Arab Gulf J. Scient. Res., **15** (2), pp. 415-435 (1997)

Seasonal Dynamics of Zooplankton Assemblages in Doha Harbour, a Neritic Region in the Arabian Gulf

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ABSTRACT. Seasonal changes in zooplankton assemblages in Doha Harbour, a neritic area in the Arabian Gulf were studied from December 1987 to November 1988 in relation to the seasonal variations of temperature, salinity and nutrients. The zooplankton community in the study area was characterized by low species diversity and a relatively low numerical density relative to other areas in the Gulf. High salinity seems to be a dominant factor affecting growth and the breeding cycles of the abundant zooplankton species. The average population densities ranged from a maximum of 4705/m^3 in June to a minimum of 993/m^3 in November. Copepods were the major component, in the ratio of 1: 1.7: 5.5 harpacticoids: calanoids: cyclopoids. This ratio showed a departure from that usually observed in warm waters. Some deep-water species were occasionally recorded indicating the possibility of adaptation of Indo-Pacific species to the area.

Despite of its importance in the marine food webs, zooplankton of Qatar waters has received little attention. Yamazi (1974) included information on the surface zooplankton in waters offshore of Qatar. Gibson *et al.* (1980) when repeating a qualitative and quantitative analyses of samples collected from the offshore waters of the eastern side of the Gulf Region in March 1977, included a few stations in the vicinity of Qatar. Michel *et al.* (1986a) described the species composition, distribution and abundance of zooplankton in open waters off Qatar, based on collections made during February 1980. Hussein (1992) gave a comprehensive list of zooplankton species and percentage abundances of each group observed during 1984 for Qatar waters. All these publications have concentrated on the offshore waters,

sometimes sampled only once, leaving the inshore waters of Qatar totally unstudied.

In this paper, we present a detailed account of the zooplankton community in the inshore waters of Qatar around Doha Harbour describing the seasonal dynamics of the numerical abundance and species composition in relation to the prevailing physio-chemical conditions.

Materials and Methods

The species composition and standing crop of zooplankton in the concerned area (Fig. 1) were assessed from quantitative samples collected by day from the bottom to the surface using plankton net with diameter of 50cm and mesh size of 110 μm, hauled vertically at 0.5m/second at nine stations ranging in depth from 4-10m. The samples were collected monthly from December 1987 to November 1988. Immediately on collection each sample was preserved in neutralized 4% formaldehyde and concentrated into 100 ml containes. The population density was estimated as numerical abundance from the average counts of three aliquots of 5 ml of the concentrated samples with an error of 5-10%. The species diversity of each sample was calculated according to the formula H = – sum Pi log Pi given by Shannon and Weaver (1949). Water temperature, salinity and nutrients (nitrate, phosphate and silicate) were also studied in the meantime by colleagues of the physical and chemical groups.

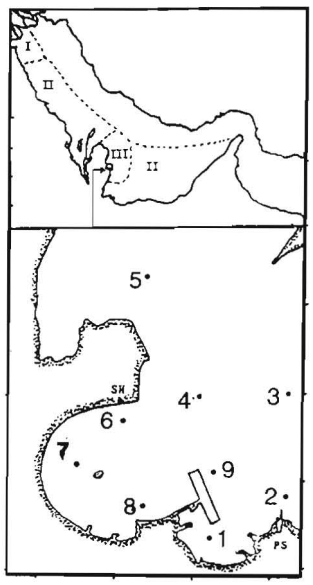

Fig. 1. Study area and sampling stations.

Results

Hydrography:

In Doha Harbour, the sea surface temperature underwent wide seasonal fluctuations. It increased gradually from a minimum of 16.9 °C in January 1987 in monthly increment of 1.5-4 °C to a maximum of 33.9 °C in September. In November 1987 there was an abrupt drop of about 9 °C, which was followed by further decrease of 6 °C in January 1988. There were three bimonthly periods during which sea surface temperature renoticed stable in November/December, June/July and August/September (Fig. 2); there were also minor interstations variations.

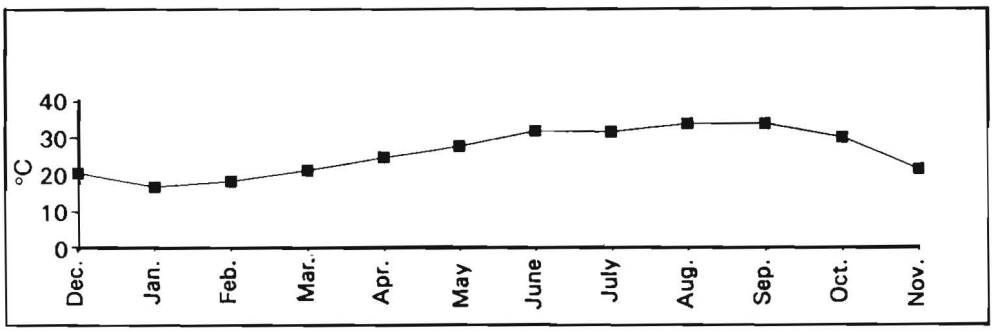

Fig. 2. Monhly average water temperatures in Doha Harbour during the period December 1987-November 1988.

The surface salinities raised from a minimum of 41.33 in March, to a maximum of 43.24 in May. Except these two extreme values, the amplitude of both seasonal and regional variations of salinity was 0.72.

Significant seasonal and spatial variations were observed for the nutrients (Fig. 3), Phosphate concentrations were at a minimum (0.02-0.11 µg at/1) during the warm period (June-September) and attained maxima in February (0.26 µg at/1) and November (0.27 µg at/1). The highest concentrations of nitrate (0.21-0.27 µg at/1) were detected from January to April. For silicate, two ranges of variations were observed throughout the year; the first, 5.12-6.65 µg at/1, was detected during the period (October-March) and the second (3.69-4.71 µg at/1) from April to September, with the exception of August.

The wind system in the Gulf Region has strong effect on its water circulation pattern. N& NW "Shamal" wind prevailing in the area all the year round except in hot months (July-September), when the E& NE winds prevail. Therefore, the surface water movements are mostly directed S& SE, while in summer the direction is W& SW (El-Gindy and El-Samra 1992). "Shamal" winds are experienced 5 days/month in the shore areas and 10-12 days in the offshore waters with a windforce reaches an average of 20 knots or more during the cooler months (Jackson 1978-80). The monsoon prevail in the Region in winter and summer. The SW summer monsoon extending from May to October are the more effective on the hydrography of the Gulf Region (Currie *et al.* 1973). Regional tidal currents are oriented approximately parallel to the axis of the Gulf, with velocities up to 50-60 cm/second some 0-4m above the bottom (Evans 1970 and Hartman *et al.* 1971). The tidal range along the Qatari coast varies between 0.5-1.0m (Houbolt 1957).

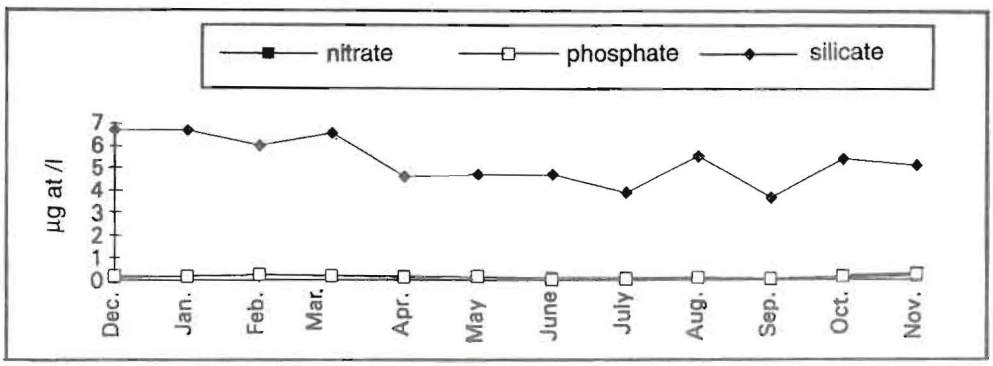

Fig. 3. The average concentrations of nutrient salts in Doha Harbour during the period December 1987-November 1988.

Zooplankton:

The zooplankton assemblage of the study area comprised 30 holoplankton taxa and several tychoplanktonic larvae (Table 1). The assemblage was characterized by low species diversity (Table 2) and a relatively low standing crop. Copepoda, Cladocera, Pteropoda, Larvacea and Chaetognatha were identified to species, whereas Foraminifera, Rotifera and Ostracoda were identified just to group. Tintinnids were represented by 100 species, and will be considered in a separate paper. Larvae of cirripeds, decapods, polychaetes, bivalves, echinoderms and ascidians were recorded.

Table 1. Species composition of zooplankton community in Doha Harbour during the period December 1987-November 1988

Species	
Copepoda:	
Acartia clausi	*O. plamifera*
A. discaudata	*O. setigera*
A. latisetosa	*Oncea venusta*
A. longiremis	*Paracalanus parvus*
A. negligans	*Pseudocalanus elongatus*
Aetideus armatus	*Temora discaudata*
Calanus vulgar	**Cladocera:**
Centropages kroyerii	*Penilia schmakeri*
Centropages sp.	**Pteropoda:**
Corycaeus bremci	*Limacina inflata*
C. flaccus	**Larvacea:**
Corycaeus sp.	*Fritillaria borealis*
Euterpina acutifrons	*Oikopleura albicans*
Harpacticus sp.	*O. dioica*
Microsetella norvegica	**Chaetognatha:**
M. rosea	*Sagitta enflata*
Oithona nana	*S. setosa*

Table 2. The means and ranges of diversity indicies of zooplankton in Doha Harbour (December 1987-November 1988)

Month	Range	Mean	Month	Range	Mean
December	0.38–1.53	0.84	June	0.92–1.65	1.29
January	0.41–1.36	0.82	July	0.84–1.34	1.11
February	0.26–1.19	0.78	August	0.33–0.75	0.58
March	1.08–1.61	1.36	September	0.68–0.83	0.77
April	1.07-1.85	1.61	October	0.25–1.35	0.76
May	1.28–1.74	1.55	November	0.33–1.43	0.97

Copepoda, represented by 23 species, was the dominant group throughout the year prevailing 59-97% of the holoplankton and 35-75% of the total zooplankton

(Fig. 4). *Oithona nana* (Giesbr.) was persistently the dominant copepod species constituting 24-59% to the total copepod population. Other species like *Euterpina acutifrons* (Dana), *Paracalanus parvus* (Claus.) and *Acartia clausi* (Giesbr.) also occurred throughout the year, at percentage of frequency fluctuating between 2.3-17%, 0.5-14% and 1.5-6.5% respectively to the total copepods (Fig. 3). A swarm of *Acartia discaudata* (Steuer) (15%) appeared just during July. The other copepod species occurred in low abundance during one or two seasons. Nauplii were the major component of the copepod populations constituting from 23.6-53.2%, with copepodites being less abundant varying between 3.5-24.9% all the year round.

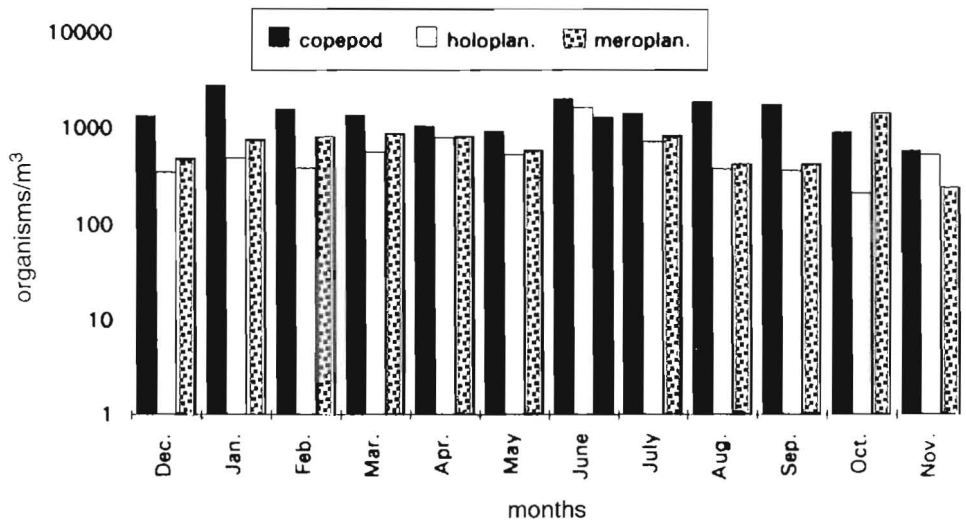

Fig. 4. Monhly variations of the standing crop of the major groups of zooplankton in Doha Harbour (December 1987-November 1988).

Holozooplankton taxa, other than copepods, showed different pattern of seasonal distribution (Fig. 5). Pteropods occurred throughout the year varying between 0.7-36.7% of the holoplankton and were dominated by *Limacina inflata.* Three species of Larvacea were recorded, with *Oikopleura dioika* (Fol) being among the most persistent of species constituting 0.2-20.6% of all holozooplankton. The other two Larvacean species were recorded once or twice during the year, *Fritillaria* sp. and *Oikopleura albicana* (Leuck).

Rotifers appeared from February to August in low numbers and ostracods were also recorded sporadically in very low numbers. A single representative of the cladoceran *Penilia schumakeri,* was found in April, and sporadically a few individuals of two of the chaetognaths, *Sagitta enflata* (Grassi) and *S. setosa* (J. Muller) were found.

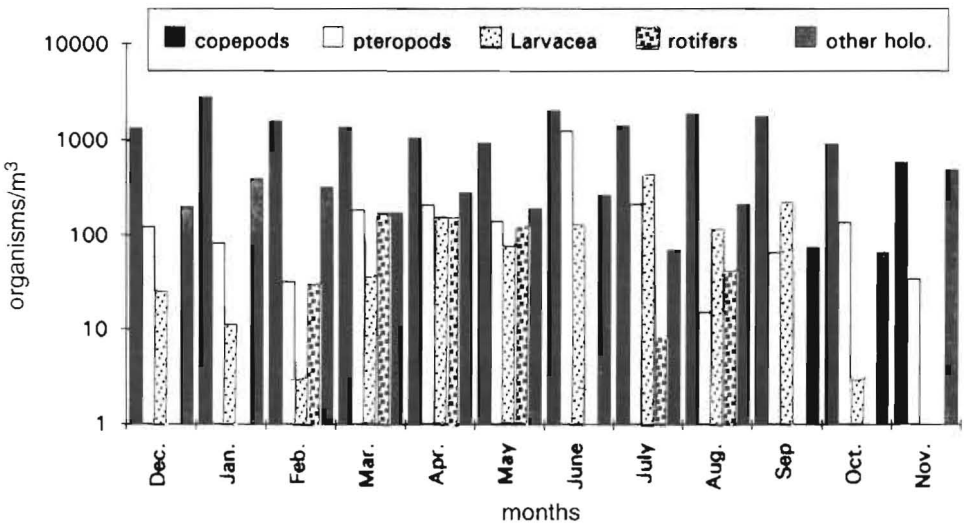

Fig. 5. Temporal distribution of the major holoplankton groups in Doha Harbour (December 1987-November 1988).

The meroplankton components were always numerically important, making 17.3-59.1% of the total zooplankton count. The highest numbers was found in October and less so from February to May (Fig. 4). Bivalve larvae were the most abundant, showing three distinct maxima (Fig. 6). Polychaete and cirriped larvae occurred throughout the year, but always with low abundance. Larvae of echinoderms, decapods and ascidians were found in very small numbers.

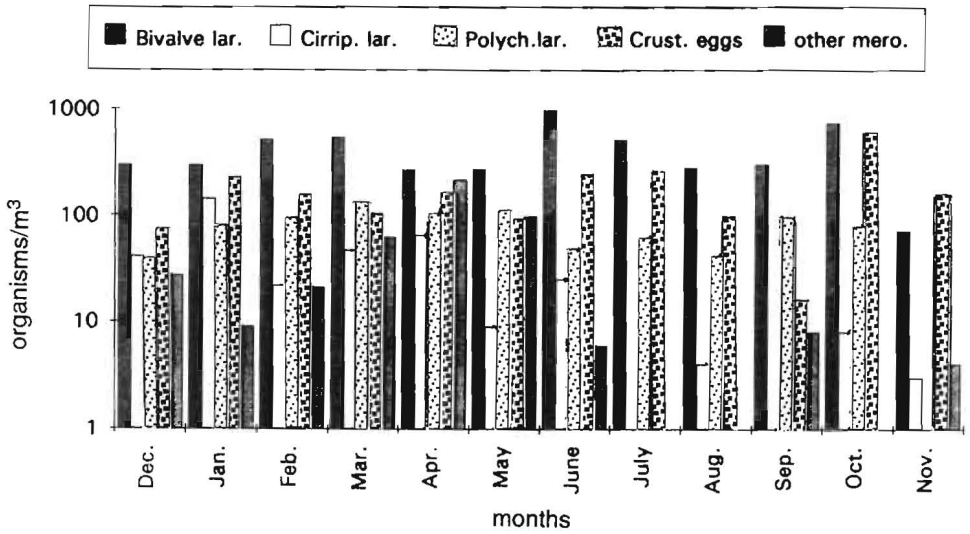

Fig. 6. Monhly variations of the major meroplankton components in Doha Harbour (December 1987-November 1988).

The average numerical abundance of zooplankton varied widely from 999/m^3 November and 4705/m^3 in June showing a bimodal pattern during the year (Fig. 7). The January peak was consisted mainly of copepods, while the higher peak in June resulted from increases in other holoplankton, particularly the pteropod *Limacina inflata,* and the larvae of benthic bivalve.

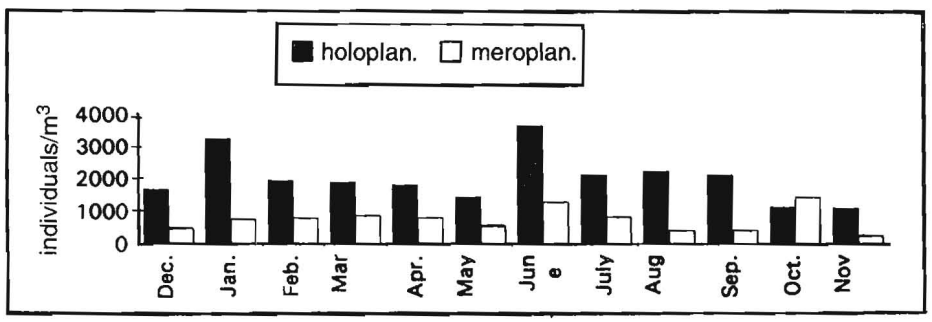

Fig. 7. Monhly average abundance of zooplankton in Doha Harbour throughout the period December 1987-November 1988.

Discussion

Comparing the Doha Harbour communities with those from other areas in the Arabian Gulf, they were clearly poor both in the number of species present and population density (Table 3). Apart from the dominance of copepods, the community structure also differs significantly. The copepods *Acartia latsitosa* (Kritz.), *A. longiremis* (Lillise.), *Aetideus armatus* (boeck), *Centropages kroyerii* (Giesbr.), *Corycaeus bremci* (steuer), *Pseudocalanus elongatus* (Boeck) and *Oncea venusta* (Philippi) were not recorded in the Arabian Gulf by Gibson *et al.* (1980), Michel *et al.* (1986a, 1986b) or Hussein (1992) and must be considered to be inshore species. Whereas coelenterate medusae, ctenophores, doliolids and salps which were abundant in the open Gulf waters, rarely occured in the study area. Similarly, chaetognaths, larvaceans and planktonic molluscs which were each represented in open Gulf water by several species, were represented by only one or two species in Doha Harbour. The ratios of relative abundance of the major copepod groups in Doha Harbour was 5.5 cyclopoids: 1.7 calanoids: 1 harpacticoids, compared with 5: 3: 1 reported from other warm seas (Michel *et al.* 1986b). In the southern Gulf Region, abundances of calanoids and cyclopoids were about equal, primarly owing to the large numbers of *Oithona* spp. and *Oncea conifera* (Giesbr.) (Michel *et al.* 1986a).

Table 3. The annual average counts and number of species in different areas of the Gulf Region. (Latin numbers indicate the areas in the Gulf, Fig. 1)

Area	Sp. no.	Count/m^3	Reference	Mesh size
Doha Harbour	30	2748	Present work	110 µm
Kuwait (I)	95	39800	Michel *et al.* (1986b)	110 µm
Western Gulf (II)	100	21812	Michel *et al.* (1986a)	110 µm
Off Qatar (III)	130	–	Hussein (1992)	110 µm

Temperature and salinity seem to be the important factors influencing the abundance of the dominant species. For example, the copepod *Oithona nana,* which throughout the year contributes 34.4% of the total copepods and 18.5% of the total zooplankton shows several maxima in its dominance indicating at least three to four peaks in breeding. However, these maxima were much lower than those observed in

other areas where temperature and salinity are lower (Dowidar and El-Maghraby 1970, Reeve 1970). Similarly, *Paracalanus parvus,* which is a neritic and oceanic cosmopolitan species and was relatively sparse in the area, occurred at its maximum abundance (924/m^3) in June at sea surface temperature of 31.9 °C, compared with an abundance sixty fold higher in the Egyptian Mediterranean, at a salinity of 38 and sea surface temperature of 25.5 °C also in June (Dowidar and El-Maghraby 1970). *Euterpina acutifrons* showed two small maxima in January and May at temperatures 17& 27 °C respectively and salinities > 40, while in Kuwait waters, at similar temperatures and salinity range of 36.4-38.7, much higher abundances were found (Michel *et al.* 1986b). Thus it seems that, the combination of high temperature and salinity may be inhibiting the growth rate of these species at Doha Harbour. Wilson (1942) concluded that a high salinity is deleterious to pelagic copepods and when combined with fairly high temperatures may even limit copepod life in the epiplankton. However, the effect of temperature in the study area was less pronounced for some species than that of salinity. *Acartia clausi* was found in the area at temperatures ranging between 21 and 34 °C, but at maximum abundance when temperatures ranged between 21.3-24.8 °C. In Egyptian waters, this species attains its maximum abundance at 18.5 °C and disappears when the temeprature exceeds 23 °C (Dowidar and El-Maghraby 1970), while in Dela Bay it does not reproduce at temperature > 20 °C (Deevey 1948).

Among other holoplanktonic animals *Limacina inflata* and *Oikopleura dioica* were abundant persistent species. The latter fluctuated in numbers from few during the cold period to 1372/m3 in July. In other Gulf areas, the same pattern was also observed for all species of *Oikopleura* but often with comparatively higher counts (Michel et al. 1986a, 1986b). On the same latitude of Doha Harbour, Hopkins (1977) found *Oikopleura dioica* among the dominant species of Tampa Bay, Florida. *Limacina inflata* constituted annually an average of 9.7% of the holozooplankton attaining its maximum in June forming 34% of the holozooplankton and 25% of the total zooplankton.

In general, the present results indicate that, late spring and summer are the reproductive times for the majority of the holozooplankton in Doha Harbour. The peak of production may shift in timing towards the lower or the higher temperature limit of that period according to the species habits. However, some of these species showed additional peaks in other seasons.

Judging from the numerical abundance of the common species, it appears that the spawning periods of the different zooplankton species often preceed their abundance maxima, and the number of breedings are related to the number of peaks.

The production of copepod nauplii in the area continues throughout the year with clear seasonal variations. Thus breeding by many copepods seems to be almost continuous but varies in intensity in response to temperature variations and the spawning regimes of the various species. These observations are in agreement with Raymont (1983), who argued that the occurrence of early stage of copepods almost throughout the year in the warm seas implies that breeding is continuous in those waters.

It is to be noted that, part of the zooplankton community in the shallow study area may be sometimes transferred from the open waters by the wave and surface water currents under the effect of the wind action. The occurrence of great numbers (up to 7172/m^3) of *Limacina inflata* in June may be accordingly explained, as this period coincides with the E&NE direction of the prevailing wind. This species is common in the Qatari open waters (Hussein 1992). The persistent and semipersistent species in the study area are indigenous, even if some of them are unable to establish dense population. On the other hand, the open water species such as *Microsetella rosea* (Dana) and *Oithona plumifera* (Baird) which were occasionally observed, particularly in winter, seem unable to build up and maintain large populations in these inshore waters. These species are apparently transported from the open waters by the wind driven circulation in the Gulf. This may be confirmed by the swarm appearance of *Acartia discaudata* in July, when the E&NE winds prevail causing transferrence of the open water masses to Doha Harbour. Furthermore, the occasional appearance of the deep water species, *Pseudocalanus elongatus, Aetideus armatus* and *Corycaeus flaccus* (Ciesbr.) in the area indicates advection in of Indo-Pacific plankton along with the low salinity surface current.

The important role of meroplankton in the area was attributable mainly to the bivalve larvae and partially to crustacean eggs. However, the role of other benthic larvae was sometimes significant. The seasonal variations of the meroplankton counts reflect the different spawning times of the benthic fauna. The peaks in bivalve larvae coincided with those observed by Michel *et al.* (1986a) elsewhere in the Gulf Region. Spawning of the bivalves in the Gulf Region occurs in spring, early summer and mid-autumn. This may explain the significant role of bivalve larvae (20%) in the June zooplankton peak. Spawning by other benthic animals, may occur in seasons other than in spring. However, spring is the spawning period of the majority of the benthic fauna in the area. Otherwise, the population density of the meroplankton was remarkably lower in Doha than that found in other parts of the Gulf Region.

Although the study area is relatively small, significant differences in species composition and numerical abundance of zooplankton were observed among the stations in different months (Fig. 8). The markedly small variations of temperature and salinity among stations prevent the discrimination of either factor as being dominant in determining the regional variations. Though, difference in both food availability (Dorgham 1990) and water circulation pattern may be important contributing factors. As shown in Figure 8, the shallow area (2.5-4.5m depths) of stations 6, 7 and 8 contained oftenly the highest abundance of zooplankton. This abundance may be attributed to the high count of meroplankton from one hand and the effect of the domestic wastes discharged from the Sheraton Hotel from the other hand. Nutrients in this part was mostly slightly higher. The deeper stations 2, 3 and

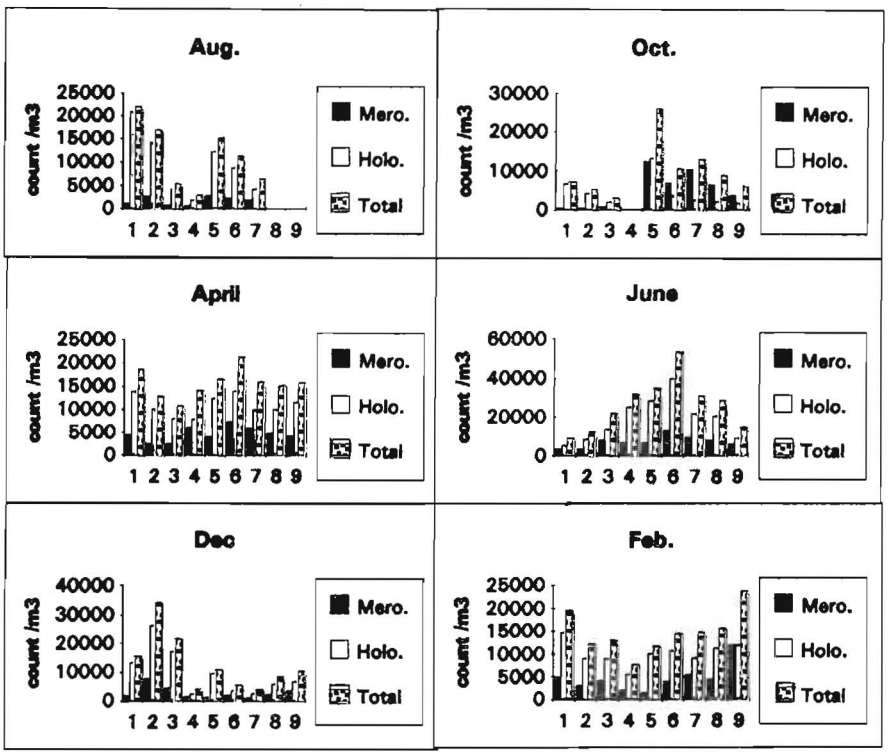

Fig. 8. Regional variations of the numerical abundance of zooplankton in Doha Harbour during the period December 1987-November 1988.

9, with depths of 8-10m, were characterized by relatively lower counts, that may be related to the less effective role of meroplankton and to other environmental factors. The Bray-Curtis similarity test undertaken for the abundant species (Figs. 9-12) showed that each species has a similarity pattern of abundance differs significantly from those of the other species. This may indicate from one side the differential effect of the ecological factors among the stations and the role of the semidiurnal tidal current and other water movements from the other side.

It is worth mentioning that, while salinity in the area remains within the tolerance range of most zooplankton species, it may still inhibit their production attaining those lavels seen in other areas which are characterized by lower salinities. However, strong illumination and low phytoplankton production are also likely to be controlling factors. In addition, the high density of carnivorous zooplankton and the close proximity of filter-feeding benthic species may also contribute to the reduction in the zooplankton count.

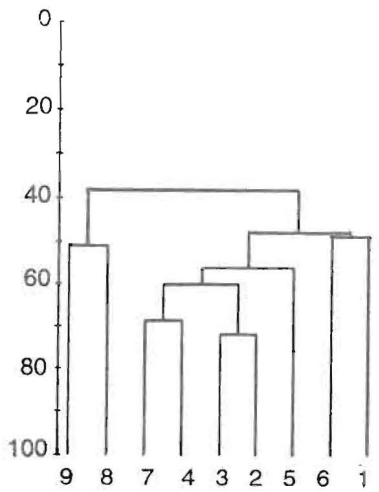

Fig. 9. Bray-Curtis similarity test for *Oithona nana* in Doha Harbour during December 1987-November 1988.

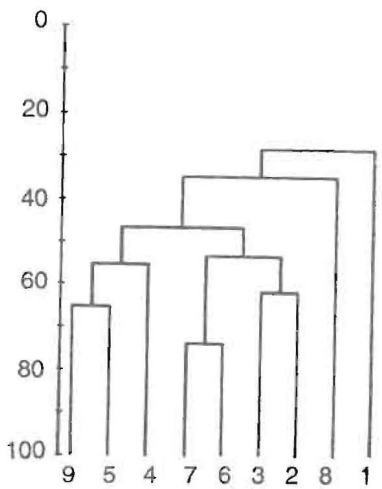

Fig. 10. Bray-Curtis similarity test for *Oitkopleura dioica* in Doha Harbour (December 1987-November 1988).

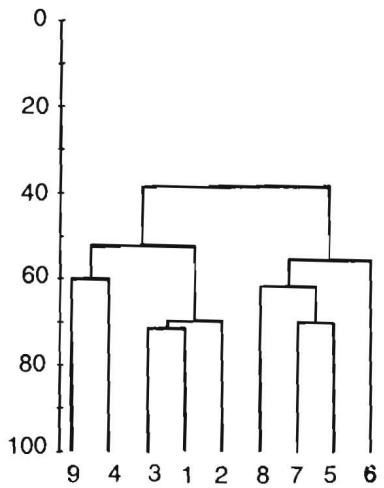

Fig. 11. Bray-Curtis similarity test for bivalve larvae in Doha Harbour (December 1987-November 1988).

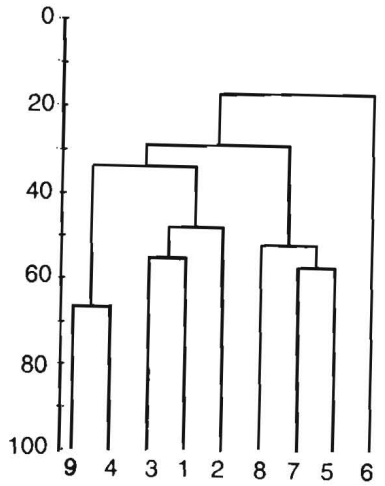

Fig. 12. Bray-Curtis similarity test for *Limacina inflata* in Doha Harbour (December 1987-November 1988).

Conclusion

Zooplankton species in Doha Harbour could be categorized into three groups; 1) The abundant persistent species, 2) Temporarly abundant species and 3) Less frequent or rare species. The majority of the community members are included in the last group. The characteristic low species diversity and relatively poor count are attributed to strong illumination, high temperature and salinity, low phytoplankton production, dense occurrence of some carnivorous zooplankton and/or filter-feeding benthic species. Significant differences in the community structure and population density between the inshore water of Doha Harbour and other Gulf areas, even the shallow, reflect the differences in ecological conditions. The appearance of oceanic and deep water forms in such neritic area is an indication of the effect of the low salinity current from the Gulf of Oman on the biota of the Arabian Gulf. Due to the shallowness of the study area the role of meroplankton was clearly shown. The water

circulation patterns, both in the shallow study area and the open waters of the Gulf Region are still one of the important factors playing significant role in the plankton distribution in the different parts. This, of course, needs more detailed comprehensive and regular studies.

Acknowledgements

The authors are deeply grateful to Prof. A. El-Gindy and Mr. K. El-Deeb for the data of physical and chemical parameters. Thanks are also due to Prof. A. Samaan and Dr. W. Hummon for reading the manuscript.

References

Currie, R.I., Fisher, A.E. and **Hargreaves, P.M.** (1973) Arabian Sea upwelling. The Biology of the Indian Ocean (**Ed.**) **Zeitzschel, B.** and **Gerlach, S.A.** 37-52 pp.

Deevey, G.B. (1948) The zooplankton of Tisbury Great Pond. *Bull. Bingham Oceanogr. Coll.* **12:** 1-44.

Dorgham, M.M. (1990) Phytoplankton cycle in the Doha Harbour, Arabian Gulf. *Bull. Fac. Sci.,* Zagazig Univ. **12**(2): 744-772.

Dowidar, N.M. and **El-Maghraby, A.M.** (1970) The neritic zooplankton of the southeastern Mediterranean at Alexandria. I-Distribution and ecology of the zooplankton organisms with special reference to copepoda. *Bull. Inst. Oceanogr. and Fisher.,* Egypt **1:** 225-273.

Evans, G. (1970) Coastal and nearshore sedimentation: a comparison of clastic and carbonate deposition. *Proc. Geol. Assoc.* London **81:** 493-508.

El-Gindy, A.A. and **El-Samra, M.I.** (1992) Variability of wind system and its expected effects on oil slick movement in the Arabian Gulf. Qatar Univ. *Sci. J.,* **12:** 215-221.

Gibson, V.R., Grice, G.D. and **Graham, S.J.** (1980) Zooplankton investigations in Gulf waters north and south of the Straits of Hormuz. *In:* Proceedings of Symposium on The coastal and marine environment of the Red Sea, Gulf of Aden and Tropical western Indian Ocean: 510-517 pp.

Hartman, M., Lange, H., Seibold, E. and **Walger, E.** (1971) OberFlachensedimente im Persischen Golf und Golf von Oman. I. Geologisch-hydrologischer Rahmen und erste sedimentologische Ergebnisse. "METEOR" *Forsch. Ergebnisse, Reihe C,* **4:** 1-76.

Hopkins, T.L. (1977) Zooplankton distribution in surface waters of Tampa Bay, Florida. *Bull. Mar. Sci.* **27:** 467-478.

Houbolt, J.J.H.C. (1957) *Surface sediments of the Persian Gulf near the Qatar Peninsula.* Doctoral Thesis, University of Utrecht. Den Heag: Mouton and Co.

Hussein, M.M. (1992) A preliminary study on the zooplankton community of Qatar waters. *Com. In Sci. and Dev. Res.* **37:** 123-141.

Jackson, C.E. (1978-80) Monthly summary report of the Doha Port Marine meteorological Office (circulars), Ministry of Communication and Transport. Qatar.

Michel, H.B., Behbehani, M. and **Herring, D.** (1986a) Zooplankton of the western Arabian Gulf south of Kuwait waters. *Kuwait Bull. Mar. Sci.* **8:** 1-36.

Michel, H.B., Behbehani, M., Arar, M., Shoushani, M. and **Brakoniecki, T.** (1986b) Zooplankton diversity, distribution and abundance in Kuwait waters. *Kuwait Bull. Mar. Sci.* **8:** 37-105.

Raymont, J.E.G. (1983) Plankton and productivity in the oceans, Pergamon Press, **2:** 1-824.

Reeve, M.R. (1970) Seasonal changes in the zooplankton of south Biscayne Bay and some problems of assessing the effects on the zooplankton of natural and artificial thermal and other fluctuations. *Bull Mar. Sci.* **20:** 894-921.

Shannon, C. and **Weaver, W.** (1949) *The mathematical theory of communications.* The University of Illinois Press, Urbana. 104-107 pp.

Wilson, C.B. (1942) Carnegie Inst. Washington Publ. 536, 237 pp.

Yamazi, I. (1974) Analyses of the data on temperature, salinity and chemical properties of the surface water and the zooplankton communities in the Arabian Gulf. *Transactions of the Tokyo University of Fisheries* **1:** 26-51.

(Received 30/10/1994;
in revised form 25/02/1996)

التغيرات الفصلية للعوالق الحيوانية في ميناء الدوحة ، منطقة شاطئية في الخليج العربي

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يتناول البحث دراسة مجتمع العوالق الحيوانية على مدار العام في منطقة ضحلة من شواطئ الخليج العربي ، وهي ميناء الدوحة ، وذلك بهدف الوقوف على التركيب النوعي والكثافة العددية لهذا المجتمع وتتبع تغيراتهما في أوقات السنة المختلفة والتي ترتبط بدورها بتغيرات مماثلة في العوامل البيئية . وقد اختيرت ميناء الدوحة لهذه الدراسة نظراً لضحالة مياهها وتنوع العوامل البيئية بها بالاضافة إلى أنه لم يسبق دراسة العوالق الحيوانية في مناطق شاطئية ضحلة في الخليج العربي .

تحددت للدراسة تسعة مواقع تمثل أجزاء الميناء بكافة تباياناتها البيئية . جمعت عينات العوالق الحيوانية شهرياً بواسطة شبكة قطرها ٥٠ سم وحجم الثقوب فيها ١١٠ ميكرومترات وذلك بسحبها رأسيا من القاع إلى السطح بسرعة نصف متر في الثانية . حفظت العينات بعد جمعها مباشرة في ٤٪ محلول فورمالين . وفي المعمل تم تعريف الأنواع المتواجدة وتقدير الكثافة العددية لكل منها في أحجام جزئيةمن العينات ثم حسب المحصول الكلي للعوالق في المتر المكعب من ماء البحر . تعرضت النتائج لبعض التحليلات

الاحصائية للتعرف على مدى التنوع في مجتمع العوالق عند المواقع المختلفة وفي الأوقات المتتالية من العام .

في نفس الوقت أجريت دراسة بعض العوامل البيئية ذات العلاقة مثل : درجة حرارة المياه وملوحتها والأملاح المغذية بها مثل : الفوسفات ، النترات والسيليكات .

ومن تحليل النتائج تبين ما يلي :

- تراوحت درجة حرارة المياه السطحية في ميناء الدوحة بين ١٦,٩ درجة مئوية في يناير و ٣٣,٩ درجة مئوية في سبتمبر ، بحيث تبدأ في الارتفاع التدريجي من فبراير لتصل إلى ذروتها في سبتمبر ، وفي نوفمبر تشهد انخفاضاً ملحوظاً يقدر بست درجات يستمر حتى تبلغ الحرارة أدنى معدلاتها في يناير .
- على النقيض فان الملوحة لم يطرأ عليها تغير ملحوظ طوال العام ، فلم تزد سعة التغيرات عن ٠,٧٢ من الجزء في الألف .
- أظهرت الأملاح المغذية تغيرات فصلية واضحة بالاضافة إلى تباين قيمها بين المواقع المختلفة . تراوحت تركيزات الفوسفات طوال العام بين ٠,٠٢ - ٠,٢٧ ميكروجرام ذرة في اللتر . أما النترات فقد اختلفت بين ٠,٠٦ - ٠,٢٧ ميكروجرام ذرة في اللتر . في الوقت ذاته تباينت قيم السيليكات بين ٣,٦٩ - ٦٥,٦ ميكروجرام ذرة في اللتر .
- بلغ عدد أنواع العوالق الحيوانية الدائم التي تم تعريفها ثلاثون نوعاً تنتمي إلى مجموعات عديدة مثل : كوبيبودا ، كلادوسيرا ، بتيروبودا ، لارفيسيا ، كيتوجناثا ، بالاضافة إلى أنواع لم تعرف من مجموعات فورامينيفرا ، روتيفرا ، اوستراكودا ، تنتنيدا . وبجانب العوالق الدائمة سجلت اعداد من اليرقات العالقة لبعض الحيوانات القاعية مثل سيريبيدا ، ديكابودا ، بوليكيتا ، بايفالفيا ، ايكنودرماتا ، اسيدييسي .

- احتلت كوبيبودا المركز الأول من ناحية عدد الأنواع (٢٣ نوعا) والكثافة العددية ، واختلفت نسب تواجدها بين ٣٥-٧٥٪ من المحصول الكلي للعوالق الحيوانية على مدى العام . كان نوع أويثونا نانا هو الغالب دائما ، كما ظهرت أنواع أخرى بكثرة نسبية أحياناً مثل يوتربينا اكيوتفرنز ، باراكالنس بارفس ، اكارشيا كلوزي .
- بالاضافة إلى كوبيبودا ظهرت عوالق دائمة أخرى بكثرة واضحة مثل ليماسينا انفلاتا من مجموعة بتيروبودا ، اويكوبلورا ديويكا من مجموعة لارفيسيا . أما المجموعات الأخرى فقد تواجدت بأعداد متواضعة .
- لعبت العوالق المؤقتة (يرقات الحيوانات القاعية) دوراً هاماً في المحصول الكلي للعوالق الحيوانية ، حيث كونت ما بين ٣ ,١٧-١ ,٥٩٪ ، وكانت يرقات بايفالفيا في مركز السيادة الواضحة .
- تراوح المحصول القائم بين ٩٩٩-٤٧٠٥ فرداً في المتر المكعب ، وشهد شهرا يونيو ويناير أعلى القيم على التوالي .

وبمناقشة النتائج أمكن استخلاص ما يلي :

١- مجتمع العوالق الحيوانية في ميناء الدوحة أقل تنوعاً في تركيبه النوعي وكثافته العددية ، كما أنه يختلف بدرجة ملحوظة في تركيبه النوعي عن بقية أجزاء الخليج العربي ، خاصة المنطقة المفتوحة .

٢- ارتفاع درجة الحرارة والملوحة في ميناء الدوحة من العوامل التي يحتمل أن تعوق نمو الأنواع السائدة من العوالق الحيوانية عن المعدل المتوقع حيث ظهر جلياً انخفاض الكثافة العددية لهذه الأنواع في الميناء بالمقارنة بمناطق أخرى تقل عنها في درجتي الحرارة والملوحة .

٣- نهاية الربيع وبداية الصيف هي الفترة الملائمة لتكاثر غالبية أنواع العوالق الدائمة ، إلا أن بعض الأنواع أظهرت قدرتها على التكاثر خلال فترات أطول ولكن مع تغير في الكثافة العددية لليرقات الناتجة في الأوقات المختلفة .

٤- يلعب نظام حركة المياه في منطقة الخليج العربي دوراً هاما في توزيع العوالق في ميناء الدوحة في المواسم المتتالية ، وخاصة خلال فصل الصيف ، والذي يختلف فيه اتجاه الرياح المؤثرة على حركة المياه في المنطقة ، وقد بدا ذلك واضحاً بوصول بعض أنواع العوالق القاطنة في المياه المفتوحة إلى الميناء وبكثرة لابأس بها .

٥- هناك تباين واضح في الكثافة العددية للعوالق بين المواقع المختلفة ، مما يعزى إلى اختلاف في الأملاح المغذية وبالتالي كثافة العوالق النباتية أو التغير المستمر في حركة المياه تحت تأثير تيارات المد والجزر أو تواجد عدد كبير من العوالق المفترسة التي تتغذى على الأنواع الأخرى . كما لعبت اليرقات المؤقتة للقاعيات دوراً بارزاً .