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Comparative study of fish larval communities in north and south part of Shatt Al-Arab River

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Abstract

Ichthyoplankton sampling was conducted at two stations in north and south part of Shatt Al-Arab River, during January to December 2012. A total of 2709 fish larvae were collected using conical plankton net (mesh size 300µm). Five families (Mugilidae, Cyprinodontidae and Cyprinidae, Cichlidae, and Clupidae) of fish larvae were identified at Station1, while station 2 eight families (Gobiidae, Engraulidae, Sciaenidae, Soleidae, Clupeidae, Polynemidae, Bothidae and Cynoglossidae) of fish larvae were identified. The highest abundance of fish larvae occurred in May (145.17 larvae/10m^2) at station 1, but station 2 in March(67.46 larvae/10m^2).Water temperature showed a significant positive correlations with the number of fishes larvae families (r =0.664, r= 0.830, $p < 0.05$ respectively) and with the total abundance of fish larvae at stations 1and 2 (r = 0.315, r= 0.470, $p < 0.05$ respectively). The salinity showed negative correlations with number of fishes larvae families and with abundance at station 1(r = -0.165, r = -0.700,$p < 0.05$ respectively), station 2 showed a significant positive correlations(r = 0.894,0.520, r= $p < 0.05$ respectively). Ecological indices were as follows: The highest value of diversity was in May (0.32) at station 1, while stations 2 in September (0.82), recorded highest evenness (0.42) in September at station 1, but (0.53) in October at station 2, and a peak of richness was apparent at station 1 during June (0.76), station 2 the highest value was (0.99) recorded in April. It seems that the lower reaches of Shatt Al-Arab River more diversity comparative with upper reaches of Shatt Al-Arab River, and plays a role as a spawning, feeding and nursery ground for fish larvae of freshwater and estuary species.

Key words: Shatt Al-Arab, fish larval, ichthyoplankton, abundance.

Introduction

Studies on community of Ichthyoplankton is considered an important on interrelationships between fish species during their early life stages, as well as an understanding of adult spawning patterns, locations of fish spawning sites, timings of peak spawning (Brander,1994; Cushing,1990; Nonaka *et al.*, 2000). Larval fish distributions may provide insight on the factors influencing

recruitment dynamics such as the location and suitability of spawning habitat (Parker & Franzin 1991; Donald, 1997)

Larval fish densities can also be used to estimate abundance index that when correlated to fisheries yield provides an alternative approach for measuring the size of the spawning stock (Smith & Richardson, 1977).

Several marine fish species move to the mouth and upper shallow parts of Shatt Al-Arab River (Hussain *et al .,* 1999; Hussain *et al*., 2006; Mohamed *et al.,* 2007 and lazem, 2009) because it provides food resources, shelter, absence of turbulence, and a reduced risk of predation (Al-Mahdi *et al*., 2000; Al-Okailee, 2010).

The Comparative of fish larval communities in north and south part of Shatt Al-Arab River studies are scarce and limited to that of the Al-Mahdi *et al*. (2000) stated that the northern part of Shatt Al-Arab was a spawning, nursery and feeding ground for larvae of fresh water and marine fishes. Al-Okailee (2001) determined the abundances and distribution of fish eggs and larvae in Shatt Al-Arab estuary in northwest Arabian Gulf. Al-Okailee (2010) determined the spatial and seasonal composition of some Ichthyoplankton and trophic relationships in north part of Shatt Al-Arab River.

This research aimed to determine the structure of the fish larval communities in northern and southern part of Shatt Al-Arab River, taking into consideration their relative abundance, the monthly changes in ecological indices (diversity index (H), Evenness index (J), Richness index (D)) between sampled months coupled with the effects of environmental factors like water temperature and salinity.

MATERIALS AND METHODS

Shatt Al-Arab River is formed by the confluence of the Tigris and Euphrates rivers at Qurna, flows southeastern direction to open in the Arabian Gulf. The total length of the Shatt al-Arab River is about 196 km; the width varies from 400 to 1500 m at the estuary of the Shatt Al-Arab (Al-Wuhaily, 2009), The depth of the channel is changing from one place to the other with maximum depth 24 m, while the minimum depth (6 m) nears the island of Al-Shmshomea (Mohammed *et al*., 1999). The water level is affected by the high and low tides of the Gulf. Hundreds outlets in the form of small rivers and canals are found on both sides of Shatt Al-Arab.

The present study was carried bimonthly for period January to December 2012. Two stations were choused for this work (fig. 1). Station 1 located at the confluence of Garmat Ali River with Shatt Al-Arab River, the average depth of the river is 2m. the second station (2) at Al-Fao on the Shatt Al-Arab estuary, the average depth of the river is 12m. Through this area Shatt Al-Arab River is connected to the Arabian Gulf. The hydrology of the region is influenced by Shatt Al-Arab River and Arabian Gulf. The sediment were composed of clay and silt (Al- badran, 1995).

Some hydrographic aspects were recorded in the field; water temperatures, salinity. These aspects were measured immediately in the field by a digital multi meter Multi350i/SET Germany. Samples were collected by a net of a mesh-size of 300 µm. The upper opening of the net was 50 cm. The net was equipped with a flow meter (General Oceanic). Oblique tows were made at a speed of 0.5-2 knots for approximately 10 minutes from near the bottom to the surface (Robinson *et al*., 1996). All plankton samples then preserved in 10% formalin solution.

In the laboratory, the specimens were examined under binoculars microscope and identified according to Fuiman *et al*. (1983); Okiyama (1988); Leis and Carson-Ewart (2000).

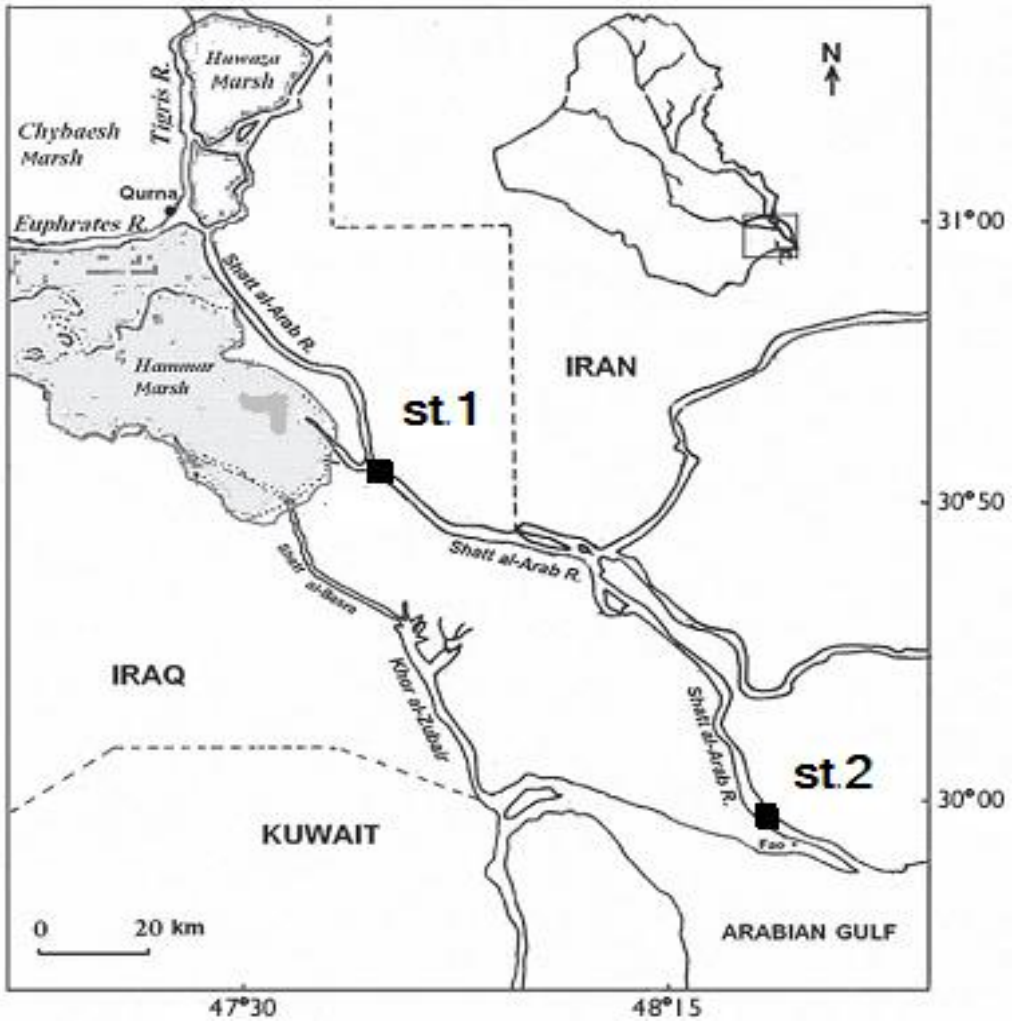

Figure 1. Map of southern of Iraq, showing the sampling stations in Shatt Al-Arab River.

Ecological Indices

Abundance of larvae was calculated according to the formula of

Smith and Richardson (1977):

$$A = N \times D \times 10 / V$$

A = abundance under $10m^2$ of sea surface.
N= number of fish larvae.
D= depth of tow (m).
V= volume of water filtered (m^3).
Diversity index (H') was calculated according to the expression of Shannon-Weaver (1949):

$$H' = -\sum_{i}^{s} Pi \ln Pi$$, where:

where pi=n/N, with n is the number of species i and N the sum of all individuals.
Evenness index (J) was calculated following the equation of Pielou (1977):

$$J = H' / \ln S,$$

where:
H = Shannon Weaver diversity index
S = Number of species fish larvae.

Richness index (D) was calculated by the equation of Margalef (1968):

$$D = S-1 / \ln N,$$

where:
S = Total number of species fish larvae.
N = Total number of individuals fish larvae.

Results

Surface temperature and Salinity

Water temperature in two sampling region were similar, it decreased during winter reaching the minima in December (12°C) then rose to reach the maxima during the summer in July (38°C) (Fig. 2).

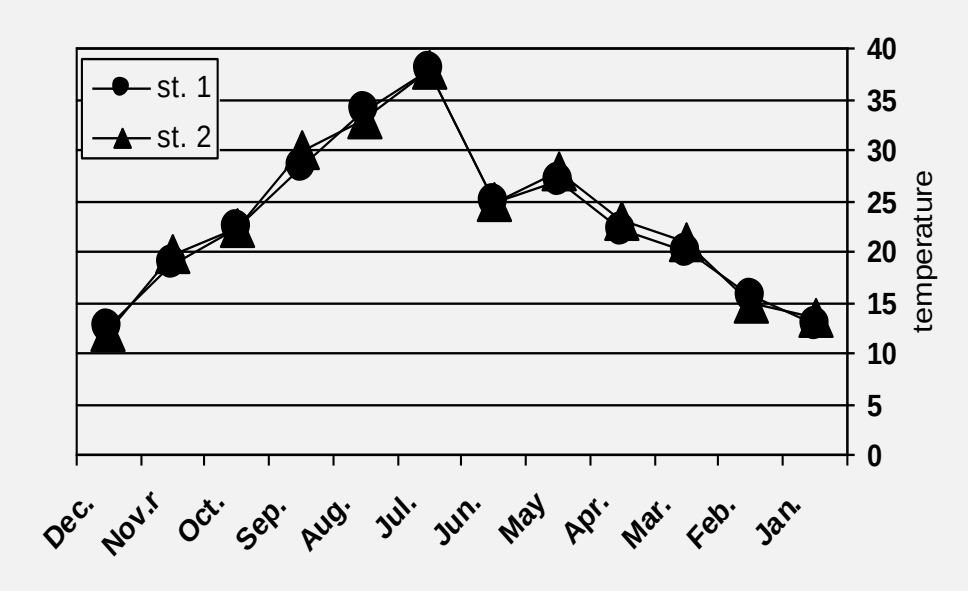

Figure 2. Monthly variation in water temperature at two stations in Shatt Al-Arab River.

Surface salinity varied between the two stations, Salinity in the station 1 upper reaches of the Shatt Al-Arab River ranged from 1.03‰ to 3.8‰ during the study period. Salinity in the station 2 ranged from 9.3‰ to 36‰ during the study period (Fig. 3).

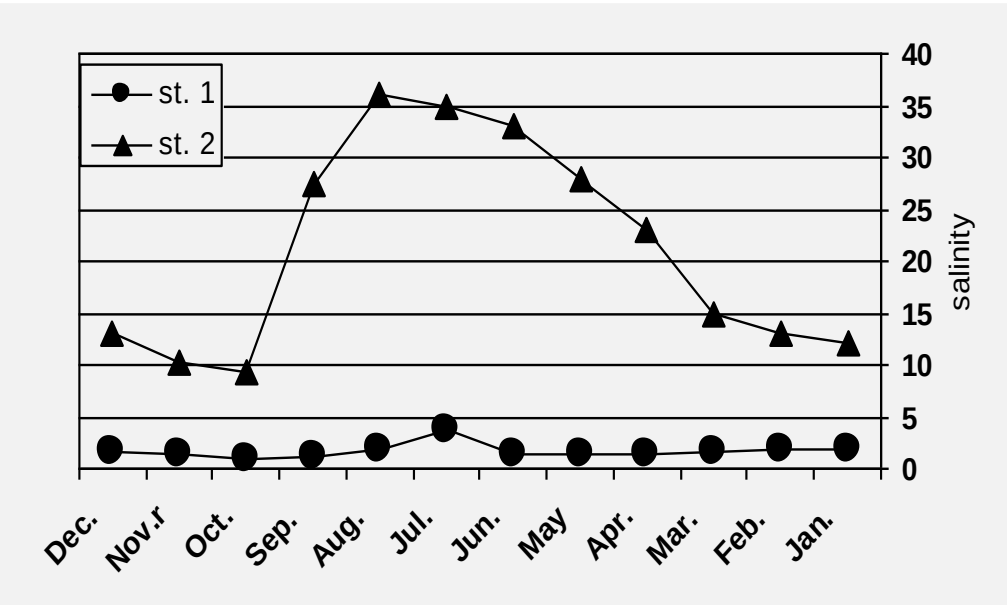

Figure 3. Monthly variation in salinity at two stations in Shatt Al-Arab River.

Composition of fish larvae

A total of 2709 fish larvae representing thirteen families were encountered in the two stations from Shatt Al-Arab River, representing five families from st.1and eight from st.2.

Table (1) showed the total number and percent composition of fish larvae collected at station 1 in Shatt Al-Arab River. These families include Mugilidae, Cyprinodontidae, Cyprinidae, Cichlidae, and Clupeidae. These families include Mugilidae formed 41.69% of the total number of families and Clupeidae formed 9.81%.

Table (1): Total number and percent composition of fish larvae collected at station 1 in Shatt Al-Arab River.

Family	Total number	%Composition
Mugilidae	374	41.69
Cyprinodontidae	179	19.95
Cyprinidae	164	18.28
Cichlidae	92	10.25
Clupeidae	88	9.81
Total	897	

Table (2) showed the total number and percent composition of fish larvae collected at station 2 in Shatt Al-Arab River. The larvae of three families (Gobiidae, Engraulidae and Clupeidae) constituted 85% of the total number of larvae.

Table (2): Total number and percent composition of fish larvae collected at station 2 in Shatt Al-Arab River .

family	Total number	%Composition
Gobiidae	689	38.02
Engraulidae	532	29.35
Clupeidae	321	17.71
Sciaenidae	186	10.26
Soleidae	36	1.987
Cynoglossidae	28	1.54
Polynemidae	15	0.83
Syngnathidae	5	0.27
Total	1812	

Seasonal distribution

A list of family groups of fish larvae and their abundance during twelve month from station 1 and 2 are give in table 3 and 4 respectively.

Abundance of larvae taken from station1 during twelve months are given in table (3). It is clear that spawning activity of fish occurred during period March to October.

Larvae from fish were most abundant in May (145.17 larvae/10m^2) the spawning activity of Mugilidae is during June, but Cyprinodontidae and Cyprinidae were during May, while Cichlidae larvae were recorded in the stations 1 with peak of abundance (23.9 larvae/10m^2) in September. Maximum abundance of Clupeidae larvae (25.28 larvae/10m^2) in June.

Table (3): Abundance (larvae/10m²) of fish larvae at station 1 in Shatt Al-Arab River.

Family	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mugilidae			61.7	40.4	74.6	81.3						
Cyprinodontidae			38.6	16	40.5	0.4	28.4	12.8				
Cyprinidae			13.1	25.3	28.5	9.5	8.2					
Cichlidae						3.4	0.6	20.3	23.9	18.4		
Clupeidae			13.57	11.42	11.57	25.28	21.71	10.1	9.05	1.43		
Total			116.97	83.12	145.17	97.88	38.91	34.2	24.95	19.83		

Table (4) shows abundance of larval fish families in the Shatt Al-Arab River at station 2. It is clear that spawning activity of fish occurred during period March to October. The highest abundance of fish larvae occurred in March(67.46 larvae/10m²).

The Gobiid larvae showed peak abundance in (25.6 larvae/10m²) in October. Engraulid larvae had maximum abundance in August (42.5 larvae/10m²). The sciaenid larvae were more abundant (21 larvae/10m²) in March.

Table (4): Abundance (larvae/10m²) of fish larvae at station 2 in Shatt Al-Arab River.

Family	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Gobiidae			22.86	7.7	2.7	2.7	0.85	0.5	22.2	25.6		
Engraulidae			23.6	24	2	0.35	5.8	42.5				
Sciaenidae			21	3.7	0.7	0.5	0.2		4.8			
Clupidae				10	13	12.6	10.8	0.98	12.3			
Soleidae				0.2	1.4	1.7	0.15	0.18	0.2	2.9		
Cynoglossidae				0.2	0.13			0.3	0.32			
Polynemidae					2.2	0.5	0.9	1				
Syngnathidae					2.2	0.6	0.5					
Total			67.46	46	24.3	18.95	19.2	45.46	39.8	28.5		

The relationships of water temperature and salinity with number of fishes families and total abundance of fish larvae in the Shatt Al-Arab River at stations 1 and 2 are shown in Fig. 3. Water temperature showed a significant positive correlations with the number of fishes larvae families at stations 1, 2 ($r = 0.664$, $r = 0.830$, $p < 0.05$ respectively) and the total abundance of fish larvae at stations 1, 2 ($r = 0.315$, $r = 0.470$, $p < 0.05$ respectively), while the salinity showed very weak negative correlations with number of fishes larvae families at stations 1 ($r = -0.165$, $p < 0.05$) and negative correlations with abundance ($r = -0.700$, $p < 0.05$), but the relationships of salinity with number of fishes families and total abundance of fish larvae at station 2 showed a significant positive correlations ($r = 0.894, 0.520$, $r = p < 0.05$ respectively).

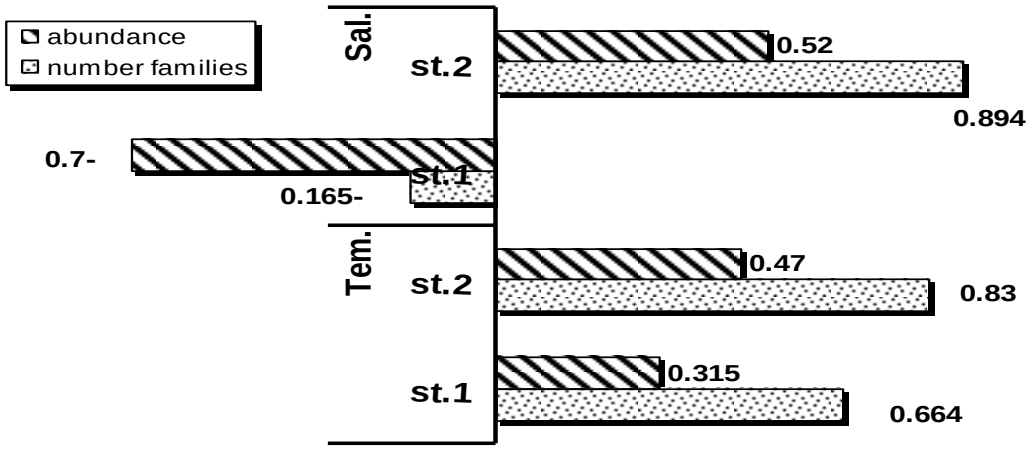

Figure 3.The relationships of water temperature and salinity with the number of fishes families and total abundance of fish larvae in the Shatt Al-Arab River at two stations.

Ecological indices

Shannon Weaver Diversity index (H):

Monthly variation in values of diversity is quite apparent and differences between the two stations were obvious. The highest value was in May (0.32) at station 1, while the highest values at stations 2 were in October (0.36) (Fig. 4). The lowest value (0) was in January, February, November and December at station 1 and 2.

Evenness index (J):

Monthly variations in evenness index of species are illustrated in Fig. 5 fluctuated from 0 in January, February, November and December at station 1 and 2 to 0.42 in September at station 1 but 0.53 in October at station 2.

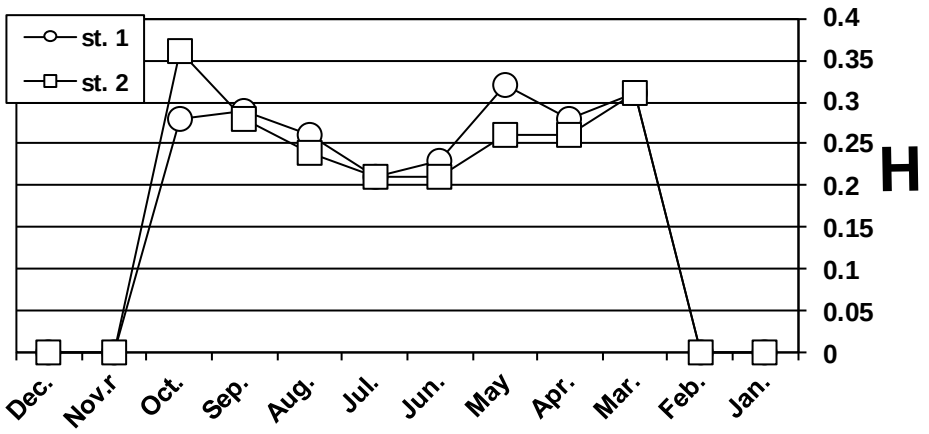

Figure 4. Monthly changes of diversity index at the two stations in the Shatt Al-Arab region during the study period.

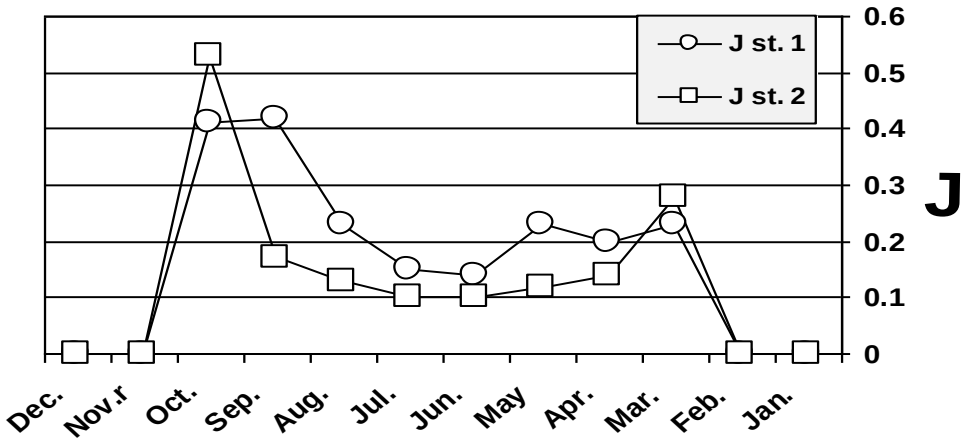

Figure 5. Monthly changes of diversity index at two stations in the Shatt Al-Arab region during the study period.

Richness index (D):

Figure (6) showed the monthly values of richness at the two stations. A peak was apparent at station 1 during June (0.76) . At station 2 the highest value was (0.99) recorded in April. Whereas, at stations 1and 2 the lowest values (0) were during January, February, November and December. In general St2were richen in species than station 1.

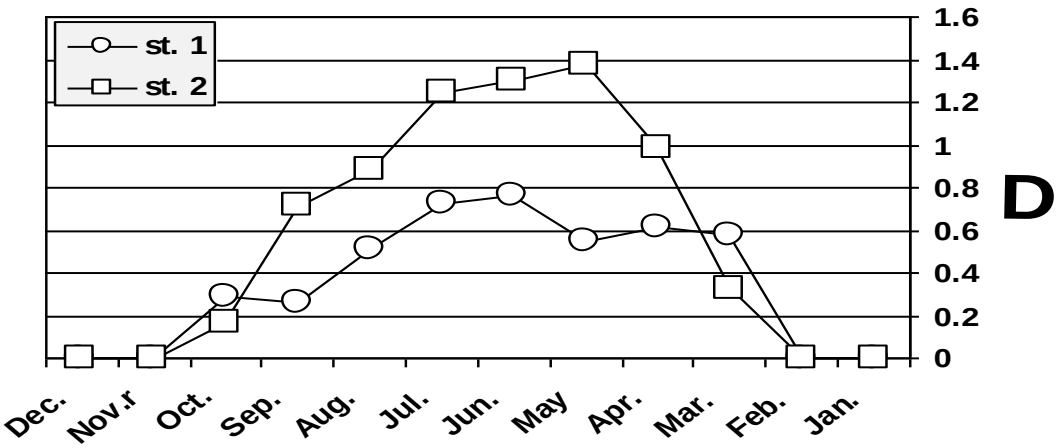

Figure 6. Monthly changes of Richness index at the two stations in the Shatt Al-Arab region during the study period.

Discussion

lazem,(2009) gave the total number of fishes in the Shatt Al-Arab River as 26 species consisting of 17 freshwater and nine marine, while the Ichthyofauna of Shatt Al-Arab River at Al- Fao is similar to that the Arabian Gulf (Mohamed, *et al.* 1993). The number of fish larvae species collected from the Shatt Al-Arab River are five species at station 1, consisting of four fresh waters and one marine, but the number of species collected from station 2 were eight marine species. The fish larvae were collected at stations 1 and 2 indicates that this area is spawning grounds for these fish, just Mohamed, *et al.* (1993); Mohamed, *et al.* (2001); lazem (2009) recorded the spawners from the same area.

Larvae of some fishes whose adults (*Barbus sharpeyi*, *Aspius vorax*, *Silurus triostegus*, *Barbus luteus*, *Liza subviridis*) are important constituents of Shatt Al-Arab River were rare absent in the collections. These fishes and others may migrate to areas more favorable for spawning.

The present results indicate that there were differences in composition fish families and abundance of fish larvae among the two stations study.

The survey showed that five families (Mugilidae, Cyprinodontidae, Cyprinidae, Cichlidae, and Clupidae) are dominating the Ichthyoplankton at station 1 of the study area. The Ichthyofauna of the Shatt Al-Arab River is dominated by Mugilid and cyprinid species. This was also found in inland waters of Iraq (Al-Daham 1982; Coad 1991; Hussain *et al.* 1997; Hussain *et al.* 2006; Mohamed, *et al.* 2007). The occurrence of fish larvae agreed with AL-Okailee (2010), she noticed that larvae of Mugilidae, Cyprinodontidae, Cyprinidae, and Clupidae occur during March to September in north part of Shatt Al-Arab River.

The survey indicated that station 1(upper part of Shatt Al-Arab River) seemed to be the best spawning habitat for freshwater fish species comparing with the station 2(south part of Shatt Al-Arab River), could be related to several reasons, environmental conditions suitable prevailing lower salinity (1.03-3.8‰), fish larvae were collected from shallow banks these banks are characterized by slow currents due to the thick growth of aquatic plants and provide a suitable shelter and spawning ground for fish.

Station 2 (Al-FAO) through this area Shatt Al-Arab River is connected to the Arabian Gulf. The environmental aspect of this area is marine habitat (Mohamed, *et al.* 1993)**.**This condition influence the fish fauna at station 2, because the physical-chemical properties differ from other part of Shatt Al-Arab River, as well as this station are turbid and salinity different due to the Gulf currents and Shatt Al-Arab River sediment lodes consequently, this characteristic tend to attract many tolerable and euryhaline species to south part of Shatt Al- Arab River. Al-Hassan and Hussain (1985) showed that hydrological parameters influenced the penetration of marine species from the gulf to the Shatt Al Arab River, and apparently is the richest, especially during the spring and summer seasons for spawning or for feeding (Richardson and Hussain 2006; Mohamed, *et al.,* 2007). The occurrence of marine species in southern fresh waters was recorded by several authors (Al-Daham, 1982, 1988; Al-Hassan and Naama, 1986; Coad, 1999; Hussain, *et al.* 2006; Mohamed, *et al.,* 2007).

Through their impact on the neuroendocrine system, photoperiod and temperature regulate physiological changes, where as temperature and water flow may initiate migration for Spawning season was between March and October similar to other inland water bodies in Iraq with minor difference in timing due to differences in geographical (AL- Okailee and Mutlak, 2014).

Temperature and salinity are coinciding with the spring flood of the Tigris and Euphrates rivers. Temperature has a stronger correlation with number of families than salinity. Increase of temperature in spring and summer accelerated the productivity cycle of plankton and also decomposition rates of organic materials, i.e. more food resources become available for fish larvae (Hammadi *et al.*, 2007, Al-Sodani *et al.* 2007).

Salinity is influence the number of families and abundance of fish larvae which is influenced by freshwater inflow and air temperature. There were certain factors which contributed to dominate of marine fish larvae population at station 2 is the influx of sea water through estuary of Shatt al-Arab River. The families recorded at station 2 (Al-Fao) were coastal species not open water i.e. euryhaline. These fish larvae were occurrence during March to October of the year which salinity is in its maximum rang during the whole year. It seems that only the euryhaline species able to tolerate the various salinity at south of Shatt Al-Arab River (9.3–36‰).

Higher diversity and richness in the Shatt Al-Arab River during March to October period coinciding with the gathering of many freshwater and marine species for spawning (Al-Hassan and Naama, 1986; Hussain *et al.* 1997; Hussain *et al.* 2006; Mohamed *et al.* 2007), the value of diversity, evenness and richness at station 2 was slightly higher than that station 1 due to the higher number of estuarine families than freshwater families.

It seems that the Shatt Al-Arab River plays a role as a spawning, feeding and nursery ground for fish larvae of freshwater and estuary species.

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دراسة مقارنة لمجتمع الهائمات السمكية في الجزء الشمالي والجنوبي لنهر شط العرب.

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مركز علوم البحار، جامعة البصرة، البصرة، العراق

الخلاصة

تم مسح للهائمات السمكية شهريا من محطتين في الجزء الشمالي والجنوبي من نهر شط العرب خلال المدة من كانون الثاني 2012 ولغاية كانون الأول 2012. جمعت 2709 يرقة باستخدام شباك هائمات حجم فتحاتها 300 مايكرون. صنفت يرقات اسماك الجزء الشمالي إلى خمس عوائل (Mugilidae و Cyprinodontidae و Cyprinidae و Cichlidae و Clupidae)، بينما صنفت في الجزء الجنوبي منه إلى ثمان عوائل (Gobiidae و Engraulidae و Clupidae و Sciaenidae و Soleidae و Cynoglossidae وPolynemidae و Bothidae و Syngnathidae). سجلت أعلى وفرة ليرقات اسماك محطة 1 (145.17يرقة / 10م²) في أيار وكانت عند محطة 2 (67.46 يرقة / 10م²) في آذار. ارتبطت درجة حرارة الماء ارتباط موجب معنوي مع الأنواع والوفرة الكلية ليرقات الأسماك في كل من محطة 1و 2، أظهرت ملوحة الماء ارتباط سالب معنوية مع عدد ووفرة يرقات الأسماك في محطة 1وموجب معنوي في محطة 2. أما الأدلة البيئة كانت كالتالي: أعلى قيمة لدليل التنوع (0.32) في أيار عند محطة 1، وعند محطة 2 0.82) في أيلول. سجلت أعلى قيمة لدليل التساوي(0.42)في أيلول عند محطة 1، لكن عند محطة 2(0.53) في تشرين الأول، وظهرت أعلى قيمة لدليل الغنى (0.76) في حزيران عند محطة 1، أما محطة 2 (0.99) في نيسان. يَبْدو بأنّ الجزء الجنوبي السفلي لنهر شطّ العرب أكثر تنوع مقارنة بالجزء الشمالي العلوي مِنْ نهرِ شطّ العرب، ويَلْعبُ دور مهم كمناطق تكاثر وحضانة وحماية وتغذيةِ ليرقاتِ الأسماك النهرية والمصبيةَ.

كلمات مفتاحية: شط العرب، يرقات الاسماك، الهائمات السمكية، الوفرة.