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Seasonal Distribution and Abundance of Small Fish in the South Coast of Lake Qarun, Egypt

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Abstract: The present study deals with seasonal abundance and distribution of small fish in relation to salinity and type of sediment in 8 selected stations in the south coast of Lake Qarun, Egypt. Data showed that, 9 of small fish (*Trachyramphus bicoarctatus*, *Aphanius fasciatus*, *Aphanius dispar*, *Aphanius*spp. (Hybrid), *Atherinaboyeri*, *Atherinomorus lacunosus*, *Pomatoschistus marmoratus*, *Silhouattea egyptia* and *Gambusia affinis*) were recorded at the south coast of Lake Qarun. The values of ecological indices fluctuated within a narrow range between the different stations sampled of the lake indicated a little diversity of small fish in Lake Qarun. The annual abundance of small fish is 1954 individuals/50m^3 in all stations.The pipefish, *T. bicoarctatus*represented 41.81% of all fish. Concerning season, the highest abundance of small fish was recorded during spring (1169) which receives fish fry in this season and recorded the lowest value of salinity with availability of food in nature. Concerning stations, the highest abundance of small fish was recorded atVillage 8 (557), followed by Auop (525) and El-Sobiahy Village (306) Stations. They recorded the sandy type of sediment and increases of salinity. The lowest numbers of fish occurred atNema Island Station (14) which recorded the clay type of sediment and changes in habitats with more turbid water. Results clear that, the changes in salinity and nature of the bottom causes a great deal of disturbance in the evenness of the fish distribution in the lake and not all the groups of fish studied were affected by salinity and nature of the bottom to the same degree.

Key words: Abundance · Distribution · Small Fish · Lake Qarun · Egypt

INTRODUCTION

Lake Qarun constitutes a very important sector in the Egyptian fisheries, for both significant total catch and a large number of economically important species. The lake has an area of about 55000 feddans, snuggling 45 meters below the main sea level into the lowest part of it. Lake Qarun is an enclosed, saline, inland lake and bounded by the West Desert to the North. The southern border of the lake forms the Northern boundary of El-Fayum Governorate, Egypt. The fresh and brackish water discharged into the lake by several drains of El-Fayum irrigation systems. Such water is loaded with wastes, salts and nutrients that may accumulate and contaminate the aquatic environment [1-5].

The fish production in Lake Qarun contributed about 3903 tons of the total inland fish catch [6]. *Mugilcephalus, M. capito, M. saliens, Liza aurata, Soleasolea*and *Tilapia zillii* were the dominant fish species recorded from the lake waters. *Dicentrarchuslabrax*, *Sparus aurata*, *Anguilla anguilla* and *Oreochromis niloticus* are rarely found in the commercial catch. The fry of mullets, sea bass, sea bream and red tilapia were mechanical transport from El-Max station in Mediterranean Sea into this lake [3-5, 7]. The introducing of fish fry from the Mediterranean Sea and other sources causes accidental introduction to other non-commercial species in Lake Qarun such as *Trachyramphus bicoarctatus*,*Aphanius fasciatus*, *Aphanius dispar*, *Aphanius*spp. *(*hybrid), *Atherinaboyeri*, *Atherinomorus lacunosus*, *Pomatoschistus marmoratus*, *Silhouattea egyptia* and *Gambusia affinis* [7].

The small nektonic or epibenthic fish play a very important ecological role as trophic intermediates below the level occupied by larger species of economic importance, feeding the latter or sometimes feeding on

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their young [8]. Up to our knowledge, no specific studies have been conducted on the non-economic fishof Lake Qarun. However, information available on the distribution of small fish in this lake is lacking. Therefore, the present study is conducted to describe the seasonal abundance and distribution of small fish in relation to salinity and type of sediment in the South coast of Lake Qarun, Egypt.

MATERIALS AND METHODS

The Study Area: The study area in this work included the South coast of Lake Qarun, Egypt. Lake Qarun is located about 80 Km southwest of Cairo and lies between longitudes of 30°.41778` & 30°.8275` E and latitudes 29°.44194` & 29°.51111` N in the lowest part of El-Fayum depression. Samples were collected seasonally from 8 stationsselected in the Southern shoreline of Lake Qarun (Table 1 and Fig. 1), during the study period from September, 2012 to August, 2013.The location of each station was determined by using GPS system.

Samples Collection: The water samples were taken below the water surface (About 30 cm) from each station. One liter of water sample bottle was utilized to obtain samples. After collection, water samples were preserved immediately by few drops of chloroform, kept in a cleaned stopper plastic bottle and stored for latter examination. In laboratory, salinity from each station during 4 seasons was determined by using the gravimetric method [9].

Bottom sediment samples were collected from each station by using core sampler at the same time of water collection. After collection, sediment samples were transferred into the laboratory in plastic bags for latter examination. In laboratory, soil texture analysis is done by determining the percentage of sand and clay & silt in each sample [10]. For determination of clay and silt, the pipette analysis method was used [11].

For collection of small fish, a seine net of 5 meters x 1.5 meters with 5ml mesh size was used. The net was dragged 5 times in each station over an area of about 5x10 = 50 m^3 from the beach with an average depth of about 50 cm. Fishes collected within the net were preserved in 10% formalin solution for latter examination. In laboratory, fishes were separated, identified, counted, recorded and photographed. Fish were taxonomically identified, as far as possible up to genera according to Randall [12], Fischer *et al.* [13] and Azab [14].

Data Analysis: Statistical analysis of the ecological indices (Diversity index, Shannon index, Evenness index, Species richness and Similarity index) as well as the graphics of data was conducted by using Microsoft Excel and Primer software, Ver. 5.2 under windows programs.

Table 1: Site location and characters of sampled stations

		Site location			
No	Stations	Longitude (E)	Latitude (N)	Sediment type	Characters
1	Ezbet Abd El-Alim	30.81603°	29.48228°	Muddy with empty shells	Near of pump station, empty shore
2	Nema Island	30.713626°	29.47817°	Gravel and clay	Front of head Nema Island, landfilling shore
3	Shakshouk Village	30.71915°	29.46304°	Mixed of sandy clay with shells	Near of aquatic research station, Urban activity
4	El-Saaida	30.6444°	29.43583°	Muddy	Near of EzbetMezar Drain, sharps plants
5	KahkVillage	30.62584°	29.42484°	Sand with shells	Front of Kahk,sewage Drain
6	El-SobiahyVillage	30.52376°	29.4096°	Mixed of sand and rock	Near of El-Sobiahy Drain, sharps plants
7	Auop	30.4785°	29.41088°	Sand	Near of Tunis Village, crops
8	Village 8	30.41155°	29.44664°	Mixed of sand and mud	Near of Qarun Village, wetland

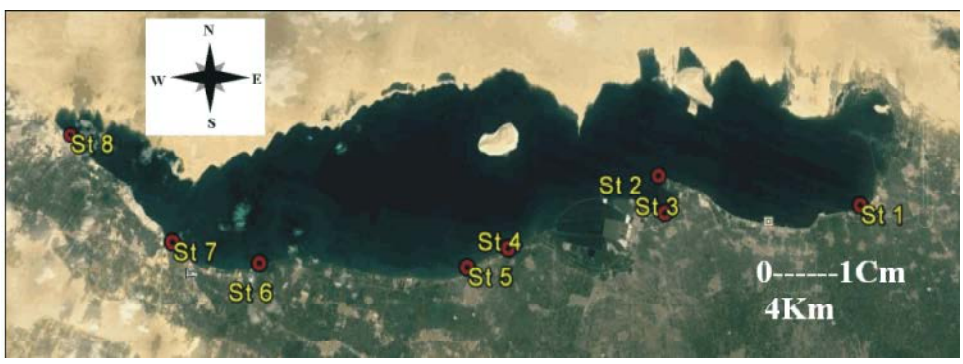

Fig. 1: Map of Lake Qarun showing the 8 stations selected in the study area

RESULTS

Salinity: Data in Table 2 showed that, the annual average value of salinity at the South coast of Lake Qarun is 45.51‰. The highest average value of salinity was recorded during autumn (49.03±15.27‰) and the lowest occurred during spring (42.95±7.75‰). Concerning stations sampled, the maximum annual average value of salinity was recorded atVillage 8 Station (59.20±7.73‰) and the minimum occurred at EzbetAbd El-Alim Station (32.58±12.09‰).

Data in Table 2 showed that, the values of salinity changed during different seasons. During autumn, the highest average value of salinity was recorded at Village 8 Station (67.30 ‰) and the lowest occurred at EzbetAbd El-Alim Station (16.40‰). During winter, the maximum average value of salinity was recorded at Nema Island Station (53.80 ‰) and the minimum occurred at Auop Station (32.60‰). During spring, the highest average value of salinity was recorded at Village 8 Station (55 ‰) and the lowest occurred at Auop Station (35‰). During summer, the maximum average value of salinity was recorded at Village 8 Station (63.90 ‰) and the minimum occurred at EzbetAbd El-Alim Station (32.70‰).

Sediment Analysis: Data in Table 3 showed that, out of the 8 examined stations, 4 were sandy in nature (EzbetAbdEl-Alim, Shakshouk Village, Auop and Village 8). Meanwhile, 2 stations (Kahk and El-SobiahyVillages) were sandy gravel in nature. On the other hand, 2 stations (Nema Island and El-Saaida) were clay in nature.

Small Fish Fauna: Data in Table 4 showed that, 9 species of the adult small fish belong to 9 genera from 5 different families were counted from theSouth coast of Lake Qarun. The collected species included the pipefish, *Trachyramphus bicoarctatus*; three tooth carp species, *Aphanius fasciatus*, *Aphanius dispar* and theirhybrid; two silverside species, *Atherina boyeri* and *Atherinomorus lacunosus*; two goboid fishes, *Pomatoschistus marmoratus* and *Silhouattea egyptia* and mosquito fish, *Gambusia affinis* (Fig. 2).

Annual Abundance: Data in Table 4 and Figure 3 showed that, the annual abundance of small fish is 1954 individuals/50m^3 in all stations. The pipefish, *Trachyramphus bicoarctatus* is abundant specimens (817); they represent about 41.81%. The tooth carp species, *Aphanius fasciatus* (417), *Aphanius dispar* (382)and their hybrid (119) amounted to 918 specimens, representing 46.98% slightly less than half percentage of all the collected fish. The silverside species, *Atherina boyeri* (99) and *Atherinomorus lacunosus* (25) amounted to 124 specimens, representing 6.35% of the total catch. The goboid fish, *Pomatoschistus marmoratus* (52) and *Silhouattea egyptia* (19) amounted to 71specimens, representing 3.63% of all fish. The mosquito fish, *Gambusia affinis* amounted to 24 specimens, representing 1.23% of all fish.

Seasonal Abundance: Data in Table 4 and Figure 4 showed that, the abundance of individuals varied considerably from season to season. The highest abundance of fish/50m^{3}was recorded during spring (1169) and the lowest (119) occurred during winter. During summer and autumn, the abundance of fish are nearly similar, being 332 and 334 respectively. The maximum number of *Trachyramphus bicoarctatus* (707) was recorded during spring and the minimum (10) occurred during winter. The lowest number of *Aphanius fasciatus* was recorded during winter (23). It increased gradually during spring (123) and reached to the highest number (223) occurred during summer. The highest number of *Aphanius dispar* (220) was recorded during spring and the lowest (3) occurred during summer. The maximum number of *Aphanius*hybrid (56) was recorded during summer and the minimum (18) occurred during autumn. It was entirely absent during winter.

The highest number of *Atherinaboyeri* (89) was recorded during spring and the lowest (1) occurred during winter.*Atherinomorus lacunosus* was entirely absent during autumn and winter and recorded by little number in spring (14) and summer (11). The maximum number of *Pomatoschistus marmoratus* (37) and *Silhouattea egyptia* (16) were recorded during winter and the minimum 2 & 1 respectively occurred during spring. It were entirely absent during summer. The lowest number of *Gambusia affinis* (2) was recorded during winter and spring. It increases gradually during summer (8) and reached to the highest number (12) occurred during autumn.

Distribution: Data in Table 5 and Figure 5 indicated that, the highest abundance of small fish / 50m^3 was recorded atVillage 8 (557), followed by Auop (525) and El-Sobiahy Village (306) Stations and the lowest occurred atNema Island Station (14). The abundance of fish varied considerably from station to station. The maximum number of *Trachyramphus bicoarctatus* (404) was recorded at Auop Station and the minimum (4) occurred atNema Island Station. The lowest number of *Aphanius fasciatus* was recorded at Shakshouk Village

Table 2: Seasonal variations of water salinity (S‰) at the South coast of Lake Qarun during the period from September 2012 to August 2013

	Stations								
Seasons	1	2	3	4	5	6	7	8	Mean±SD.
Autumn	16.4	50.6	45.3	42.6	57.4	56.2	56.4	67.3	49.03±15.27
Winter	45.5	53.8	36.2	49.4	40.4	51.6	32.6	50.6	45.01± 7.79
Spring	35.7	48.1	46.3	36.4	37.3	49.8	35	55	42.95± 7.75
Summer	32.7	45.7	35.7	41.7	42.6	56.5	41.5	63.9	45.04±10.40
Mean± SD	32.58±12.09	49.55±3.47	40.87±5.70	42.52±5.34	44.42±8.92	53.53±3.35	41.37±10.70	59.20±7.73	45.51

Table 3: Sediment analysis in stations at the South coast of Lake Qarun during the period from September 2012 to August 2013

		Component					
No	Stations	Gravel	Shells	Sand	Silt	Clay	Types of sediment
1	EzbetAbd El-Alim	0.00	30	68.5	0.39	1.11	Sand + shells
2	Nema Island	0.00	0.00	0.00	1.24	98.76	Clay
3	Shakshouk Village	0.00	11.6	88.2	0.00	0.2	Sand + shells
4	El-Saaida	0.00	0.00	0.00	0.00	100	Clay
5	KahkVillage	29.8	20.2	50	0.00	0.00	Sand + shells + gravel
6	El-SobiahyVillage	24	0.00	76	0.00	0.00	Sand + gravel
7	Auop	0.00	11.4	88.6	0.00	0.00	Sand + shells
8	Village 8	0.00	0.00	97	0.00	3	Sandy clay

Table 4: Seasonal abundance/50m^3 of small fish species in 8 stations at the South coast of Lake Qarun during the period from September 2012 to August 2013

		Seasons					
No	Species	Autumn	Winter	Spring	Summer	Total	%
1	*Trachyramphus bicoarctatus*	89	10	707	11	817	41.81
2	*Aphanius fasciatus*	48	23	123	223	417	21.34
3	*Aphanius dispar*	129	30	220	3	382	19.55
4	*Aphanius* hybrid	18	0.00	45	56	119	6.09
5	*Atherina boyeri*	23	1	55	20	99	5.07
6	*Atherinomorus lacunosus*	0.00	0.00	14	11	25	1.28
7	*Pomatoschistus marmoratus*	13	37	2	0.00	52	2.66
8	*Silhouattea egyptia*	2	16	1	0.00	19	0.97
9	*Gambusia affinis*	12	2	2	8	24	1.23
Total		334	119	1169	332	1954	100

Table 5: Abundance/50m^3 and distribution of small fish species in 8 stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

		Stations								
No	Species	1	2	3	4	5	6	7	8	Total
1	*Trachyramphus bicoarctatus*	142	4	50	20	113	71	404	13	817
2	*Aphanius fasciatus*	27	-	10	17	28	94	45	196	417
3	*Aphanius dispar*	1	1	1	1	1	77	2	298	382
4	*Aphanius* hybrid	3	1	3	26	15	24	10	37	119
5	*Atherina boyeri*	2	4	4	-	20	13	47	9	99
6	*Atherinomorus lacunosus*	3	-	4	1	17	-	-	-	25
7	*Pomatoschistus marmoratus*	-	1	2	9	7	16	17	-	52
8	*Silhouattea egyptia*	-	1	7	1	3	7	-	-	19
9	*Gambusia affinis*	3	2	4	5	2	4	-	4	24
Total		181	14	85	80	206	306	525	557	1954

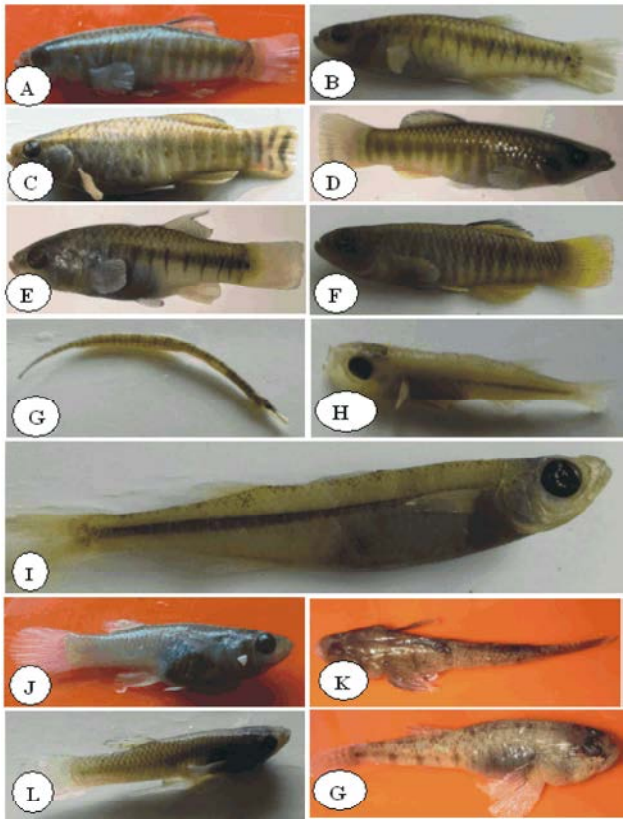

Fig. 2: A-Male of*Aphanius fasciatus*, B-Female of *Aphanius fasciatus* C- Male of *Aphanius dispar*, D- Female of *Aphanius dispar*, E- Male of *Aphanius hybrid*, F- Female of *Aphanius hybrid*, G- *Trachyramp husbicoarctatus*, H- *Atherinaboyeri*, *I- Atherinomorus lacunosus*, J- Female of *Gambusia affinis*, K- *Silhouattea egyptia*, L- Male of *Gambusia affinis* and M- *Pomatoschistus marmoratus*

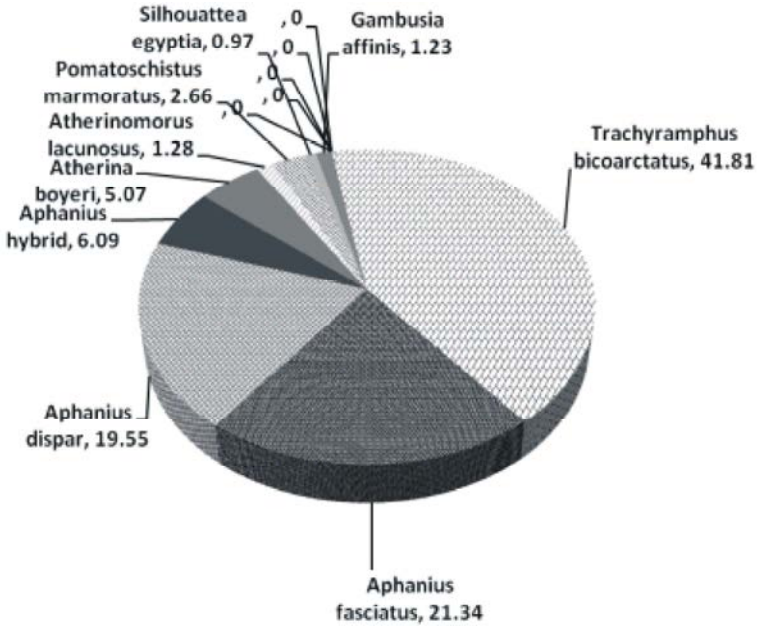

Fig. 3: Annual percentage abundance/50m^3 of small fish species in 8 stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

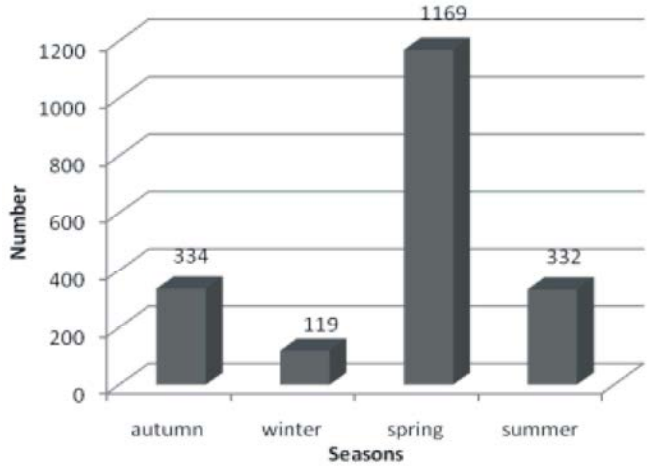

Fig. 4: Seasonal abundance/50m^3 of small fish species in 8 stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

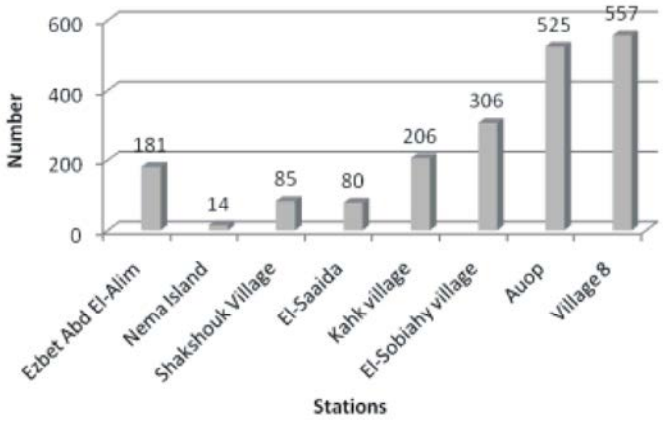

Fig. 5: Abundance/50m^3 of small fish species in 8stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

Station (10) and the highest (196) occurred at Village 8 Station. It was entirely absent at Nema Island Station. The highest number of *Aphanius dispar* was recorded at Village 8 Station (298), followed byEl-Sobiahy Village Station (77) and the lowest (1) occurred at remnant stations. The maximum number of *Aphanius*hybrid (37) was recorded at Village 8 Station and the minimum (1) occurred at Nema Island Station.

The highest number of *Atherinaboyeri* (69) was recorded at Auop Station and the lowest (2) occurred at EzbetAbd El-Alim Station. It was entirely absent at El-Saaida Station. *Atherinomorus lacunosus* was entirely absent at EzbetAbd El-Alim, El-SobiahyVillage, Auop and Village 8 Stations and recorded by little numbers in remnant stations. The maximum number of *Pomatoschistus marmoratus* (17) was recorded atAuop Station and the minimum (1) occurred at Nema Island Station. It was entirely absent atEzbetAbd El-Alim and Village 8 Stations. *Silhouattea egyptia* was entirely absent at EzbetAbd El-Alim, Auop and Village 8 Stations and recorded by little numbers in remnant stations. *Gambusia affinis* was entirely absent at Auop Station and recorded by little numbers in remnant stations.

Ecological Indices: Statistical analysis in table 6 showed that, the highest diversity (9) was recorded at Shakshouk and KahkVillage Stations and the lowest (6) occurred at Auop and Village 8 Stations. Species richness fluctuated between0.79 at Auop and Village 8 Stations and 2.27occurred at Nema Island Station. The maximum values of Simpson Index, Shannon Index and Evennes Index were recorded at EzbetAbd El-Alim Station and the minimum occurred at Nema Island Station, being 0.36, 0.76&0.39 in the former and 0.86,1.75&0.90in the latter. All these indices indicated a little diversity of small fish in Lake Qarun. Similarity Index between the different stations

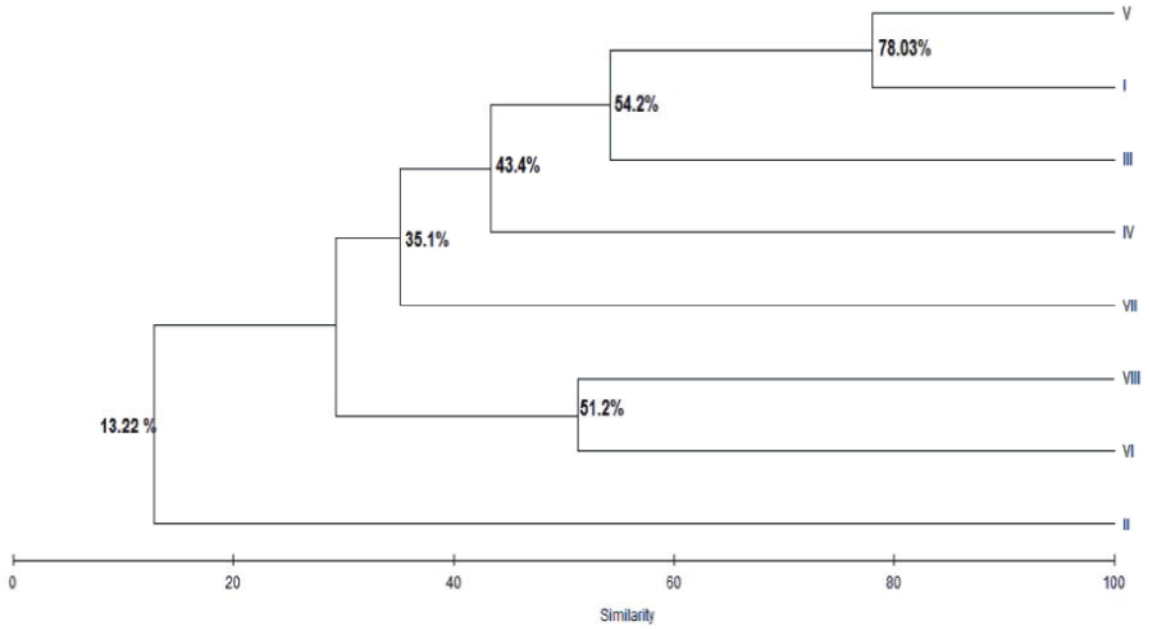

Fig. 6: Dendrogram showing the similarity of small fish in 8 stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

Table 6: Diversity indices of small fish species in 8 stations at the south coast of Lake Qarun during the period from September 2012 to August 2013

		Indices				
No	Stations	Diversity	Species Richness	Simpson	Shannon	Evenness
1	EzbetAbd El-Alim	7	1.15	0.36	0.76	0.39
2	Nema Island	7	2.27	0.86	1.75	0.90
3	Shakshouk Village	9	1.80	0.63	1.45	0.66
4	El-Saaida	8	1.59	0.78	1.62	0.78
5	KahkVillage	9	1.50	0.66	1.47	0.67
6	El-SobiahyVillage	8	1.22	0.78	1.68	0.81
7	Auop	6	0.79	0.39	0.83	0.47
8	Village 8	6	0.79	0.58	1.07	0.60

Table 7: Similarity Index of small fish in 8 stations at the south coast of LakeQarun during the period from September 2012 to August 2013

Stations	Village 8	Auop	El-SobiahyVillage	KahkVillage	El-Saaida	Shakshouk Village	Nema Island	EzbetAbd El-Alim
EzbetAbd El-Alim	13.28	49.57	43.94	78.04	34.48	54.14	10.25	-
Nema Island	4.20	4.08	8.75	12.73	21.28	28.28	-	
Shakshouk Village	10.90	22.95	41.43	54.30	50.91	-		
El-Saaida	19.15	18.84	39.38	44.75	-			
KahkVillage	17.82	48.97	54.69	-				
El-SobiahyVillage	51.22	37.78	-					
Auop	14.60	-						
Village 8	-							

sampled showed that, the highest similarity (78.03%) was recorded between EzbetAbd El-Alimand Kahk Stations. The lowest similarity nearly 4 occurred between Nema Island and Auop&Village 8 Stations. At the majority of stations sampled, similarity was fluctuated between 10.26% - 54.29% (Table 7).

Results of the cluster analysis of similarity between stations are represented in dendrogram (Fig. 6). The analysis of data showed that, the stations are separated into two major clusters. The first cluster separates Nema Island Station and recorded the lowest similarity (13.22%) with the remnant stations. The second cluster includes

two major sub-clusters, the first comprising El-Sobiahyand Village 8 Stations with similarity (51.2%) between them. The second contain overlapping between stations. The highest similarity (78.03%) was recorded betweenEzbetAbd El-Alim and Kahk Stations.

DISCUSSION

Lake Qarun constitutes a very important sector in the Egyptian fisheries, for both significant total catch and a large number of economically important species. A small fish has rendered various species useful to man in other respects such as mosquito control, domestic aquaria, experimental animal and above all as indicators for environmental conditions of the lakes. The south coast of Lake Qarun is bounded by irrigation systems which discharge the fresh and brackish waters into the lake by several drains. The drainage waters heavily loaded with wastes, salts and nutrients that causing in blooming of phyto and zooplankton for feeding of small fish [1, 3, 7, 15]. The present study was done on the south coast of the lake, where small fish aggregate for feeding.

In the present study, 9 of small fish species were recorded at the south coast of Lake Qarun. Among these 5 were nonnative species and represent 55.56% (*Atherinaboyeri*, *Atherinomorus lacunosus*, *Pomatoschistus marmoratus*, *Silhouattea egyptia* and *Gambusia affinis*). Four species were native and represent 44.44% (*Trachyramphus bicoarctatus*, *Aphanius dispar*, *Aphanius fasciatus* and their hybrid). These indicate disturbances in the lake; similar results were obtained from Hassan and Schaeffer *et al.* [3, 16] who found that, the decrease in native fish species was associated with the ecosystem disturbance. Also, a dominance of nonnative species is indicative of lake ecological degradation [17].

In the present study, the highest diversity (9) was recorded at Shakshouk and Kahk Village Stations and the lowest (6) occurred at Auop and Village 8 Stations. The highest similarity (78.03%) was recorded between EzbetAbd El-Alim and Kahk Stations. It may be attributed to the presence of urban activities in Shakshouk station and sandy sediment in KahkVillage Station. The cluster analysis of similarity showed that, the first cluster separates Nema Island Station and recorded the lowest similarity (13.22%) with the remnant stations. It may be due to the clay type of sediment and changes in structure of habitats by land filling shore with more turbid water. Mohsin *et al.* [18] mentioned that, the reduction in number and abundance of fish species is mainly due to anthropogenic impacts, especially the fishing pressure, destruction ofnatural habitats by constructing roads and so on.

In the present study, the species richness fluctuated between 0.79 at Auop and Village 8 Stations and 2.27 occurred at Nema Island Station. Similar to the species richness, all ecological indices also, showed values fluctuating within a narrow range between the different stations sampled of the lake. Hence, essential variations of diversity among the different stations of the lake are not exist. These results demonstrate that, the diversity of the lake is poorly proportion to large area which reach 55000 feddans. These results also indicate that, unstable in the ecosystem of the lake. The decline of species within the sources of fauna may lead to restriction of the diversity in receiver system. Therefore, Mediterranean Sea counts one of the important sources which accidentally supply the lake with non-commercial fishes by stacking with fish fries. Also, drains act as second source which supply the lake with some of non-commercial fish [3]. Also, the introducing of fish fry to Lake Qarun from the Mediterranean Sea and other sources causes accidental introduction of other non-commercial fish species [7]. This was also evident in the present study.

These fishes included *A. fasciatus*, *A. dispar* and their hybrid; *T. bicoarctatus* and *A. boyeri*. These fishes start to be acclimatized within the lake and form stable populations which will share the food resources with the other species. *A. lacunosus*, *P. marmoratus*, *S. egyptia* and *G. affinis* were entirely absent at some stations and recorded by little numbers in remnant stations. It may be due to these species is non-endemic in the lake. The changes in environmental conditions and habitats were unstable for living of these fishes. This was also evident in the present study. Meanwhile, some of these fishes could cause a problem in the fish farms in the lake coast if it penetrates the farm with the water [7].

The distribution pattern of animals in any ecosystem evolves as the end product of an evolutionary process under environmental conditions. As well as, the abundance and distribution of small fish affected by the changes in environmental factors such as salinity and type of sediment. Salinity is one of the important factors that effects on the faunal composition, distribution and diversity in many aquatic ecosystems [3, 19]. In the present study, the highest average value of salinity in the south coast of Lake Qarun was recorded during autumn (49.03±15.27‰) and the lowest occurred during spring (42.95±7.75‰). These results do not agree with that obtained by Khalaf–Allah [2], Ghanem [4], Ghanem [5],

Sabae [15], Goher [20] and Abdel-Mageed [21]. This controversy might be due to the limitation of the present study on the south coast of Lake Qarun only. Salinity of waters in Lake Qarun increased with increasing time. It is generally affected by three main factors: amount of drained waters, rate of evaporation and the meteorological parameters of these areas (Winds, humidity, rains,etc.) [2, 4, 20, 22].

In the present study, the highest abundance of small fish was recorded during spring (1169). It may be due to the introducing of fish fry transplantation from the Mediterranean Sea during this season and the water temperature increase with availability of food in nature. The highest abundance of small fish was recorded atVillage 8 (557), followed by Auop (525) and El-Sobiahy Village (306) Stations, which recorded the sandy type of sediment and increases of salinity. The lowest abundance of small fish occurred atNema Island Station (14) which may be attributed to the landfilling at head of Nema Island causes the changes in structures of habitats and the water is highly turbid.

In the present study, the maximum number of pipefish, *Trachyramphus bicoarctatus* in all stations (707) was recorded during spring. This may be due to the spawning time of *T. bicoarctatus*in winter. The maximum number of *T. bicoarctatus* (404) was recorded at Auop Station, because the bottom in this station was formed of sandy type. The major factor which seems to effect on the distribution of the fry and young of *Soleasolea* is the nature of the bottom and availability of the suitable food. The fry and young of *S. solea*are most abundant on sandy-silty bottom and at least abundant on silty-clay bottom [23, 24].

Seasonal changes in the abundance of individuals in genus *Aphanius* reflect the combined action of young recruitment to the adult population, mortality and seasonal migration of adults. In the present study, it was found that, *Aphanius fasciatus* are abundant during summer (223) due to the influx of young to the adult population during spring. However, the sharp decline in abundance during winter (23) was neither a result of low temperature nor a result of changes in water salinity. This species is able to tolerate varies of environmental conditions. The same result was confirmed byAzab [8, 14].

The distribution of genus *Aphanius*give rise to different hypotheses on the origin and evolution of its species [14, 25]. Genus *Aphanius* may be defined as marine ancestors. It well understands that they are able to tolerate special conditions of saline's, ponds and lakes within dry areas. Genus *Aphanius* also has to tolerate a wide range of day and night differences in temperature. These specialized in tolerance of environmental conditions, because the distribution of different *Aphanius* species has a natural situation [14, 26]. In the present study, the highest number of genus *Aphanius*was recorded at village 8 Station which recorded the highest value of salinity (59.2±7.73‰). The most limiting factor in the distribution of genus *Aphanius* is the salinity which ranges from 2.2‰ to 55‰ and bottom texture are either sandy or muddy [8, 14].

Ecologists increasingly recognize that their choice of spatial scales may influence greatly their interpretation of ecological systems that small changes in the patchiness of habitat resources can produce abrupt, sometimes dramatic shifts in abundance and distribution patterns of a species. This was quite clear in our study of small fish species diversity of Lake Qarun, where the change even in salinity and nature of the bottom cause a great deal of disturbance in the evenness of the fish distribution or in other ward affect the equitability of the distribution within the lake environment. The same results were also reported by Zaid[7], Bishai and Kirollus [23] and Eggleston *et al.* [27].

In the present study, it was also clear that, not all the groups of studied fish were affected by salinity and nature of the bottom to the same degree. The same results were also reported byZaid [7] and Perkins-Visser*et al.* [28] where they stated that, small micro-fauna were more sensitive to habitat patchiness than large macro-fauna and most macro-fauna were more sensitive to patchiness in certain habitat.

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