Mesopot. J. Mar. Sci., 2016, 31(1): 75 - 84

Distribution and abundance of Hilsa, *Tenualosa ilisha* larvae in the Shatt Al-Arab River and East Al-Hammar Marsh

M.T.K. Al-Okailee*, F.M. Mutlak and K.H. Younis
Marine Science Centre, Basrah University, Basrah, Iraq
**e-mail: munaokailee99@yahoo.com*

(Received: 12 Jan. 2016 - Accepted: 28 June 2016)

Abstract - The larvae of *Tenualosa ilisha* were surveyed in the present research at four stations in the Shatt Al-Arab River and East Al-Hammar marsh. The study was conducted from April 2013 to March 2014. Water temperature was ranged from 12°C in December to 38 °C in July at all stations. Salinity was changed from 9.35‰ in October to 36 ‰ in August at station A, while salinity changed was from 1.03 ‰ - 3.5 ‰ at stations B, C and D. A total of 185 *T. ilisha* larvae (5.0-20 mm TL.) were collected. Higher number of *T. ilisha* larvae was recorded at station C (88), comprised 47.56 % of the total fishes larvae collected, and the lowest number (23) was from station A, comprised 12.43 % of the total fishes larvae collected. *T. ilisha* larvae were found in the study region during eighth month of the year, from March to October. The highest abundance of larvae at station C in March was 3.28 larvae/10 m², and lowest was 0.14 larvae/10 m² at station D in April. Water temperature showed a significant positive correlations with abundance of *T. ilisha* larvae at stations A, B, C and D ($r = 0.833$, o.692, 0.890, 0.616 $p < 0.05$ respectively). While, the salinity showed negative correlations with abundance of *T. ilisha* larvae at stations A ($r = -0.700$, $p < 0.05$), and a weak negative correlations with stations B, C and D ($r = -0.523$, -0.455, -0.470 $p < 0.05$ respectively). The results sh0wed that Shatt Al-Arab river and East Al-Hammar marsh play a vital role in *T. ilisha* reproduction, may urgent plan need to it protect the spawning and nursery ground for larvae of this species.

Key words: *Tenualosa ilisha*, Larvae, Distribution, Abundance, Shatt Al-Arab river, East Al-Hammar marsh.

Introduction

Tenualosa ilisha is an important tropical fish belonging to the family Clupeidae and an anadromous fish occurring in the Indo-West Pacific region from the Arabian Gulf, along the coast of Pakistan, India, Bangladesh and Burma to South Vietnam and Burma, also it was recorded near the coasts of China (Bhaumik, 2015).

It occured in the foreshore areas, estuaries, brackish water lakes and freshwater rivers. It ascends the rivers for breeding and returns to the sea after completion of spawning to marine habitats. It feeds and grows mainly in the sea, but migrates to fresh water for spawning (Roomiani *et al.*, 2014). Juveniles develop and grow in fresh water, but soon migrate to the ocean, where they spend most of their lives.

T. ilisha may reach up to Qalaat Salah on the Tigris River and to Al-Fahod on the Euphrates River about 150-180 km north of Basrah (Al-Dham, 1977). It was recorded in the fisheries in the lower parts of Tigris, Euphrates during 2005 (Mohamed *et al.*, 2008). Mohamed *et al.* (2009) recorded the species in the East Al-Hammar marsh north Basrah. Mutlak (2012) mentioned that the increasing of salinity in Shatt Al-Arab River during the last years pushing adult individuals of *T. ilisha* to enter east Hammar marsh for spawning.

Studies of on distribution of *T. ilisha* larvae in the East Hammar marsh and the Shatt Al-Arab River are limited to that of Al-Noor (1998) pointed out that *T. ilisha* larvae distributed along the banks of the Shatt Al-Arab River. Al-Mahdi *et al.* (2000) collected *T. ilisha* larvae from the northern part of Shatt Al-Arab. Mohamed *et al.* (2012), on the other hand, studied the variations in occurrence, abundance and diet of *T. ilisha* larvae in the north of Shatt Al-Arab River, Basrah, Iraq.

Therefore, the present study was aimed to provide the information on the distribution and abundance of *T. ilisha* larvae in the Shatt Al-Arab River and East Al-Hammar marsh.

Materials and Methods

Study Area:

Al-Hammar marsh is the largest southern marsh extending through two provinces (Basrah and Nasiriyah). It is approximately 120 km long and 25 km wide. Maximum water depth in the marsh ranges from 1.8 m to 3.0 m (Partow, 2001).

The marsh narrows about its middle, and consequently can be divided roughly into two parts, west and east, connected by a shallow channel. Eastern part of Al-Hammar was tidal marsh affected by semidiurnal tide from Arabian Gulf, with well-oxygenated oligosaline water, sediments are grey clayey silt contain low TOC and alkaline pH (Hussain and Taher, 2007; Taher *et al.*, 2008).

The Shatt Al-Arab was located in the south-eastern part of Iraq, at the confluence of Tigris and Euphrates Rivers and extends downstream to the Arabian Gulf a distance of 204 kilometers (Al-Mansouri, 1996). The width of Shatt Al-Arab varies from 200 to 2250 m, depth from 7.5 to 12.5 m (Al-Wuhaily, 2009). The water level was affected by the high and low tides of the Gulf.

Four stations were selected in East Al-Hammar Marsh and the Shatt Al-Arab river (Fig. 1), station (A) at Al-Fao, station (B) was located near the Abu Al-khasib, station (C) was near Al-Sindibad Island and station (D) at East Al-Hammar Marsh.

Ichthyoplankton samples were collected from the four stations monthly from April 2013 to March 2014, during day time. Sampling was conducted using conical plankton net (1.25 meter length, upper opening of the net was 50 cm, mesh size 500 µm). The net was equipped with a flow meter. Oblique tows were made at a speed of 0.5 m/s for approximately 10 minutes from near the bottom to the surface. All samples were preserved in 10 % formalin solution (Robinson *et al.*, 1996). After each sampling, water temperature and salinity were measured by using YASI 556MPS.

The *T. ilisha* larvae were examined under binoculars microscope and identified according to the procedure suggested by Leis and Carson-Ewart (2000) and the total length of each specimen was measured.

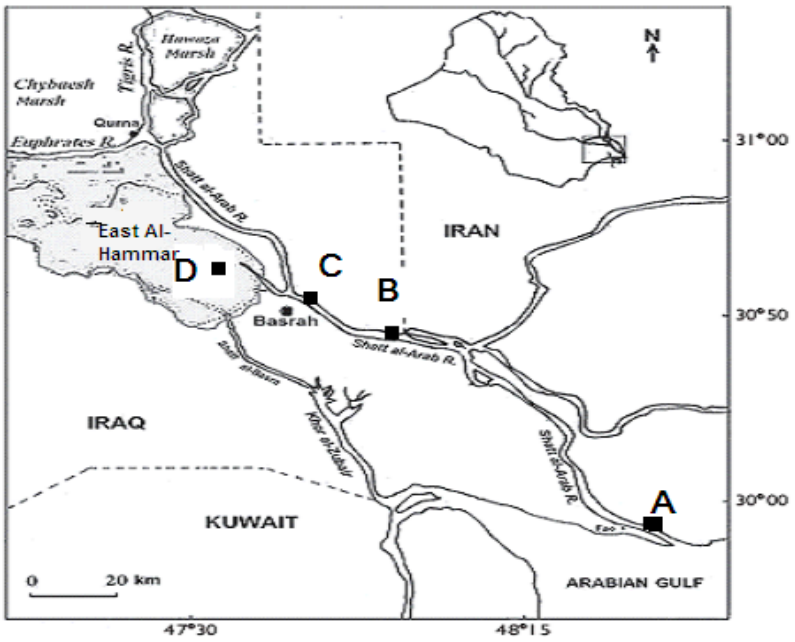

Figure 1. Map of southern of Iraq, showing the location of the stations (A, B, C, D).

Abundance of larvae was calculated according to the formula of Smith and Richardson (1977):

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

Where; A: Abundance under 10 m^2 of water surface.
N: Number of larvae.
D: Depth (m) of tow.
V: Volume (m^3) of water filtered.

The similarity among the stations based on their number of larvae was calculated according to Jaccard similarity coefficient, using SPSS software (ver.11, 2001) statistical package.

Results

Water temperature and Salinity:

Monthly changes in values of water temperature and salinity in study region are illustrated in Table (1). Water temperature in four sampling region were similar, it was decreased during winter reaching the minima in December (12 °C) then rose to reach the maxima 38 °C in July. Salinity changed was from 9.35 ‰ in October to 36 ‰ in August at station A. Salinity values tended to decrease to reach the minimum in October (1.03 ‰), followed by increase reaching the maximum in January (3 ‰) at stations B, while changed from 1.03 ‰ in October to 3.8 ‰ in July at stations C. The minimum value of salinity was 1.09 ‰ in January and the maximum value was 3.5 ‰ recorded in July at station D (Table 1).

Table 1. Monthly changes in values of water temperature (°C) and salinity (‰) in the stations (A, B, C and D).

Months	Stations							
	A		B		C		D	
	Temp. (°C)	Sal. (‰)	Temp. (°C)	Sal. (‰)	Temp. (°C)	Sal. (‰)	Temp. (°C)	Sal. (‰)
April	22.5	23	22	2.7	22	1.4	22	1.3
May	28	28	28	2.5	27.5	1.5	27.5	1.5
June	25	33	24.9	1.89	25	1.46	24.3	2.71
July	37	35	37	1.96	37.5	3.8	37	3.5
August	33	36	34	2.34	33.9	1.75	33.5	2.74
September	30	27.35	29.2	2.1	29	1.07	29	1.69
October	22.3	9.35	22.7	1.03	22.4	1.03	22.9	1.35
November	19.8	10.2	19	1.92	19.9	1.4	19.5	1.56
December	12	13	12	2	12	1.7	12	1.2
January	13.5	12	13	3	13	1.8	13	1.09
February	15	13	15	2.4	15.5	1.9	15.5	1.3
March	21	15	20.7	2.9	20.5	1.7	20.8	1.3

Ichthyoplankton Distribution:

In total, 48 samples were taken by plankton nets resulting in the capture of 185 larvae of *T. ilisha* were collected from four stations (A-D). The length of larvae ranged from 5 to 20 mm.

The highest number (88) of *T. ilisha* larvae was recorded at station C, comprised 47.56 % of the total number of fish larvae, and the lowest number (23) was from station A, comprised 12.43 % of the total number of fish larvae. However, the number of larvae in station B and D 46 (24.86 %) and 28 (15.13 %) respectively.

Monthly variations in the number of *T. ilisha* larvae during the study period are presented in Figure (2). It is clear that spawning activity of *T. ilisha* occurred during eight months of the year from March to October, no larvae were found from November to February. These larvae appeared during seven months (April to October) in station B, with peak in number during October (10 larvae), at station D occurred during March to September, with peak in number during March (13 larvae), On the other hand, in station C collected during March to August, with peak in number during March (25 larvae), As for station A collected during three months (July to September), reached the peak in September (10 larvae).

Table (2) shows abundance of *T. ilisha* larvae in four stations (A-D). Their abundance at various locations and in various months is given below. The highest abundance of larvae in March was recorded at station C (3.57 larvae/10 m^2), and the lowest abundance of *T. ilisha* larvae was 0.14 larvae/10 m^2 at station D in April.

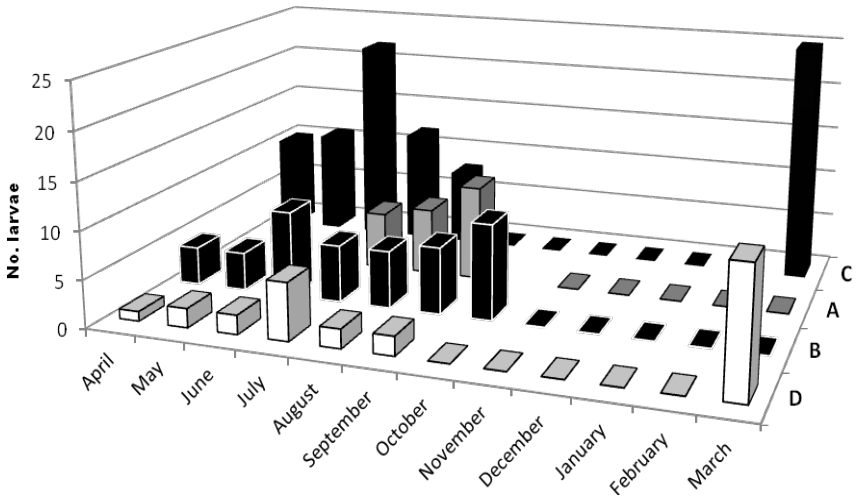

Figure 2. Monthly variation in number of *Tenualosa ilisha* larvae at four stations.

Table 2. Abundance (larvae/10 m²) of *T. ilisha* larvae at East Al-Hammar marsh and the Shatt Al-Arab River.

Months	Station			
	A	B	C	D
April	-	0.45	1.42	0.14
May	-	0.45	1.57	0.28
June	-	1.28	3.28	0.28
July	0.8	0.8	1.71	0.8
August	1.05	0.8	1.1	0.28
September	1.42	1.05	-	0.28
October	-	1.42	-	-
November	-	-	-	-
December	-	-	-	-
January	-	-	-	-
February	-	-	-	-
March	-	-	3.57	1.85

The relationship of temperature and salinity with abundance of *T. ilisha* larvae were established through the determination of correlation coefficients (r) at stations A, B, C and D are shown in Figure (3). Water temperature showed a significant positive correlations with abundance of *T. ilisha* larvae at stations A, B, C and D (r = 0.0.833, o.692, 0.890 and 0.616 $p<0.05$, respectively), while the salinity showed negative correlations with abundance of *T. ilisha* larvae at stations A (r = -0.700, $p < 0.05$), and week negative correlations with stations B, C and D (r = -0.523, -0.455 and -0.470 $p<0.05$ respectively).

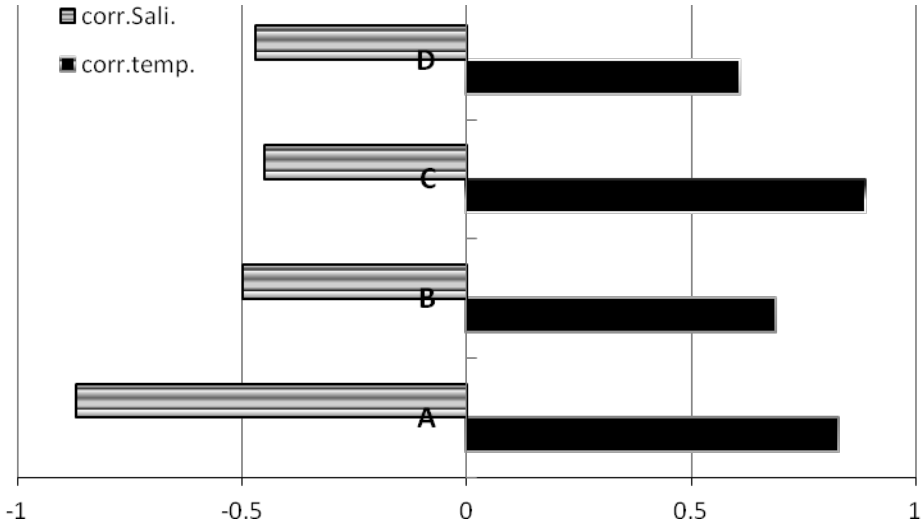

Figure 3. The relationships of water temperature and salinity with abundance of *T. ilisha* larvae at East Hammar marsh and the Shatt Al-Arab River.

The similarity cluster indicated the presence of two major groups based on larval number. The first group could be divided into two subgroups, the first formed of two stations C and D while the second include station B. The second group comprised the stations A (Fig. 4).

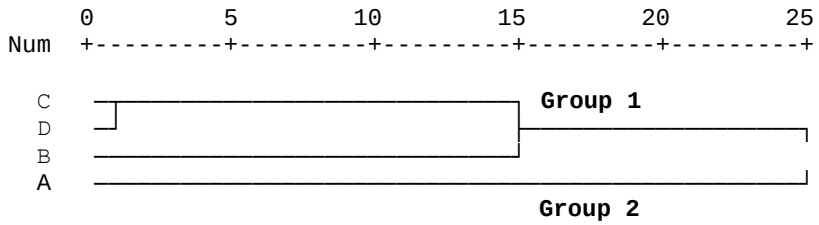

Figure 4. Average linkage of cluster analysis of larval number between four stations at EastAl-Hammar Marsh and the Shatt Al-Arab River.

Discussion

In this present study, *T. ilisha* larvae were collected from all stations in the study region, but the highest number (88 larvae) were found in the shallower and denser vegetation station (C), which was situated at the confluence of Garmat Ali River with Shatt Al-Arab River.

Al-Noor (1998) pointed out that the *T. ilisha* larvae distributed along the banks of the Shatt Al-Arab River which are characterized by slow currents due to the thick growth of aquatic plants within the area extended from 30 to 120 km from the estuary. Al-Mahdi *et al.* (2000) collected *T. ilisha* larvae from the Al-Jebasi to Abu Flwos in the Shatt Al-Arab.

Al-Okailee (2010) also collected *T. ilisha* larvae from shallow banks in the northern part of the Shatt Al-Arab. Young of *T. ilisha* were collected from shallow banks in the northern part of Shatt Al-Arab (Hussain *et al*., 1997). The presence of high cover of aquatic plants in the marsh area and Shatt Al-Arab River this was probably due to higher water impulse to the Southern marshes which led to flourishing of aquatic plants and algae (Al-Abbawy and Al-Mayah, 2010; Hussain *et al*., 2012) provide a suitable shelter and spawning ground for fish. The occurrence *T. ilisha* larvae in the region indicate that this area was the spawning ground for these fishes. Al-Noor (1998); Mahdi *et al.* (2000) and Mohamed *et al*. (2012) collected *T. ilisha* larvae from the same area.

T. ilisha larvae were found in the study region from March to October and the peak of occurrence was during March, no hilsa larvae were found from October to February.

Al-Noor (1998) collected *T. ilisha* larvae in the Shatt Al-Arab River in June to October 1997, while Al-Mahdi *et al.* (2000) collected *T. ilisha* larvae in the Shatt Al-Arab River in May, June and July 1997, 1998.

At the same time, Mohamed *et al*. (2012) stated that the larvae of *T. ilisha* captured in the north part of Shatt Al-Arab River. In Kuwaiti, coastal waters of Arabian Gulf showed that *T. ilisha* spawns in May to July with a peak in June (Al-Baz and Grove, 1995).

In Iran, the spawning season of *T. ilisha* in Khouzestan Province was from May to August (Roomiani *et al.*, 2014). Panhwar *et al.* (2011) reported that the spawning season in *T. ilisha* was from May to October in Pakistan. In Indian, Bhaumik (2015) reported that spawning of *T. ilisha* takes place in the month of August to November and January-March, and indicating that *T. ilisha* spawns more than once in a year.

The disappearance of larvae at October to February could be due to the growth of the larvae and increase of their ability to avoid the net. Mohamed *et al.* (2008) showed that the disappearance of juveniles of *T. ilisha* from the east Hammer marsh during the winter months and they concluded that *T. ilisha* may be moved back to marine habit to complete their growth. These differences in the spawning periods of population in different areas may be to genetic and environmental factors (Roomiani *et al.*, 2014).

In the present study, range of temperature and salinity controlled the spawning season in the East Hammer marsh and Shatt Al-Arab River and showed positive correlations between the abundance of *T. ilisha* larvae and water temperature and negative correlations with salinity. It was appeared that the water temperature and salinity have effect on the occurrence of *T. ilisha* larvae in the East Hammer marsh and Shatt Al-Arab River.

The highest abundance of *T. ilisha* larvae was corresponding with the highest water temperature and low salinity the same was reached by Mohamed *et al.* (2012) and Brinda *et al.* (2010) in the marshes ecosystem the temperature influences the spawning season and the abundance of fish larvae. The results suggested the abundance of *T. ilisha* larvae are governed more directly by temperature, due to its influence on spawning, than by salinity (Charnov and Gillooly, 2004).

In conclusion, the Shatt Al-Arab River and East Al-Hammar marsh play a vital role in *T. ilisha* reproduction, there was an urgent need to protect the spawning and nursery ground for larvae of *T. ilisha*.

References

Al-Abbawy, D.A.H. and Al-Mayah, A.A. 2010. Ecological Survey of Aquatic Macrophytes in Restored Marshes of Southern Iraq during 2006 and 2007. Marsh Bull, 5: 177-196.

Al-Baz, A.F. and Grove, D.J.1995. Population biology of sbour *Tenualosa ilisha* (Hamilton-Buchanan) in Kuwait. Asian Fisheries Science, 8: 239-254.

Al-Daham, N. K.1977. Fishes of Iraq and the Arabian Gulf. Volume 1, Basrah Univ. press, Iraq, 406 pp. (In Arabic).

Al-Mahdi, A.A., Hussain, N.A. and Al-Noor, S.S. 2000. Survey of ichthyoplankton from northern part of Shatt Al-Arab River. Marina Mesopotamica, 15: 571-380. (In Arabic).

Al-Mansouri, F.Y. 1996. Study of sediment transport in the southern part of the Shatt Al-Arab. M.Sc. Thesis, College of Agriculture, University of Basrah. 119 pp. (In Arabic).

Al-Noor, S.S.H. 1998. Reproductive biology of *Tenualosa ilisha* in the Shatt Al-Arab River. Ph.D. thesis, College of Agriculture, Basrah University, 161 pp. (In Arabic).

Al-Okailee, M.T.K. 2010. The spatial and seasonal composition of some ichthyoplankton and trophic relationships in north part of Shatt Al-Arab River. Ph.D. thesis, College of Agriculture, Basrah University, 207 pp. (In Arabic).

Al-Wuhaily, O.Q.K. 2009. Sedimentological and geomorphological study of Shatt Al-Arab Islands between Basrah and Saybah. M.Sc. Thesis, College of Science, University of Basrah, 68 pp. (In Arabic).

Bhaumik, U. 2015. Review of Global Studies on Food, Growth and Maturity Profile of Indian Shad (*Tenualosa ilisha*). Int. J. Curr. Res. Aca. Rev., 3(10): 127-139.

Brinda, S., Srinivasan, M. and Balakrishnan, S. 2010. Studies on diversity of fin fish larvae in Vellar Estuary, southeast coast of India. World Journal of Fish and Marine Sciences, 2(1): 44-50.

Charnov, E.L. and Gillooly, J.F. 2004. Size and temperature in the evolution of fish life histories. Integrative and Comparative Biology, 44: 494-497.

Hussain, N.A., Ali, A.H. and Lazem, L.F. 2012. Ecological indices of key biological groups in Southern Iraqi marshland during 2005-2007. Mesopot. J. Mar. Sci., 27(2): 112-125.

Hussain, N.A. and Taher, M.A. 2007. Effect of daily variations, diurnal fluctuations and tidal stage on water parameters of East Hammar marshland, Southern Iraq. Marsh Bulletin, 2: 32-42.

Hussain, N.A., Younis, K.H. and Yousif, U.H. 1997. The composition of small fish assemblages in the river Shatt Al-Arab near Basrah (Iraq). Acta Hydrobiologia, 39(1/2): 29-37.

Leis, J.M. and Carson-Ewart, B.M. 2000. The larvae of Indo-Pacific Costal Fishes: An identification guide to marine fish larvae. Fauna Malesiana. Vol. 2. Leiden; Boston; Koln: Bril., 850 pp.

Mohamed, M.A.R., Ahmed, S.M. and Al-Okailee, M.T.K. 2012. Variations in occurrence, abundance and diet of hilsa, *Tenualosa ilisha* larvae in the north of Shatt Al-Arab River, Basrah, Iraq. Basrah J. Agri. Sci., 25(Special Issue 2).

Mohamed, A.R.M., Al-Noor, S.S. and Faris, R.A. 2008. The status of artisanal

fisheries in the lower reaches of Mesopotamian Int. rivers, north Basrah, Iraq. Proc. 5 Con. Biol. Sci. (Zool), 5: 126-132.

Mohamed, A.R.M., Hussain, N.A., Al-Noor, S.S., Coad, B.W. and Mutlak, F.M. 2009. Status of Diadromous Fish Species in the Restored East Hammar Marsh in Southern Iraq. In: A.J. Haro, K.L. Smith, R.A. Rulifson, C.M. Moffitt, R.J. Klauda, M.J. Dadswell, R.A. Cunjak, J.E. Cooper, K.L. Beal and T.S. Avery (Eds.), pp: 577-588. Internat. Symp. Diadromous Fishes, Challenges for Diadromous Fishes in a Dynamic Global Environment, 18-22 June 2007, Halifax, Nova Scotia, Canada, American Fish Soc. Symposium.

Mutlak, F.M. 2012. Stock assessment of some fish species in east Hammar marsh. Ph.D. Thesis, College of Agriculture, Basrah University, 195 pp. (In Arabic).

Panhwar, S.K., Siddiqui, G. and Ayub, Z. 2011. Reproductive pattern and some biological features of fish *Tenualosa ilisha* (Family: Clupeidae) from Pakistan. Indian Journal of Geo. Marine Sciences, 40(5): 687-696.

Partow, H. 2001. The Mesopotamian marshlands: demise of an ecosystem. United Nations Environment Programme, Early Warning and Assessment Technical Report, UNEP/DEWA/TR.01–3 Rev 1, Nairobi, Kenya.

Robinson, C.L.K., Hay, D.E., Booth, J. and Truscott, J. 1996. Standard Methods for Sampling Resources and Habitats in Coastal Sub tidal Regions of British Columbia: Part 2- Review of Sampling with Preliminary Recommendations. Can. Tech. Rep. Fish. Aquat. Sci., XXXX: xii + 119 p.

Roomiani, L., Sotudeh, A.M. and Hakimi Mofrad, R. 2014. Reproductive biology of Hilsa shad (*Tenualosa ilisha*) in coastal Waters of the Northwest of Persian Gulf. Iranian Journal of Fisheries Sciences, 13(1): 201-215.

Smith, P.E. and Richardson, S.L. 1977. Standard techniques for pelagic fish eggs and larvae survey. FAO Fish.Tech. Pap. No. A5., 100 pp.

Tahir, M.A., Risen, A.K. and Hussain, N.A. 2008. Monthly variations the physical and chemical properties of therestored southern Iraq marshes. Marsh Bulletin, 3: 78-91.

انتشار ووفرة يرقات اسماك الصبور *Tenualosa ilisha* في شط العرب وهور شرق الحمار

منى طه خضير العكيلي وفلاح معروف مطلك وكاظم حسن يونس
مركز علوم البحار، جامعة البصرة، البصرة-العراق

المستخلص - تم جمع يرقات أسماك *Tenualosa ilisha* من أربع محطات في نهر شط العرب وهور شرق الحمار من نيسان 2013 إلى اذار 2014. تراوحت درجة حرارة الماء بين 12 °م في كانون الأول إلى 38 °م في تموز في جميع المحطات. تراوحت الملوحة بين 9.35 ‰ في تشرين الأول و36 ‰ في آب في محطة A، بينما تَغيّرتْ مِنْ 1.03 ‰ - 3.5 ‰ في المحطاتِ B وC و D. جمعت 185 يرقة صبور (5.0-20 ملم). سجل أكبر عدد يرقات (88 يرقة) في محطة C وشكلت نسبة

47.56 % من المجموع الكلي ليرقات الصبور المجموعة، وسجل أقل عدد (23 يرقة) في محطة A وشكلت نسبة 12.43 % من المجموع الكلي ليرقات الصبور المجموعة. تواجدت يرقات الصبور خلال ثمان أشهر من آذار إلى تشرين الأول ولم تظهر اليرقات خلال شهر تشرين الثاني إلى شباط. سجلت أعلى وفرة (3.57 يرقة /10م^2) عند محطة C في آذار وأقل وفرة (0.14 يرقة/10م^2) عند محطة D في نيسان. أظهرت درجات الحرارة إرتباط موجب معنوي مع وفرة يرقات *T. ilisha* في محطات A، B، C، D (r =0.0.833, o.692, 0.890, 0.616 p < 0.05) على التوالي، وأظهرت الملوحة إرتباطاً سالباً مع وفرة يرقات محطةA (r = -0.700, p < 0.05)، كما أظهرت إرتباطاً ضعيفاً سالباً في المحطات B، C، D (r = -0.523,- 0.455,-0.470 p < 0.05) على التوالي. تؤكد النتائج أن نهر شط العرب وهور شرق الحمار يلعب دوراً حيوياً في تكاثر أسماك *T. ilisha*، ومن الضرورة العاجلة حماية أماكن طرح السرء وحضانة يرقات أسماك الصبور.