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Fish Assemblage **of Ktiban creek the upper** Reach of Shatt Al-Arab River

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Abstract: The study was conducted at the Shatt Al-Arab River at Ktiban creek in three stations during the period from October 2017 to September 2018. The first station was in the Shatt Al-Arab near Al- Hartha power Station, the second and third stations were in the Ktiban creek. Samples were collected once a monthly. A total of 5106 fish were collected from the study, period included 24 species belong to 12 families, and consisted of eight marine species and 16 freshwater species (nine native and seven exotic species). Physical and chemical characteristics were measured during sampling period. water temperature, dissolved oxygen, pH, light penetration, salinity, current flow, total dissolve solid (TDS), nitrate, nitrite and phosphates The range of parameters in the Shatt Al-Arab were within their normal levels except salinity values and TDS (8.7 PSU and 8210 mg /l respectively). The values of the diversity index (H) were calculated in the study stations between 1.06 -1.87 and evenness index (j) ranged from 0.42 -0.83and richness index(D) between 1.00 -2.62.

Keywords: Fertility traits, Polymorphism, sheep, TGF-B gene.

Introduction

Shatt Al-Arab is one of the main rivers in Iraq. Because it is economically and socially important so It is the main source of water surface In the province of Basra. Shatt al-Arab has been still used for purposes irrigation, aquaculture fisheries, river transport and industrial (Moyel, 2014). Aquatic ecosystems and other fish and life communities are directly and indirectly affected by environmental factors (Gomes *et al*., 2001). Temperature, salinity, pH and nutrient concentration affect the structure of fish communities and lead to increase bioactivity of fish interactions. The importance of these factors have led to differences in control and conservation of these communities (Ibarra *et al*., 2005). Water temperature is one of the most important factors affecting the structure of the fish community and the abundance of species (Clark, 2003). The Salinity is also great importance in the aquatic environment and a determinant factor of fish growth (O'Neill *et al*., 2011; Pérez-Robles *et al*., 2012; Fazio *et al*., 2013). The transparency of light through the water column is an valuable

environmental factor influencing the activity and structure of fish communities and their relationship to other food and life (Mrosso *et al*., 2004). The presence of nutrients in the aquatic environment is essential for sustainability and productivity, which is the primary food pyramid aquatic base including fish (Wetzel, 2001).

The study of freshwater fish communities is an important factor in understanding the abundance and diversity of fish in the water surface by using environmental indces including the Richness, the Diversity, and the Evidence Indices (Pihl and Wennhage, 2002). Several local studies have been conducted to describe the nature of fish assemblages omitted in many water bodies in Iraq, especially in the Shatt al-Arab (Hussain *et al*., 1997; Jassim, 2003; Younis, 2005; Mahmood *et al*. 2008; Lazem, 2009; Mohamed, 2010; Mohamed *et al*. 2012; Lazem, 2014; Abdullah, 2015; Al-Okailee *et al*., 2016; Mohamed *et al*., 2017; Mohamed & Abood, 2017b).

Due to the lack of environmental and fish ecological studies on the ktiban creek near the conveyor canal which is identified by water resources as the end of the saline tide, the present study aims to give an example for describing the nature of the fish community ,dominant and abundance of species in the Shatt al-Arab and the Ktiban creek through the use of biological indices. as well as, study of the environmental changes in the region to identify their impact on the presence of species.

Materials & Methods

The current study was conducted on the creek of ktiban, Northeastern of Basrah Province, one of the branches of the Shatt Al-Arab river. The length of the river is about.4.5 km. It is about 25 m wide and the depth is 3-3.5 m. The study area is affected. semi-diurnal tide. The region is also characterized by various intensities of aquatic plants, *Ceratophyllum demersum* that was as adense strap during the study period and *Phragmites australis, Typha australis, Vallisneria spiralis Schoenoplectus litoralis*, which were intensity fluctuates with the seasons and classified according to Al-Abbawy & Al-Mayah (2010). Three sampling stations were selected as clarified in fig. (1)

The first station is located on the other side opposite to the Hartha station in the Shatt al-Arab and close to the branch of the Ktiban creek within the site of 30 ° 41'30.6" North and 47 ° 45'23.36" East, the width of this area 21.5 m and the depth of water through the lowest tide between 3- 4.5 m. The second station is located near the bridge of the yellow ktiban creek after the regulator and is located 1 km away from the first station at 30°41'43.39" N and 47°45'37.6" E, known as the Biban region, the width of the river in this area reaches 25 m and the depth of the water is 1.5 to 2 m. The third station is located in the ktiban river at site 30°42' 38.82" North and 47°46'55.46" East and known as the area of Ruwab and away from the second station with 3.220 km, the width of this area 20 m and the depth of water 2 - 2.5 m.

Water and fish samples were collected from the stud stations from the period of October 2017 to September 2018, with one sample per month during ebb tide time for some environmental factors, including water temperature, salinity, dissolved oxygen, light transparency, active NO_3, and active phosphate. Three fishing methods were adopted Drift gill net with a length of 120 m and a height of 4 m and mesh size 16 x 16 mm time was 30 minutes process was

achieved. Cast net with diameter of 9 m and mesh size hole 22 x 22 mm. Electro-fishing with power 500 volts with distance effect of 2 m ^{2} in low-density near dense plants. The fishes were kept in icebox until reached to the laboratory and the fish were classified according to Carpenter *et al*. (1997) and Coad (2017).

The number of species were recorded and the weight and total length were measured.

Ecological indices were calculated that include Diversity index according to Shannon and Winner (1949), Richness index according to Margalefe (1968) and Evenness index according to Pielou (1977). Canonical Correspondence Analysis (CCA) using the Canoca program version 4.5 to assess the relationships between different environmental factors and fish communities. The Statistical Program (SPSS) was used for data analysis at significance 0.05.

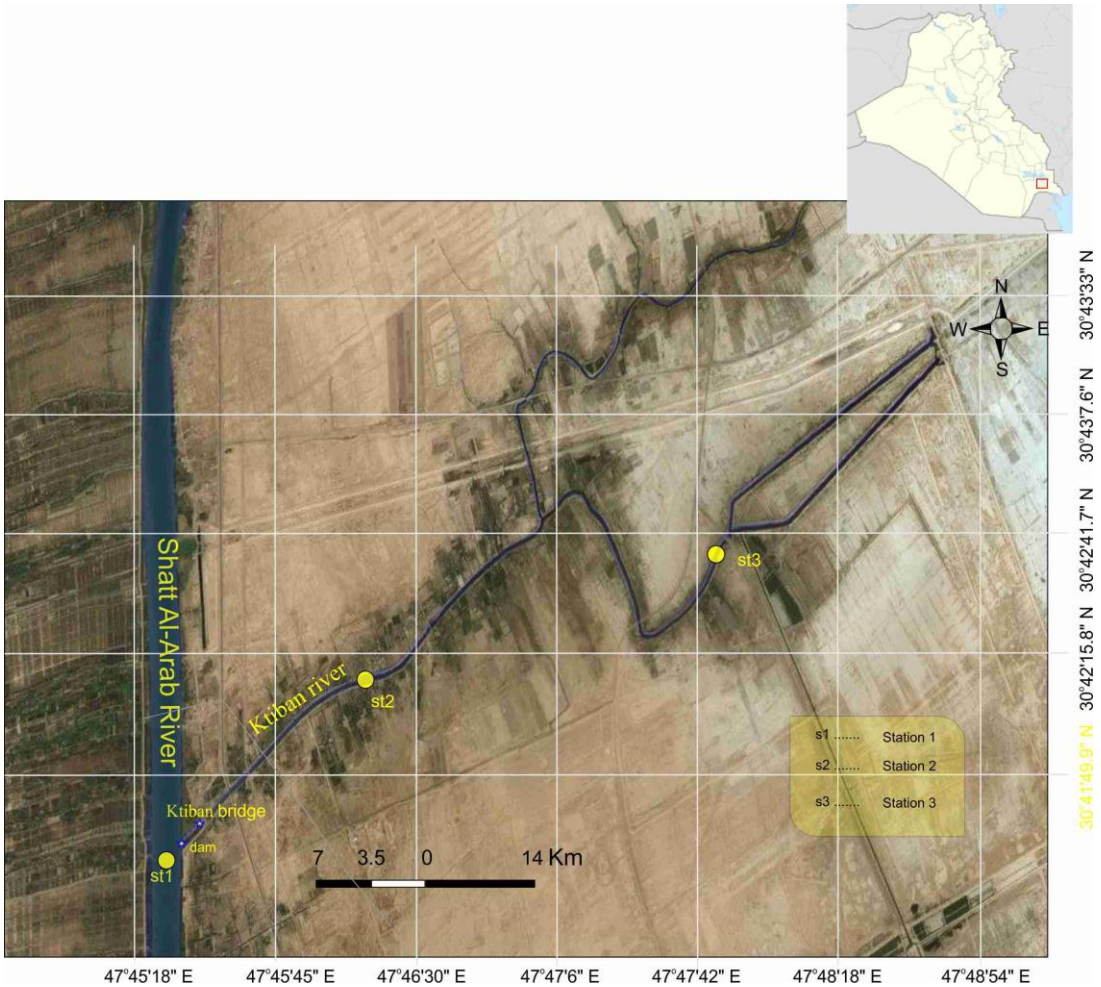

Fig. (1) Map showing the study sites on the Ktiban river.

Results

Water temperature

Fig. (2) exhibited the monthly changes of the water temperature in the studied stations. The lowest temperature degrees were 18 °C, 19°C and 19 °C in January 2018 at the first, second and third stations respectively. whereas water temperature increased gradually to reach highest of 34 °C, 35 °C and 36° C during July 2018 for the first, second and third stations, respectively.

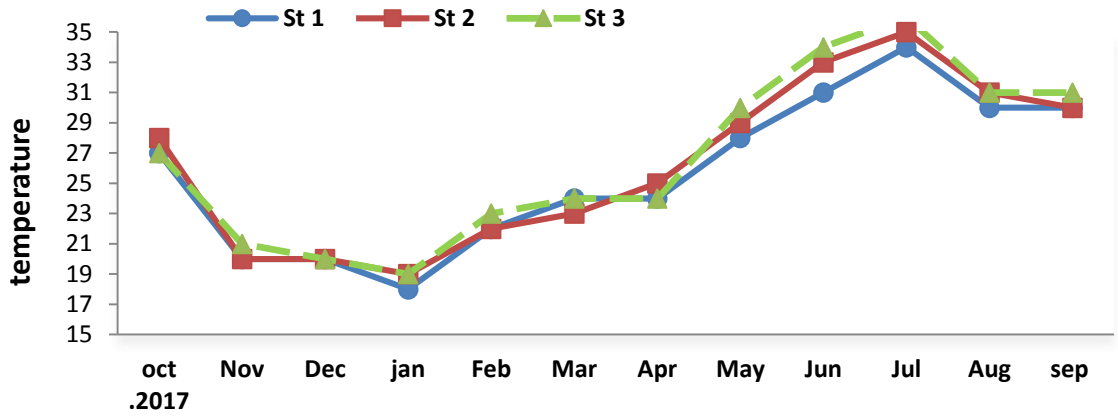

Fig. (2): Local monthly changes in water temperature values of selected stations during the period from Oct 2017 to Nov. 2018.

Salinity

Fig. (3) indicated the monthly changes in salinity in Ktiban creek during the study period. The lowest values of salinity were recorded in January (2.2, 2 and 2) PSU for the first, second and third stations respectively, while the highest salinity values were recorded in September (8.7, 8 and 7.2) PSU for the first, second and third stations respectively.

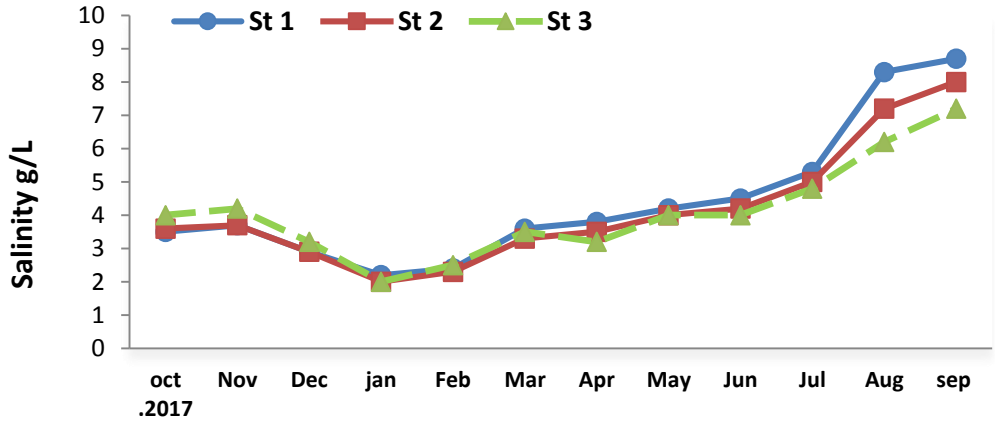

Fig. (3): Local monthly changes in salinity of selected stations during the period from Oct 2017 to Nov. 2018.

Dissolved Oxygen

Fig. (4) revealed the monthly changes in dissolved oxygen of the study stations. The lowest oxygen values was recorded in July (4.6, 4.3 and 4.1) mg^{-1} in the first, second and third stations respectively. The highest oxygen values were 12 $mg.l^{-1}$ in December for the first station and 11.8 $mg.l^{-1}$ in February for the second station and 11.5 $mg.l^{-1}$ in January 2018 for the third station.

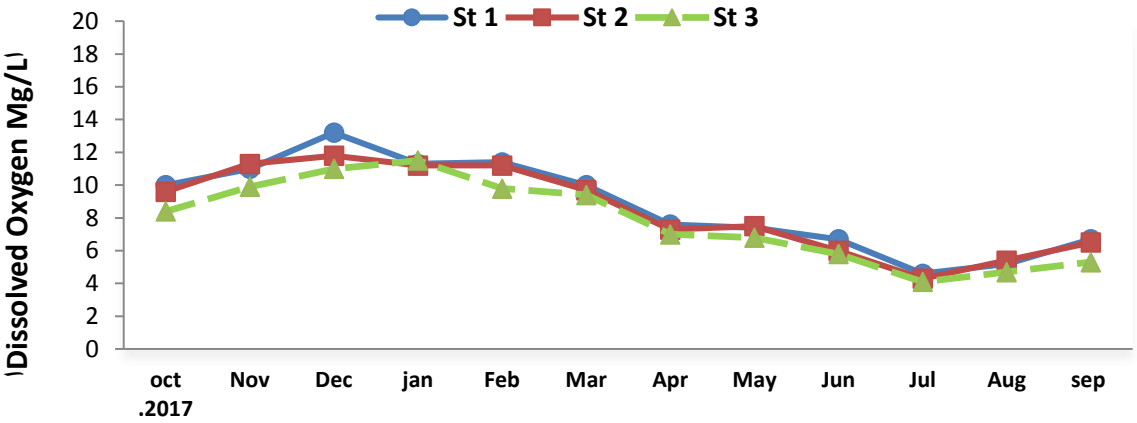

Fig. (4) local monthly changes in dissolved oxygen values during the period from Oct 2017 to Nov. 2018.

Light penetration

Fig. (5) presented the monthly changes in light penetration values during the water column at the studied stations. The lowest permeability of the light were (33 cm, 31 and 38) cm in May for the first, second and third stations respectively, while the highest values were (60, 54, and 55) cm for the first station, second and third stations, respectively.

Nitrate (NO3)

Fig. (6) indicated the monthly changes in the nitrate values for the studied stations, which recorded a significant increase during the study period. The lowest values were 44.35, 40.67 µg-N-No_3. l^{-1} in September 2018 at the first and second stations respectively, and 43.34 µg-N-No_3.l^{-1} in August for the third station, while the highest values were 97.11, 96.82 and 95.87 µg-N-No_3 l^{-1} in June and September respectively.

Reactive Phosphate

Fig. (7) exhibited the monthly changes in phosphate concentration values during the studied stations, with the lowest values of 0.063, 0.114 and 0.105 µg. P-PO_4. l^{-1} in June, July and August of the first, second and third stations respectively, while the highest values were (0.438, 0.495.and 0.383) µg. P-PO_4.l^{-1} in November 2017 for the first and second third stations, respectively.

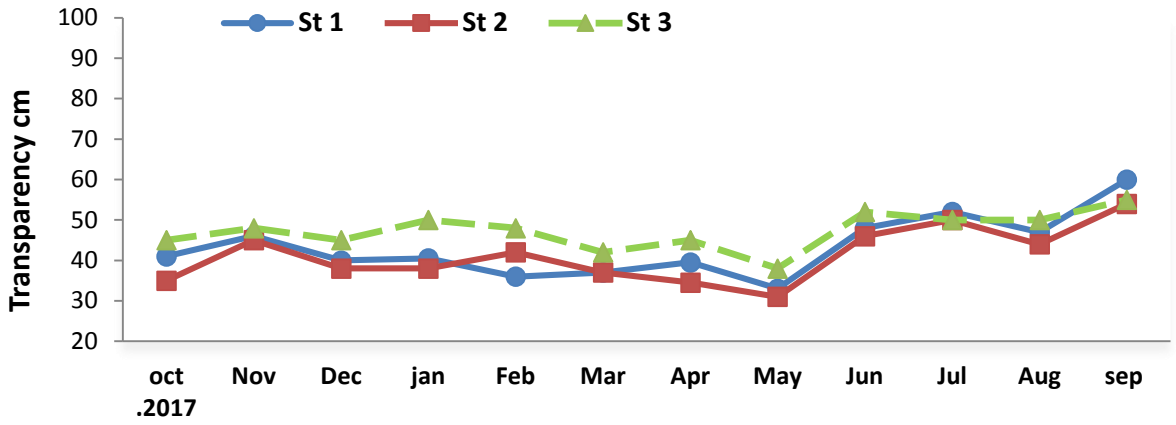

Fig. (5): Local monthly changes in light permeability values of selected stations during the period from Oct 2017 to Nov. 2018.

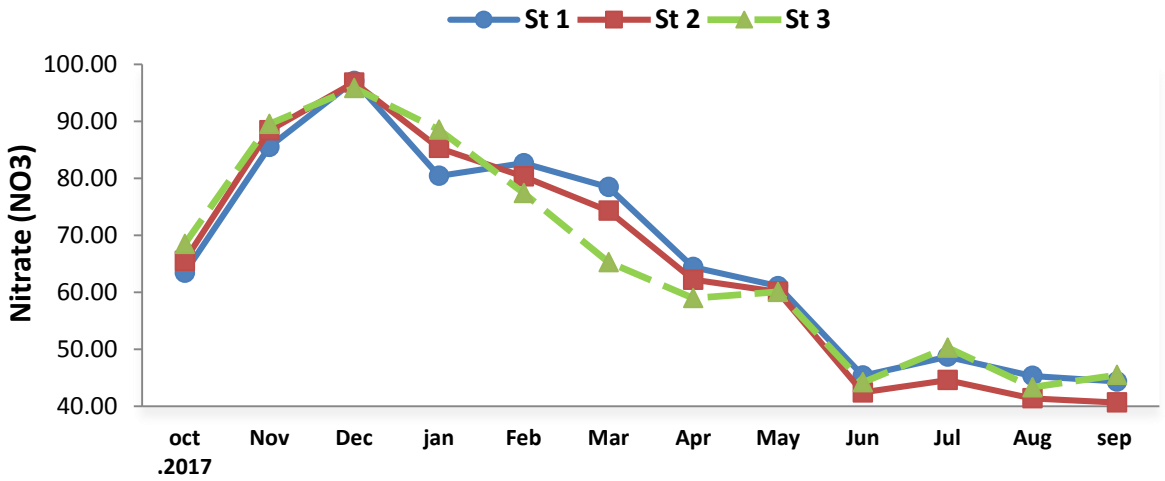

Fig. (6): Monthly changes in nitrate concentration values for selected stations during the period from Oct 2017 to Nov. 2018.

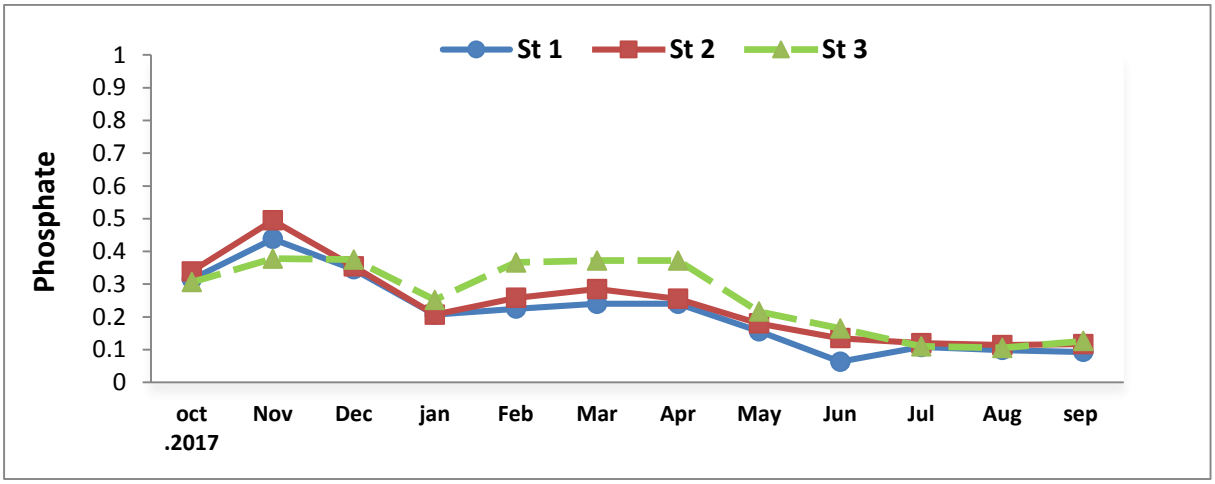

Fig. (7) Monthly changes in phosphate concentration values of selected stations during the period from Oct 2017 to Nov. 2018.

Fish Assemblage

A total of 5105 fish individual were collected, including 24 species from studied stations belong to 21 genera and 12 families all from the Osteichthyes, representing eight marine species and 16 freshwater species (Nine native species and seven alien species) as shown in table (1).

Fig. (8) revealed monthly changes in the number of fish species in the study area, with a total of 24 species in the first station. The number of species that recorded ranged from six species in December to 14 species in February and March for first station, 20 species in the second station and varied between six species in December and 14 species in May. While 14 species were recorded in the third station and varied between six species in February and March and nine species in October 2017 and May 2018.

Fig. (9) indicated the monthly changes in the number of fish individual of the study area. The total numbers reached 2314 fish in the first station ranging between 115 individuals in August 2018 and 317 individuals in May 2018. The total number of individuals in the second station was 1434 and varied between 72 individuals in January 2018 to 205 individuals in October 2017. The total number of individuals in the third station was 1357 individuals and varied between 59 individuals in July 2018 and 240 individuals in November 2017.

Fig. (10) exhibited the monthly changes in fish weight in the study area. The total weight of individuals was 5640.55 g for the first station. The monthly weights ranged from 191.33 g in and 981.68 kg in August and January 2017 respectively. In the second station the total weight was 4279.74 g and the weight fluctuated from 201.40 g in June to 533.91 g in February 2018. The total weight of individuals was 5209.91 g for the third station and the monthly weights ranged between 241.32 g in June and 960.77 g in February 2018.

Table (1): Fish families, species and habitat in the northern part of the Shatt Al-Arab in the Ktiban creek for the period from October 2017 to September 2018.

NO.	Fish species	Family	Habitat
1	*Acanthobrama marmid*	Cyprinidae	F
2	*Alburnus sellal*		F
3	*Carasobarbus luteus*		F
4	*Carassius auratus*		A
5	*Garra rufa*		F
6	*Hemiculter leucisculus*		A
7	*Cyprinus carpio*		A
8	*Leuciscus vorax*		F
9	*Thryssa hamiltonii*	Engraulidae	M
10	*Thryssa whiteheadi*		M
11	*Tenualosa ilisha*	Clupeidae	M
12	*Mystus pelusius*	Bagridae	F
13	*Silurus triostegus*	Siluridae	F
14	*Poecilia latipinna*	Poeciliidae	A
15	*Mastacembelus mastacembelus*	Mastacembelidae	F
16	*Coptodon zillii*	Cichlidae	A
17	*Oreochromis aureus*		A
18	*Oreochromis niloticus*		A
19	*Acanthopagrus arabicus*	Sparidae	M
20	*Bathygobius fuscus*	Gobiidae	M
21	*Boleophthalmus dussumieri*		M
22	*Photopectoralis bindus*	Leiognathidae	M
23	*Planiliza abu*	Mugilidae	F
24	*Planiliza subviridis*		M

***A-Alien species, F-Freshwater species & M-Marine species).**

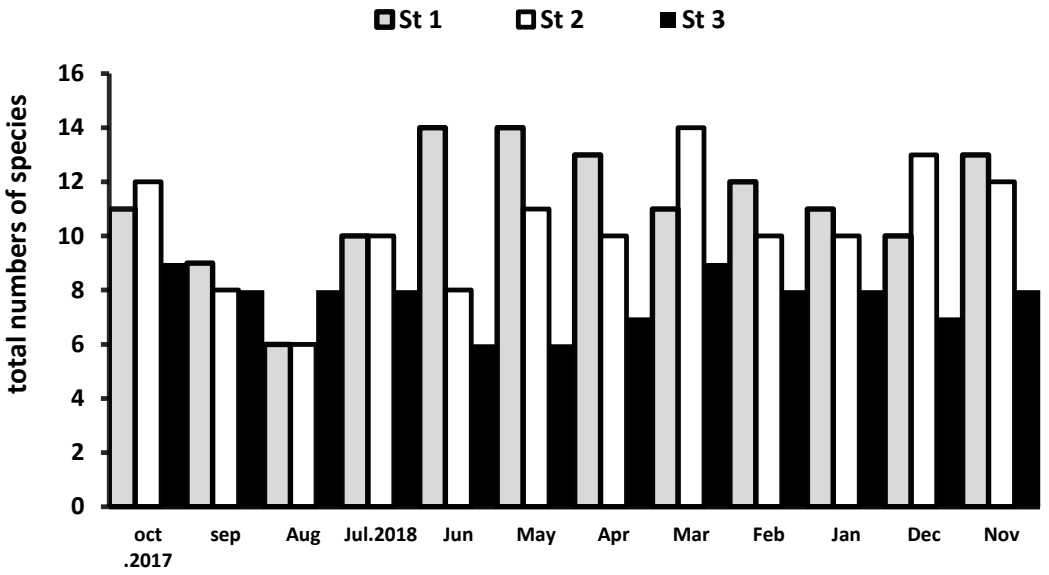

Fig. (8) Monthly changes in the numbers of fish species in the ktiban creek during the period from Oct 2017 to Nov. 2018.

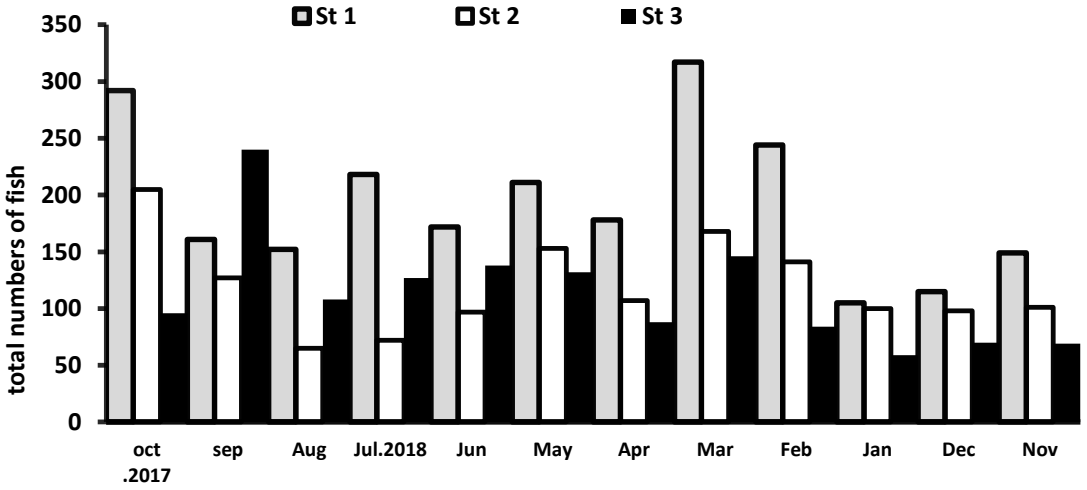

Fig. (9): Monthly changes in the total numbers of individuals in the the ktiban creek during the period from Oct 2017 to Nov. 2018.

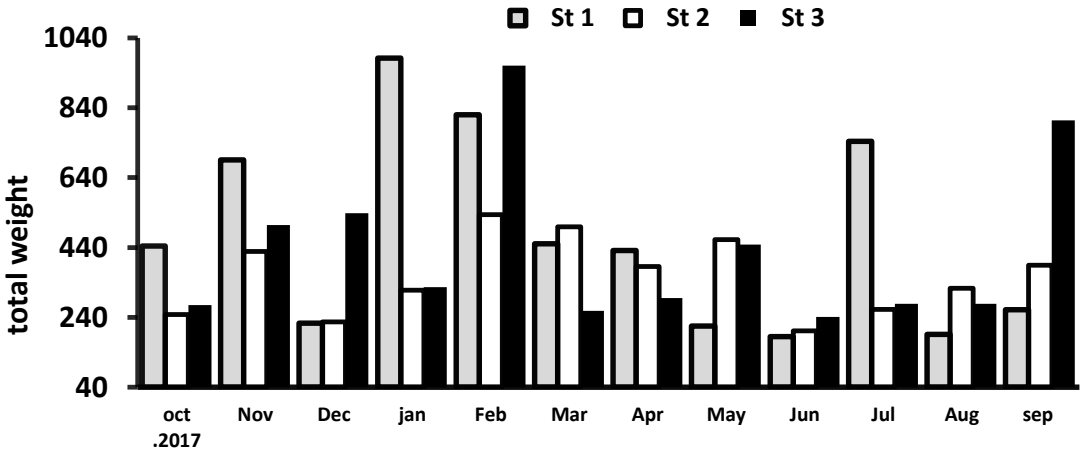

Fig (10) Monthly changes in the total weight of individuals in the study stations.

Fig. (11) displayed the monthly changes in the number of, native, exotic and marine species in the studied stations. The number of native, exotic and marine species in the first station was nine, seven and eight species respectively were recorded. The number of native, exotic and marine species in the second station was seven, seven and six species respectively were recorded. The number of native, exotic and marine species in the third station was five, six and three species respectively were recorded.

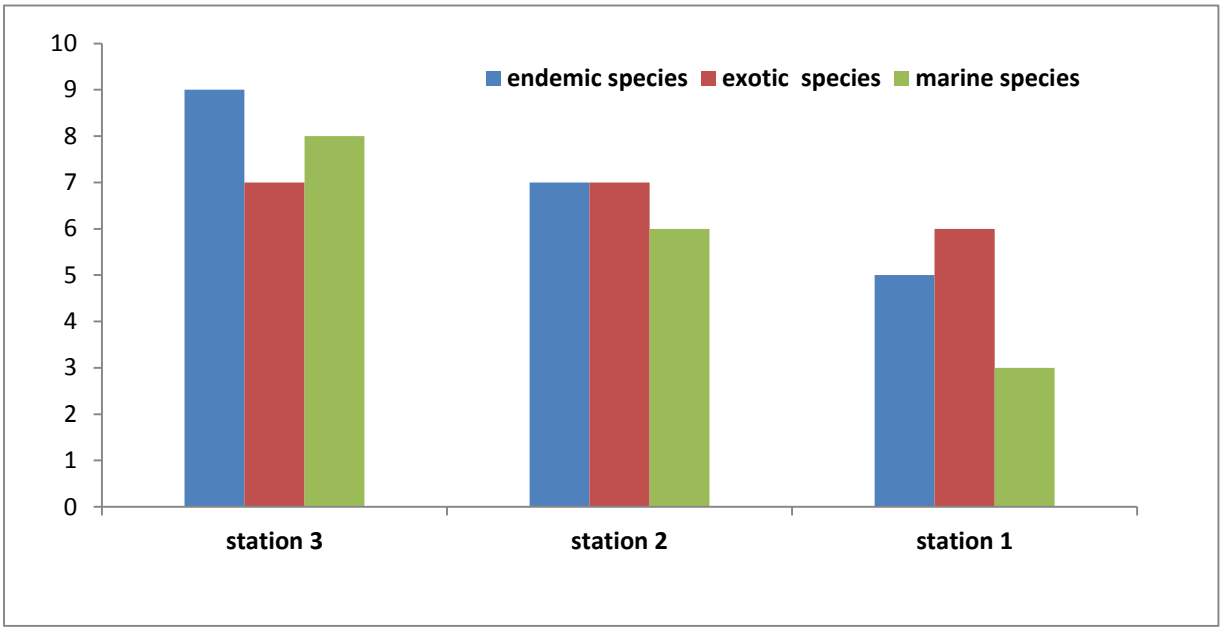

Fig. (11): Monthly changes in the number of Native, exotic and marine species in the studied stations at ktiban creek during the period from Oct 2017 to Nov. 2018.

Relative abundance

Table (2) presented the monthly changes in the numerical and relative abundance of the fishes in the first station during the study period. The number of dominant fish species varied, with 82.88% of the total number of fishes. However the number of the Nile tilapia *(O. niloticus*) has taken place the first, with 605 individuals and 26.12% and the relative duration ranged between 4.7% in September 2018 and 45.96% in November 2017. In second level Prussian carp *C. auratus* with a numerical abundance of 464 and a the relative abuncance of 20.3% ranging 0.47% in March and 59.7% in September The redbelly tilapia *C. zillii* was the third level with a numerical and relative abundance of 304 and 13.13% respectively and ranged from 0.7% in September 2018 to 39.47% in December 2017. The fourth level with blue tilapia *O. aureus* and with 285 and 31.12% of numerical and relative abundance repectively and ranging between 1.3% in September 2018 and 24.34% in December 2017. The swordtail molly *P. latipinna* was fifth in level with numerical and relative abundance 260 and 11.23% repectively, ranging between 1.32% in December 2017 and 25.59% in March 2018 during the study period.

Table (3) exhibited the monthly changes in the numerical and relative abundance in the second station during collection period. The number of four dominance fish species varied, with 75.17% of the total number of fish.

Table (2): The monthly changes in the numerical and relative abundance of the first station during the study.

Species	Oct-17		NOV		Dec		jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Total	%
	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	
O. niloticus	71	24.32	74	45.96	44	29	78	35.78	40	23.26	60	28.44	51	28.7	111	35	55	22.45	8	7.62	6	5.22	7	4.7	605	26.12
C. auratus	47	16.1	8	4.97	6	4	11	5.05	31	18.02	1	0.47	13	7.3	76	24	60	24.49	56	53.33	66	57.39	89	59.7	464	20.03
C. zillii	26	8.9	24	14.91	60	39	51	23.39	30	17.44	34	16.11	24	13.5	8	2.5	46	18.78					1	0.7	304	13.13
O. aureus	67	22.95	31	19.25	37	24	52	23.85	21	12.21	12	5.69	12	6.74	30	9.5	17	6.94	4	3.81			2	1.3	285	12.31
P. latipinna					2	1.3	20	9.17	6	3.49	54	25.59	36	20.2	72	22.7	37	15.1	8	7.62	17	14.78	8	5.4	260	11.23
P. abu	48	16.44	15	9.32	3	2	2	0.92	8	4.65	1	0.47	2	1.12	4	1.3	13	5.31	14	13.33	12	10.43	18	12.1	140	6.04
H. leucisculus	4	1.37					1	0.46	15	8.72	15	7.11	13	7.3	3	0.9	5	2.04	4	3.81	6	5.22	5	3.4	71	3.07
T. whiteheadi	20	6.85	3	1.86	0	0			4	2.33	5	2.37	7	3.93	4	1.3	3	1.22	2	1.9	1	0.87	8	5.4	57	2.46
P. subviridis	1	0.34	2	1.24	0	0			1	0.58	10	4.74	9	5.06	2	0.6					1	0.87		0	26	1.12
A. sellal							1	0.46	9	5.23									2	1.9			3	2	15	0.65
M. pelusius											10	4.74	5	2.81											15	0.65
A. marmid									4	2.33	5	2.37					2	0.82	2	1.9					13	0.56
B. fuscus									1	0.58			2	1.12	4	1.3	3	1.22			1	0.87	2	1.3	13	0.56
T. hamiltonii	4	1.37		0		0				0	1	0.47	2	1.12		0							2	1.3	9	0.39
A. arabicus																	1	0.41	4	3.81	3	2.61			8	0.35
L. vorax	3	1.03	3	1.86																			1	0.7	7	0.3
C. carpio																					2	1.74	3	2	5	0.22
B. dussumieri															3	0.9	2	0.82							5	0.22
T. ilisha							1	0.46			2	0.95	2	1.12											5	0.22
S. triostegus							1	0.46	1	0.58									1	0.95					3	0.13
C. luteus			1	0.62																					1	0.04
G. rufa											1	0.47													1	0.04
P. bindus	1	0.34																							1	0.04
M. mastacembelus									1	0.58															1	0.04
Number individuals	292		161		152		218		172		211		178		317		244		105		115		149		2314	
Number species	11		9		6		10		14		14		13		11		12		11		10		13			

Table (3): The monthly changes in the numerical and relative abundance of the second station during the study.

Species	Oct-17		NOV		Dec		jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Total	%
	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	
O. niloticus	66	32.2	52	40.94	26	40	25	34.72	21	21.65	45	29.4	26	24.3	47	28	42	29.79	12	12	3	3.06	4	4	369	25.73
O. aureus	63	30.73	24	18.9	26	40	12	16.67	21	21.65	24	15.7	25	23.36	23	13.7	36	25.53	10	10	6	6.12	4	4	274	19.11
C. auratus	12	5.85	6	4.72	1	1.54	4	5.56	31	31.96	11	7.19	6	5.61	4	2.4	16	11.35	43	43	58	59.18	63	62.4	255	17.78
C. zillii	18	8.78	16	12.6	6	9.23	10	13.89	11	11.34	41	26.8	24	22.43	39	23.2	7	4.96	7	7	1	1.02	-	-	180	12.55
T. whiteheadi	12	5.85	10	7.87	-	-	-	-	-	-	16	10.5	12	11.21	27	16.1	16	11.35	7	7	4	4.08	3	3	107	7.46
P. abu	4	1.95	16	12.6	-	-	1	1.39	-	-	-	-	-	-	1	0.6	7	4.96	11	11	15	15.31	12	11.9	67	4.67
H. leucisculus	17	8.29	-	-	5	7.69	7	9.72	3	3.09	3	1.96	5	4.67	10	6	-	-	-	-	2	2.04	5	5	57	3.97
A. sellal	7	3.41	-	-	-	-	3	4.17	-	-	1	0.65	2	1.87	1	0.6	9	6.38	4	4	-	-	3	3	30	2.09
C. luteus	1	0.49	-	-	1	1.54	5	6.94	6	6.19	3	1.96	2	1.87	4	2.4	3	2.13	-	-	2	2.04	2	2	29	2.02
T. hamiltonii	3	1.46	1	0.79	-	-	-	-	-	-	6	3.92	3	2.8	8	4.8	4	2.84	2	2	-	-	1	1	28	1.95
S. triostegus	-	-	-	-	-	-	-	-	3	3.09	-	-	-	-	-	-	-	-	-	-	2	2.04	1	1	6	0.42
L. vorax	1	0.49	2	1.57	-	-	1	1.39	-	-	-	-	-	-	-	-	-	-	-	-	1	1.02	-	-	5	0.35
P. latipinna	-	-	-	-	-	-	4	5.56	1	1.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0.35
T. ilisha	1	0.49	-	-	-	-	-	-	-	-	1	0.65	2	1.87	1	0.6	-	-	-	-	-	-	-	-	5	0.35
B. dussumieri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	1.02	1	1	4	0.28
C. carpio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.02	2	2	3	0.21
P. subviridis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.6	-	-	-	-	2	2.04	-	-	3	0.21
A. arabicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.71	2	2	-	-	-	-	3	0.21
M. pelusius	-	-	-	-	-	-	-	-	-	-	2	1.31	-	-	1	0.6	-	-	-	-	-	-	-	-	3	0.21
M. mastacembelus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.6	-	-	-	-	-	-	-	-	1	0.07
Number individuals	205	-	127	-	65	-	72	-	97	-	153	-	107	-	168	-	141	-	100	-	98	-	101	-	1434	-
Number species	12	-	8	-	6	-	10	-	8	-	11	-	10	-	14	-	10	-	10	-	13	-	12	-	-	-

The Nile tilapia *(O. niloticus)* was the first level, with 369 and 25.73%. The relative duration ranged between 3.06% in September 2018 and 45.94% in November 2017. Blue tilapia *O. aureus* in the second rank with 274 and 19.11% in numerical abundance and relative abundance respectively, ranging from 4% in September 2018 to 30.73 % in October 2017. The third level was *C. auratus*, with a numerical abundance of 255 and relative abundance of 17.78%, ranging between 1.54% in December 2017 and 62.4% in September 2018. The redbelly telapia *C. zillii* was the fourth level with numerical abundance of 180 and a relative abundance of 55.12% In February 2018 and 23.2% in May 2018.

Table (4) demonstrated the monthly changes in the numerical and relative abundances of the third station during the collection period. The number of four dominance fish species varied, with 82.24% of the total number of fish. *O. niloticus* was the first level, with 442 and 32.57% for numerical and relative abundances respectively. The relative duration ranged between 11.6% in September 2018 and 48.96% in October 2017. *C. luteus* was second level in number and with 269 and 19.82% for numerical and relative abundances respectively, ranging from 4.17% in October 2017 to 55.8% in February 2018. The Prussian carp *C. auratus* took the third level with 248 and 18.28% for numerical and relative abundances respectively, and ranged between 3.03% in March 2018 and 65.2% in September 2018. Redbelly tilapia, *C. zillii,* in the fourth level with 157 and 11.57% for numerical and relative abundances respectively, and ranged between 3.39% in July 2018 and 28.35% in December 2017.

Spatial and temporal Occurrence

There were 24 species of fishes as appeared in the collection samples. All recorded species were reported in the all stations except *G. rufa* and *P. bindus*, which appeared only at the first station.

Fig. (12) revealed the monthly occurrence of common, seasonal and occasional species in the stations, where eight of common species and two species of seasonal and 14 occasional species. The number of common species in the second station was seven species and three species of seasonal and ten occasional species. The third station presented five common species, three seasonal species and six occasional species.

A-Common species

It represented with eight species, included three species which appeared in all months (*O. niloticus, C. auratus* and *P. abu*) and four species (*C. zillii, P. latipinna*, *H. leucisculus* and *T. whiteheadi*) were found in ten months, while *O. aureus* was recorded in 11 months. The second station was represented with seven species included three species (*O. niloticus*, *C. auratus* and *O. aureus*) found in 12 months, while the *C. zillii* appeared in 11 months and *C. luteus* in 10 months and *H. leucisculus* and *T. whiteheadi* appeared in nine months. The third station included five species (*O. niloticus, C. auratus, O. aureus, C. luteus*) in 12 months and *C. zillii* appeared in ten months.

B-Seasonal species

It included two species in the first station, the one that appeared in seven months was *P. subviridis* and *B. fuscus* appeared in six months. The number of seasonal species in the second station was three species that appeared in eight months (*P. abu, A. sellal*

Table (4): The monthly changes in the numerical and relative abundance of the third station during the study.

Species	Oct-17		NOV		Dec		jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Total	%
	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	%	Num	
O. niloticus	47	48.96	91	37.92	30	27.78	37	29.13	30	21.74	35	26.52	23	26.14	75	51.4	34	40.48	18	30.51	14	20	8	11.6	442	32.57
C. luteus	4	4.17	20	8.33	18	16.67	24	18.9	77	55.8	44	33.33	22	25	25	17.1	20	23.81	8	13.56	3	4.29	4	5.8	269	19.82
C. auratus	10	10.42	55	22.92	18	16.67	6	4.72	13	9.42	4	3.03	6	6.82	16	11	11	13.1	23	38.98	41	58.57	45	65.2	248	18.28
C. zillii	6	6.25	13	5.42	19	17.59	36	28.35	12	8.7	32	24.24	16	18.18	14	9.6	7	8.33	2	3.39	-	-	-	-	157	11.57
O. aureus	18	18.75	36	15	13	12.04	13	10.24	5	3.62	14	10.61	16	18.18	5	3.4	7	8.33	3	5.08	2	2.86	4	5.8	136	10.02
P. abu	7	7.29	19	7.92	6	5.56	5	3.94	-	-	-	-	3	3.41	2	1.4	-	-	-	-	6	8.57	4	5.8	52	3.83
L. vorax	2	2.08	4	1.67	-	-	-	-	-	-	-	-	-	-	7	4.8	2	2.38	2	3.39	3	4.29	1	1.4	21	1.55
A. sellal	1	1.04	2	0.83	1	0.93	3	2.36	-	-	3	2.27	-	-	-	-	-	-	-	-	-	-	1	1.4	11	0.81
H. leucisculus	-	-	-	-	-	-	3	2.36	-	-	-	-	2	2.27	-	-	2	2.38	2	3.39	-	-	-	-	9	0.66
M. mastacembelus	-	-	-	-	3	2.78	-	-	1	0.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.29
C. carpio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.43	2	2.9	3	0.22
T. whiteheadi	1	1.04	-	-	-	-	-	-	-	-	-	-	-	-	1	0.7	-	-	1	1.69	-	-	-	-	3	0.22
A. arabicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.19	-	-	-	-	-	-	1	0.07
B. fuscus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.7	-	-	-	-	-	-	-	-	1	0.07
Number individuals	96	-	240	-	108	-	127	-	138	-	132	-	88	-	146	-	84	-	59	-	70	-	69	-	1357	-
Number species	9	-	8	-	8	-	8	-	6	-	6	-	7	-	9	-	8	-	8	-	7	-	8	-	-	-

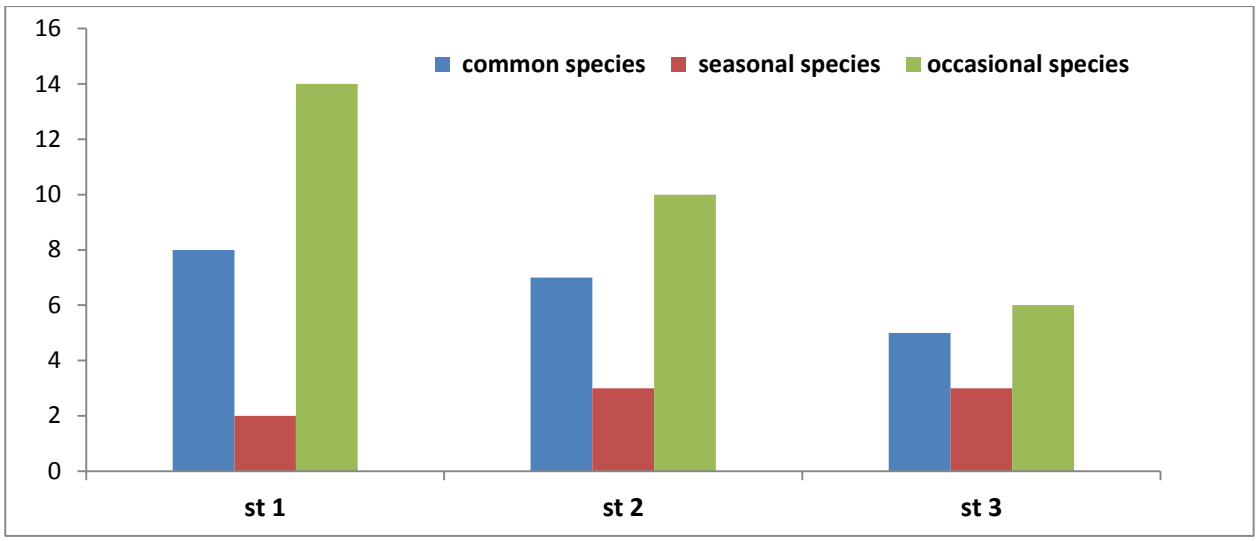

Fig. (12): Monthly changes in the common seasonal and occasional species during the period from Oct 2017 to Nov. 2018.

and *T. hamiltonii*). The third station included three fish species: *P. abu* appeared in eight months, *L. vorax* appeared in seven months and *A. sellal* appeared in six months.

c-occasional species

A total of 14 fish species were found in the first station, three species (*A. sellal, A. marmid* and *T. hamiltonii*) appeared in four months and four species (*A. arabicus, L. vorax, T. ilisha, S. triostegus*) appeared in three months and three species *(M. pelusius, C. carpio* and *B. dussumieri*) appeared in two months and four species (*C. luteus, G. rufa, P. bindus and M. mastacembelus*) appeared in one month only. The second station represented with ten species included two species (*L. vorax* and *T. ilisha*) appeared in four months and two species (*S. triostegus* and *B. dussumieri*) in the three months and five species (*C. carpio, A. arabicus, M. pelusius, P. subviridis* and *P. latipinna*) appeared in two months and one species (M. mastacembelus) appeared in one month. The third station contained six occasional species. One species (*H. leucisculus*) appeared in four months, one species (*T. whiteheadi*) appeared in three months, *C. carpio* and *M. mastacembelus* appeared in two months and *B. fuscus and A. arabicus* appeared in one month.

Ecological indices

Diversity index (H)

Fig. (13) demonstrated the monthly changes in the diversity index values for fish species in the studied stations. The lowest values of 1.13, 1.06 and 1.13 were recorded in September for first, second and third stations respectively, and the highest values of 1.87 and 1.79 in October for first and second stations and 1.67 In December for the third station.

Evenness index (j)

Fig. (14) exhibited the monthly changes in the values of the Evenness index for fish in the stations. The lowest values were 0.44 and 0.54 in September for the first and third stations respectively, 0.42 in the second station and higher values were 0.78 in October for the first station, 0.79 in November for the second station and 0.83 for the third station in March and April.

Richness index (D)

Fig. (15) displayed the monthly changes in the Richness index values at the study

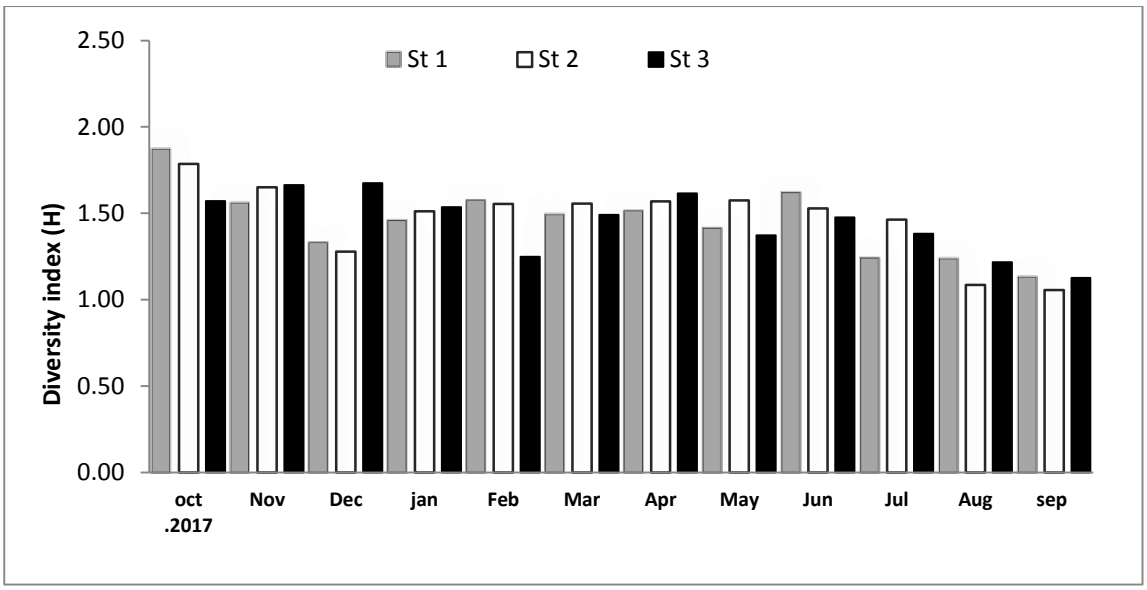

Fig. (13) Monthly changes in the diversity index values of three stations during the period from Oct 2017 to Nov. 2018.

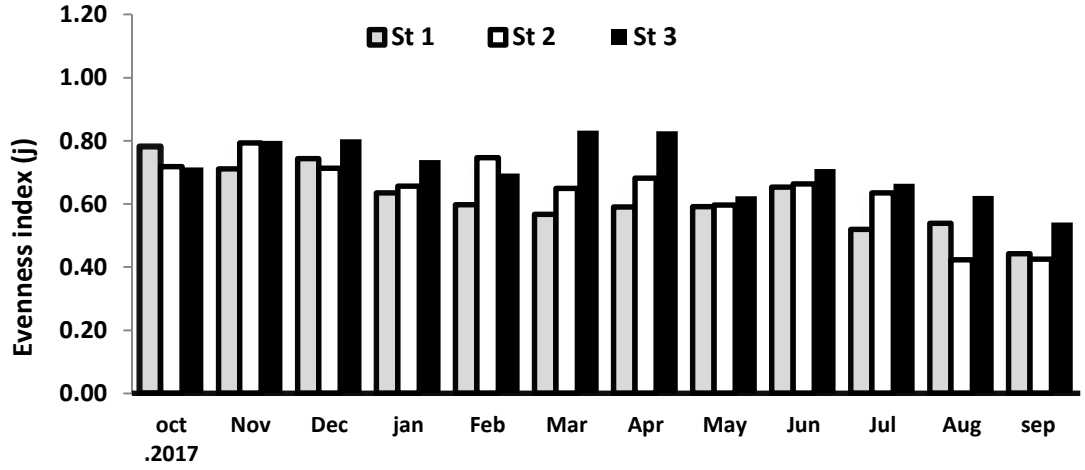

Fig. (14) Monthly changes in the values of the Evenness index of the three stations the ktiban creek during the period from Oct 2017 to Nov. 2018.

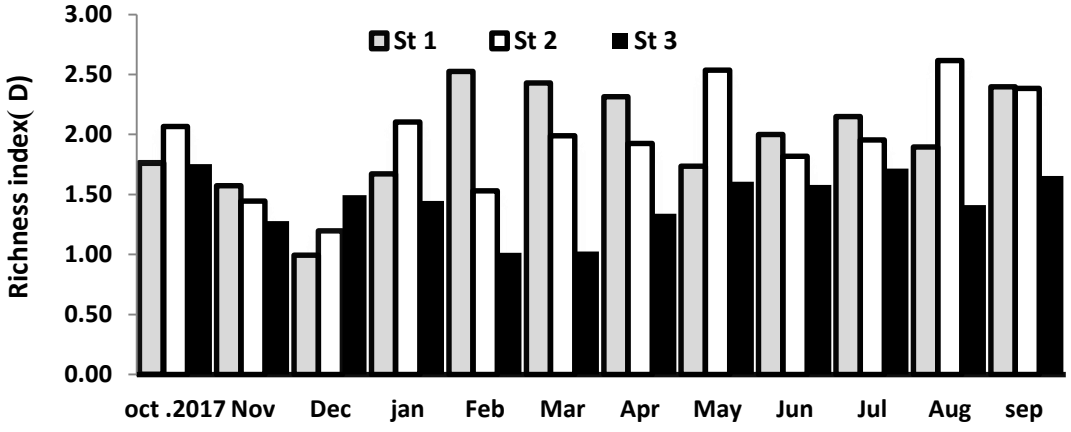

Fig. (15): Monthly changes in the Richness index values in the three stations n ktiban creek during the period from Oct 2017 to Nov. 2018..

stations. The lowest values of 1.00 and 1.20 were recorded in December for the first and second stations respectively, 1.01 in February for the third station and the highest of 2.53 in February for the first station, 2.62 for the second station and 1.75 In October for the third station.

Discussion

Environmental factors have interferences influences on aquatic organisms. The effect of one factor on the other cannot be separated. The temperature of the environmental characteristics have effectiveness on the ecosystem, the physiology, behavior of the organisms and the composition of the fish community (Durance & Ormerod, 2007). Due to local variation, differences in collecting times and water depth variation, as well as thermal capacity of water leading to daily fluctuation and low temperature values (Lampert *et al*., 1997).

The results of the present study were consistent with other studies (Al-Saad *et al*., 2015; Mohamed *et al*., 2017b; Aboud, 2018); Salinity values varied during the study period in the Shatt al-Arab and the ktiban creek, it recorded an increase in August and decreased in January 2018. Salinity levels were higher than in previous years. Salinity values ranged from 1.33 to 2.35 PSU during the period 2003-2004 (Younis *et al*., 2010), while in the current study, salinity was 1.3 - 8.7 PSU. The reason for those differences to low water discharges from the Tigris and Euphrates rivers to the Shatt al-Arab and the diversion of the river. The fluxes of Karun water from Iranian territory helped to push the saline water from the Arabian Gulf toward Shatt Al-Arab (Tawash *et al*., 2013; Hameed & Aljorany, 2011; Abdullah *et al*. 2016a).

The study showed a significant increase in the dissolved oxygen values, especially in December 2017 and January 2018 in the all stations. This is due to low temperatures and continuous mixing of water and the capacity of the surface area (Hassan, 2004).

The transparency of light which is one of the physical characteristics has a direct impact on the presence and spread of fish species (Hussein *et al*., 2000). It is an important factor for water bodies and an indicator of the relationships between organisms, especially fishes (Mrosso *et al*., 2004). Due to low water levels and increased concentration of suspended materials that resulted from high productivity which reduces light penetration (Al-Ridini, 2010). The light transparency value was higher in the third station because of low current speed, which leads to the deposition of suspended materials. This study agreed with Abdallah (2015) who also, pointed out that nutrients are a key element in sustaining the primary productivity that forms the basis of food pyramid in the aquatic environment, especially fishes. The results of the present study indicated a clear raise in the values of active nitrates from October 2017 to January 2018 for all stations and this may be due to precipitation on Nitrogenous agricultural land, which eventually drifts into the surrounding water bodies (Hussein & Fahad, 2008) and does not reduce nitrate to nitrite at low temperatures and thereby increase its concentration (Abdullah *et al*., 2001), and in decline in June and September in all stations; This may be due to the high concentration of oxygen that oxidizes nitrite to nitrate that resulted the abundance of oxygen at low temperatures and its consumption by phytoplankton and aquatic plants in hot months, reduces the concentration (Abbadi, 2009).

Phosphate values were high in the present study in November 2017, due to their low consumption of phytoplankton and other

organisms. Rain may play an important role in the decomposition of phosphorus compounds from the earth's crust and the washing of agricultural land and its removal to the water surface (Wetzel, 2001; Sharpley, 2001), and decreased during the rest of the year in all plants, which likely be consumed by phytoplankton, algae and aquatic plants of aquatic organisms, including fishes. This is consistent with Moel (2010), Al-Mayah & Al-Asadi (2010) and Abdullah (2015).

The structure of the fish community

Table (5) showed a comparison between the structure of the fish community in the Shatt Al-Arab and the ktiban creek in the current study with previous studies. The total number of species was 24 species, while Hussain *et al*. (1997) recorded 21 species in the Jabassi region, while Younis *et al*. (2010) recorded 28 species in Qarmat Ali, and Mohamed *et al*. (2012b; 2013) recorded 18 and 26 species respectively, while Abdullah (2015), Hamid (2017) and Abood (2018) recorded 32, 34 and 45 species respectively.

There are differences in, native marine and exotic fish community compared to previous studies in the Shatt Al-Arab river. The number of native, exotic and marine species in the present study were nine, eight and seven, respectively, while Mohamed *et al*. (2008) recorded 23 species from the Tigris river North Qurna, eight marine species, the hydrological changes and variation in the amount of river flow have a role in the differences in the structure of the fish community (Larned *et al*., 2010; Mohamed *et al*. (2012b; Matono *et al*., 2014; Whiterod *et al*., 2015).

Salinity is one of the main factors affecting the composition, distribution and abundance of different species of fishes along the Shatt al-Arab river. The occurrence of any disturbance in the nature of the aquatic body leads to a decline in endemic species with the increase of exotic species (Kumar & Pandey, 2013).

The study showed the dominance of four fish species in all stations that comprised 72.8% of the total number of fishes, included *O. niloticus* with 27.7% and *C. auratus* with 13.61%, *O. aureus* with 18.9% and *C. zillii* with 12.5%. The alien species that have

Table (5): Showed a comparison between the structure of the fish community in the Shatt Al-Arab and the ktiban creek in the current study with previous studies.

Reference	species	Native species	Marine species	Exotic species
Hussain *et al*. (1997)	21	13	5	3
Younis *et al.* (2010)	28	13	10	5
Mohamed *et al*. (2012b)	18	6	7	5
Mohamed *et al*. (2013)	26	11	9	6
Abdullah (2015)	32	13	8	11
Humaid (2017)	34	8	18	8
Abood (2018)	45	14	19	12
current study	24	9	8	7

accidentally entered the common water system with neighboring countries (Mutlak & Al-Faisal, 2009) that tolerate high salinity, low oxygen concentrations, high reproduction capacity and rapid adaptation to new environments (Ridha, 2006). Prussian carp ranked second, an exotic species, first listed in Coad (1991) that tolerate poor environmental conditions, low oxygen concentration, and a wide range of nutrients.

Present study is consistent with most of the studies being conducted by southern in Iraq (Younis *et al*., 2008; Mohamed *et al*., 2013; Abdullah, 2015). Hussein (2000) mentioned in his study on five species of fishes introduced into the Shatt al-Arab river, and showed that these species have different capacities to expand their distribution, affecting the composition of the fish community through competition, fertilization, and nesting, are considered one of the reasons for the low densities of local species. *P. latipinna* represent 11.23% in the first station in the Shatt Al-Arab river between the species caught, that it has invaded this species in Shatt Al-Arab a few years ago, and adapted to the prevailing environmental conditions and spread quickly, one of the advantage of this species that has the ability to live in a wide range of salinity and rivers and lakes with poor water quality (Haney & Walsh, 2003; Vasagam *et al*., 2005). There has a sharp decline in the number of common carp in all the stations that have been prevalent in the past two decades and which have been recorded in previous studies more abundantly. This may be attributed to the lack of water levels due to the establishment of several dams on the Tigris and Euphrates in Turkey (Partow, 2001). The absence of some local species such as *Mesopotamichthys sharpeyi* and *Arabibarbus gyrypus* were observed by Younis (2005). *C. luteus* ranked second in the third station with 19.82%, which is due to the fact that it is considered omnivorous habit and has a high potential for competition (Hussain *et al*., 2008).

Table (6) explained a comparison of the number of common, seasonal and occasional species in the Shatt al-Arab river. The table explained that the highest number of occasional and common species while the lowest number in the seasonal species is consistent with the study of Yunus *et al*. (2010), Hamid (2017) and Abdullah (2015). This is due to environmental changes affecting the composition of fish populations and the times of duration or the presence of the species (Tyler, 1971).

Ecological indices

The evidence of biodiversity is great importance in the knowledge of fish community, and the values of biodiversity

Table (6): showed the common, Seasonal and occasional species in the study stations compared to previous studies.

Reference	Duration	Common species	Seasonal species	Occasional species
Younis et al. (2010)	2004-2003	11	3	14
Mohamed *et al.*(2013)	2008 -2007	10	7	9
Abbas (2014)	2013-2012	5	2	2
Abdullah (2015)	2015-2013	15	4	14
Humaid (2017)	2016-2015	14	3	17
Ahmed (2017)	2017-2016	2	6	15
current study	2018-2017	8	2	14

indices in the knowledge of the number of naturally growing species can that be observed in different locations of the river and also indicate the degree of stability of fish community at very high rates (Sandu & Oprea, 2013).

The values of the diversity index exhibited the poor range in all stations ranged between 1.06 - 1.87 and the study agreed with Abdullah (2015) and Mohamed *et al*. (2012a). The study differed from that of Abood (2018) through the study of fish populations in the Shatt al-Arab river due to fishing pressure and the use of illegal tools. The values of the diversity indices are also affected by several environmental factors, including migration, fishing time, competition for food and environmental space (Horn & Allen, 1985). The values of the Richness index in the study stations ranged from 1.00 to 2.62 and were considered distributed range according to Hussain's study (2014).

The study agreed with Hamid (2017) and Abdullah (2015) and differed with that of Abood (2018). The index of diversity and richness are influenced by the abundance of species in the aquatic environment due to the abundance of marine and exotic species and their high catch ratios (Mohamed *et al*., 2017b).

Table (7): Comparison of diversity indexes in the three stations in Ktiban creek with previous studies.

Reference	indexes			Study site
	Richness (D)	**Evenness (J)**	**Diversity (H)**	
Hussian *et al* .(1995)	2.50	0.37	1.19	Shatt Al Arab
Hussian *et al* .(1997)	0.75-0.10	-	1.75-0.30	Shatt Al Arab
Younis (2010)	-	0.60-0.05	1.50-0.42	Shatt Al Arab
Younis *et al*. (2010)	2.18-0.94	0.60-0.05	0.150-0.42	Qarmat Ali
Mohamed *et al.* (2012a)	3.94-2.98	0.79-0.66	2.56-1.91	Shatt Al Arab
Abbas (2014)	2.08-1.61	0.91-0.71	1.85-1.26	Shatt Al Arab
Abdullah (2015)	2.97-0.95	0.78-0.38	1.90-0.92	The northern part of the Shatt Al-Arab
Humaid (2017)	2.26-1.05	0.63-0.23	1.57-0.47	Qarmat Ali
Ahmed (2017)	2.95-0.40	0.98-0.51	2.41-0.67	Qarmat Ali
Aboud (2018)	3.9-2.0	0.7-0.2	2.2-1.6	Al dyeer
Current study	2.62-1.00	0.83-0.44	1.87-1.06	Shatt Al Arab

The decrease of the freshwater discharge in the Shatt al-Arab was also reflected on the values of the richness index. Warm months represent the preferred seasons for the presence of fishes. This is expressed in many previous studies (olden *et al*., 2007). The values of the Evenness index were distributed between the scales the half the range, between 0.44 and 0.83. The values of the Evenness index are influenced by the values of the diversity index, where there is a direct correlation between them. The values of what are limited between (0-1) and the values are closer to 1, this indicates a lack of the dominance to a certain species (Routledge, 1983), where in the current study values were closer to 1.

The results of the study agreed with Abdullah, (2015) and converged with Abboud (2018) and Mohamed *et al*. (2015); This may be due to the increasing the enter the marine species that increase the values of environmental indexes (Hussain *et al.,* 2012). Studies also showed that the greatest proportion of the numerical abundance of fish species is due to the wide range of Evenness index (Hussain *et al*., 1997; Younis, 2005).

Conclusions

1-Salinity values in current study were higher than that in historical studies, which effect on the fish assemblage in the area and, and it was positive relation between the salinity and the number of marine fishes.

2-The temperature, salinity and transparency consider the most affect factors on the abundance of fishes.

3- A total of 24 fish species belong to 21 genera and 12 families, with dominance of Cyprinidae (eight species) in the north part of Shatt Al-Arab and Ktiban rivers were reported.

4- The study revealed a decline in relative abundance of common carp, and absence of *Mesopotamichthys sharpeyi*, *Luciobarbus xanthopterus* and *Arabibarbus grypus*.

5-The results were confirming distinct dominance of number of exotic species in compared with other native species.

6- High similarity in fish assemblage between second and third stations and may be related to the sources of the water used Jaccard index to calculated similarity or dissimilarity among stations.

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Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval: all applicable national and international guidelines for the care and use of animals were followed.

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