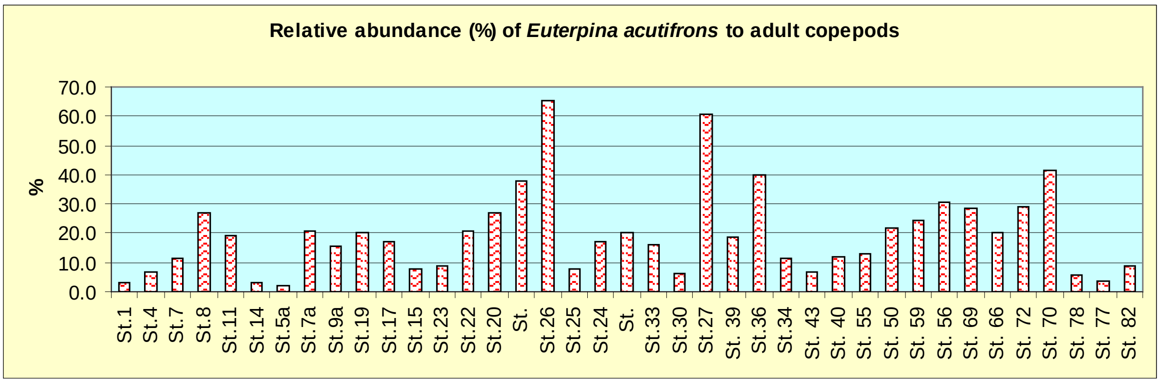

Fig 58a- Relative abundance (%) of *Euterpina acutifrons* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

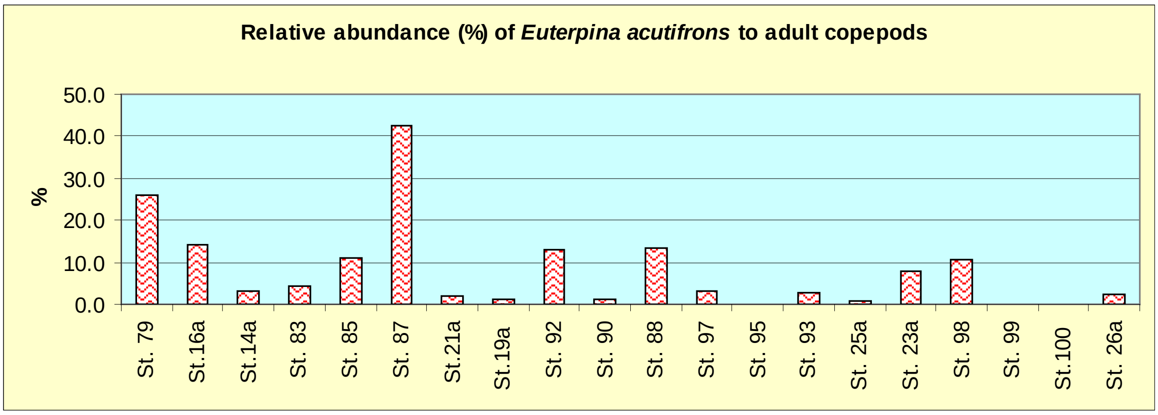

Fig 58b- Relative abundance (%) of *Euterpina acutifrons* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

Microsetella rosea was encountered among the dominant zooplankton components and distributed at 48 stations in the ROPME Sea Area during winter. It seems that the species could establish healty population in the Strait of Hormuz and Sea of Oman , whreas its count mostly exceeds 500 organisms/m^3, increased to 3327, 2249, 3010, 2751 & 2412 organisms/m^3 at stations 19a, 90, 92, 93 & 25a respectively. On the other hand, *M. rosea* could not build healthy population in the whole inner RSA, since it displayed comparatively low counts at all stations (<100 organisms/m^3), except 268 & 489 & 2323 organisms/m^3 at station 11a, 27 and 78 respectively (Fig. 59). The relative abundance of the species reflects weak contribution to the total zooplankton in the inner RSA (<1%) and comparatively active constitution in the Strait of Hormuz and Sea of Oman (2.6 - 12.3%). However, the contribution of the species was more active to the adult copepods in Strait of Hormuz and Sea of Oman (mostly 4.2% – 21.5%) against < 2% in the inner RSA (Fig. 60a,b).

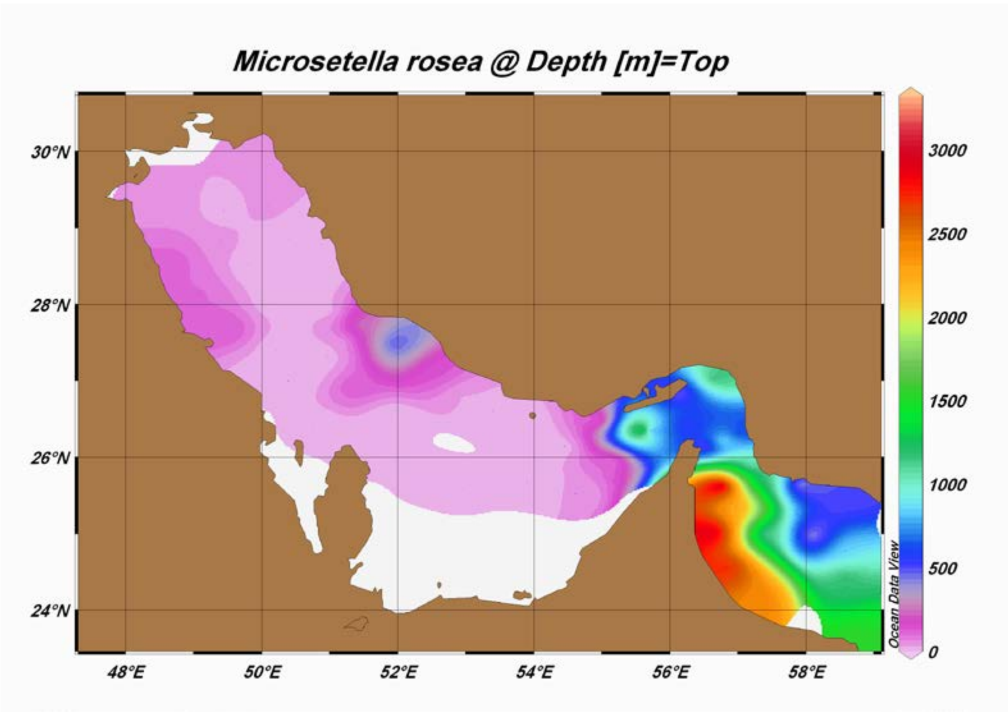

Fig. 59- *Microsetella rosea* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

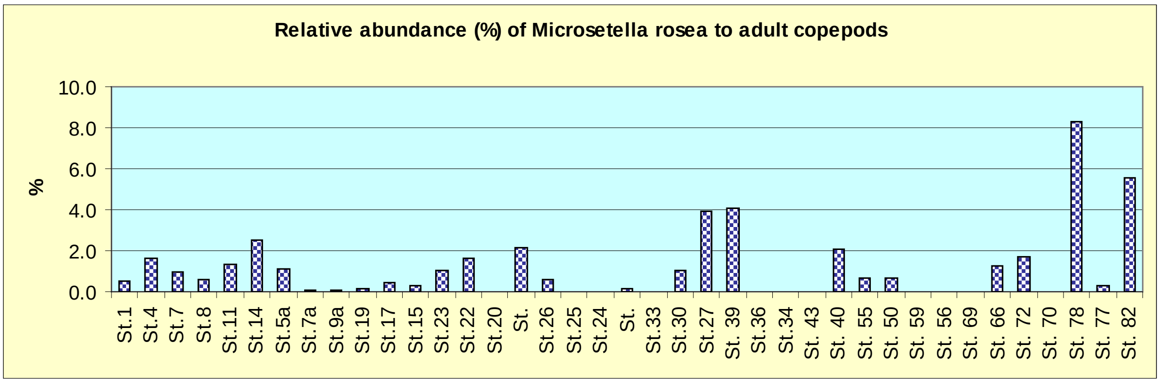

Fig 60a- Relative abundance (%) of *Microsetella rosea* to adult copepods at the sampled stations in the inner RSA (Feb. 2006).

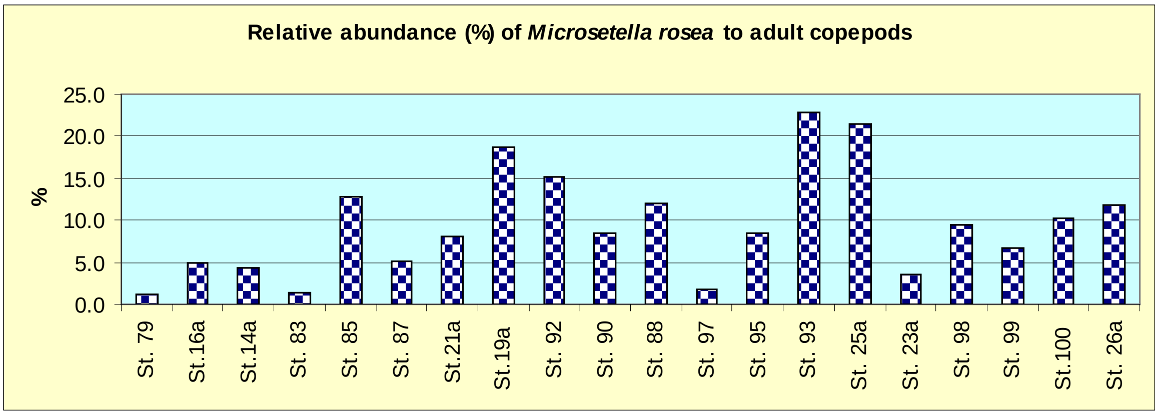

Fig 60b- Relative abundance (%) of *Microsetella rosea* to adult copepods at the sampled stations in the Sea of Oman (Feb. 2006).

In addition to the dominant species mentioned above, other copepod species attained relatively high counts at some stations of the ROPME Sea Area. *Oncaea minuta* disappeared at several stations, reported low counts at other stations (mostly < 100 Organisms/m^3), and amounted to 957, 695 and 659 organisms/m^3 at stations 21a, 95 and 100 respectively in the Sea of Oman , forming 4.5, 4.3 and 4.8% of the total zooplankton at the three stations respectively. *Pleuromama abdominalis* was observed at 3 stations in very low counts (< 5 organisms/m^3), and attained high count (316 organisms/m^3) at station 99 in the Sea of Oman . *Euchaeta marina* appeared at 7 stations with counts < 88 organisms/m^3, increased to 837 organisms/m^3 at station 100. *Clausocalanus furcatus* was reported at 5 stations, with counts < 102 organisms/m^3, except 277 and 1272 organisms/m^3 at stations 93 in the Sea of Oman and 15 in the inner RSA respectively. *Temora discaudata* appeared at 11 stations, mostly in low counts (< 140 organisms/m^3), but it attained 719 organisms/m^3 at station 15. *Oncaea mediterranea* occurred at 15 stations, usually in moderately low counts, but it displayed high counts (404, 688, 534 organisms/m^3) at stations 15, 16a and 78 respectively.

3.2.2.2 Cladocerans

Penilia avirostris was found at 37 stations (Fig. 2a,b), mostly in low counts, but it showed clear dominance at several stations over the ROPME Sea Area (Fig. 61). It attained <200 organisms/m^3 at all stations in the Sea of Oman and 87 – 646 organisms/m^3 in the Strait of Hormuz. In the inner RSA, *P. avirostris* showed widely variable counts, whereas it was missed or amounted to < 120 organisms/m^3 in the central and southern parts, and sustained markedly high counts (1380, 854, 2975, 688, 5048 organisms/m^3) at stations 8, 11, 14, 5a & 7a respectively in the northern part. The role of the species in the total zooplankton was lower than 1% over the major part of the ROPME Sea Area, while in the northern part of the inner RSA it raised to 4 – 28.5%, at the stations mentioned above. This role was greater (70 – 100%) as regard to the total cladoceran (Fig. 62a,b).

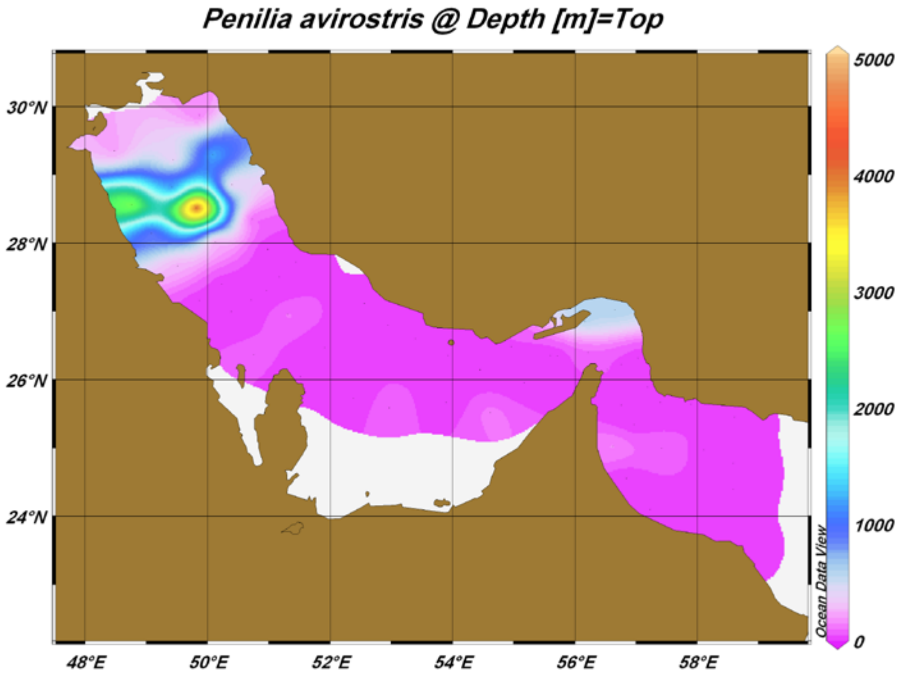

Fig. 61- *Penilia avirostris* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

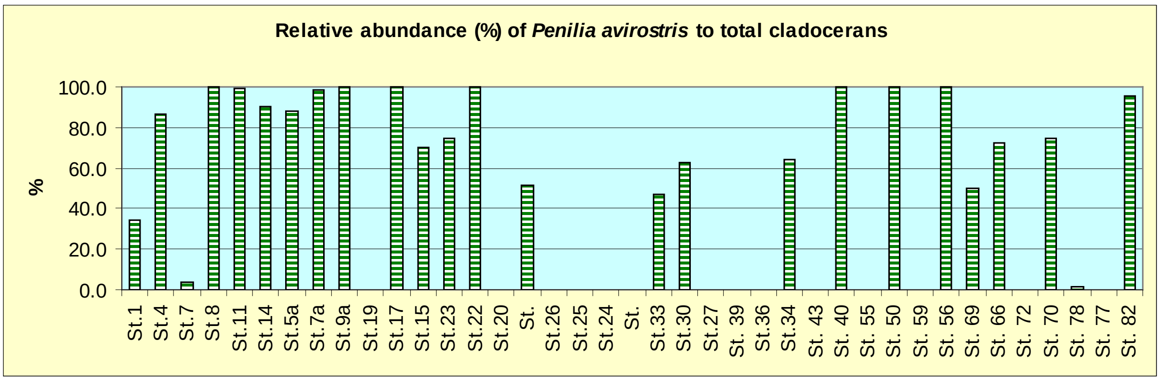

Fig 62a- Relative abundance (%) of *Penilia avirostris* to total cladocerans at the sampled stations in the inner RSA (Feb. 2006).

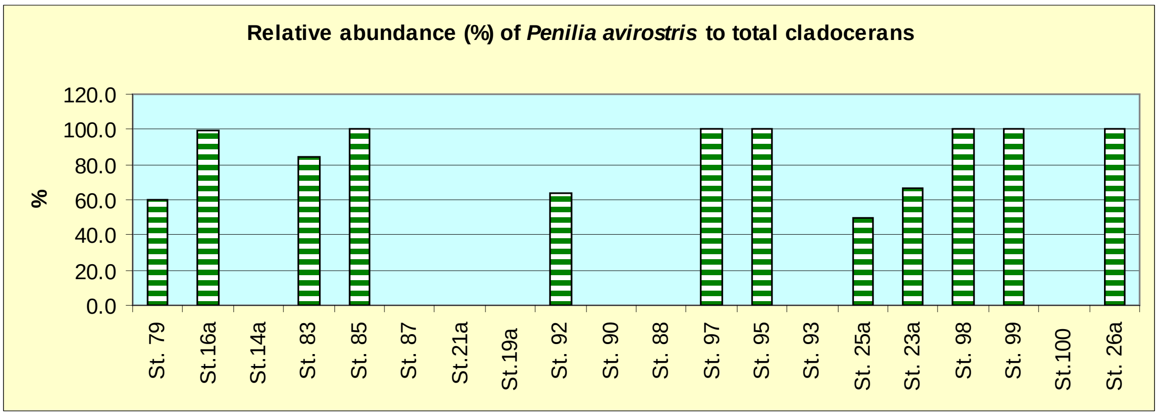

Fig 62b- Relative abundance (%) of *Penilia avirostris* to total cladocerans at the sampled stations in the Sea of Oman (Feb. 2006).

3.2.2.3 Larvaceans

Oikopleura dioica was one of the persistent and widely distributed larvacean species, occurring at 55 stations over the ROPME Sea Area (Fig. 2a,b), sustaining numerical density between 7 and 4442 organisms/m^3 (Fig. 63). In the inner RSA, the count was almost lower than 400 organism/m^3, except those (1401, 1395, 831 & 1083 organisms/m^3) at stations 1, 15, 27 and 30 respectively. In the Strait of Hormuz and Sea of Oman , the counts exceeds 1000 organism/m^3 at several stations, increased to 4442, 2407, 2362, 2697, 1690, 2145, at stations 77, 78, 19a, 90, 92 & 25a respectively. Regardless of its weak contribution (< 1%) at a few stations, *O. dioica* formed from 1.2% to 14.4 % of the total zooplankton count at most of stations, and displayed pronouncedly great role in the total count of larvaceans at numerous stations (21.5 – 100%) (Fig. 64a,b). *Oikopleura longicauda* was observed at 16 stations, mainly in the Strait of Hormuz and Sea of Oman , with counts between 1 – 2185 organism/m^3, but the high counts (350, 2185, 638 & 427 organism/m^3) were recorded at stations 7a, 77, 19a and 21a respectively. The species demonstrated active role in total larvaceans (27.2 - 75.3%) at stations 7a, 23, 77 in the inner RSA and (15.9 - 33.2%) at stations, 19a, 21a, 23a, 99 & 26a in the Sea of Oman .

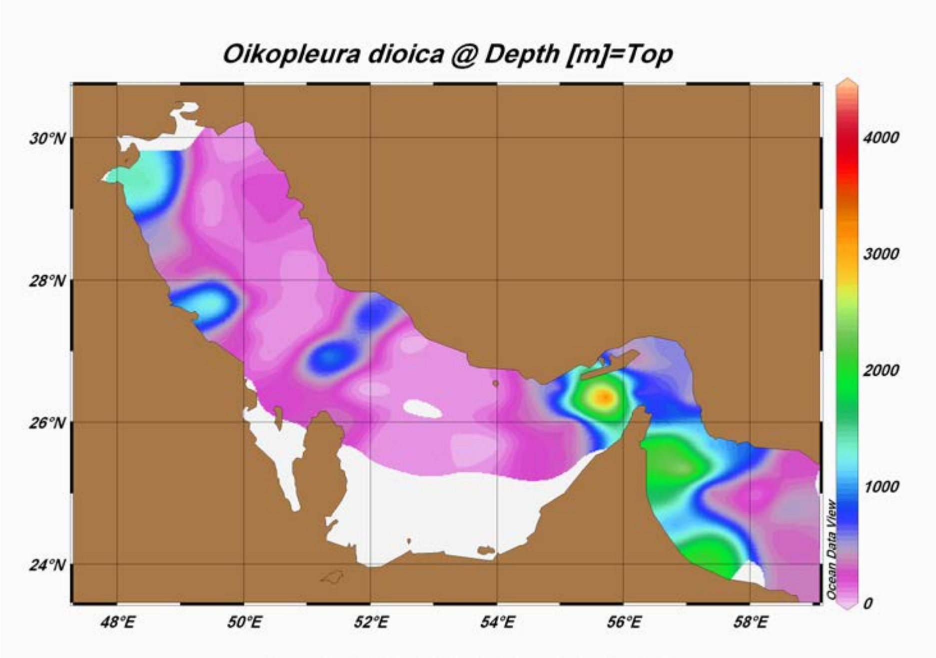

Fig. 63- *Oikopleura dioica* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

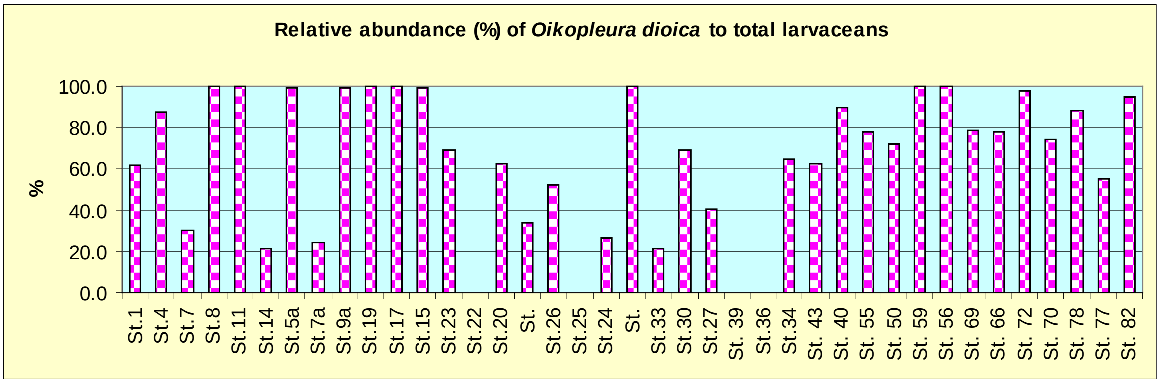

Fig 64a- Relative abundance (%) of *Oikopleura dioica* to total larvaceans at the The sampled stations in the inner RSA (Feb. 2006).

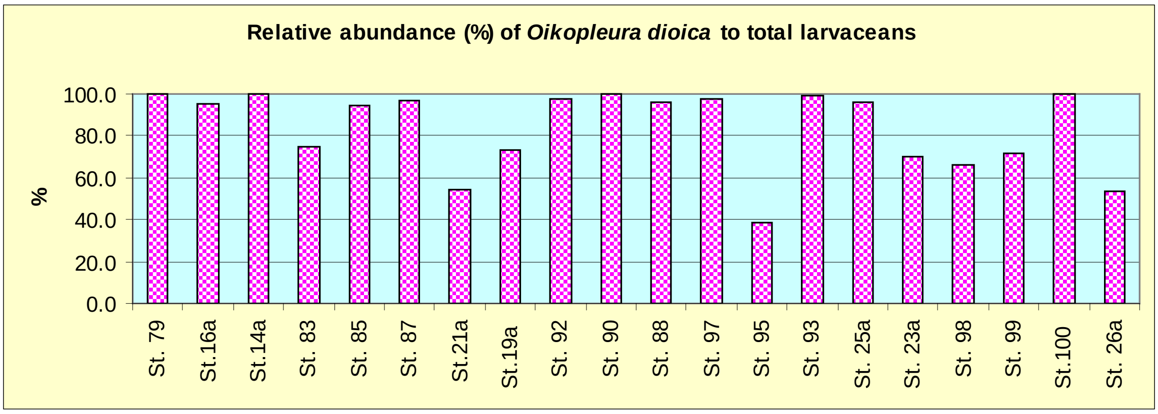

Fig 64b- Relative abundance (%) of *Oikopleura dioica* to total larvaceans at the sampled stations in the Sea of Oman (Feb. 2006).

Other species had pronounced roles in larvacean count at some stations although they were limited in their distribution to few stations. For example, *Appendicularia sicula* formed 38.4% & 78.5% of total larvaceans at tstaions 1 and 14 respectively in the inner RSA, while *Oikopleura parva* constituted 12.1%, 25.5%, 16.3%, 61.5% and 16.8% at stations 77, 83, 21a, 95 & 98 respectively near and inside the Strait of Hormuz and the Sea of Oman .

3.2.2.4 Thaliaceans

Thalia democratica appeared to be the most common thaliacean in the ROPME Sea Area, found at 24 stations, mainly in the central and southern part of the inner RSA and the Strait of Hormuz (Fig. 2a,b), with count fluctuating between 4 and 6041 organism/m^3 (Fig. 65). At most stations the count was < 400 organism/m^3, increased to 611 and 513 organism/m^3 at stations 20 & 25 respectively and reached the highest values (6041 & 1258 organism/m^3) at stations 70 & 87 respectively. The species contributed 33.3% - 100 to total thaliaceans at most stations (Fig. 66a,b). Other species such as *Doliolum denticulatum* was also widely distributed (38 stations) throughout the ROPME Sea Area (Fig. 2a,b). Its count varied between 1-2487 organism/m^3, with great differences between the inner RSA and Sea of Oman . In the inner RSA, the highest count of species was 2487 organism/m^3 occurred at station 79 adjacent to the Strait of Hormuz, while in the Sea of Oman , the maximum counts were 135 & 147 at stations 87 & 92. On the other hand, *D. denticulatum* formed 72.4% - 100% of total thaliaceans at some stations (Fig. 67a,b).

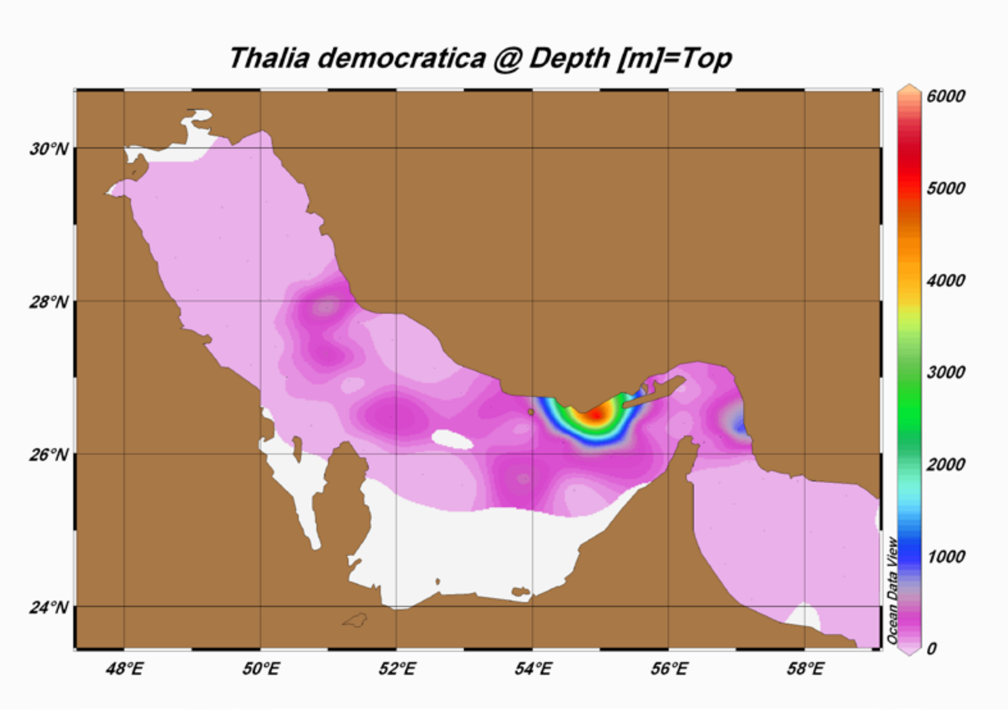

Fig. 65- *Thalia democratica* count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

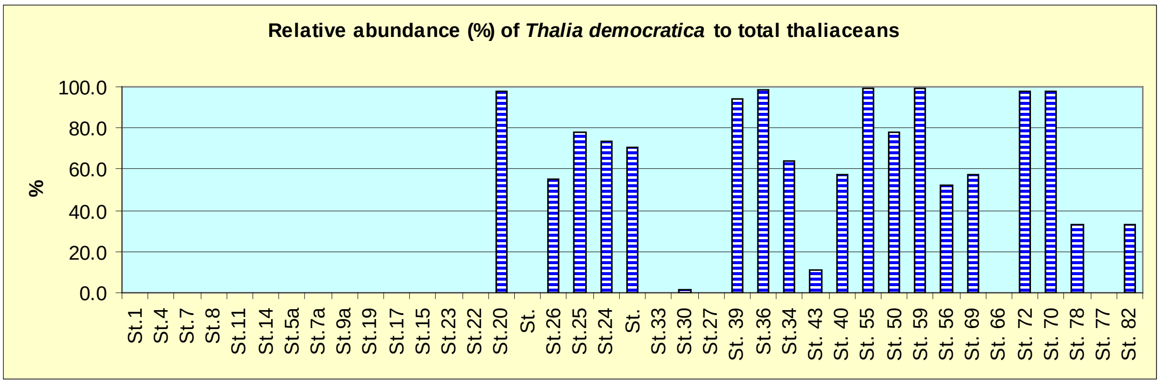

Fig 66a- Relative abundance (%) of *Thalia democratica* to total thaliaceans at the sampled stations in the inner RSA (Feb. 2006).

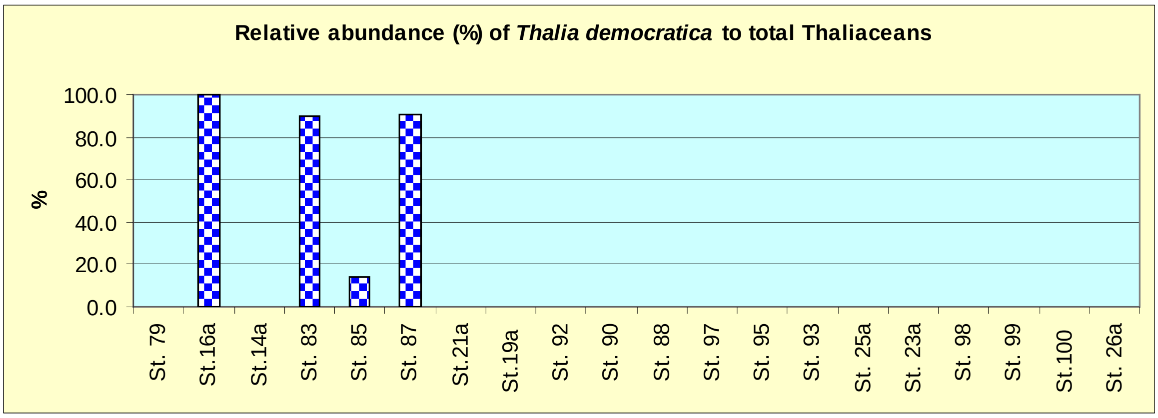

Fig 66b- Relative abundance (%) of *Thalia democratica* to total thaliaceans at the sampled stations in the Sea of Oman (Feb. 2006).

In addition, some thaliaceans showed active contributions at certain stations, like *Doliolum gegenbouri*, which was reported at 15 stations mainly in the central and southern parts of the inner RSA with counts varying from 1 -211 organism/m^3, forming 87.3% , 39.3% , 77.2% & 34.6% of total thaliaceans at stations 30, 40, 43 & 69 respectively. *Salpa fusiformis* was observed at 7 stations in the western part of the inner RSA, with the highest count (127 & 270 organisms/m^3) at stations 19 and 22 respectively, forming 94.1% & 90.3% of total thaliaceans. *Salpa cylinderica* appeared at 7 stations in the central part of the inner RSA, possessing the highest count (147 organism/m^3) at station 25.

3.2.3 Meroplankton

The larval stages of benthic animals (meroplankton) belong to annelids, mollusks, crustaceans, echinoderms, ascidiaceans beside fish eggs and larvae. They showed different patterns of spatial distribution in both their numerical abundance and contribution to the total zooplankton over the ROPME Sea Area. The total count of meroplankton fluctuated between 15 and 5883 organisms/m^3 over the ROPME Sea Area (Fig. 67), with denser population in the Sea of Oman (average: 1768 organisms/m^3) than in the inner RSA (average: 868 organisms/m^3). Except the comparatively high counts (3653 & 3427 organisms/m^3) at stations 26 and 33 respectively, the meroplankton count was lower than 2000 organisms/m^3) over the whole inner RSA, while it exceeds 2000 organisms/m^3 at stations 16a, 87, 19a, 90, 92 & 97 respectively in the Strait of Hormuz and Sea of Oman. The relative abundance of meroplankton indicates that it played limited role over the whole ROPME Sea Area. In the inner RSA, meroplankton formed les than 5% of total zooplankton at most stations of the northern part, against more than 10% at several stations in the southern part, reaching a maximum of 35.3% at station 26 (Fig. 68a). In the Sea of Oman, the meroplankton formed < 5% of total zooplankton at several stations, increased pronouncedly to 10% - 22% at stations 87, 90, 92 & 97 respectively (Fig. 68b).

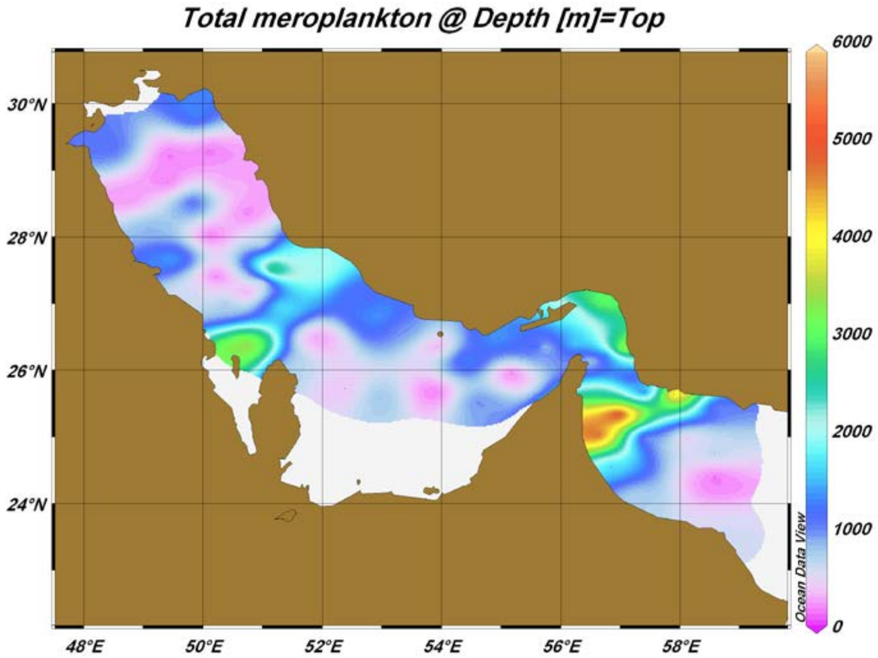

Fig. 67- Meroplankton count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

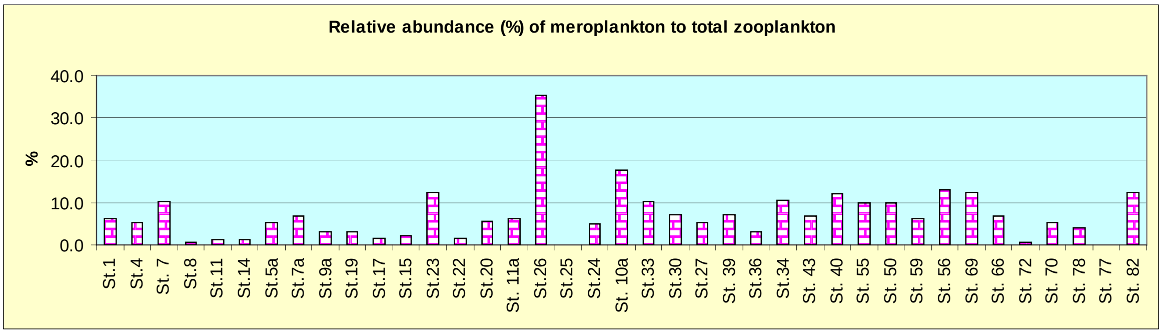

Fig. 68a- Relative abundance (%) of total meroplankton to total zooplankton at the sampled stations in the inner RSA (Feb. 2006).

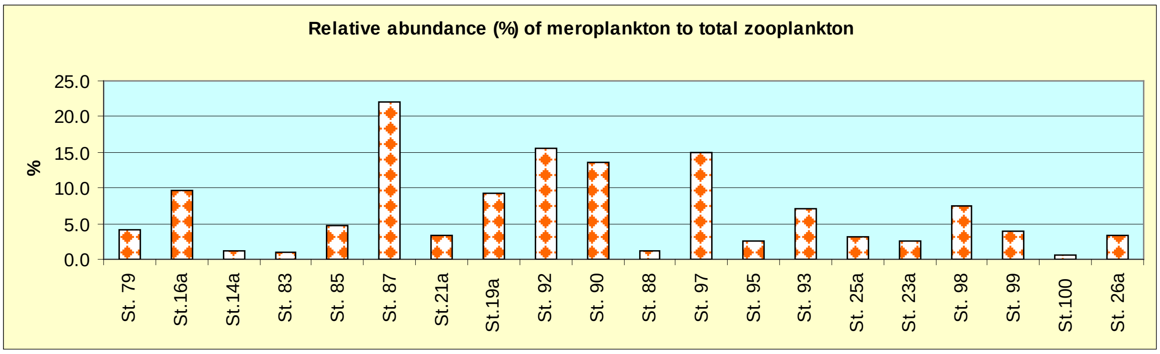

Fig. 68b- Relative abundance (%) of total meroplankton to total zooplankton at the sampled stations in the Sea of Oman (Feb. 2006).

As shown in (Fig. 69), mollusks larvae predominated meroplankton by 60%, followed by deacapods larvae (26%), annelids larvae (5.5%) crustacean eggs (4%) and cirripedes larvae (2.9%). However, each of these groups displayed pronouncedly variable roles over the whole area.

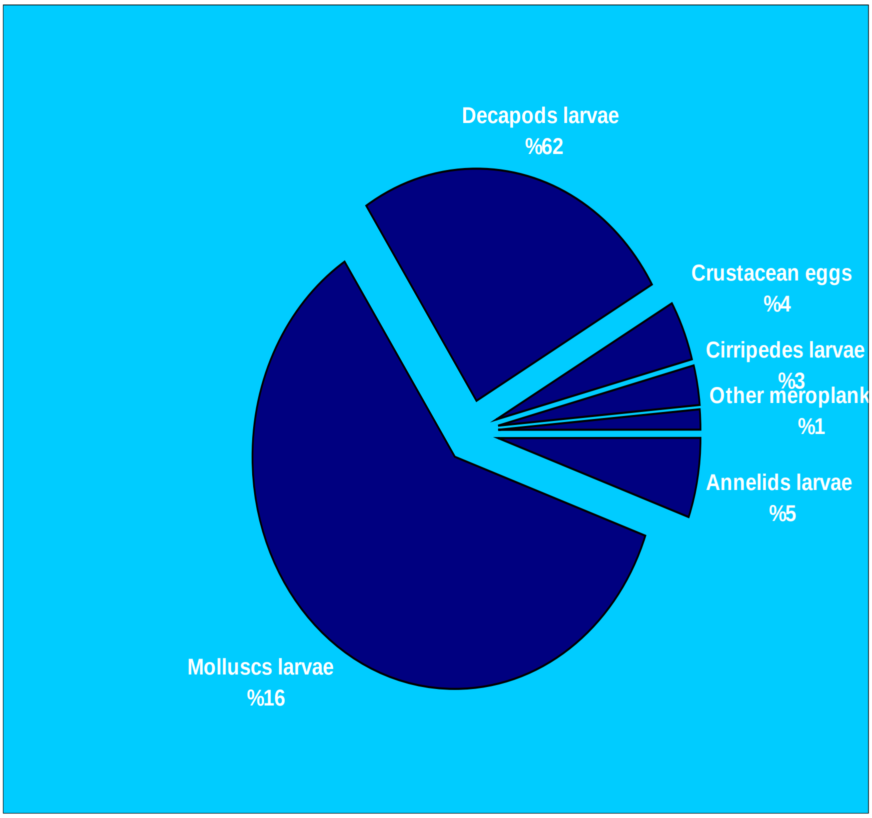

Fig. 69-Relative abundance of meroplanktonic larvae to the total zooplankton in the ROPME Sea Area (Feb.2006).

The count of mollusks larvae in ROPME Sea Area varied between 4 - 3909 larvae/m^3 (Fig. 70). Although several stations in the inner RSA sustained high counts, the average count (average: 637 larvae/m^3) was lower than that in the Sea of Oman (average: 864 larvae/m^3). Molluscs larvae comprized gastropods and lamellibranchs veligers, but the latter group was the predominant over the whole ROPME Sea Area, except at a few stations in the inner RSA, whereas the gastropods veligers either predominated or shared the dominance (Fig. 71a,b).

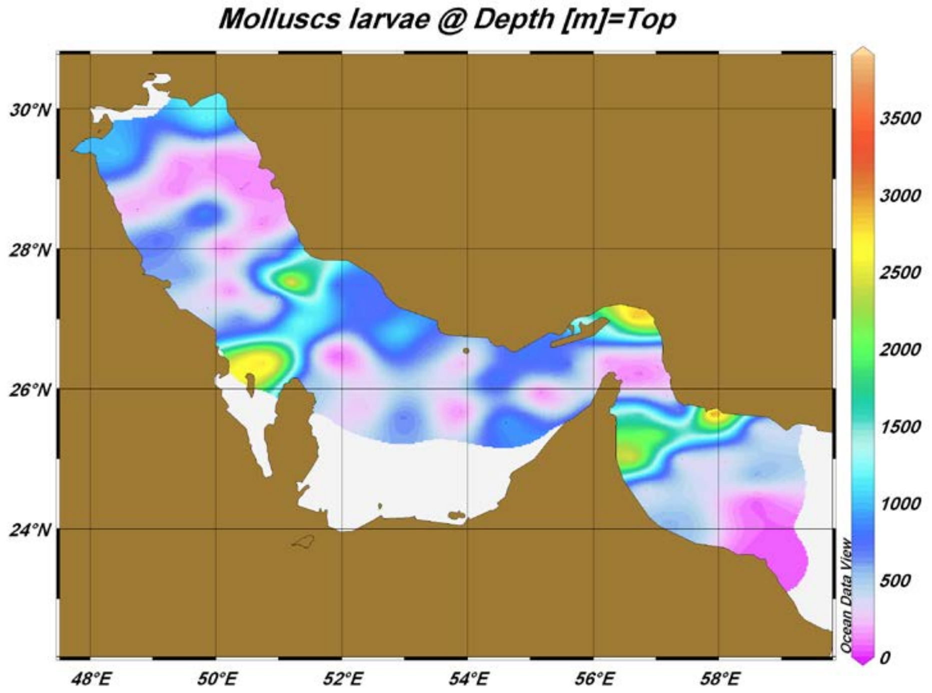

Fig. 70- Mollusks larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

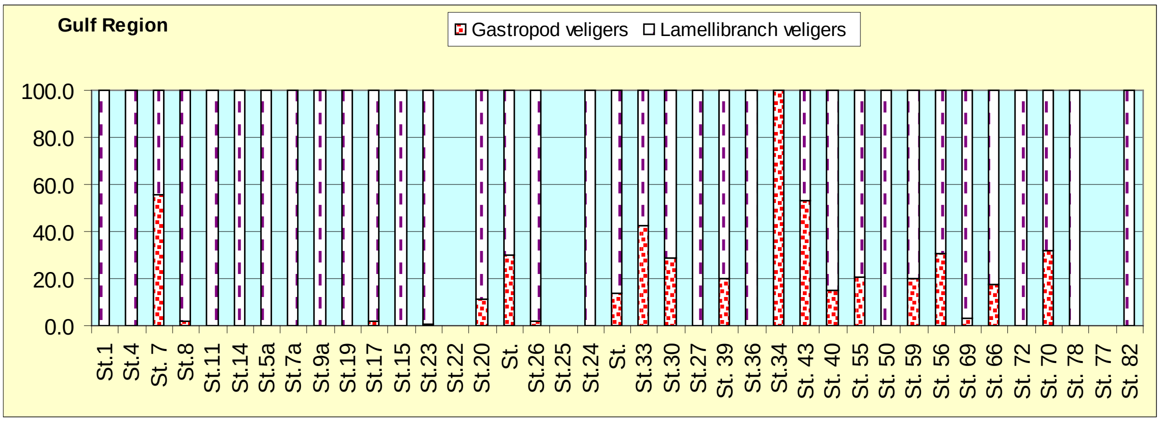

Fig. 71a- Relative abundance (%) of the major mollusks larvae to meroplanktonic mollusks at the sampled stations in the inner RSA (Feb. 2006).

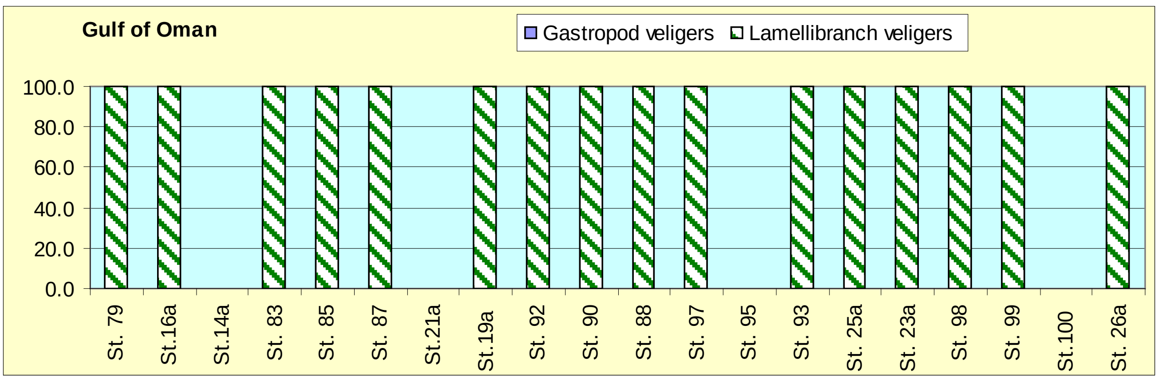

Fig. 71b- Relative abundance (%) of the major mollusks larvae to meroplanktonic mollusks at the sampled stations in the Sea of Oman (Feb. 2006).

Decapods larvae showed widely variable counts at the sampled stations (1 - 3940 larvae/m^3 (Fig. 72). In the inner RSA, high counts (mostly < 500 larvae/m^3) were concentrated in southern part, while in the Strait of Hormuz and Sea of Oman, the count was greater than 500 larvae/m^3 at most stations. Despite of their limited role in total zooplankton (0.8%), decapods larvae appeared to contribute very actively to the total meroplankton at numerous stations in the study area (Fig. 73a,b).

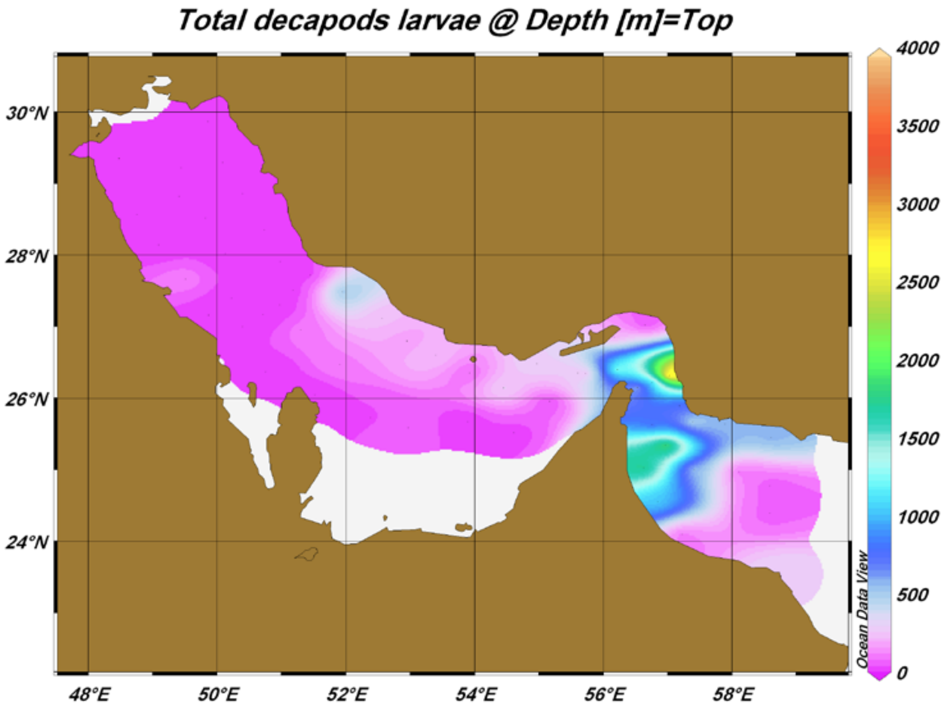

Fig. 72- Decapods larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

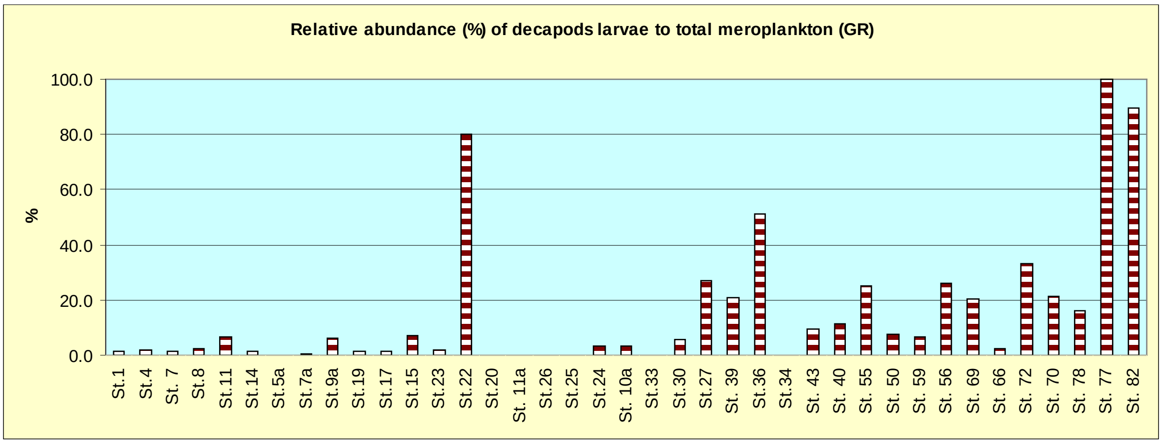

Fig. 73 a- Relative abundance (%) of the decapods larvae to total meroplankton at the sampled stations in the inner RSA (Feb. 2006).

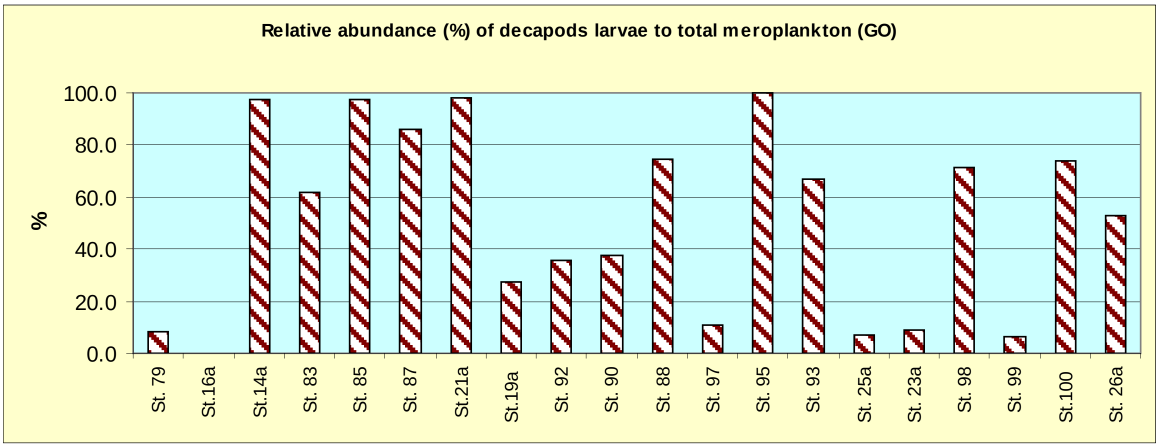

Fig. 73 b- Relative abundance (%) of the decapods larvae to total meroplankton at the sampled stations in the Sea of Oman (Feb. 2006).

Prawns Larvae attained markedly higher counts (1 – 3940 larvae/m^3) than the crabs (1- 523 larvae/m^3). However, both types of larvae showed different distribution over the ROPME Sea Area. Prawns Larvae were more concentrated in the Strait of Hormuz and Sea of Oman, with the highest count (3940 larvae/m^3) at station 87 near Irani coast, while they seem to be rare in the whole inner RSA (Fig. 74).

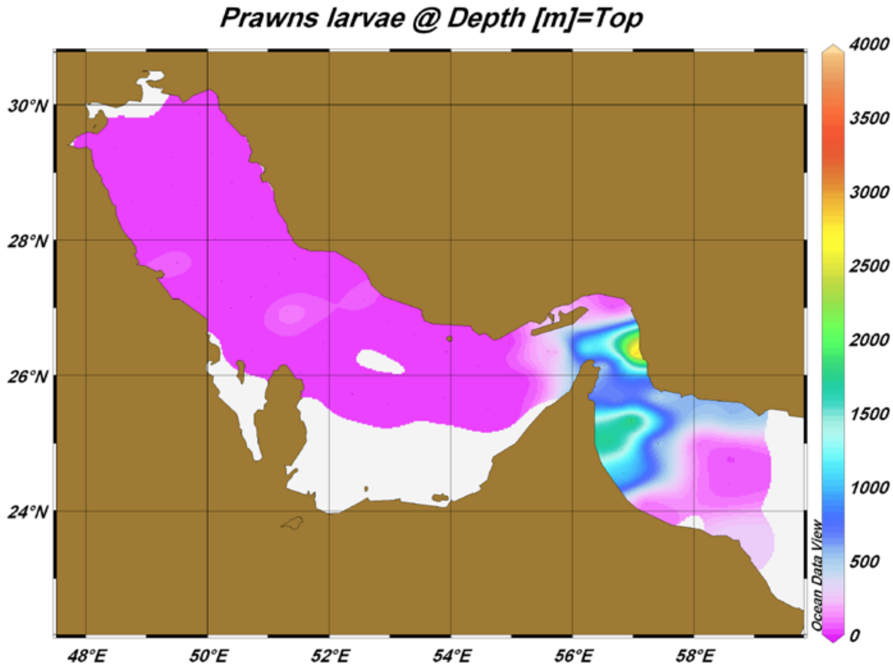

Fig. 74- Prawn larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

In contrast, crabs larvae reported moderately high counts in the inner RSA, particularly in the southern half, whereas several stations harboured higher than 200 larvae/m^3, while they were rarely found in the northern half of the inner RSA and the Sea of Oman (< 50 larvae/m^3), except that (226 larvae/m^3) at station 19a in the Sea of Oman (Fig. 75). It seems that prawns larvae demonstrated greater role than did crabs, whereas the former constituted 6.1% of meroplankton in the inner RSA against 38% in the Sea of Oman, while the latter formed 6.3 in the inner RSA and 1.2 in the Sea of Oman, clear variable p[ercentages in both the inner RSA and Sea of Oman (Fig. 76a,b).

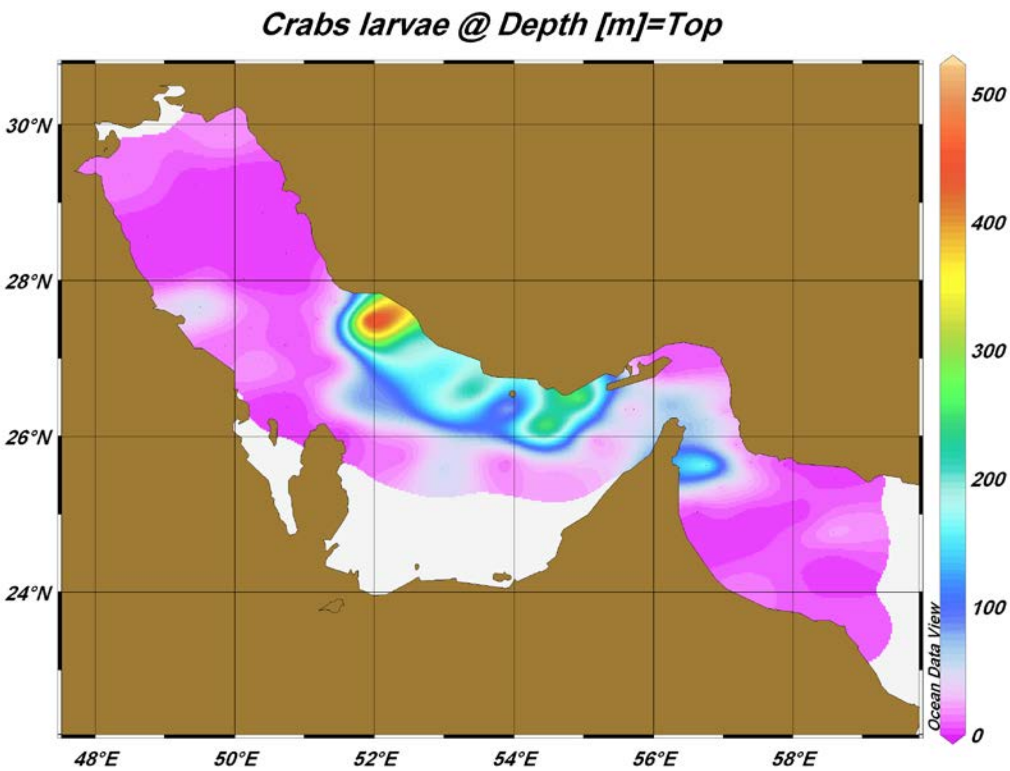

Fig. 75- Crabs larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

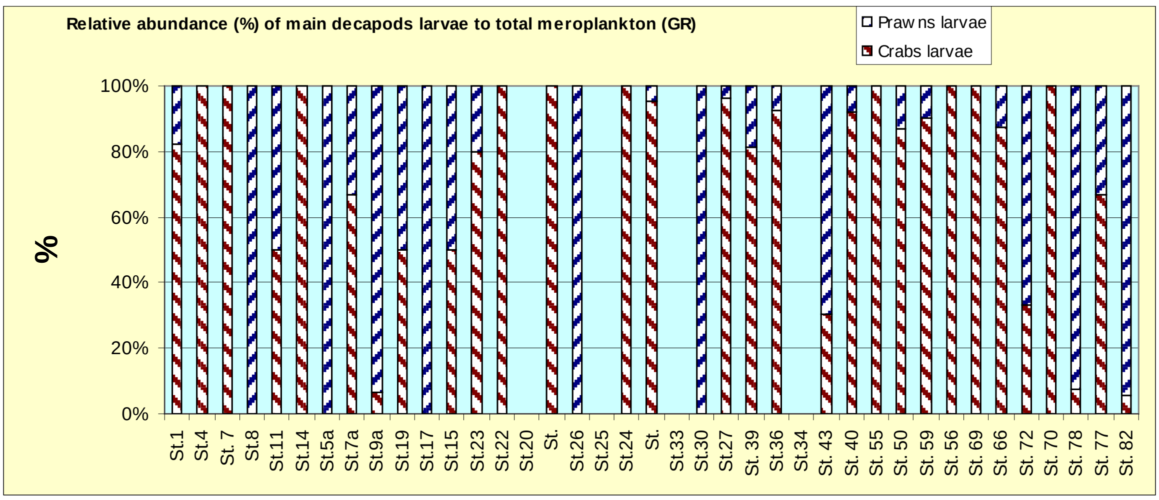

Fig. 76 a- Relative abundance (%) of main decapods larvae to total meroplankton at the sampled stations in the inner RSA (Feb. 2006).

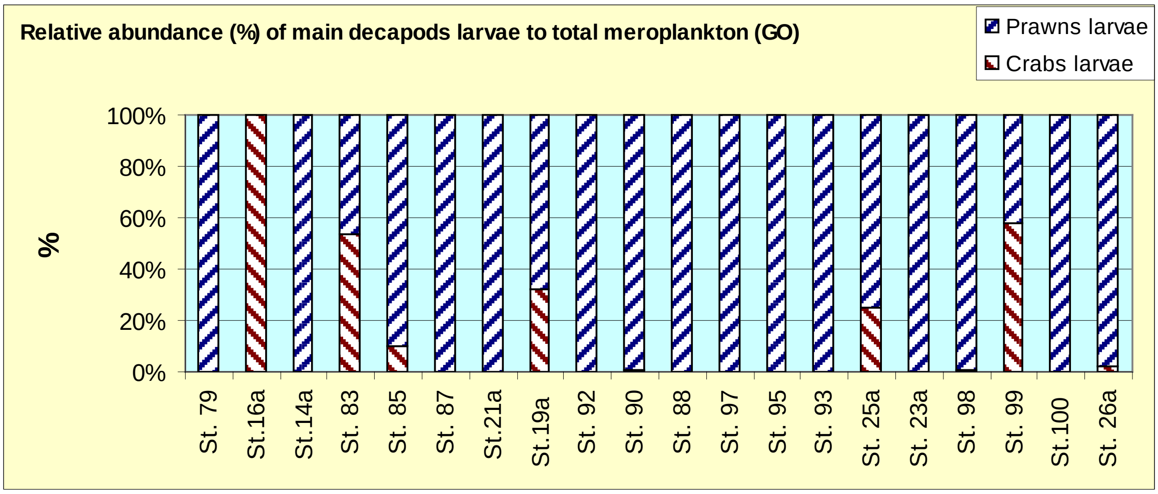

Fig. 76 b- Relative abundance (%) of main decapods larvae to total meroplankton at the sampled stations in the Sea of Oman (Feb. 2006).

The polychaete larvae were widely distributed in the ROPME Sea Area, varying numerically between 1 and 806 larvae/m^3, with pronouncedly high counts (up to 806 larvae/ m^3)in the inner RSA and low counts in the Strait of Hormuz and Sea of Oman (mostly < 50 larvae/m^3) (Fig. 77). Although polychaetes larvae displayed small role in the total meroplankton for the whole ROPME Sea Area, they showed markedly active contribution at several stations, forming 10 – 71.2% of meroplankton, particularly in the inner RSA (Fig. 78a,b).

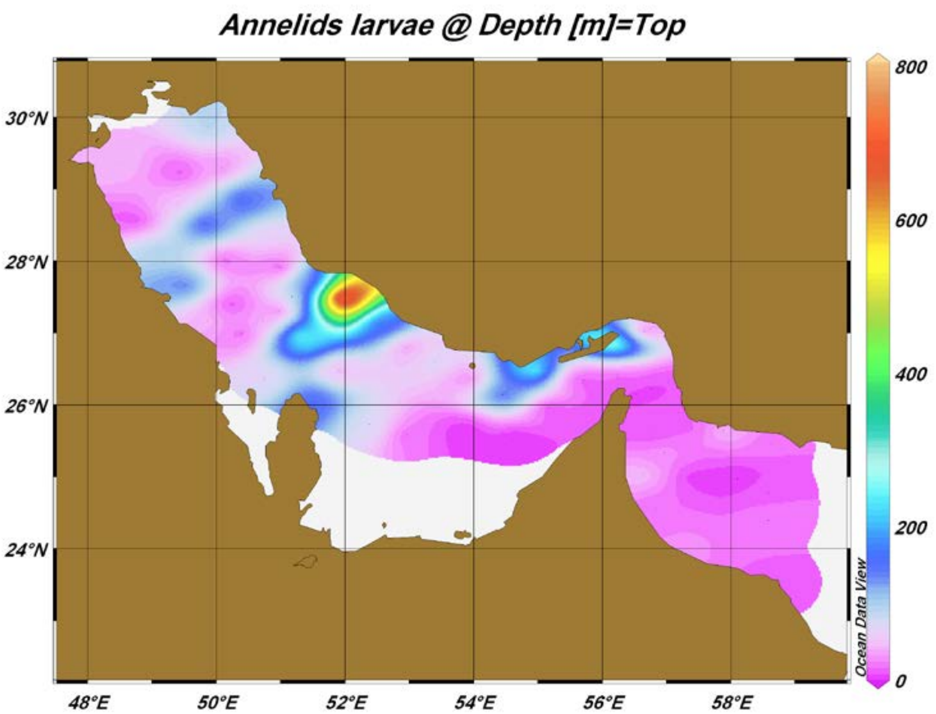

Fig. 77- Polychaetes larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006).

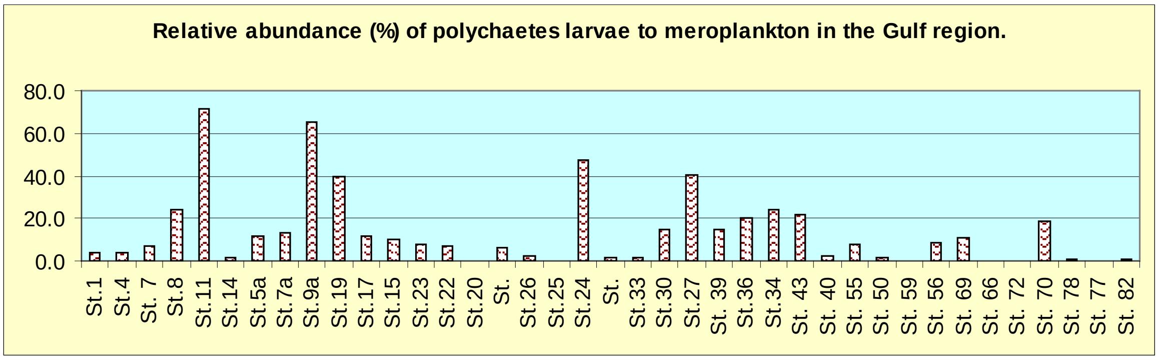

Fig. 78a- Relative abundance (%) of polychaetes larvae to meroplankton at the sampled stations in the inner RSA (Feb. 2006).

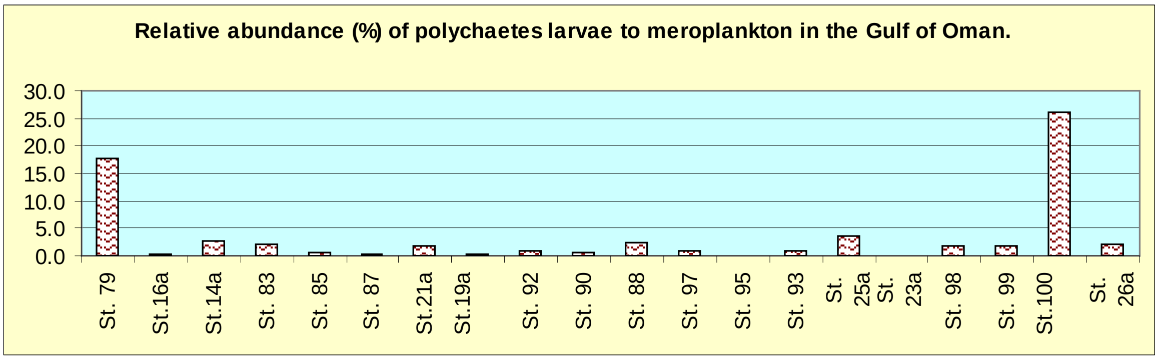

Fig. 78b- Relative abundance (%) of polychaetes larvae to meroplankton at the sampled stations in the Sea of Oman (Feb. 2006).

Cirripedes larvae appeared at 22 stations throughout the whole study area mostly in low counts (<100 larvae/m^3), except those (501 and 445 larvae/m^3) at stations 15 and 33 in the inner RSA (Fig. 79). However, cirripedes larvae displayed clear roles (5% – 36.4%) in the meroplankton count at about 10 stations over the whole ROPME Sea Area (Fig. 80a,b).

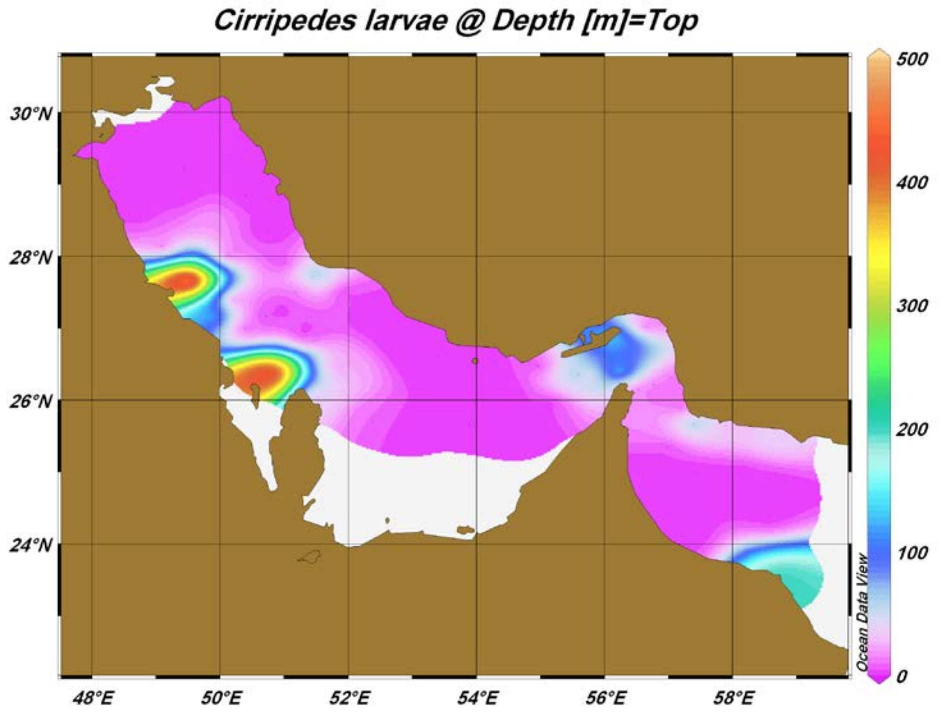

Fig.79- Cirripedes larvae count (organism/m^3) in the ROPME Sea Area (Feb. 2006)

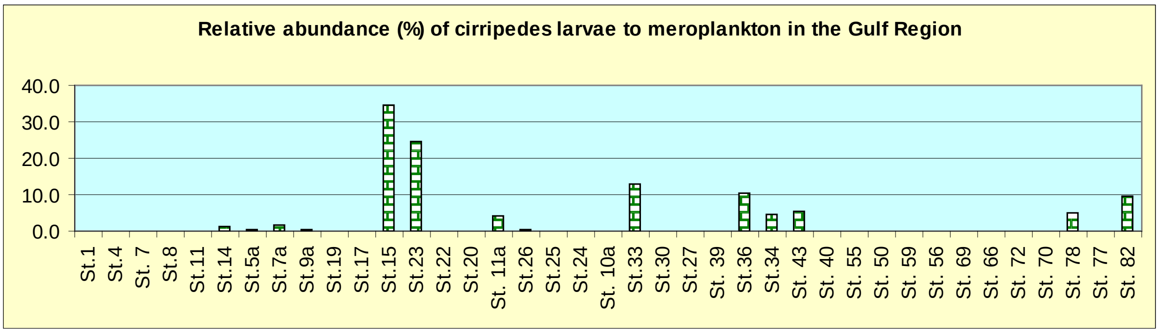

Fig. 80a- Relative abundance (%) of cirripedes larvae to meroplankton at the sampled stations in the inner RSA (Feb. 2006).

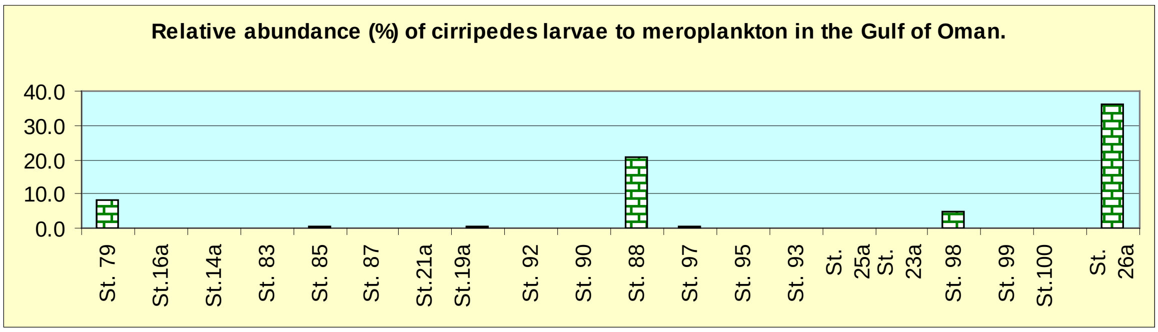

Fig. 80b- Relative abundance (%) of cirripedes larvae to meroplankton at the sampled stations in the Sea of Oman (Feb. 2006).

It is worth mentioning that fish larvae and eggs were found in the zooplankton samples collected at several stations during the present study. Fish larvae appeared at 22 staions in the inner RSA, in very low numbers (< 7 larvae/m^3), and 7 stations in the Sea of Oman with counts of 15 - 70 larvae/m^3. In the meantime, fish eggs were observed at 19 stations mostly in the inner RSA, with counts of 1 -14 eggs/m^3. Pronouncedly high counts (108, 87, 176 egg/m^3) were observed at stations 30, 33 & 97 respectively. Furthermore, crustacean eggs occurred occasionally at 2 stations only in the inner RSA, while they attained high counts (427, 1274, 458, 226 and 305 egg/m^3) at stations 87, 90, 92, 93 and 97 respectively in the Strait of Hormuz and Sea of Oman, forming 6 – 21.6% of the total meroplankton. The planktonic larvae of Echinodermata, Ascidiaceae and Branchiostoma were reported at a few stations, mostly in low counts and weak contributions.

4. Discussion

The survey of the earlier studies on the ROPME Sea Area revealed the occurrence of numerous publications on zooplankton in the area, but they differed in methods of collection, number of stations, localities, mesh size and mouth diameter of the plankton net, frequency of collection .. etc. Some of these publications concerned with zooplankton in the whole inner RSA (Frontier, 1963a;b; Sarnthein, 1967; Martini, 1969); Kimor, 1973; Yamazi, 1974; Grice and Gibson, 1978; Gibson *et al.*, 1980; Michel, 1980; 1983; Halim, 1984; Michael *et al.*, 1986a; Al-Yamani, *et al.*, 1998), while the majority of them were concentrated on localized parts of the area, like Kuwait waters (Jacob, 1978; Jacob and Zarba, 1979; Jacob *et al.*, 1979; Michael *et al.*, 1981; 1982; 1986b; Fahmi *et al.*, 1987; Al-Yamani, 1989; 1993a,b; 1994; Grabe and Lees, 1992; Faraj *et al.*, 1994; AL-Khabbaz nad Fahmi, 1998; Al-Yamani *et al.*, 1998; 2004; 2006; SOMER, 2003), Qatari waters (Hussein, 1992; Dorgham and Hussein, 1997; Ghobashy *et al.*, 1999;; Nour EL-Din and AL-Khayat, 2001; 2005; Nour El-Din and Abdel Moati, 2001) , UAE waters (Sharaf and AL-Ghais, 1997 ; El-Serehy, 1998; 2004 Home page;) Saudi waters (Basson *et al.*, 1977; Price, 1979; 1982; Salman *et al.*, 1990; Price *et al.*, 1991; Valavi *et al.*, 1993; Abdul Aziz *et al.*, 2003 ; Al-Aidaros *et al.*, 2003; Baker and Hosny, 2005 Batang *et al.*, 2007). Other studies were concentrated on certain groups, like copepods (AL-Khabbaz and Fahmi, 1998; Nour El-Din and Ghobashy, 1999), tintinnids (Dorgham, 1990; Dorgham and Abdel-Aziz, 2003; Skryabin and AL-Yamani, 2007), Chaetognatha (Furnestin and Codaccioni, 1968; Michel, 1995; Haghi *et al.*, 2007), larvacean (Fenoux, 1973).

The present study revealed significant differences in the community structure as well in then abundance of zooplankton in the ROPME Sea Area. These differences are related changes in the environmental conditions which have a great impact on the biological components of the ecosystem in general and zooplankton in particulalr.

The winter of 2006 reported southward increase in winter surface water temperature in the inner RSA from 17.3^{o}C in the northern part to 23 ^{o}C at the south, and still about 23 ^{o}C in the Strait of Hormuz and Sea of Oman. Throughout the sampled depth (upper 12m) the thermal difference was mostly small (0.5 - <1.5 ^{o}C).

The surface salinity demonstrated pronounced spatial variations, whereas most stations in the inner RSA sustained more or less closed values (39.63 – 40.76 psu), except the low value (37.7 psu) near Kuwait coast. The Irani coast at stations 55- 82 represents a transition area between the inner RSA and Sea of Oman, with salinities between 37.76psu and 38.71 psu, while the Sea of Oman showed the lowest salinities (36.4 – 36.94 psu). On the vertical scale, salinity values reflected will mixing over the whole ROPME Sea Area, especially within the upper 12 m depth, whereas the vertical differences were <0.1 psu, increased to 0.2-0.5 psu at a few stations, and reached a maximum of 2.63 psu at station 33.

The mixing process caused well aeration of the surface water layer, as indicated from relatively high values of dissolved oxygen (> 6.0 – 8.8 ppm), with the exception of that (5.2 – 5.9 ppm) at stations 23a – 26a. In the meantime, the differences in dissolved oxygen between the surface and 12 m depth do not exceed 0.5 ppm throughout great part of the study area.

The pH experienced limited spatial variations, particularly in the inner RSA, varying between 8.14 and 8.53, while unexpected value (6.97 was reported at station 72. In the Sea of

Oman, pH fluctuated around 8.0 (7.89 – 8.02), and the amplitude of vertival variation was 0.05 at most stations.

It seems that, the winter mixing process in the ROPME Sea Area caused pronounced water turbidity, the secchi disc readings varied from 1 – 3 m in the whole area, but they increased to 4.3 – 4.5m at a few stations in the Strait of Hormuz and southern Sea of Oman. These observations contradict with Clarke and Keij (1973) who reported 30m in the axial part of the inner RSA and less so in the coastal waters.

The average value of chlorophyll a demonstrated low phytoplankton biomass (< 1.0 μg/l) throughout the most parts of the inner RSA, indicating oligotrophic conditions or reflecting the high stress of grazing by dense population of zooplankton reported during the present study. However, stations 1, 27, 39 and 36 sustained relatively high chlorophyll (2.01 – 2.84 μg/l). In the Strait of Hormuz and Sea of Oman, comparatively high phytoplankton biomass was observed (1.0 – 4.0 μg/l), reached a maximum of 5.92 μg/l) at station 88. These values indicate eutrophication condition. Vertically, chlorophyll a experienced clear variations in the upper 12 m depth (0.01 μg/l - 6.4 μg/l) among the stations.

The ecological differences and the current regime throughout the ROPME Sea Area are important in charcatrizing the distribution of different zooplankton groups and configuration their abundance. This agrees with the earlier observations (Yamazi, 1974; Grice and Gibson, 1978; Gibson *et al.*, 1980; Michael *et al.*, 1986a; Al-Yamani, *et al.*, 1998)

The community structure and standing crop of zooplankton during the present study showed pronounced spatial differences over the ROPME Sea Area. The large number of zooplankton species (230 species), beside the wide variations in species number among the sampled stations (17 -69 species) reflect the wide array of ecological niches in the study area. This also could be supported from the values of diversity index which varied spatially from 1.74 to 3.25 nats (Fig. 81a,b). However, at 32.2% of stations, the diversity index sustained values between 2 – < 2.5 nats, and 57.6% sustained values 2.5 - <3.0 nats (Fig. 82). Statistical analysis indicated that the divesrsity index was affected by the number of species ($r = 0.57946$ at $p = 0.05$, $n = 59$) rather than by the standing crop, which showed insignificant correlation with diversity index. On the other hand, both the highest and lowest values of diversity index were reported mostly at stations with negligible ecological differences inside the inner RSA(Fig 79a).

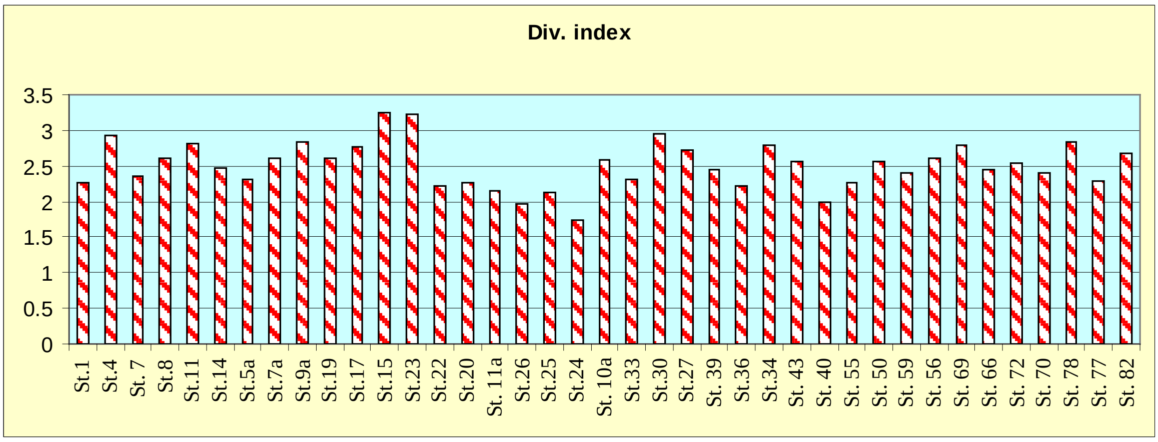

Fig. 81a- Diversity index of zooplankton at the sampled stations in the inner RSA.

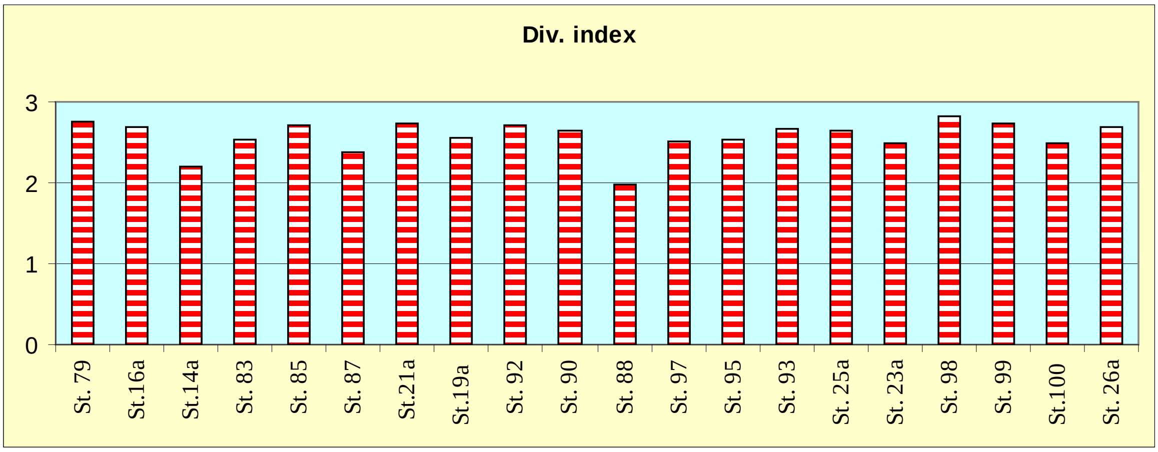

Fig. 81b- Diversity index of zooplankton at the sampled stations in the Sea of Oman.

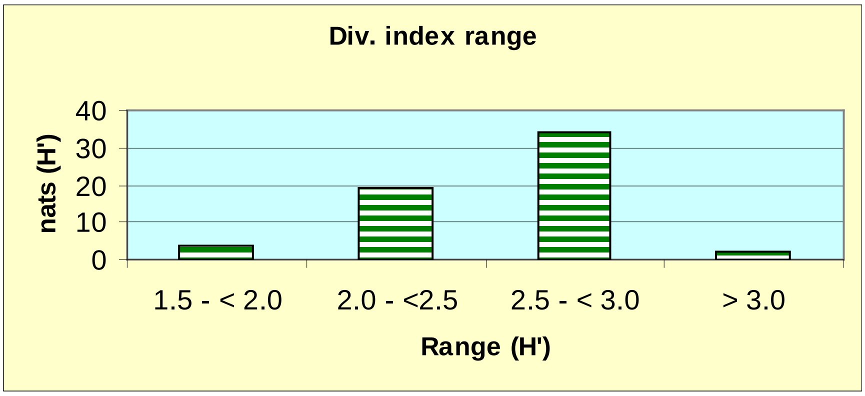

Fig. 82- The dominant ranges of diversity index of zooplankton n the ROPME Sea Area.

The variation range of diversity index during the present study was wider than that (1 – 2.5 nats) reported by Margaleff (1964; 1978) for the actively growing coastal populations, but it was closed to that (0-3.2 nats) observed in the stressed environments (Ismael & Dorgham, 2003; Gharib and Dorgham, 2006). However, The variations of diversity index are related to several factors such as water stability, water quality, productivity, trophic structure and migration (Balloch, *et al.*, 1976; Mc-Naughton, 1977; Tilman, 1996; Caley and Schluter, 1997; Colwell and Lees, 2000) as well as by the degree of dominance, species richness and/or total standing crop (Gharib and Dorgham, 2006, Abdel-Aziz *et al*., 2007, Shams-El-Din and Dorgham, 2007). A high diversity also indicates the availability of a large number of richness (Michel, 1983), whereas the tropical inshore waters are characterized by a comparatively high concentration of plankton composed of few species, and oceanic waters support a more sparse but widely diversified zooplankton community (Deevey, 1964; Bjornberg, 1971; Sander and Moor, 1978; Herman and Beers, 1969; Coker and Gonzalez, 1960; Moore, 1967; Bowman, 1971).

The inner RSA appeared to be highly diversified in zooplankton (210 species) as compared to the Sea of Oman (144 species). Such conditions are attributed to the wide variety of ecological niches in the inner RSA which gives chances for more zooplankton species than that in the Sea of Oman, which displayed narrower ecological variations. The number of zooplankton species in the inner RSA during the present study is markedly higher than those (100 spp.) reported in February-March 1980 in the whole Gulf (Michel *et al*., 1986b) and those (181 spp.) in the northwestern Gulf (Patang *et al*., 2007). Such increase in zooplankton species richness support the continuous transference of new species from the Sea of Oman, as indicated from 113 new species found during the present study in the inner RSA. Since all of them are Indo-Pacific, it is difficult to define whether of these species are endemic in the inner RSA but not recorded before or they were transferred to the area recently. However, the distributional pattern of the new species in the inner RSA revealed that many of them could pass the salinity barrier and reach the northern part of the inner RSA, whereas some of these species established reproducing populations, and others failed to do this at high salinity. On the other hand, several species were found in the southern inner RSA, indicating that they have no ability to penetrate the high salinity of the inner RSA.

Regardless of the water exchange between the inner RSA and Sea of Oman, zooplankton species demonstrated a peculiarity in their distribution throughout the ROPME Sea Area, whereas 92 species were restricted to the inner RSA, 18 to Sea of Oman and 120 found in both gulfs. This means that the inner RSA species are adapted to the high temperature and high salinity, but those in the Sea of Oman could not enter the inner RSA due to the high salinity.

Although copepods comprised the highest number of species at the majority of sampled stations, other groups were represented by numerous species at some stations such as tintinnids at stations 27, 39, 40 & 88, hydromedusae at stations 7a, 23, 92 & 26a, siphonophores at stations 17, 82 & 21a, polychaetes at stations 7a & 23, mollusks at station 23, chaetognaths at stations 50 & 69, larvaceans at stations 77 & 21a and thaliaceans at station 22.

The standing crop of total zooplankton as well as of the different groups experienced great spatial variability throughout the ROPME Sea Area during the present study. This contradicts with (Gibson *et al*., 1980), who reported relatively homogeneous distribution of spring zooplankton in the inner RSA.

The present zooplankton count in the inner RSA (average :14.1 x10^3 organisms/m^3) appeared to be slightly higher than that (12.7 x 10^3 organisms/m^3) in February-March 1980 (Michel *et al.*, 1986a) and markedly higher than that (1.7 x10^3 organisms/m^3) in March 1977 (Gibson *et al*., 1980). These observations support that zooplankton in the inner RSA tended toward continuous increase during the past three decades. Al-Yamani *et al*. (1998) recorded an average zooplankton count of 20645 organisms/m^3 during December 1993 in the inner RSA. On the other hand, the present data reported higher zooplankton count (23.8 x 10^3 organisms/m^3) in the Sea of Oman than (14.2 x 10^3 organisms/m^3) in the inner RSA during winter. These observations are in agreement with Haq *et al*. (1973) and Gibson *et al*. (1980**)**

Furthermore, the western side of the inner RSA harboured relatively higher count (average: 17329 organisms/m^3) than the eastern side (average: 16563 organisms/m^3), but both sides are approximately twice that found in the central axis (9157 organisms/m^3). Similar findings were reported by Michel *et al.* (1986a). In the meantime, the northern part of the inner RSA was slightly richer in zooplankton (14273 organisms/m^3) than the southern part (13907 organisms/m^3 respectively). These observations are in agreement with Yamazi, (1974) and Michel *et al.*, (1986b) who found that zooplankton density was higher in Kuwaiti waters than in the other parts of the inner RSA. On the localazied scale, the present counts were different from those reported previously, for example, the present counts off Saudi (up to 71.7 x 10^3 organisms/m^3) and Kuwaiti coasts (up to 18.1 x 10^3 organisms/m^3) were lower than those (101.4 x 10^3 & 25 x 10^3 organisms/m^3) recorded earlier in the two areas respectively (Abdul Aziz *et al*., 2003; Michel *et al*., 1986b). Off Qatari and UAE coasts, the counts of the present study (6160 & 14415 organisms/m^3 respectively) were higher than those (2193 & 4000 organisms/m^3) found previously (Nour El-Din and Al-Khyayat, 2005; Sharaf and Al-Ghais, 1997). Both the increase in water temperature and decrease in surface salinity, as well as other environmemntal factors must be considered as the main factors causing such differences.

It seems that salinity variation plays a crucial role in the distribution of zooplankton crop over the study area, whereas negative significant correlation was found between the abundance of zooplankton as well as copepods and salinity (R= -0.3617 & -0.3697 respectively, at $p > 0.05$, $n= 57$). Meanwhile, temperature, chlorophyll and turbidity also impact the zooplankton abundance, as indicated from the positive correlations (r= 0.2849, 0.4137 & 0.2575 respectively at $p > 0.05$, $n= 57$).

Copepods represented the highest percentage of zooplankton abundance in the ROPME Sea Area, and demonstrated wide spatial variations throughout the area, not only as a total count but also the different components, including nauplii, copepodides, adult calanoids, cyclopoids and harpacticoids. The total copepods count averaged 11039 organisms/m^3 in the inner RSA and 19623 organisms/m^3 in the Sea of Oman, forming in average 78% and 82.5% of total zooplankton in the two regions respectively. The comparison with previous studies (Table 16) revealed that the role as well as the count of copepods in the inner RSA appeared to be widely variable, on both the time and space scales. These variations are attributed partially to methods of collection and mesh size of the net and partially to the ecological differences and seasonal variations over the ROPME Sea Area. In accordance with Al-Yamani *et al*. (1998), the present study recorded higher copepods count in the western side of the inner RSA than in the eastern.

Table 16 - The contribution of copepods to total zooplankton at different localities of ROPME Sea Area.

Area	**% of zoopl.**	**Copepods count**	**Date**	**Referenfce**
inner RSA	77.9%	11039	February-March 2006	Present study
Central inner RSA	51.7%	13830	Dec 1993	Al-Yamani *et al.*, 1998
Central inner RSA	22.1%		April-May 1992	Al-Yamani *et al.*, 1993
Central inner RSA	66.6%	4228	December 1994	AL-Khabbaz & Fahmi, 1998
inner RSA	53.8%	917	March 1977	Gibson *et al.*, 1980
inner RSA (S.Kuwait)	69.5%	8828	February-March 1980	Michael *et al.*, 1986*a*
Kuwaiti waters	51%	18747	February-March 1980	Michael *et al.*, 1986*b*
Saudi waters (Al-Jubail)	53%		Winter 1998	Abdul Aziz *et al.*, 2003
Saudi waters (Northwestern inner RSA	47%		Annual average (2002-2003)	Batang *et al.*, 2007
UAE	51%	1864	Annual average	Sharaf & Al-Ghais, 1997
Qatari water	76%	1896	Annual average (1994-1995)	Nour El-Din & Ghobashy, 1999
Qatari water	74%		Unknown	Nour El-Din & Al-Khayat, 2001
Qatari water	70%	511	Winter	Nour El-Din & Al-Khayat, 2005
Doha Harbour	56.9%	1573	February 1988	Dorgham & Hussein, 1997

On the other hand, the nauplii, copepodides and adults copepods showed also pronounced differences among the sampled stations. The contribution of nauplii larvae (average: 20.2% of copepods) in the inner RSA and Sea of Oman respectively during the present study was lower than those (29.5%) reported by (Michel *et al*. 1986*a*) in the inner RSA, (23.4%) in Kuwiati waters (Michel *et al*. 1986*b*) and (39-44%) in Doha Harbour (Dorgham and Hussein, 1997). Copepodides formed an average of 23.9% in the inner RSA against 18% in the Sea of Oman, but it could not be compared with either of these studies, because several authors included copeodides in the count of the adult copepods. The three adult copepod groups displayed different roles in total copepods in the inner RSA, following the rank: cyclopoids: 42.9% > calanoids: 36.8% > harpacticoids: 20.3%. Similar sequence of relative abundance was observed earlierly at different localities in the inner RSA, but with different percentages (Al-Khabbaz and Fahmi, 1998; AL-Yamani *et al*. 1998; Nour El-Din and Abdel Moati, 2001; Nour El-Din and AL-Khayat, 2005). However, different patterns were reported during the present study, whereas harpacticoids (Calanoids: 49%, cyclopoids: 46%, harpacticoids: 5%). Harpacticoids overcome both the calanoids and cyclopoids at stations 7, 11a, 26, 27, 36 & 70. On the other hand, both calanoids and cyclopoids displayed higher counts along the western side of the inner RSA than the astern, but they are markedly higher than the central area, while the count of harpacticoids in the eastern side was about 2.5 times that in the western side. In contrast, AL-Yamani *et al. (*1998) observed equally abundant calanoids and cyclopoids at most sampled stations, while Michel *et al*. (1986a) found that the counts of the two groups were close to each other. Furthermore, Yamazi (1974) found uniform distribution of cyclopoids in the inner RSA, but AL-Yamani *et al*. (1998) reported marked increase in cyclopoids count at the western side of the inner RSA.

The dominance of zooplankton species illustrated widely spatial variations in the ROPMER Sea Area during the present study, however, some species demonstrated clear dominance over a great part of the area. *Paracalanus parvus* was the most abundant calanoid copepod, forming in the inner RSA 38.8% of this group, fllowed by *Paracalanus aculeatus* (12%) and *Paracalanus (Parvocalanus) crassirostris* (7.9%). *P. crassirostris* and/or *P. aculeatus* were frequently reported among the abundant calanoids in the inner RSA (Michel *et al*., 1986a,b; Sharaf and Al-Ghais, 1997; Nour El-Din and Ghobashy, 1999; Nour El-Din and Abdel Moati, 2001) while *P. parvus* was observed among the abundant copepods in Qatari waters (Dorgham and Hussein, 1997; Nour El-Din and L-Khayat (2005) and rare off UAE Coast (Sharaf and Al-Ghais, 1997).

Several cyclopoid species were reported as dominant during the present study, like *Oithona nana*, *Oithona plumifera*, *Oncaea venusta*, *Oncaea clevei*, *Oncaea conifera*. Some of these species were predominant in the different parts of the inner RSA, while others appeared to be less frequent in the earlier studies (Sharaf and Al-Ghais, 1997; Dorgham and Hussein, 1997; Nour El-Din and Abdel Moati, 2001; Nour El-Din and AL-Khayat, 2005; Michel *et al*. (1986a,b). Among the harpacticoids, *Euterpina acutifrons* was the absolutely dominant species in both the inner RSA (81.3%), but it shared the dominance (49.5%) with *Microseteela rosea* (50.1%) in the Sea of Oman. One or both harpacticoid species were abundant in the records of (Michel *et al*., 1986a,b; Nour El-Din and Ghobashy, 1999; Nour El-Din and AL-Khayat, 2005; Nour El-Din and Abdel Moati, 2001; Hussein, 1992; Dorgham and Hussein, 1997; AL-Yamani *et al*. 1998).

From the above mentioned, it is clear that *Paracalanus*, *Oithona*, *Oncaea* and *Euterpina* were respectively the most abundant genera in the ROPME Sea Area during the present study. These observations are more less similar to those of all works done on the Area, but with pronouncedly differences in numerical counts as well as the relative abundance of each genus at the sampled stations ((Michel *et al*., 1986a,b; Nour El-Din and Ghobashy, 1999; Nour El-Din and AL-Khayat, 2005; Nour El-Din and Abdel Moati, 2001; Hussein, 1992; Dorgham and Hussein, 1997; AL-Yamani *et al*., 1998). Such differences may be attributed to the differences in methods of collection and to ecological characteristics of the sampled areas.

In addition to the dominant species mentioned above others were observed in markedly high counts at some stations and showed active contribution to total zooplankton over the whole ROPME Sea Area, like *Clausocalanus minor* (0.83%), *Nannocalanus minor* (0.68%), *Temora stylifera* (0.96%), *Temora turbinata* (1.53%), *Corycaeus speciosus* (1.54%), *Oithona* sp. (1.41%), *Microsetella norvegica* (0.71%). Several other copepods attained relatively or pronouncedly high counts at some stations (Table 17).

Table 17 - Copepod species attained high counts at some stations in the inner RSA.

Species	**Max.(No./m^3)**	**Species**	**Max.(No./m^3)**
Acartia amboinesis	381	*Corycaeus typicus*	118
Acartia erythraea	166	*Corycaeus ovalis*	229
Acrocalanus gibber	233	*Corycaeus pacificus*	177
Centropages furcatus	415	*Corycaeus rostratus*	1097
Centropages tenuiremis	147	*Oithona attenuata*	464
Clausocalanus furcatus	1272	*Oncaea mediterranea*	534
Eucalanus crassus	965	*Oncaea minuta*	266
Corycaeus dahli	428	*Oncaea sp.*	1235
Rhincalanus cornutus	506	*Sapphirina sp2*	449
Temora discaudata	719		

Temora turbinata was among the predominant copepods (6672 /m3) in March 1980 in Kuwaiti waters (Michel *et al.*, 1986b), but it had low counts (70 /m^3) at the same time in inner RSA south of Kuwait (Michel *et al.*, 1986a), while other species mentioned above were not reported by those authors. *Temora discaudata* appeared among the abundant species in Qatari waters (Nour El-Din and AL-Khayat, 2005). On the other hand, the copepod species *Acartia clausi*, *Acartia negligens* and *Labidocera wallastoni* form the bulk of copepods in Qatari waters (Nour El-Din and AL-Khayat, 2005), while both *Acartia* species were represented by small numbers (17 and 97 /m^3), while *Labidocera wallastoni* was completely missed. Furethermore, the present counts of *Labidocera minuta* and *Canthocalanus pauper (*91 & 65 organisms/m^3 respectively) were pronouncedly lower than those (438, 341 organisms/m^3) given by (AL-Yamani *et al*., 1998), but the the present counts of *Clausocalanaus furcatus* and *Eucalanus subcrassus* (1272 & 965 organisms/m^3 respectively) were markedly higher than those (195 & 97 organisms/m^3 respectively) of AL-Yamani *et al*. (1998).

Regardless of the large number of (21) new copepod species during the present study, 10 were restricted to the inner RSA and found in very low counts (1-4 organisms/m^3) at small number of stations each (*Acartia danae*, *Candacia longimana*, *Neocalanus tenuicornis*, *Pleuromama xiphias*, *Tortanus* sp, *Corycaeus lautus*, *Sapphirina gemma*, *Sapphirina intestinata*, *Sapphirina vorax*), one to the Sea of Oman (*Bathycalanus maximus*), and 10 species appeared in both the inner RSA and Sea of Oman, namely, *Anomalocera patersoni*, *Calocalanus pavo*, *Candacia aethiopica*, *Euchaeta spinosa*, *Nannocalanus minor*, *Pleuromama abdominalis*, *Pontella fera*, *Pontellina plumata*, *Corycaeus elongatus*, *Oncaea mediterranea*, *Oncaea minuta*, *Sapphirina ovatolanceolata* (Fig 2a,b). The extension to which the species penetrates reflects its adaptability to the surrounding ecological conditions.

Although all of the new copepod species are indo-Pacific or cosmopolitan, most of them were not observed previously, neither in the Gr nor in the Sea of Oman. This means that all of them species were recently transferred to the ROME Sea Area from the Sea of Oman. On the other hand, *Anomalocera patersoni* is usually found in the neuston samples in the Indian Ocean and North Sea (Romano *et al*., 1996).

The present study reported some pontellid copepods which were found in the inner RSA in March 1977 by Gibson *et al.*, (1980), like *Labidocera acuta, L. kroyeri, L. minuta, L. pavo, Pontella karachiensis, Pontellina plumata* and *Pontellopsis krameri*. However, all of these species were most wide spread in the samples of 1977, while they showed localized distribution during winter 2005 (mostly at 1-6 stations). Other pontellids disappeared during the present study, namely *Labidocera detruncate, Pontella securifer, Pontellopsis harmani*, and *Pontellopsis regalis*. Such variations could be attributed due to the long term changes of the ecological conditions in the inner RSA during the past three decades mainly relative to the war conditions.

Although 94 tintinnid species are previously known in the ROPME Sea Area, particularly in the inner RSA (Dorgham, 1990; Dorgham and Abdel-Aziz, 2001; Al-Yamani, *et al*., 2004; Skryabin and Al-Yamani, 2007), the present study added 13 new Indo-Pacific species, which have never been found in the ROPME Sea Area. Some of these species appeared in the Sea of Oman in high count (*Xy stonella treforti*, *Helicostomella subulata*, *Codonellopsis orthoceras* and *Amphorides quadrilineata*), while in the inner RSA they occurred in low counts mainly at sations 27 and 39 on Irani Coast. In contrast, *Codonellopsis morchella* was observed at 10 stations throughout the ROPME Sea Area, but with pronouncedly higher counts (171-977 organisms/m^3) in the inner RSA than in the Sea of Oman (6 – 141 organisms/m^3), indicating that *C. morchella* could build healthy populations in the inner RSA. On the other hand, the rest of new species (*Eutintinnus stramentus, Leptotintinnus botnicus, Parafavella gigantea, Petalotricha ampulla and Tintinnidum mucicola*) were found in low counts, usually at 1-4 stations in the inner RSA only. However, *Parafavella gigantea* amounted to 107 and 440 organisms/m^3) at stations 27 and 39 respectively, while *Tintinnidum mucicola* attained 195 organisms/m^3) at station 27. This supports their recent transference from the Indian Ocean to the ROPME Sea Area.

It seems that tintinnids during the present study sustained markedly low count in both the inner RSA (average: 189 organisms/m^3) and Sea of Oman (average: 565 organisms/m^3) as compared to the previous records. Rergarding some localities, tintinnids were completely missed in both Kuwaiti and Qatari waters, while Skryabin and Al-Yamani, 2007 recorded an annual average of 204 x 10^3 organisms/m^3 with a peak in February and March in Bubiyan Island at northwestern inner RSA, while the February peak in Doha Harbor amounted to 1214 organisms/m^3 (Dorgham and Abdel-Aziz, 2003). The counts of Skryabin and Al-Yamani are extremely high, and it have never been found in the ROPME Sea Area. On the other hand, the number of tintinnids species in the present study was smaller than that found earlier during September 1986 in the inner RSA (58 species) and Sea of Oman (35 species) (Dorgham, 1990).

The relative abundance of the zooplankton groups during winter 2006 in the inner RSA was more or less pronouncedly different from those reported by earlier studies (Table 18). Such differences indicate that the role of zooplankton groups in the ROPME Sea Area experienced clear variations relative to analogous changes in the ecological characteristics.

Table 18 – Relative abundance (%) of zooplankton groups in the inner RSA during the past three decades.

Group	Michael *et al.*, 1986b	Gibson *et al.*, 1980	Present study
	Feb.- March 1980	Mar-77	Feb.-Mar 2006
Copepods	69.5	53.8	78.0
Cladocerans	0.8	5.4	2.9
Ostracods	2.8	22.7	1.4
Chordates	7.0	8.5	6.7
Chaetognaths	0.9	2.1	1.2
Protozoa			1.4
Molluscs	18.1	3.2	5.6

Cladocerans, represented by 4 species were the fourth abundant group during the present study in the inner RSA, forming 2.9% of total zooplankton, but it was less important in the Sea of Oman (0.5%). *Penilia avirostris* was the predominant species, forming 77.7% in inner RSA and 73.8% in the Sea of Oman, and was more abundant in the northern inner RSA and the Strait of Hormuz. On the other hand, *Evadne tergestina* appeared in low counts over the ROPME Sea Area (<100/m^3 in the inner RSA and < 27/m^3 in the Sea of Oman) but it had pronouncedly high counts (660, 368& 179 organisms/m^3) at station 27, 78 & 79 respectively. Although *Podon schmackeri* was completely missed from the whole area, it showed a flash appearance (1303 organisms/m^3) at station 7, at salinity of 40.37 psu and chlorophyll-a of (076 μg/l), while *Podon polyphemoides* sustained it highest counts (306, 317, 293 & 253 organisms/m^3) at stations 1, 14, 27& 79 respectively, where salinity fall within a range of 36.94 – 39.81 psu and chlorophyll-a (0.69-2.84 μg/l). The coincidence of high counts of most cladocerans with comparatively low salinity and high chlorophyll-a at some stations is related to the feeding habits of these zooplankters, as they are mainly phytoplankton consumers. The new cladocerans species during the present study have a remarkably wide distribution in the world seas (On be, 1977; Della Croce and Venogopal, 1972; Tregouboff, 1963; Casanova, 1968; Margineanu, 1963) and at times for short periods, their numbers can be exceptionally large (Raymont, 1983). On the other hand, water temperature is believed in general the chief factor, affecting cladocerans succession. In Japanase water Onbe 1977 reported high count of Penilia avirostris during high summer, Evadne tergistina in spring (24-28oC). The low limit of the latter temperature range is close to that reported during the present study. The flash appearance of Podon schmackeri at station 7 as well as the high counts of the other three cladocerans species at aother stations may be related to the rapid parthenogenitic reproduction habits of cladocerns.

As compared to the previous studies, in March 1977, cladoceran showed approximated contribution to total zooplankton (5.4% & 4.9%) in the inner RSA and Sea of Oman respectively, but no information were given about the dominant species (Gibson *et al*., 1980). Similar to the present study, *Penilia avirostris* was the most abundant cladocearn in the inner RSA (Yamazi, 1974; Michel *et al*., 1986a; Al-Yamani, 1998), while off UAE coast, *Evadne tergestina* was the predominant (Sharaf and Al-Ghais, 1997).

Ostracods demonstrated relatively small role in zooplankton abundance (1.4%) in the inner RSA and markedly small in the Sea of Oman (0.02%). Of the seven species found in the ROPME Sea Area, four species were new records, namely *Conchoecia elegans,* *Conchoecia obtusata*, *Euconchoecia chierchiae* and *Philomedes macandrei*. These species showed limited distribution in the ROPME Sea Area, being found at one or a few stations and mostly sustained low counts (<50 organisms/m^3), except *Conchoecia elegans* which was widely distributed in the northern inner RSA, attaining pronouncedly high counts (585, 368, & 2526 organisms/m^3) at stations 9a, 19 & 15 respectively. Such counts may indicate that the latter species could adapt to the high salinity in the inner RSA and build dense population. These observations are agreement with Raymont (1983), who admitted that ostracods are not usually regard as contributing significantly to the biomass of zooplankton, but their counts during the present study appeared to be markedly higher than that (36 organisms/m^3) found in March off Bermuda (Deevey, 1968) and that (>1m organisms/m^3) for *Conchoecia elegans* off British Columbia (Fulton, 1968). However, Panikkar and Rao (1973) found that during the winter monoon period ostracods appeared to spread as a high density band approximately from the Gulf of Aden along the coast of Saudi Arabia and across the northern Arabian Sea to the south-west coast of India. On the other hand, Detailed bathymetric profiles show that *C*. obtusata is a shallow mesopelagic species that is overwhelmingly dominant at depths of 50–200 m in subpolar seas, and shows limited ability to submerge at lower depths, so that it is restricted to seas that have a marked seasonal cycle of turn-over and stratification (Angel and Blachowiak-Samolyk, 2006).

In March 1980, ostracods formed abut 2.8% of total zooplankton in the inner RSA, with the absolute dominance of *Euconchoecia* sp. (Michel *et al.,* 1986a), while in March 1977 they exhibited markedly greater role (22.7%) in the inner RSA against 0.5% in the Sea of Oman (Gibson *et al*., 1980). In different parts of the inner RSA, the present study recorded higher count of ostracods in Qatari waters (stations 34 and 43) than those found by Nour El-Din and AL-Khayat (2005), but Nour El-Din and AL-Khayat, (2001) observed that ostracods formed 4.7% of total zooplamnkton in Qatari waters, while in Doha Harbour ostracods have not found (Dorgham and Hussein, 1997), while similar to the present study they suatained low count off UAE coast (Sharaf and Al-Ghais, 1997). Furthermore, Yamazi *et al*., (1974) and AL- Yamani *et al.* (1998) reported similar relative abundances of ostracods (9% & 8.8%) in the inner RSA during December 1968 and December 1993 respectively. *Euconcohoecia aculeata* was earlierly the predominant ostarcod (Yamazi, 1974; Michel *et al*., 1986a; AL-Yamani *et al.*,1998).

The Holoplanctonic mollusks had limited and similar contribution (1.1%) to zooplankton in the inner RSA and Sea of Oman. Ten adult mollusks species were found in the whole ROPME Sea Area, including seven Indo-Pacific forms are recorded for the first time in the area. All mollusks species showed different patterns of spatial distribution and abundance. *Creseis acicula* and *Limacina inflata* were widespread and abundant in the ROPME Sea Area. The new species demonstrated different patterns of spatila distribution, whereas *Euclio* sp. appeared to be the second abundant mollusk (37.9%) in the northern inner RSA (stations 17, 15 & 23), but it appeared in markedly low count in the Sea of Oman. In contrast, *Diacria trispinosa* was the most abundant (56%) in the Sea of Oman and absent from the inner RSA except at stations 78, 72 and 17. It, therefore, could be supposed that this species penetrated to the inner RSA and succeeded to reach to the northern part at station 17 off Saudi Coast. The other new species *Atlanta inflata*, *Limacina trochiformis*, *Clione* sp., *Cavolinia* sp. and *Limacina bulloides* were confined mostly to the inner RSA, but at different localities with differentr salinities. It is to be noted that all the new species were mostly reported in pronouncedly low counts in the inner RSA, indicating that none of them could adapt to the high salinity.

The world distribution of the new found mollusk species demonstrates that 71,000 specimens of *Creceis acicula* per tow were found off the edge of the continental shelf at Nosy Be,Madagascar (Frontier, 1973). This species is often found nearer coast (Tesch, 1946) and dominant at tropical surface water mass at temperature of 27^{o}C and salinity 36.25psu (Haagensen, 1976). *Atlanta inflata* was listed among the inhabitants of the open warm oceanic Atlantic waters and rarely approach continental shelf (Furnestin, 1964). *Limacina bulinoides* is essentially tropical and subtropical, while *Limacina trochiformis* is bisub-tropical (Vander Spoel, 1967). The latter species beside *Cavalonia longirostris* were dominant at tropical surface water mass at temperature of 27^{o}C and salinity 36.25psu (Haagensen, 1976). *Clio cuspidata* appeared as a subtropical species in the subsurface waters (Sakthivel, 1973). The pteropods are mostly epipelagic (McGowan, 1968; Moore, 1949; Chen and Be, 1964).

Regarding the previous studies little is known about planktonic adult mollusks. In March 1980 in Kuwati waters they were represented by *creseis* sp. in both Kuwaiti waters and the inner RSA south Kuwait (Michel *et al*., 1986a;b). In December 1993, *Creseis acicula* formed 7.8% of total mollusks (including larvae), in addition to *Desmopterus papilio* and *Carolina longirostris* in the central inner RSA (AL-Yamani *et al*., 1997). *Creseis acicula* was relatively abundant in the Coastal waters of UAE, while *Atlanta* sp. and *Cavolinia longirostris* were rare (Sharaf & Al-Ghais, 1997).

Larvacea, represented by 9 species, appeared to be one of the important holoplanktonic groups in the ROPME Sea Area, constituting 4.75% and 4.3% of the total zooplankton in the inner RSA and Sea of Oman respectively. Six Indo-Pacific forms were found for the first time during the present. *Oikopleura dioica* was the most abundant and wide spread Larvacean in the ROPME Sea Area, constituting 58.6% and 84.9% of their total count in the inner RSA and Sea of Oman respectively. It was also dominant in the previous records (Yamazi, 1974; Sharaf and AL-Ghais, 1997; Dorgham and Hussein, 1997; Al-Yamani *et al*., 1998).

Although the new larvacean species were observed in the Sea of Oman, their occurrence in the inner RSA was mostly confined to stations adjacent to the Strait of Hormuz, at salinity range of 37-38psu, attaining high counts, like *Oikopleura Intermedia, Oikopleura parva, Oikopleura rufescens, Oikopleura longicauda* and *Stegosoma magnum*. Such distribution indicates that these species are still unable to pass the higher salinity in the inner RSA. However, two species, *Appendicularia sicula* wand *Oikopleura longicauda* were observed in the northern inner RSA, with markedly high counts, which reflect their tolerance to salinity and high reproduction in such conditions. On the other hand, *Fritillaria formica* was completely missed in the inner RSA and found in low counts at few stations in the Sea of Oman with a maximum of 143 organisms/m^3 at station 21a. *Oikopleura longicauda* was recorded off Saudi coast without data on its numerical abundance (Basson *et al*., 1977).

The greatest majority of appendicularians are worm-loving and somewhat eurythermal, but the seasonal effect on these animals is probably more related to phytoplankton production than to temperature changes (Fenaux, 1967). These observations may explain the high counts of larvaceans at stations 27, 30, 77, 78 which harboured high chlorophyll (1.42 – 2.21 μg/l) during the present study. *Oikopleura parava, Oikopleura longicauda, Appendicularia sicula and Stegosoma magnum* are widely distributed in tropical, subtropicaland temperate waters and sometimes they extends to the cold waters, but mostly in deep layers (Thompson, 1948; Tokioka, 1960; 1964; Fenaux, 1967; Raymont, 1983).

In comparison with the earlier studies, larvaceans In February-March 1980 were represented mainly by unidentified *Oikopleura* sp., which collectively formed about 7% of the total zooplankton (Michel *et al*., 1986a), and amounted to 3550 organisms/m^3 in Kuwiti waters (Michel *et al*., 1986b). The latter count is about 5 times that of the present study (675 organisms/m^3). In contrast, Gibson *et al*. (1980) found that in March 1977 larvaceans constituted 5.5% of zooplankton in the inner RSA against 21.7% in the Sea of Oman. According to Michel *et al*. (1986b), *Oikopleura* spp. are tolerant of extremes of temperature and salinity and are able to maintain large populations throughout the inner RSA.

Thaliacea displayed more or less active contribution to zooplankton in the ROPME Sea Area, forming 1.9% in the inner RSA and 0.98% in the Sea of Oman. Among 11 species found during the present study, *Thalia democratica* was the predominant and widespread in the inner RSA, constituting 84.3% of total thaliaceans in the inner RSA and 33.2% in the Sea of Oman. It reported remarkably high count (6041 organisms/m^3) at station 70 on the eastern coast north to the Strait of Hormuz, encountered 22.8% of total zooplankton. The species was completely missed in the earlier studies, except that of Michael *et al*. (1986a), who found few specimens in July and November only, while Sharaf and Al-Ghais (1997) observed that and *Thalia democratica* accounted for 11.5% of total tunicates against 85% for *Doliolum denticulatum* in the coast of UAE. In the present study, *D. denticulatum* formed 3.5% of the total thaliacea in the inner RSA and 65.9% in the Sea of Oman, but it was widely distributed in the inner RSA, usually in low count. The present study recorded seven new thaliacean species, the former five species appeared in the inner RSA only, and the latter two occurred in both the inner RSA and Sea of Oman.

In the inner RSA, the new species were confined to 1-3 different stations in the northern part, and usually found in low counts (< 13 organisms/m^3), indicating their tolerance to high salinity in the inner RSA. *Salpa fusiformis*, *Doliolum mulleri* and *Salpa maxima* succeeded to penetrate to the inner RSA, reach to the northern part and sustained high. *Salpa fusiformis* is a truly cosmopolitan, being widely distributed and plentiful in the Atlantic Ocean, Indian Ocean and acroos the Pacific (Berrill, 1950; Freser, 1961; Hunt, 1968), while both *Iasis zonaria* and *Salpa maxima* were found among the relatively common species in tropical and subtropical waters of Pacific, Atlantic and Indian Oceans (c.f. Raymont, 1983).

It is to be noted that, *Doliolum gegenbouri* was found in the Indian Ocean, particularly in India and Somali, and recorded for the first time as rare species in the southwestern coast of the inner RSA during 1993-1994 by Sharaf and Al-Ghais (1997). During the present study the species occurred at several stations in both the coastal and offshore waters of the inner RSA, attaining relatively high counts (211, 93.6 & 122.5 organisms/m3) at stations 30, 43& 70. This means that *D. gegenbouri* and *D. mulleri*, could adapt to different salinities in the inner RSA and built healthy populations. It is to be noticed that Gibson *et al*., (1980) and Michel *et al*., (1986a,b) mentioned only the genus *Doliolum*, and it was represented by a few specimens in the whole inner RSA, while Al-Yamani *et al*. (1998) reported a maximum of 148 organisms/m^3 of *Doliolum* species. All these counts are pronuncedly lower than that observed for total *Doliolum* species (387 organisms/m^3) during the present study. In addition *Salpa cylindrica* was rarely found in UAE (Sharaf and Al-Ghais, (1997), while during the present study it occurred at 7 station in the central part of the inner RSA, with a maximum count (147 organisms/m^3) at station 25.

Although it is a small animal phylum, Chaetognatha is one of the most important and abundant groups in the marine habitat (Lalli and Parsons, 1997; Casanova *et al*., 2003; Castro and Huber, 2003; Hernandez *et al*., 2005). The chaetognath species are considered as key stone species in the marine food webs since they are active carnivores of different zooplankton components (Reeve, 1970; Sameoto, 1972; Kotori, 1972; Feigenbaum and Maris, 1984; Angel, 1993; Castro and Huber, 2003) and serve as food for some commercial fishes (Boltovskeoy, 1975; Nagasawa and Muramo, 1981; Rezai *et al*., 2003).

In the present study, Chaetognatha comprised 8 species, including 3 unidentified *Sagitta* species, displayed collectively more active role in zooplankton (1.2%) in the inner RSA than in the Sea of Oman (0.5%). Each of the recorded species demonstrated a characteristic pattern of spatial distribution in the ROPME Sea Area. *Sagitta enflata* appeared to be one of the most widely distributed zooplankton species over the whole study area, occurring at 54 stations. This is in agreement with Fournestin and Codaccioni, 1968; Yamazi, 1974; Basson *et al*., 1977; Michael, *et al*., 1986a,b; Gibson *et al*., 1980; Sharaf and Al-Ghais, 1997; Al-Yamani *et al*., 1998; Haghi *et al*., 2007).

Sagitta serratodentata was the only new chaetognath species to the study area, concentrated in the northern inner RSA and appeared at a few stations in the Sea of Oman, usually with low counts (<12 organisms/m^3). It is an Indo-Pacific form and was considered as indicators of coastal water bodies during south-west to north-east monsoon transition at Kalpakkam (India) transferred to the area with warm Gulf Stream (Saravanane *et al*., 2000). *This species* is an immigrant species, which flows in with the surface waters mainly via the Eastern Channel approach to the Gulf of Maine. It can be rtegarded as oceanic species occurs essentially outside the continental shelf southewest and west of the British Isles (Bainbridge, 1963). This species appears to breed more or less continuously in spring, autumn and winter in Miami (Owre, 1960), in summer and late autumn in the cooler waters of Delaware Bay (Deevey, 1960), but is a warm species and it does not reproduce at all in the colder conditions (c.f. Raymont, 1983). The occurrence *Sagitta serratodentata* at station 15 in the northern part of the inner RSA in high count (1254 organisms/m^3) indicates that it pneterated the whole Gulf, tolerating the high salinity and establishing a dense population. Although *Sagitta neglecta* was observed in low count in the inner RSA (Michel *et al*., 1986a,b) and abundant in the northeastern part (Haghi *et al*., 2007) it was confined to the Sea of Oman and the southern inner RSA north to the Strait of Hormuz during the present study, attaining comparatively higher counts than those recorded earlier. Such differences are relative to the long term changes in the ecological characteristics of the inner RSA.

Sagitta ferox was completely missed in most previous studies, but it appeared frequently in the southern inner RSA (Michel *et al*., 1986a), rare off UAE coast (Sharaf and AL-Ghais, 1997) and formed 49.7% of total Chaetognatha in the northeastern end of the inner RSA (Haghi *et al*., 2007). This contradicts with the present study, whereas the species was completely absent from the northern inner RSA, and found at seven stations along the central area, forming 44.4% at station 55 on Irani coast. These observations are in agreement with those of Michel *et al*. (1986a,b), but the present counts are pronouncedly higher (up to 117 organisms/m^3) at station 30. *Sagitta ferox* was also reported as indicatot of neritic communities (Bour and Frontier, 1974). The occurrence of high count the species during the present study confirms that it become one of the permanent components of chaetognaths in the inner RSA.

Krohnitta subtilis was also restricted to few stations in the inner RSA during the present study, but in low counts (<20 organisms/m^3). This species was rarely found in the inner RSA (Basson *et al*., 1977; Michel *et al.,* 1986a,b). Although it is known as a cosmopolitan, usually mesopelagic tropical and subtropical (Frountier and Bour, 1976); Srinivasan, 1979), its occurrence in the inner RSA is indicator of intrusion of the offshore waters through the counterclockwise circulating waters (Michel *et al*., 1986a). However, the low counts of the species throughout the past three decades indicate that the species has no ability to adapt to the ecological conditions in the inner RSA and consequently building healthy population. Regardless of the small difference in the average abundance of chaetognatha between the present study (174 organisms/m^3) and that (109 organisms/m^3) of Michel *et al*. (1986a) in Feruary-March 1980, markedly higher counts were found during the present study (1280 organisms/m^3) at station 15 due to *Sagitta serratodentata* and (1295 organisms/m^3) at station 27 due to *Sagitta enflata* and juveniles of *Sagitta* spp. On the other hand, Chaetognatha was represented by 11 species in the samples of Michel *et al*., (1986a), while three only of them were found during the present study (*Sagitta enflata*, *Sagitta ferox and Sagitta neglecta*). Gibson *et al*. (1980) reported pronouncedly low count of chaetognatha in March 1977 compared to those of both February-March 1980 and the present study. In the northeastern end of the inner RSA, 7 chaetognath species were identified, but they were given synonems (Haghi *et al*., 2007). According to latter authors *Ferosagitta (Sagitta) ferox* formed 49.7% of total chaetognaths, followed by *Flaccisagitta (Sagitta) enflata* (17.2%), *Sagitta (Aidanosagitta) neglecta* (13.5%) and *Krohnitta pacifica* (2.7%). The latter species was not observed during the present study. Although *Aidanosagitta neglecta* was among the abundant species in the northeastern end of the inner RSA (Haghi *et al*., 2007), it was missed completely from the whole inner RSA during the present study, except at three stations in the southern part near the Strait of Hormuz.

Despite their relatively high diversity during the present study (18 species), hydromedusae demonstrated markedly low count in the ROPME Sea Area, forming 0.08% of zooplankton in the inner RSA and 0.04% the Sea of Oman. They were found in Qatari waters without numerical abundance (Nour El-Din and AL-Khayat, 2005), formed 0.05-0.07 % in the inner RSA in February-March 1980 (Michel *et al*., 1986a) and 0.3% in December 1993 (AL-Yamani *et al.*, 1997), 0.5% off UAE coast (Sharaf and Al-Ghais, 1997) and 0.1%-76% off Saudi coast (Abdul Aziz, *et al.*, 2003). Of 18 species of hydromedusae found during the present study, 12 species were recorded for the first time, 8 appeared to be confined to the inner RSA, 2 to the Sea of Oman and 2 occurred in both regions. All of new species of Anthomedusae, Leptomedusae and Trachymedusae were observed either once or at a few stations, mostly in small numbers (<5 organisms/m^3). On the other hand, some species of the present study were previously recorded, such as the leptomedusa, *Obelia* sp. the limnomedusa, *Olindias singularis*, the trachymedusa *Aglaura hemistoma* and the narchomedusa *Solmundella bitentaculata*. *Obelia* species during the present study occurred only in the Sea of Oman, while Michel *et al*. (1986a) recorded it in Region III, near the Strait of Hormuz also in very low count. *The limnomedusa Olindias singularis* was reported by Al-Yamani *et al*. (2004) in Kuwaiti waters, while in the present study one speciemen of *the species* was found at staion 23 on Saudi coast, indicating its transferrene from Kuwaiti waters southward. In contrast, the trachymedusa *Aglaura hemistoma* was widely distributed in the inner RSA, forming 56.4% of total medusae, with high counts (65, and 70 organisms/m^3) at stations 50 and 66, while in Kuwaiti waters no records were given about its abundance (Al-Yamani *et al*., 2004). The latter authors reported markedly higher counts of cnidarians in Kuwaiti waters (up to 1500 organisms/m^3) than that found during the presnt study (70 organisms/m^3).

Siphonophores were represented by 16 species during the present study, but all of them are new to the ROPME Sea Area, since none was observed earlierly, except a *Lensia* sp.

The role of this group appeared to be very limited during the present study (GR: 0.3% and Sea of Oman: 0.04% of zooplankton) as well as in the previous studies (Michel *et al.*, 1986a,b; Abdul-Aziz *et al*., 2003). The majority of these species were usually rare and each of them occurred at a few stations either in the inner RSA or throughout the ROPME Sea Area. Their spatial distribution reflects their tolerance to salinirty variation. *Abylopsis escholtzii*, *Abylopsis tetragona, Agalma elegans, Bassia bessensis* and *Forskalia* sp., were observed in the Sea of Oman and in the northern inner RSA adjacent to the Strait of Hormuz. This means that these species could not penetrate the salinity barrier in the inner RSA. *Muggiaea atlantica* penetrated to stations 11 and 15 in the northern inner RSA, but it was absent from other parts. Both *Lensia conoidea* and *Sulculeolaria biloba* showed wide distribution in the inner RSA with the highest count (182 organisms/m^3) at station 66 for the former, and 164 organisms/m^3 at station 30 for the latter, while they were less frequent in the Sea of Oman. It is clear that both species established dense population in the inner RSA at different salinities. Six species appeared to be restricted to the inner RSA (*Chelophyes appendiculata, Diphyes sp., Eudoxoides spiralis , Lensia subtilis, Muggiaea kockii, Sulculeolaria quadrivalves*), mostly found in very low count, except Diphyes sp., which was found at several stations over the inner RSA, suataing high counts (94, 138, 118 organisms/m^3) at stations 7, 20 and 30 respectively. This species also tolerated the high salinity in the inner RSA and established healthy population.

The larval stages of the benthic animals demonstrated relatively active contribution to the standing crop of zooplankton in the study area. Their average count in the Sea of Oman was twice that in the inner RSA, but the relative abundance was slightly higher (7.4% and 6.2% respectively). The small role of meroplankton in the inner RSA and the Sea of Oman (5.7% & 4.2% respectively) was also observed in March 1977 (Gibson *et al*., 1980). However, in February-March 1980 it played greater role (18%) in the inner RSA (Michel *et al.*, 1986a) against about 11% in December 1993 (Al-Yamani *et al*., 1998). In the Doha Harbor, the meroplanktonic larvae contributed 30-58% of the total zooplankton over the year (Dorgham and Hussein, 1997), while in Kuwaiti waters, they played an important role in the productivity cycle (Jacob *et al*., 1979a). From all published plankton studies on the ROPME Sea Area, it seems that lamellibranch veligers are the major component of meroplankton, over the whole area, but some times they altered the dominance with gastropods larvae. The abundance of veligers during the present study reflects the high spawning of benthic mollusks during March. (Michel; *et al.*, 1986a) supposed that the spawning periods of benthic mollusks in the inner RSA occurred in summer and early spring.

Zooplankton of the inner RSA is composed of mixed communities of neritic and oceanic forms of larger size and inlet water forms of smaller size, both habitually being adapted to the environment of high salinity and temperature.

It is clear that the slow counterclockwise (Hunter, 1982) associated with the southwest monsoons from May to October (Leavu and Szekielda, 1968) affect the distribution of zooplankton species in in the inner RSA. According to authors mentioned above deep living planktonic organisms will not pass over the shallow entrance at the Straits or survive at the high salinity and temperature in the inner RSA. The present study showed that many of epiplanktonic species survive in the inner RSA and pass over the whole area, eastablishing at some stations breading populations, while they were reported previously as rare species. For example *Eucalanus crassus* was widespread in the inner RSA and attained high counts (102 organisms/m^3) at station 1 in Kuwaiti waters and (965 organisms/m^3) at station 15 off Saudi coast. *Eucalanus elongates* occurred off Kuawiti and Saudi coasts (Stations 1, 8, 15 & 23), with counts of 26 & 18 organisms/m^3 at the latter two stations respectively. However, *Candacia pachydactyla* and *Lucicutia flavicornis* still found in very low counts as reported by Michel *et al.* (1986a), indicating that they could not tolerate the high salinity and temperature in the inner RSA and occur as expatriet species. The latter authors supposed that all chaetognaths species can be considered potential indicators of either neritic or oceanic waters outside the inner RSA. *Krohnitta subtilis*, which is mesopelagic in subtropical and tropical seas was accedently found in Kuwaiti waters (1 organisms/m^3) (Michel *et al.*, 1986b), while during the present study it appeared at station 24 off Saudi coast and station 39 near Irani coast. This means that the species survived at salinity higher than that in the Sea of Oman and could establish breeding population. *Krohnitta subtilis* and *Oncaea conifera* are considered offshore water indicators (Michel *et al.*, 1986a). The latter species was among the abundant copepods, particulallrly in the nortrh inner RSA and it could be assumed that it has a resident population in the inner RSA.

Conclusions

The present study revealed that the zooplankton community in the ROPME Sea Areea during winter 2006 was highly diversified, and was characterized by high productivity at numerous stations. Regardless of the great variabiltity among the sampled stations the inner RSA harboured markedly higher number (210 species) than the Sea of Oman (144 species), while the Sea of Oman was richer in zooplankton count (23790 organisms/m^3) than the inner RSA (14151 organisms/m^3).

The zooplankton biodiversity has increased pronouncedly in the study area due to the continuous inflow of new immigrant species from the Sea of Oman through the lowsalinity surface current from the Sea of Oman. Several of the transferred species were confined to the southern inner RSA, because they could not pass the salinity barrier inside the inner RSA. However, other species extended their distribution to different part of the inner RSA even to its northen ende, and attained markedly high counts indicating their adapatability and ability to reproduce at the new conditions. It seems that, the counterclockwise current in the inner RSA plays a crucial role in the transference and dispersal of the new immigrant zooplankton species.

The comparison with the previous studies illustrated that zooplankton community in the ROPME Sea Area experienced serious changes during the past three decades, particularly in species composition, numerical density, the role of the different groups, and the pattern of dominant species. These changes are related to ecological changes in the area, due to the war conditions prevailing in the area since more than two decades.

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