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SPATIAL AND TEMPORAL VARIATIONS OF PLANKTONIC CRUSTACEA FROM WADI EL RAYAN LAKES, El FAYOUM WESTERN DESERT, EGYPT

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ABSTRACT

Wadi El Rayan Lakes lie in Wadi El Rayan Depression, southwest of Cairo in the western desert of Egypt. Zooplankton samples were collected monthly during twelve cruises from February 1996 to January 1997. Crustacea constituted 70% of the total zooplankton organisms which were represented by Cladocera, Copepoda, and Ostracoda (27.74%, 71.79%, and 0.47% respectively).

The Cladocera was represented by nine species dominated by *Diaphanosoma excisum*, though all of the cladoceran species were previously reported from Wadi El Rayan Lakes except *Macrothrix laticornis*. The Copepoda was represented by five species where *Thermocyclops neglectus* was the most dominating one (60% of total adult copepods). The Ostracoda was represented by only *Cyprideis torosa*. The first lake harboured the maximum numbers of Crustacea whereas their lowest numbers were recorded at the drain and the second lake. The peak of crustacean flourishing was during autumn.

INTRODUCTION

Wadi El Rayan Lakes (30° 23` E and 20`68`N) are one of the most recent man-made lakes. They lie in Wadi El Rayan Depression; southwest of Cairo in the Western Desert of Egypt. The depression was connected with the agricultural drainage water of El Fayoum province in 1973. Following the connection, the first lake was formed with an area of about 58.8 Km^2 and depth of about 23m. The water flowed in through a connecting canal about 5 Km long. It reached to the great depression of Wadi El Rayan forming the second lake with an area of about 110 Km^2 and depth of about 29. The first and the second lakes lie below the sea water level by -10 and -18m respectively. So, the first lake was filled with water whereas the second one was still in the filling phase through a strong waterfall. The connecting canal inbetween the two lakes has a lot of submerged and emergent macrophytes that can lead to great variation in the aquatic communities.

Crustacea are one of the most affected aquatic communities by these variations. They were studied previously in Wadi El Rayan by Khalil (1984), Saleh (1984–5), Ramadan *et al.* (1992), Guerguess (1993), Shebrawy (1993), and Ramadan & Shebrawy (1994).

This study was conducted to assess the spatial and temporal variations of planktonic Crustacea during a complete year through ten selected stations on Wadi El Rayan Lakes.

MATERIAL AND METHODS

The samples of planktonic Crustacea were collected monthly during the period from February 1996 to January 1997. Ten stations were chosen to represent the different sites of Wadi El Rayan lakes (Figure 1 and Table 1). A plankton net having 55μ mesh size was used to collect Crustacea samples. At each station, one vertical haul from the photic layer was collected. The samples were immediately preserved in 4% neutral formalin solution till microscopic examination. The different species were identified according to Edmondson (1959), Pennak (1978), and Verheye & Dumont (1984).

The physicochemical parameters were measured during sampling by specialized apparatuses and the obtained data were pooled to give the average seasonal values for these parameters.

RESULTS

Data of physicochemical parameters are shown in table (2).Crustacea constituted about 70% of total zooplankton count at Wadi El Rayan Lakes. It was represented by Cladacera, Copepoda, and Ostracoda. The systematic list of the obtained species can be recorded as follows:

Class : Crustacea

A-Subclass : Branchiopoda

Order : Cladocera

Suborder : Eucladocera

1- Family : Sididae

Genus : ***Diaphanosoma***

D. excisum Sars, 1885

2- Family : Chydoridae

Genus : ***Chydorus***

C. sphaericus Müller, 1785

Genus : ***Leydigia***

L. acanthocercoides Fisher, 1854

Genus : ***Alona***

A. rectângula Sars, 1862

Genus : ***Macrothrix***

: *M.laticornis* Jurine, 1820

3- Family : Bosminidae

Genus : ***Bosmina***

: *B. longirostris* Müller, 1785

4- Family : Daphnidae

Genus : ***Daphnia***

D. cucullata Sars, 1862

D. langispina Müller, 1785

Genus : ***Ceriodaphnia***

C. quadrangula Muller, 1785

B-Subclass : Copepoda

Order : Cyclopoida

Family : Cyclopidae

Genus : ***Thermocyclops***

T. neglectus (Sars, 1909)

Genus : ***Megacyclops***

M. viridis (Jurin, 1820)

Order : Calanoida

Family : Diaptomidae

Genus : *Thermodiaptomus*

T. galebi (Barrois, 1891)

Order : Harpacticoida

Family : Ameiridae

Genus : ***Nitocra***

N. lacustris (Schmankevitch, 1875)

Family : Laophontidae

Genus : ***Onychocamptus***

O. mohammed (Blanchard and Richard, 1891)

C-Subclass : Ostracoda

Cypredis torosa (Jones, 1850)

Both Cladocera and Copepoda represented 99.53% of the total Crustacea number. Fifteen species of Crustacea were found, those recorded species, their average number, and percentages are listed in Table (3).

The first lake encountered the highest counts of Crustacea (85572, 70969 and 43169 organisms/m^3 at stations 3, 2, and 4 respectively). The lowest counts were observed at the drain and station 10 (4974 and 4421 organisms/m^3

respectively) as in Figure (2). In general, the first lake was the richest site whereas the second one was the poorest one (Fig. 3)

The peak of crustacean flourishing was recorded during September, November and December (34419, 63691, and 35748 organisms/m^3 respectively) as shown in figure (4).

The spatial and temporal cycles of the most abundant crustacean species in Wadi El Rayan sites are as follows:

A-Cladocera group (Fig. 5)

Cladocera constituted 27.74% of total Crustacea. They were mostly concentrated at the first lake and appeared with two peaks of growth, the first one in February and the second in late autumn. It was represented by 9 species namely: *Diaphanosma excisum, Bosmina longirostris, Ceriodophnia quadrangula, Daphnia longispina* and *D. cucculata, Alona rectangula, Chydorus sphaericus, Macrothrix laticornis,* and *Leydigia acanthocercoides.*

D. excisum occupied the first order of abundance in Cladocera (48.88%). It disappeared from the drain and had few numbers at the connecting canal (average of 148 organisms/m^3). The highest counts were recorded at the first lake followed by the second one. The peak of flourishing was observed in summer and early autumn (Fig. 6).

B. longirostris was obtained at the first lake with higher counts than in others, and had scarce individuals at other sites. Its populations increased strongly during November-February period especially in December (Fig.7).

C. quadrangula represented 13-44% of total Cladocera. It appeared with few individuals but higher at the first lake. It disappeared completely from the samples during October-

January period. The highest numbers were observed during February-May with maximum count during February (13079 organisms/m^3) (Fig. 8).

Daphnia spp. were represented by *D. longispina* and *D. cucullata.* They were more or less similar in distribution and seasonality. Both species were recorded at the first lake with average numbers of 293 and 173 organism/m^3 respectively. They were missing totally from the connecting canal and appeared only during January at the drain and during September in the second lake. Their peak of growth was during winter season.

The other four species appeared as rare forms that were represented by 2.35 % of total Cladocera. *M. laticornis* was recorded during this study for the first time. It was observed only at the drain during February and March. *L. acanthocercoides* was recorded also at the drain only; whereas, *A. rectangula* and *C. sphaericus* were noticed at the drain and station 6 (second lake) with maximum counts during March in addition to the connecting canal for the first species.

B-Copepoda group (Fig.9)

Copepoda occupied the first order of abundance in Crustacea (71.79 % of total Crustacea) at Wadi El Rayan Lakes. It was represented by five species namely: *Thermocyclops neglectus, Megacyclops viridis, Thermodiaptomus galebi, Nitocra lacustris* and *Onychocamptus mohammed.* The first one represented 60% of total adult copepods that was recorded only at the first lake all over the year and at the connecting canal only in May and January. The number of *T. neglectus* increased till the end of

autumn and early winter and decreased to the lowest level in February and March at the first lake (Fig.10).

M. viridis constituted 3.50% of total adult Copepoda, and appeared as a rare form. It disappeared completely from the second lake; while few individuals were recorded during February at the drain and the connecting canal (667 and 333 organisms/m^3 respectively) and during August at the connecting canal (667 organisms/m^3).

T. galebi represented 13.27% of total adult Copepoda. It was recorded only at the two lakes with the highest counts at the first lake especially during January.

N. lacustris and *O. mohammed* were recorded only at the shallow areas (drain, connecting canal and station 6). They appeared during April-October period with very few individuals except during October the number increased to 2000 and 3000 organisms/m^3 at the drain and the connecting canal respectively.

Juvenile stages of Copepoda: (Figs. 11 and 12)

Nauplius larvae and copepodite stages of the recorded species constituted about 89.78% of total Copepoda individuals (67.44 and 22.34% respectively).

The first lake was the richest site with both juvenile stages. It harbored three times more of those recorded at the other sites (drain, connecting canal and the second lake). The maximum counts were observed during autumn and early winter.

C-Ostracoda group

Cyprideis torosa was the only recorded ostracod species. It was observed as rare form at the drain, connecting canal and station 6 (second lake) with maximum count during June at the drain (1473 organisms/m^3).

DISCUSSION

As the first lake of Wadi El Rayan Lakes received a lot of organic and inorganic fertilizers through the agricultural drainage water, intense primary production occurs with a peak in autumn (Konswa, 1993). During the present study, the lowest transparency (as indicator for productivity) was observed during autumn. This may indicate flourishing of Crustacea during autumn at the first lake as reported by Shebrawy (1993).

The first lake of Wadi El Rayan and the connecting canal were the richest sites with Crustacea whereas the second lake and the drain were the poorest sites. Rabeh (1993 and 1996) and Mageed (1998) indicated that the levels of nutrients are higher in the first lake than the second one. Mageed (1998) recorded that, the incursion of submerged plants in the first lake and the connecting canal in addition to fertilizers of the drainage water become suitable for flourishing of zooplankton organisms.

Turbidity is one of the most important factors that affect the distribution of Crustacea. Haney and Buchanan (1987) and Schmid – Araya and Zuniga (1992) concluded that water turbidity influences the abundance of Cladocera and Copepoda as the inorganic particles interfered with filter feeding mode. Hart (1990) explained that the high turbidity reduces the standing stock of Cladocera and Copepoda, where it hinders the plankton development. Therefore the number of Crustacea was lowest at the drain.

Harpacticoida was represented by *N. lacustris* and *O.mohammed.* They were recorded only at the shallow areas (drain, connecting canal and station 6 (second lake). This coincided with results of Shebrawy (1993) and Ramadan and Shebrawy (1993). The two species were recorded also from Lake Burollus (Aboul Ezz, 1984), Lake Manzala (Guerguess, 1979), Lake Maruit (Guerguess, 1993), and Lake Idkue (Kiefer, 1978 and Guerguess, 1993). Brown and Schram (1989) reported that Harpacticoids were only sparsely represented in the samples and only collected from tails of canals. Edmondson (1959) concluded that most species of the genus *Nitocra* are benthic and may be found on the bottom or among aquatic vegetation of shallow lakes.

Thermodiaptomus galebi was only the calanoid species recorded in the lakes. Fernando (1980 a and b) stated that the low occurrence of calanoid species is typically of the tropics .The maximum abundance of this species was observed during winter. Verhey and Dumont (1984) stated that *T. galebi* is a typical species of the Nile System. It was observed by El Hawary (1960) in Lake Maruit, Kiefer (1978) in Lake Idku and Mageed (1995) in Lake Nasser.

Cladocera was concentrated at the first lake especially during autumn. *D. excisum* was the most frequent cladoceran species. It was recorded as dominant species in Lake Nasser by Zaghloul (1985), Iskaros (1993) and Mageed (1992 and 1995). The cladoceran *Macrothrix laticornis* was recorded for the first time at El Fayoum depression. It was recorded in the Nile River and its branches by Helal (1981) and Guerguess (1993).

Mc Lachlan (1974) indicated that the development of the lake ecosystem in the newely created lakes falls into three phases. The first lake of Wadi El Rayan may be in the third phase (equilibrium phase) whereas the second lake is still in the first phase (filling phase) which is characterized by drastic changes. Therefore, the aquatic fauna and flora of the second lake are unstable and should be monitored carefully.

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Table 1. Stations of study and their latitude, longitude and depth (m).

Site	Station	Latitude	Longitude	Depth (m)
Drain	1	29° 15' 30"	30° 31' 03"	2
1st Lake	2	43	31	22.4
	3	3 6	0 5	8.5
	4	16 25	27 21	10.8
Conn. cannal	5	13 38	26 28	1.5
2nd Lake	6	12 50	18	5
	7	10 51	57	25.5
	8	10 51	21 55	10.4
	9	09 32	04	7.7
	10	06 44	24 21	6.5

Table 2. Physico chemical parameters of Wadi El Rayan Lakes during 1996- 1997

*Winter Season

	Drain	1st Lake	Conn. Canal	2nd Lake
Air temperature (°C)	21.3	20.7	20.2	16.5
Water temperature (°C)	20.7	19.6	21.0	18.4
PH	7.09	8.50	8.0	8.80
Dissolved oxygen (mg/L)	9.1	10.7	10.5	8.80
Transparency (m)	0.05	2.00	100%	3.50
Photic depth (m)	-	8.9	100%	17.8

*Sprin Season

	Drain	1st Lake	Conn. Canal	2nd Lake
Air temperature (°C)	24.5	25.3	24.0	24.3
Water temperature (°C)	21.9	19.6	21.4	21.5
PH	7.62	8.45	8.02	8.41
Dissolved oxygen (mg/L)	8.6	12.56	9.5	8.5
Transparency (m)	0.10	1.90	100%	3.00
Photic depth (m)	-	8.5	100%	17.0

*Summer Season

	Drain	1st Lake	Conn. Canal	2nd Lake
Air temperature (°C)	31.2	31.8	31.0	28.9
Water temperature (°C)	29.4	28.1	28.2	27.9
PH	7.54	8.13	8.8	8.45
Dissolved oxygen (mg/L)	7.5	9.50	7.5	7.5
Transparency (m)	0.15	1.70	100%	2.6
Photic depth (m)	-	8.9	100%	14.5

*Winter Season

	Drain	1st Lake	Conn. Canal	2nd Lake
Air temperature (°C)	23.0	27.2	25	23.7
Water temperature (°C)	19.6	23.5	22.6	23.5
PH	7.85	8.41	7.98	8.57
Dissolved oxygen (mg/L)	8.8	9.12	9.4	7.2
Transparency (m)	0.10	1.40	100%	4.40
Photic depth (m)	-	8.7	100%	16

Table 3. Average numbers of crustacean organisms (organisms/m^3) and their percentages in Wadi El Rayan Lakes

	Drain		1 st Lake		Conn. Can.		2 nd Lake	
	No	%	No	%	No	%	No	%
A-Cladocera:	1318	30.33	18095	26.93	1403	15.21	3897	45.29
Diaphanosoma excisum	0	0	8067	44.58	148	10.55	3869	99.28
Bosmina longirostris	756	57.36	6530	36.09	944	67.28	10	0.26
Ceriodaphnia quadrangula	56	4.25	3032	16.76	222	15.82	12	0.31
Daphnia longispina	0	0	293	1.62	0	0	2	0.05
D. cucullata	25	1.90	173	0.96	0	0	0	0
Alona rectangula	56	4.25	0	0	89	6.34	2	0.05
Chydorus sphaericus	56	4.25	0	0	0	0	2	0.05
Macrothrix laticornis	194	14.72	0	0	0	0	0	0
Ledigia acanthocercoides	175	13.28	0	0	0	0	0	0
B-Copepoda:	2612	60.12	49107	73.07	7559	81.96	4690	54.50
Thermocyclops neglectus	0	0	4571	84.26	170	32.02	0	0
Megacyclops viridis	56	25.11	138	2.50	83	15.63	0	0
Thermodiaptomus galebi	0	0	715	13.20	0	0	333	96.52
Nitocra lacustris	75	33.63	0	0	139	26.18	6	1.74
Onychocamptus mohammed	92	41.26	0	0	139	26.18	6	1.74
Copepodite stages	78	2.99	12499	25.45	478	6.32	1236	26.35
Nauplius larvae	2311	88.48	31183	63.50	6550	86.65	3109	66.29
C-Ostracoda:	287	6.61	0	0	123	1.32	12	0.14
Cyprideis torosa	287	6.61	0	0	123	1.32	12	0.14

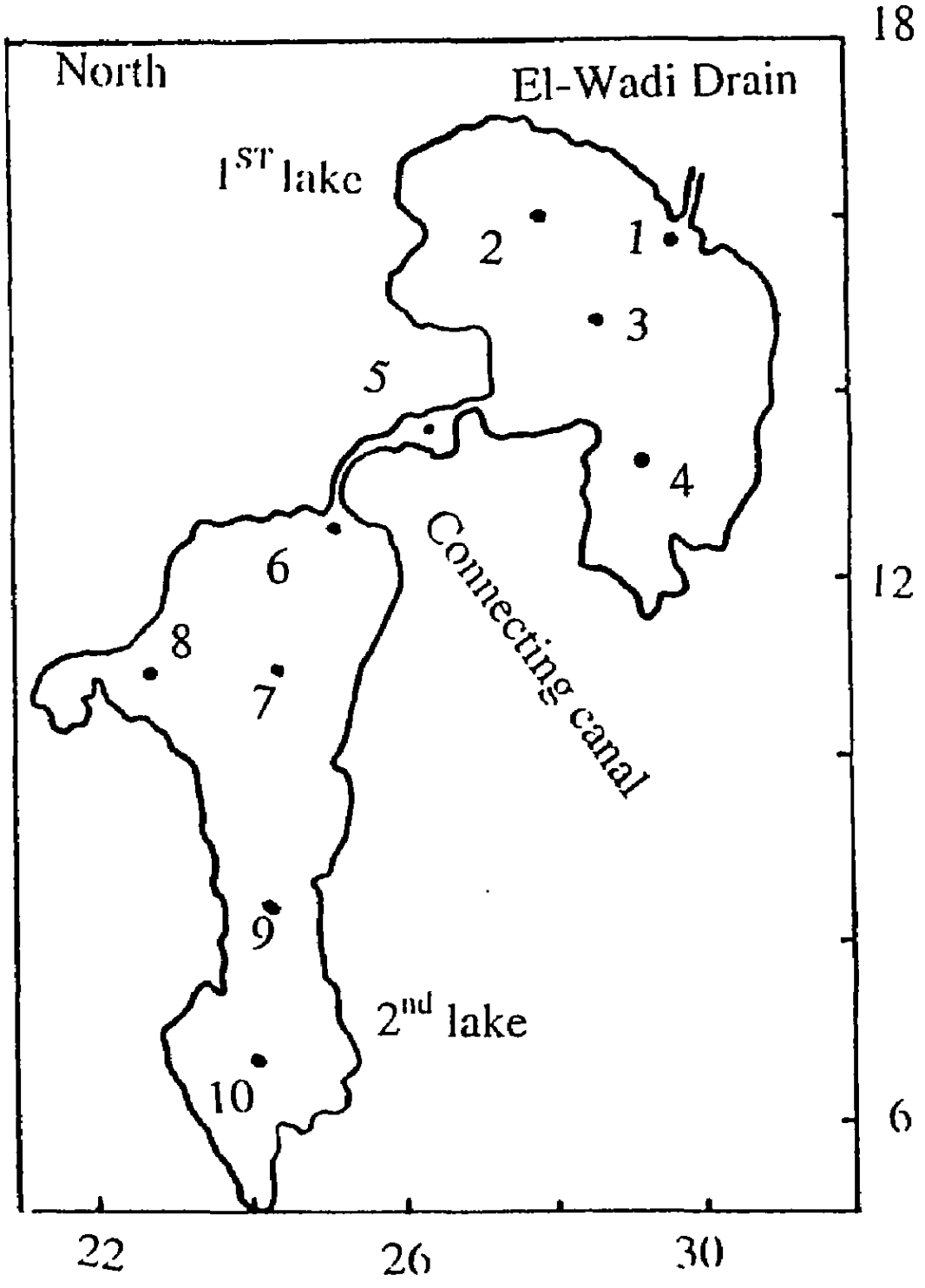
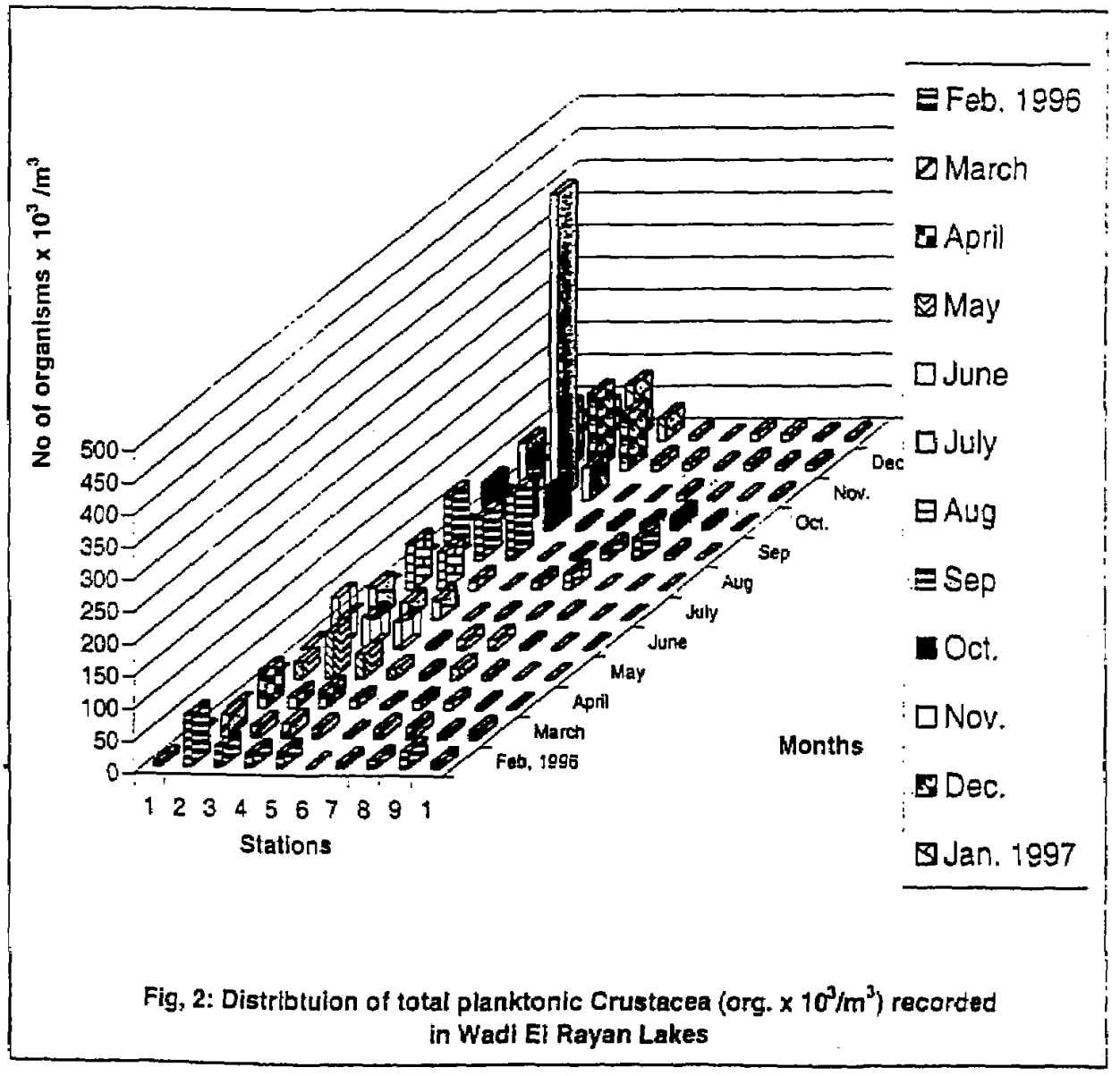


Fig. 1: Showing sits of sampling collection at Wadi El Rayan Laks



Fig, 2: Distribtuion of total planktonic Crustacea (org. x $10^3/m^3$) recorded in Wadi El Rayan Lakes

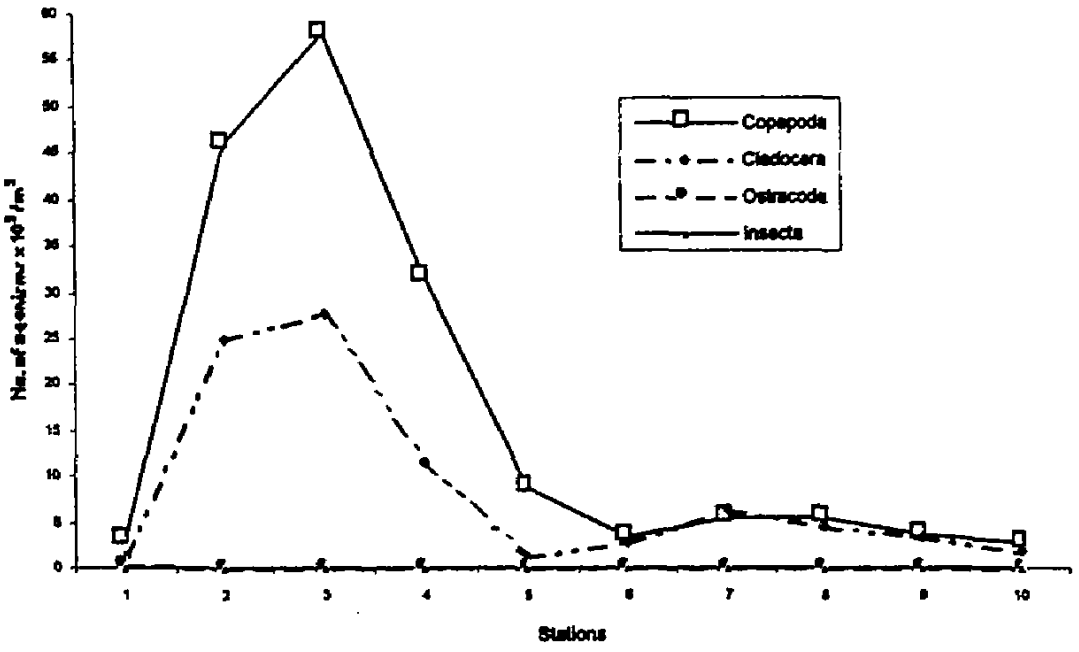


Fig. 3: Distribution of the recorded groups of Crustacea (org.x$10^3/m^3$) at Wadi El Rayan Lakes

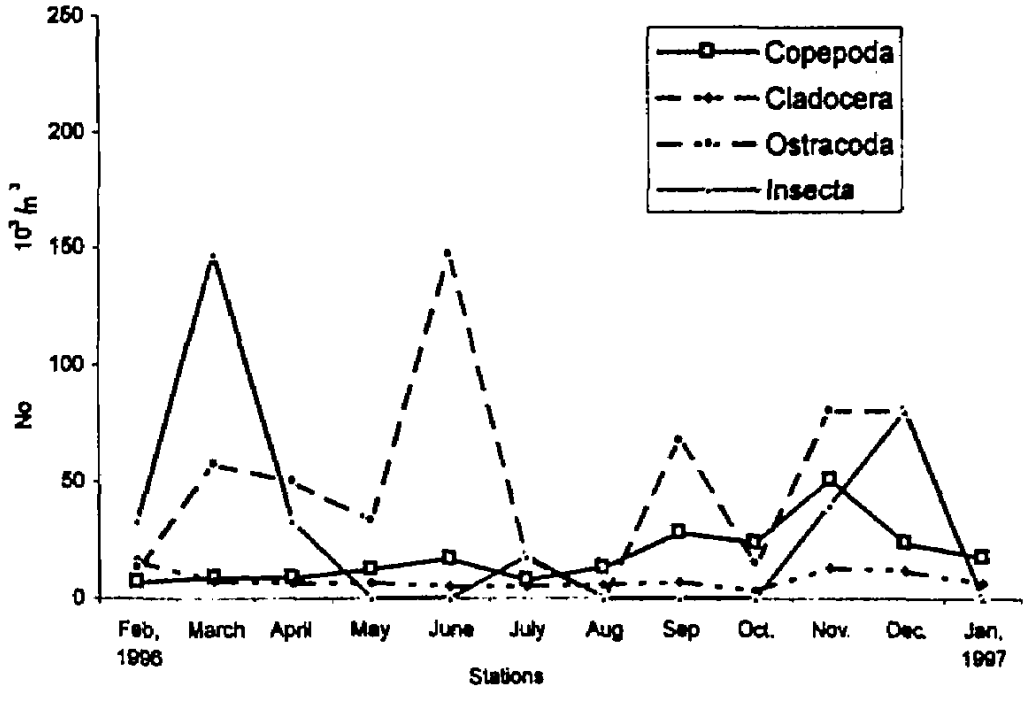


Fig. 4: Monthly variations of the recorded groups of Crustacea(org.x$10^3/m^3$) at Wadi El Rayan Lakes

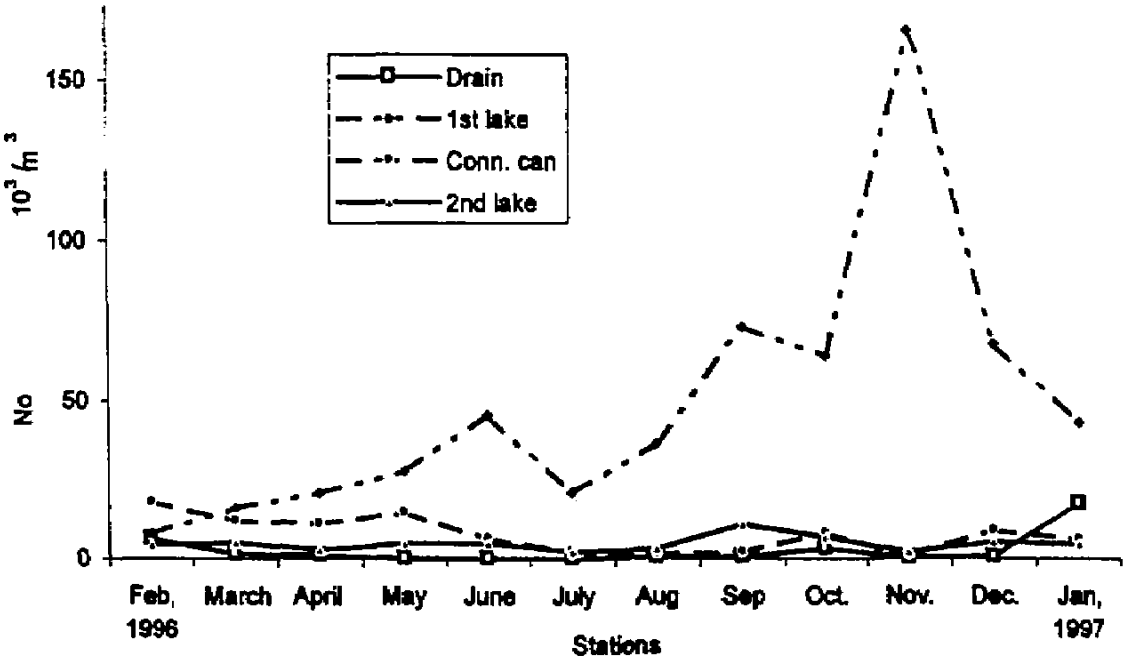


Fig. 5: Distribution of total Copepoda(org.x$10^3/m^3$) at Wadi El Rayan Lakes

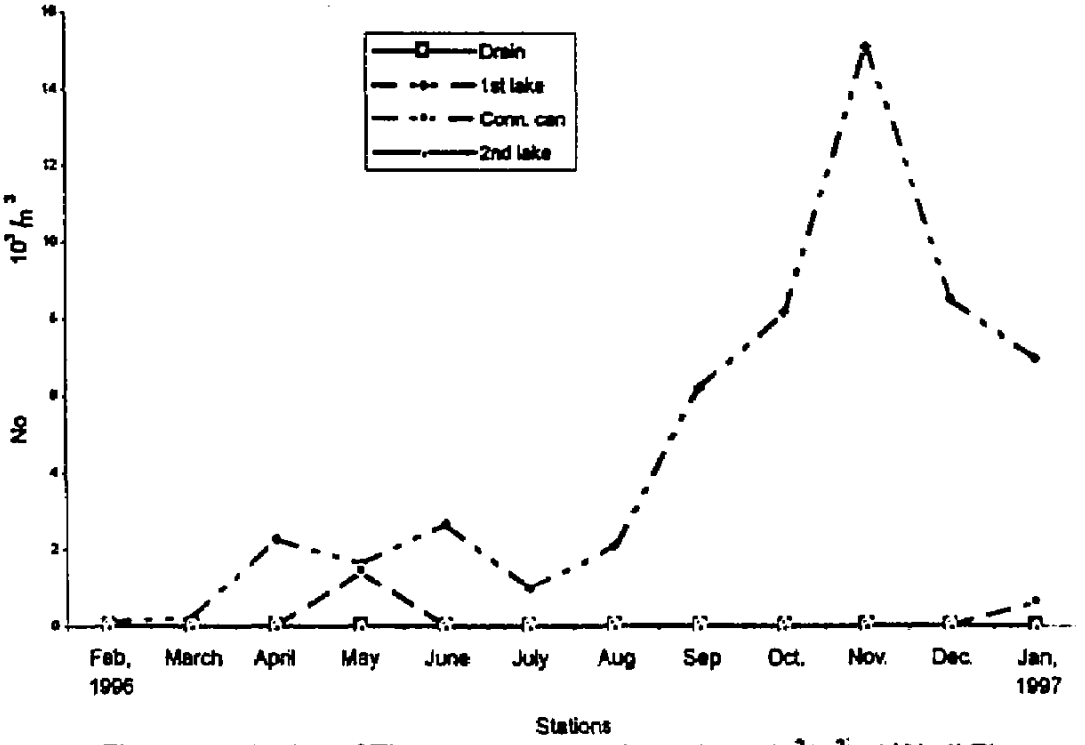


Fig. 6: Distribution of Thermocyclops neglectus(org.x$10^3/m^3$) at Wadi El Rayan Lakes

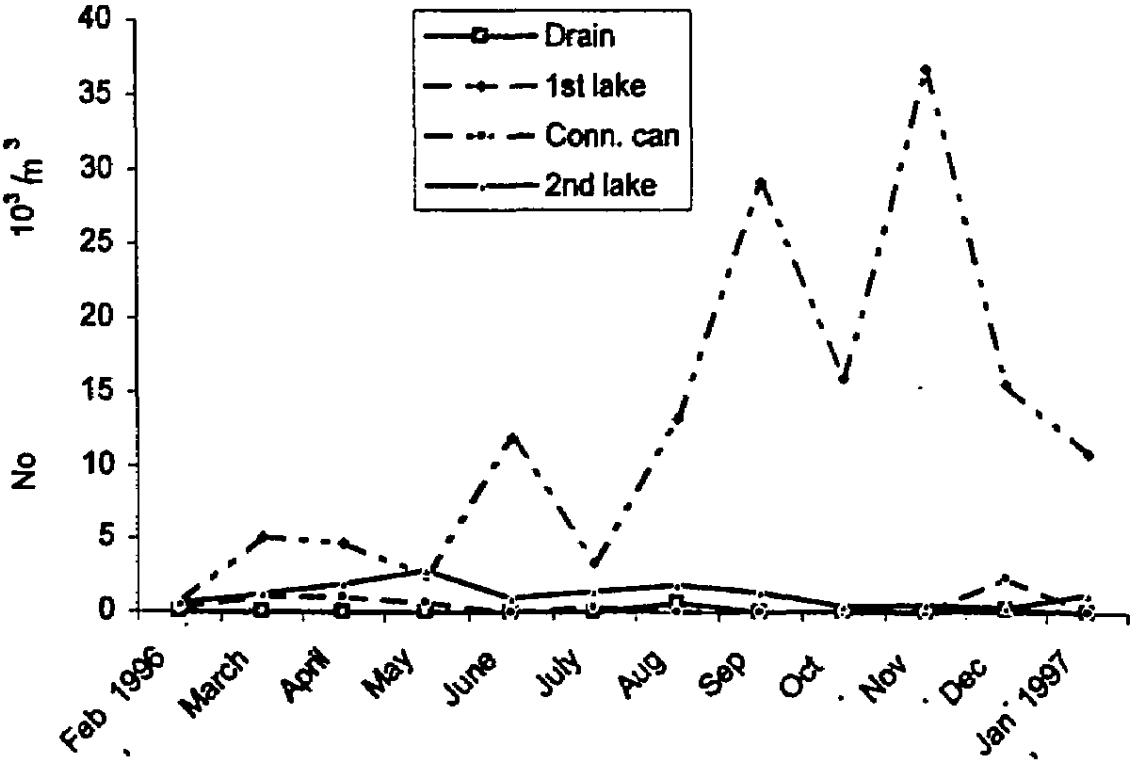


Fig. 7: Distribution of copepodite stages of Copedopda(org.x$10^3/m^3$) at Wadi El Rayan Lakes

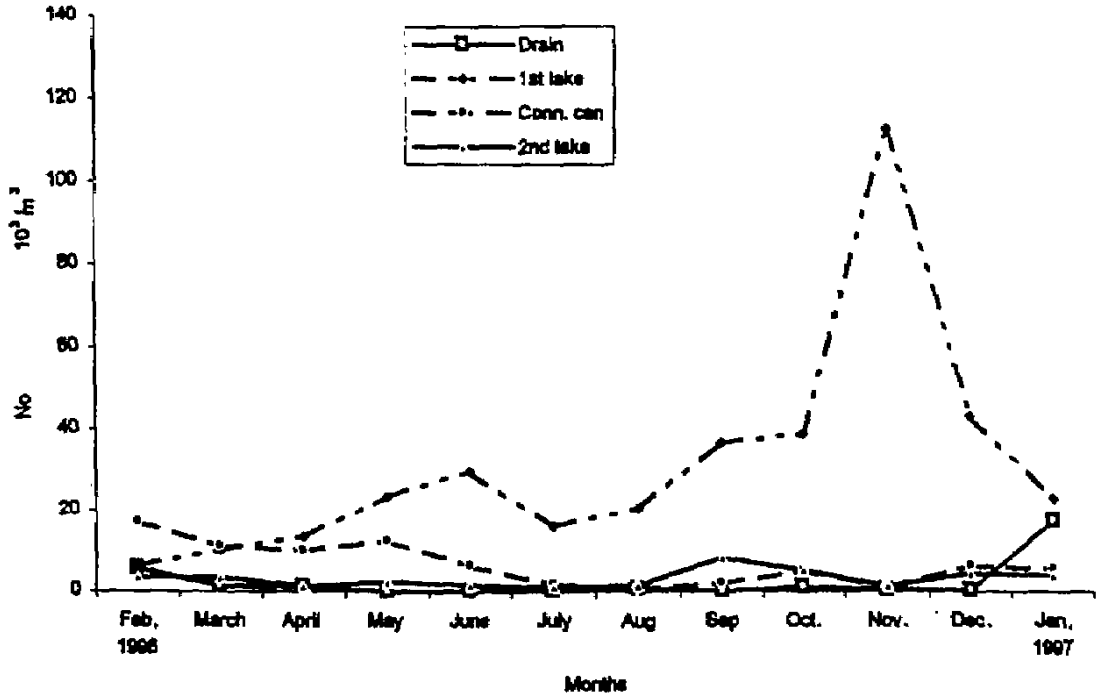


Fig. 8: Distribution of nauplius larvae of Copepoda(org.x10^3/m^3) at Wadi El Rayan Lakes

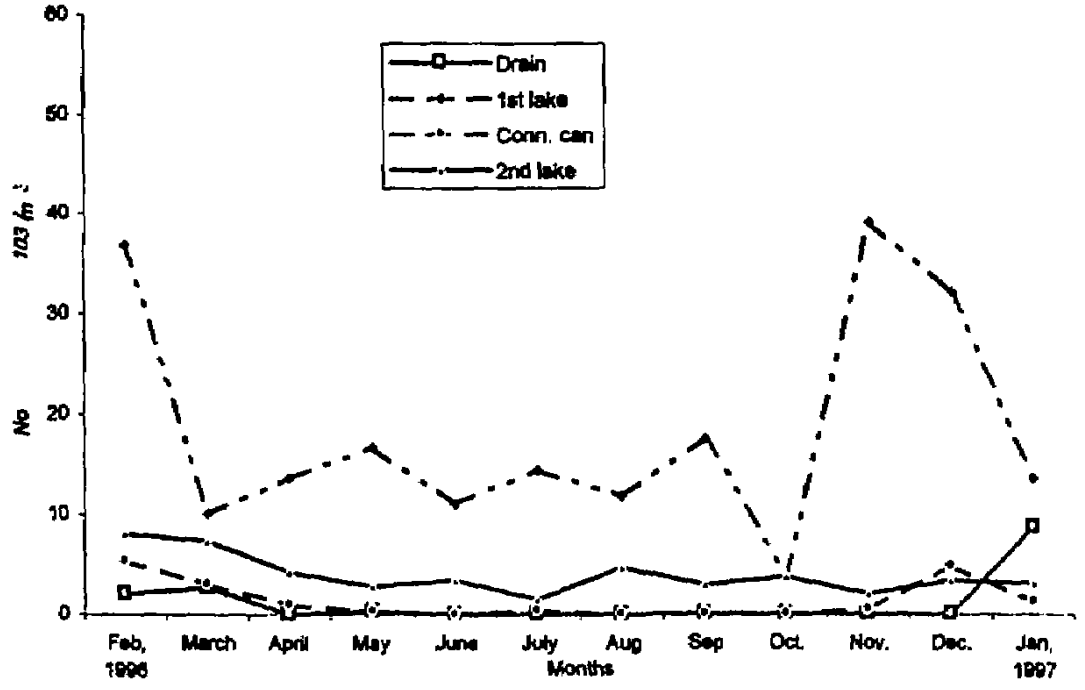


Fig. 9: Distribution of total Cladocera (org.x10^3/m^3) at Wadi El Rayan Lakes

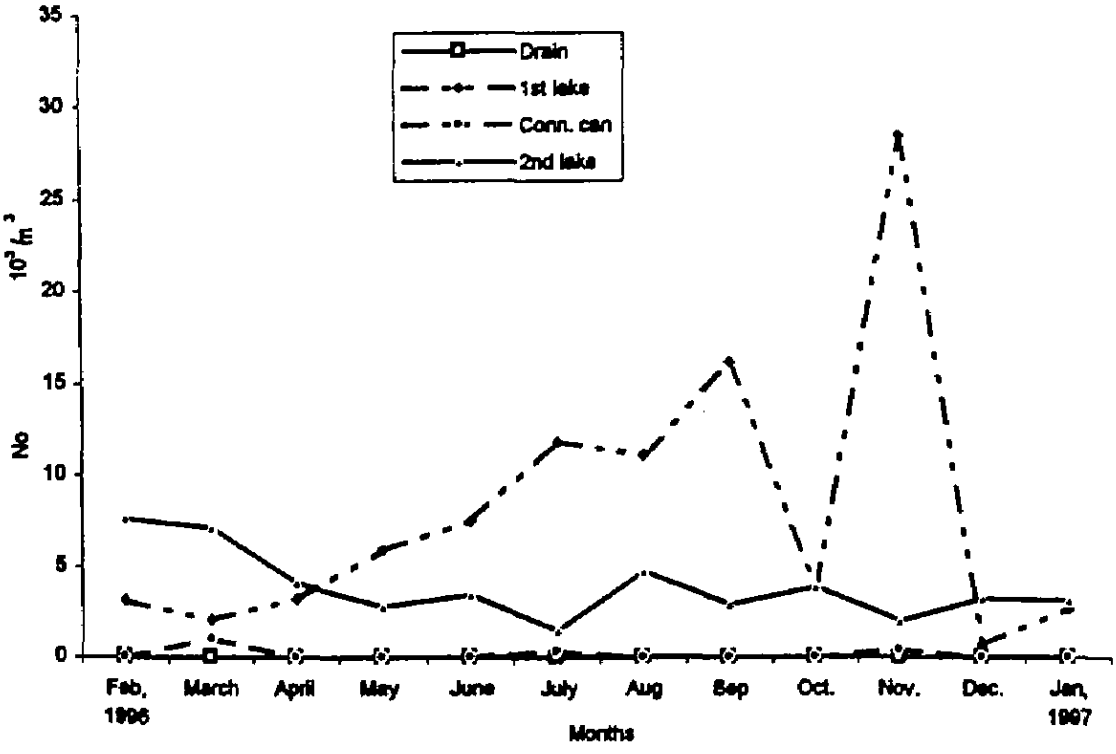


Fig. 10: Distribution of Diaphanosma excisum (org.x$10^3/m^3$) at Wadi El Rayan Lakes