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THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE DENSITY AND DISTRIBUTION OF THE ISOPOD *SPHAEROMA ANNANDALEI ANNANDALEI* ALONG THE INTERTIDAL ZONE OF THE SHATT AL-ARAB RIVER, IRAQ

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Abstract

Some environmental factors affects both the density and distribution of the isopod *Sphaeroma annandalei annandalei* along the intertidal zone of the Shatt al-Arab River. Samples were collected monthly at three stations (Al-Sharish, Al-Salhiya and Duwaib) during the period from December 2017 to November 2018. Some environmental factors were recorded such as water temperature as the lowest water temperature reached 12 °C in January and the highest temperature was 33 °C during July, both at Salhiya station, The lowest value of salinity was 0.5 ppt recorded at April and November in Al-Sharish and the highest value was 39.3 ppt recorded during July in Duwaib station. The bottom deposits in the three stations were alluvial deposits with a few different percentages of sand and clay. The study showed that the environmental factors studied have an effect on the distribution and abundance of this species within the horizontal and vertical section in the intertidal zone of the Shatt al-Arab River and that individuals of this species are building their burrows in the alluvial areas mixed with sand and clay used for hiding from predators. There was a positive correlation between the density of the species and the salinity and Total organic carbon. The results indicate that there is no fixed effect of water temperature on the distribution of the species within the horizontal section of the tidal zone. The total population density was found to be between 64-288 ind. / m^2 during June, April and November at Al-Sharish station and 112-624 ind. / m^2 during January and November at Al-Salhiya station and 160-576 ind./m^2 during and January and October at Duwaib station. The temperature played an important role in the vertical distribution of the species within the intertidal zone and because of the invertebrates of this zone, need to adapt quickly to environmental changes such as high temperature, salinity and drought to maintain their lives. The complete absence of this crustacean species for some months explains significant seasonal changes that are inappropriate for invertebrates living in the Shatt al-Arab environment.
***Keywords*:** Density, distribution, environmental factors, intertidal zone.

Introduction

The isopod *S. a. annandalei* was first recorded in the Shatt al-Arab waters by Ahmed (1971), individuals of this species live on the muddy bottom, which has a role in the bottom erosion process as a result of continuous drilling (Grant and Daborn, 1994). It is usually found in seawater but is more abundant in river reserves (Pillai, 1965). It is found at the intertidal zone in the Shatt al-Arab (Daoud, 1976), species of the genus are found under the deep sea m>500 or lives in shallow waters while others live in other environments such as caves and land (Wetzer, 2015). All species of this group are widely tolerance for eurythermic and euryhaline conditions (Daoud, 1976), and their adaptation is slow to gradual change in the coast al salinity and is found in near-shore coastal environments such as tides, rocks, ponds or trees (Wilkinson, 2000). This group invaded estuaries and salt water (Pillai, 1965).

Nests of these organisms were found under rocks and inside empty barnacles (Davidson, 2008). These species are an important link between the aquatic environment and land by exploiting food that is not prepared for other aquatic organisms such as fish. *S. a. annandalei* and *Annina mesopotamica* have a high prevalence at the top edge and are dug in clay soils in small craters scattered on the edges in the intertidal zone of the Shatt al-Arab. Studies on the occurrence and distribution of species in Iraq have been conducted by Daoud (1976), his study included the monthly changes in its density, reproduction and animal behavior during the moulting process, followed by the study of Saoud (1987) where he studied population dynamics and secondary production of the same species. Khalaji-Pirabalouty and Wagele, (2010) also described the occurrence of species that were recorded as genus belonging to the *Sphaeroma.* As Al-Zubaidy, (2017) shows that these animals live in sediments consisting of clay or silt and sediments containing fine sand. These deposits came from the floodplains of the Tigris and Euphrates Rivers. Mohammad, (2014) collected individuals from two locations in Lake Razaza and Hor al-Dalmaj and described this species and distinguish males from females. The specie S. a. annandalei makes networks of intricate burrows within the sandstone of the shoreline edges of Lake Razaza. explained Al-Zubaidy et al. (2017) *S.a. annandalei* from the mud pits in the coastal area of Al-Hawizeh marsh.

There are three other species belonging to isopoda crustaceans in the region:

Littorophiloscia culebrae, Asellus coxalis and *Annina mesopotamica*

These species are an important link between the aquatic environment and land by exploiting food that is not available for other aquatic organisms such as fish. *S. a. annandalei* and *Annina mesopotamica* have a high prevalence at the top edge and are dug in clay soils, living in small pits scattered on the edges of the Shatt al-Arab tidal zone. *Asellus coxalis* is rarely hidden among algae and aquatic plants (Saoud, 1997). Salman, (1975) studied the post –embryonic stage, moulting and population growth behavior of *Annina mesopotamica* in the Shatt al-Arab River, while *Littorophiloscia culebrae*, a terrestrial isopoda, was recorded in Khor al-Zubier in Iraq and the Arabian Gulf by (Naser *et al*., 2015)

Total organic carbon (TOC) in sediment represents the amount of residual organic matter after decomposition whose value is influenced by many factors such as primary productivity, sedimentation rate, quantities of organic crumbs resulting from decomposition of organisms after death and rapid decomposition of organic matter by decomposers (Routh *et al*., 2004). Recent studies have confirmed that increased human activity and increased introduction of organic pollutants increase the amount of TOC in sediments (Choudhary *et al*., 2010; Das, 2005). Sediments are the most common source of water pollution consisting of minerals and solid organic matter (EPA, 2007). The total organic carbon concentration in natural water is generally less than 10 mg/l.

Objectives of the present study: The present study aims at highlighting the importance of the intertidal zone of the Shatt al - Arab River and the role it plays as an appropriate ecosystem for the occurrence of a specie of invertebrates such as *S. a. annandalie* which is an important link between the aquatic environment and land. It is necessary to know the role played in the environment by calculating the amount of occurrence and densities and monthly and site changes of productivity and thus we can know the environmental efficiency of this species, which may play a role in the erosion the soil of the Shatt Al-Arab River.

Materials and Methods

Description of the study stations:

The first Station: Al-Sharish St. This station is located in the south of Al-Qurna town within the N30˚ 97.318′ E47˚47.252′. This area is characterized by a small slope of the beach and an open coastal gradient and the presence of several types of plants with high density.

The second station: Al-Salhiya St. This station is located in the Al-Salhiya area within the coordinates of N30˚50.896′ E47˚85.736′ opposite the Teaching Hospital in the eastern side of the River, the region is characterized by the presence of water plants in various diversity and varying density.

The third station: Duwaib St. This station is located in Al-Duwaib area within the coordinates of N30˚10.569′ E48˚39.993′. (Fig. 1).

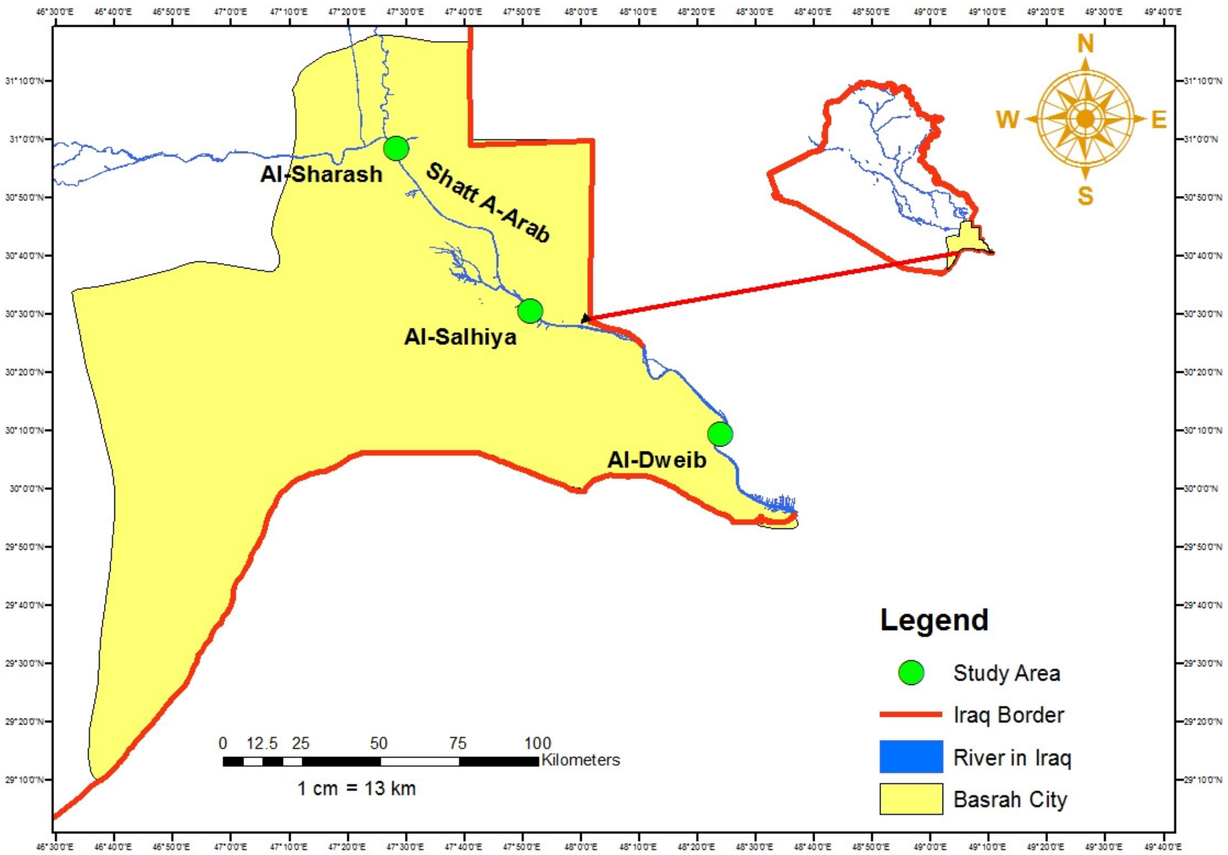

Fig. 1 : Three study stations at Shatt Al-Arab river.

Sample collection:

Samples were collected monthly for one year from December 2017 to November 2018 from the three study stations by one sample per month during the lowest tide. Most environmental factors were recorded in the field. Temperature The water temperature was measured using a mercury thermometer 0-100 ^oC.

Sediment texture was analyzed from each station, sediment samples were taken monthly by shovel to a depth between 5-10 cm randomly from the three replicates. Soil tissue was estimated by mechanical analysis (Forth and Turk, 1972).

The collection of sediment samples:

The sediment samples were collected monthly and for all stations at the same time as water and invertebrate samples were collected using a shovel in the intertidal zone during the lowest tide and for the three stations and for three replicates and a depth of about 10 cm from the surface and placed in bags and brought to the laboratory then dried and milled for the purpose of subsequent measurements.

Determination of total organic carbon in Sediments (TOC):

According to the organic carbon concentration using TOC Analyzer TOC-L CSN manufactured by SHIMADZU (APHA, 2005)

Results

1. Water Temperature

Water temperatures varied during the study period and for all stations, with the highest temperature reaching 33 ° C recorded during July and the lowest 12 ° C recorded during January both in Al-Salhiya station. No significant differences were observed between the three stations while significant differences were recorded between months (p> 0.05) (Fig. 2).

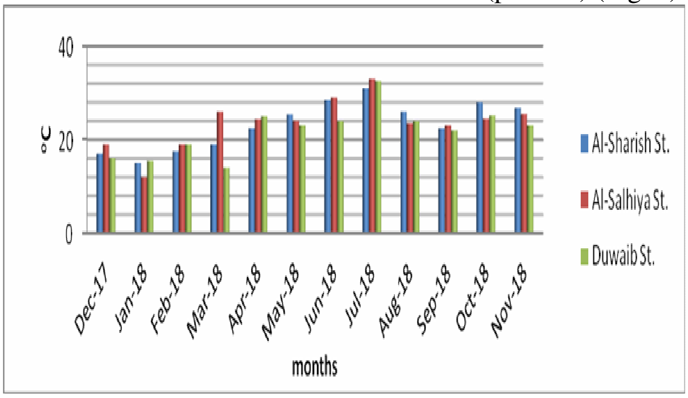

Fig. 2 : Water temp. at the three stations of the Shatt Al-Arab River from Dec. 2017 to Nov. 2018.

2. Salinity

The salinity values of the water of the study stations of three ranged from 0.5 parts per thousand recorded in April and November at Al-Sharish station and 39.3 ppt recorded in July at Duwaib station. The higher values were 9.2, 16.0, 39.3 ppt recorded in August, October and July at Al-Sharish, Al-Salhiya and Duwaib stations respectively. No significant differences were observed between Al-Sharish and Duwaib and between Al-Salhiya and Duwaib. No significant differences were found between the Sharish and Al-Salhiya and significant differences were recorded during the months (p> 0.05).

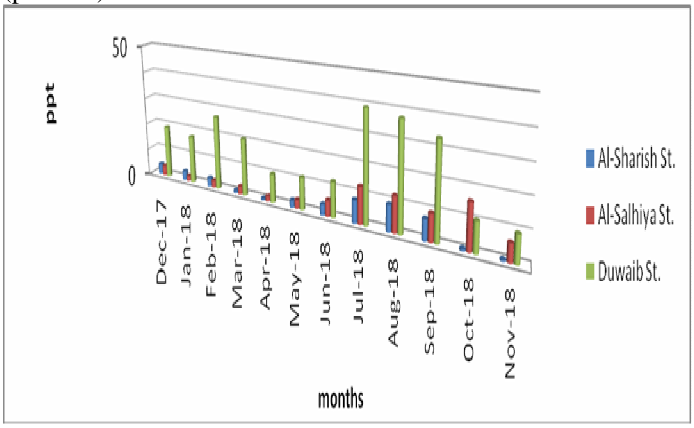

Fig. 3 : Salinity values at the three stations of the Shatt Al-Arab River during Dec. 2017 to Nov. 2018.

3. Sediment Texture

Table (1) shows the results of the analyses of the bottom sediments of the stations and was a mixture of sand, silt and mud, The results of the analyses of the bottom sediment tissue of the stations during the study period showed that all stations are alluvial with few percentages of other components. Al-Sharish station was alluvial with a few percentages of sand and mud, Al-Salhiya station was alluvial with a small percentage of sand, and Duwaib station was characterized as an alluvial clay with a small percentage of sand.

Table 1 : Sediment Texture at the 3 stations of the Shatt Al-Arab River.

Average	Al-Sharash St.	Al-Salhiya St.	Duwaib St.	Station
9.3	4	17	7	**Sand (%)**
78.66	93	70	73	**Silt (%)**
12	3	13	20	**Clay (%)**
alluvial clay	alluvial clay	alluvial clay	alluvial clay	**Sediment type**

4. Total Organic Carbon (TOC%):

The highest percentage of total organic carbon in sediments was (10.09%) and (5.91%) during August at Al-Salhiya and Al-Sharish stations respectively, while Duwaib station reached 5.95% at September, while the lowest percentage was 0.64% in February at Duwaib station. It also reached 0.68% and 0.94% during January and March for Al-Sharish and Al-Salhia stations respectively.

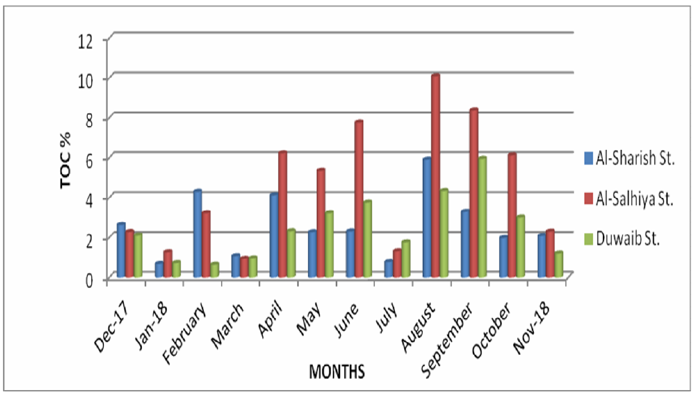

Fig. 4 : Total Organic Carbon (TOC%)at the 3 stations of the Shatt Al-Arab River.

Significant differences were observed between Al-Sharish and Duwaib stations and between Al-Salhiya and Duwaib stations. There are no significant differences between Al-Sharish and Al-Salhiya stations. Significant differences were recorded during the months (p> 0.05). Figure 4.

5. Estimation of the total density of *S.a. annandalei*

Changes in population density were studied at the three stations at a rate of three replicates and expressed as average density (individual/m^2) for the period from December 2017 to November 2018.

Figure 5. shows the monthly and site changes in the total population densities of *S. a. annandalei* at the three selected stations, with the highest value of 288 ind. / m^2 during April and November and the lowest value of 64 ind. / m^2 recorded during June. The animals were absent in August of Al-Sharish and ranged between 112-624 ind. / m^2 during January and November in Al-Salhiya, respectively. And 160-576 ind. / m^2 during January and October at Duwaib, respectively.

The results of the statistical analyses showed that there were significant differences between Al-Sharish and Al-

Salhiya and between Al-Sharish and Duwaib while there were no significant differences between Al-Salhiya and Duwaib.

Found significant differences between the months of November, January, February, and December.

There were no significant differences between the remaining months (table). The results of the statistical analysis showed that there were significant differences between Al-Sharish and Al-Salhiya stations and between Al-Sharish and Al-Duwaib stations

While there are no significant differences between Salhiya and Duwaib stations. In the Duwaib, this species was inversely correlated with salinity ($p < 0.01$, $r = -0.834$).

In Al-Salhiya this species was correlated with a significant correlation with the environmental factors of temperature and salinity ($p < 0.01$, $r = 0.542$ and $r = 0.620$).

In Duwaib this species was correlated with a significant correlation with environmental factors temperature and total organic carbon ($p < 0.01$, $r = 0.515$ and $r = 0.532$).

At Al-Salhiya the present species showed a significant correlation with environmental factors like temperature and salinity ($p < 0.01$, $r = 0.542$ and $r = 0.620$).

At Duwaib this species was positive correlated with environmental factors temperature and total organic carbon ($p < 0.01$, $r = 0.515$ and $r = 0.532$).

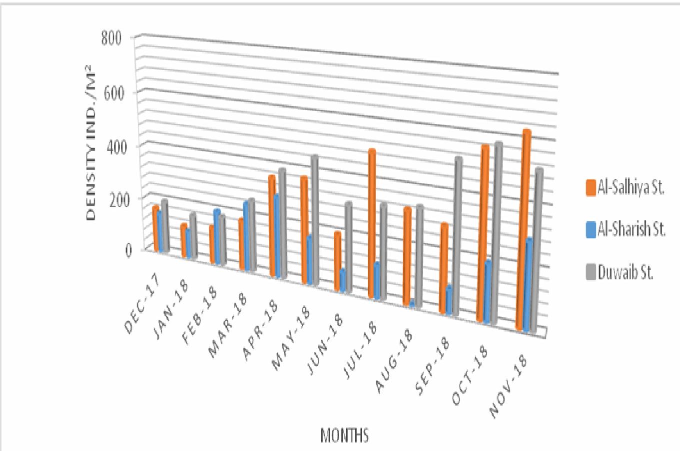

Fig. 5 : Density (ind./m^2) of S. a. anninale at the 3 stations of the Shatt Al-Arab River during Dec. 2017 to Nov. 2018

6. Density within vertical distribution mode:

The density of the studied species was calculated on a monthly basis during the study period for the different vertical sections that were divided by distance from water during the lowest tide to the first site (away from water) and the second site (middle) and a third site (close to the water),

The results showed the highest values recorded in October and November in the second site (middle) in Al-Sharish and in the second and third site in Al-Salhiya and Duwaib.

It did not register in the first site in the summer months, as well as the second site except July in the second and third site in the Al-Sharish station.

The highest values were recorded in February at the first site and April at the third site in Al-Sharish.

In Al-Salhiya, the highest values appeared in April, May and July in the first site, and were absent for most months of the year except October, November and July in the third site.

In Duwaib, the highest values appeared in July and September in the first site and disappeared for all months except February, October and November in the third site. Significant differences were found at 0.05 level in the densities between different sections for each station as in Table (2. 1, 2, 3).

Table 2.1 : Average density of *S. a. Annandale* from 3 stations at the 3 intertidal levels in the Shatt Al-Arab River.

S. a. Annandale **Density ± standard deviation**	**Location**
a**119.12**±149.33	Away from water
b**86.99**±89.33	Center
c**66.60**±38.22	Close to water

Table 2.2 : Average density of *S. a. Annandale* at 3 stations in the Shatt Al-Arab River.

S. a. Annandale Density ± standard deviation	**Stations**
b 51.55±58.39	Al-Sharash Density ± standard deviation
a 104.88±109.55	Al-Salhiya Density ± standard deviation
a 120.44±120.25	Al-Duwaib Density ± standard deviation

Table 2.3 : Average monthly density of *S. a. Annandale* at 3 stations in the Shatt Al-Arab River.

S. a. annandale **Density ± Standard deviation**	**Months**
b**71.15±55.11**	December2017
b **96.66±58.66**	January2018
b **53.73±55.11**	February
ab**86.16±74.66**	March
ab **101.33±113.77**	April
ab **121.79±108.44**	May
ab **67.14±62.22**	June
ab **147.10±103.11**	July
ab **117.06±72.88**	August
ab **135.63±97.77**	September
ab **98.23±147.55**	October
a **96.14±158.22**	November2018

Discussion

Temperature is the most important physical factor in the estimation of water quality and is not rivaled by another factor in the direct and indirect impact on living organisms as it plays an important role in the behavior, abundance and distribution of aquatic organisms (Peterson *et al.*, 2013). The results of the present study showed that there were significant differences in water temperature during the study period between the months and a large convergence between water temperature and air. The highest temperature was recorded at Al-Salhiya station during July and the lowest temperature was recorded during January at the same station.

In the ecosystem, high water temperature is closely associated with ambient heat (Gupta and Paliwal, 2010; Ishaq and Khan, 2013), as the shallowness of the river and its rapid heating during long daylight hours during summer make it vulnerable to air temperatures (Corbitt, 2004). The nature of the Iraqi climate in general is with high temperature in summer and low in winter (Fahd, 2006).

Salinity is a determining factor for the distribution and diversity of living organisms and is one of the environmental factors with significant fluctuations affecting the distribution and spread of aquatic organisms and determining the size of the community (Sundaramanickam *et al*., 2008; UNEP, 2008; Abowei, 2010).

Salinity is of great importance in determining the types of organisms present in an ecosystem, and the types and numbers of organisms in water vary according to salinity (Nielsen *et al*., 2003). This study showed that the highest values of salinity in the Shatt al-Arab water were recorded at Duwaib station, while the lowest values was recorded in Al-Sharish station, which is higher than previous records (Al-Heluo, 2001; Al-Mahmoud *et al*., 2008; Moyel, 2010). The Karon River is completely closed from the Iranian side as the drainage water acts as a barrier to limit the progress of the salt water block from the Arabian Gulf towards the Shatt al-Arab (Amir, 2010; Hassan *et al*., 2011), as well as the continuous increase in the addition of salt ions to the River water from Watering agricultural land and sewage on both sides of the river together with the processes of evaporation in the summer months (Hammadi, 2010).

The increase in water temperature has to do with the increase of salt concentration in the Shatt Al-Arab waters due to evaporation factor as well as the shortage of water coming from the Tigris and Euphrates Rivers due to the construction of dams and reservoirs in Turkey, Syria and Iran, which reduces the amount of water entering the Shatt Al Arab (Hussain and Grab, 2009).

This result was consistent with that of Hreeb and Moufeed, 2018), when they studied Hamdan, Gardelan and Garmat Ali stations in Shatt al-Arab River.

Sediment components have an important role in determining the type of sediment and their physical and chemical properties, as it affects the sediment's ability to retain ions of elements, salts and organic materials in quantity and quality (Al-Saadi, 2006 and Al-Hejuje, 2014). It is an important factor affecting the lives of large invertebrates in the tidal region of the aquatic ecosystem (Southward, 1971.) Sediment texture plays an important role in changing large invertebrate communities during the year.

There are many species of organisms whose numerical abundance relates to sediment components, some of which prefer soft sediments and others prefer coarse sediments (Silva *et al*., 2006). The prevalence of large invertebrates in rivers, reservoirs and lakes is directly related to sediment type, food availability, bottom type and water flow velocity (Callisto *et al*., 2005). The Shatt al-Arab sediments are a mixture of silt, sand, and mostly silt (Albdran *et al*., 1996). The results of this study showed that there was a difference in sediment tissue in the three stations. All the stations used to be siltine and differed in clay and sand ratios. There was a small percentage of sand and mud at Al-Sharish station compared to siltine. In Al-Salhiya station, the sand content was higher than the mud ratio, while in Duwaib station the mud ratio was higher than the sand.

In other words, the rate of sediments in the Shatt al-Arab River in general is silt clay, which is not consistent with what Khafaji *et al*. (2015) found at Al-Diir station, as they recorded clay silt this is maybe due to the reason that their station is located at the top of the Shatt al-Arab. The results of this study were in agreement with Al-Hejuje (2014), because the highest percentage of silt was followed by mud and the lowest by sand. As for other studies, the ratios of silt, sand and mud were closely related (Al-Hejuje, 1999; Al-Essa, 2004; Khalaf, 2011; Al-Khafaji, 2015).

The results of the present study showed an increase in the values of total organic carbon in the hot months, especially during the month of August at the Al-Salhiya station due to untreated wastewater and rich in organic materials from nearby communities (Resen, 2001 and Maliki, 2002). Thus, human activities add large amounts of organic matter (EL-Sammak *et al*., 2006). As well as the quality of waste that is discharged to the area and carried with river water and deposited on the bottom Antoine, 1984 (Alkhion, 2001). Also, the areas adjacent to the river played a role in the pollution of the area (Al-Jana'i, 2010). In addition, the density of aquatic organisms and plants increases the accumulation of suspended organic matter in the water and its erosion (Sanchez-Carrillo and Al-Varez-cobelas, 2001). The results of the present study are consistent with the results of Khalaf (2011) with the highest rate of organic matter in the summer months at Al-Salhiya station and the lowest rate in the winter months at Abu Al-Khaseeb station.

This explains the rise in total organic carbon values in Al-Sharish station and is consistent with the results of Ahmed, (2015) when there was an increase in total organic carbon values in Al-Qurna as the high density of aquatic plants increases the accumulation of dead organisms and organic matter in sediments (Al-Shaban, 1996, Kazar, (2009) agreed with the Canaanie study, when the highest total organic carbon values were recorded at the Al-Barathiya station near the presidential palaces and agreed with Khafaji *et al*., 2015 which recorded the highest organic content in Al-Salhiya. Temperature also plays a major role in increasing the activity of microorganisms that decompose parts of plants and dead organisms, thereby increasing organic matter (Arocena, 2007). This explains the rise in values in the hot months of August and September. In the present study, the extent of organic carbon was recorded to be almost identical to the minimum with previous studies (Al-Khyoun, 2001; Al-Maliki, 2002; 1999 Al-Hejuje Al-Sabah, 2007; Mahmoud 2008; Salim, 2013; Al-Hejuje, 2014 and Khalaf, 2016)

Population Density

Population density of *S.a. annandalei*

The results of the present study showed that the total density of the species varied at the three stations, where they were lower at Al-Sharish station than in the other two stations Al-Salhiya and Duwaib. The overall density was higher in the present study than recorded by Saud (1997) when studying the same species at in Al-Chibasi station.

The reason for this difference is spatial or temporal changes affecting the density of the species or due to errors in the sampling methods. The highest values of total density were recorded at Al-Duwaib station followed by Al-Salhiya and by Al-Sharish station. The difference between the stations maybe due to the nature of the soil in the tidal area.

It is well known that this type of animal prefers to live and dig in hard clay soils more than water-saturated sandy clay (Saoud, 1987; Harvey *et al*., 1973).

Also, the departure of Duwaib waters from domestic sewage and agricultural and industrial wastes may play a role in increasing the density of this type higher than the other stations. Al-Chibasi station is located near a source of oil pollution.

The results also showed that this species was highly saline (Daoud, 1976) at Duwaib, where there was a direct correlation between salinity and the density of the species and the density decreased with decreasing salt concentrations. This finding is consistent with that of Davidson, 2008. The author found most burrows of *S. quoianum* species in salinity ranging from 5.5 to 30; individuals recorded in salinity less than 5 and above 30 had lower densities, concluding that salinity was the main controlling factor. The presence of this species disappears in salinity less than 5 and higher than 30. He also showed that the effect of predation on their distribution, which was small because they spend most of their time in burrows and are therefore less vulnerable to most predators.

The results showed that the highest densities were in November and low densities in January at Al-Salhiya station this result was accordance with that of (Saoud, 1987).

The presence of the species in high density for all months except August, perhaps because it stealth in the burrows to escape the inappropriate conditions (Davidson, 2008). The species is also tolerant to heat and salinity and inappropriate conditions such as drought characterized by the tide effect (Saoud, 1987 ; Daoud 1976). There were noticeable changes in the population density of the species during the study period. While the lowest values were in June at Al-Sharish station, this is not consistent with Saoud's study (1995). In his study, he recorded the first peak of this animal in June 1994 at Al-Chibasi station and recorded the second peak in October, which agreed with Duwaib station and in January at both stations Al-Salhiya and Duwaib.

however the lowest density recorded was in June in conjunction with reduced salinity. As for the Salhiya station, the highest density was recorded during November and the lowest level in January.

There were significant differences between Al-Sharish, Al-Salhiya and Al-Sharish, Duwaib stations due to the large difference in densities, while there were no significant differences between Al-Salhiya and Duwaib due to the convergent densities of the species in Al-Salhiya and Duwaib.

This type also had a negative correlation with salinity in Al-Sharish station, a direct correlation with temperature in Al-Salhiya and Duwaib and a direct correlation with salinity in Salhiya station and with total organic carbon in Duwaib. We note the role of total organic carbon in sediments appears in increasing abundance and density of this species only in Duwaib.

There is a common effect of temperature and salinity concentration and animal resistance to different concentrations of salinity varies according to temperature and this is confirmed by Saoud (1987).

At Duwaib station a significant positive correlation was found with some environmental factors. The numbers increased with temperature, total organic carbon and nitrate.

As shown by the results there is no fixed effect of water temperature on animal distribution. The effect of temperature varied according to plant location with other environmental factors on the animal distribution. This was not consistent with (Salman, 1975; Daoud, 1976; Murphy and Learner, 1982; Bamber, 1985 and Saoud, 1987). The absence of this species in August at the Al-Sharish station may be due to several reasons and this is consistent with Davidson, (2008) when he conducted a study on *S. quoianum* in the estuary of the North Pacific River. He pointed out that the factors that normally limit tidal organisms are salinity, water temperature, propagation, availability of suitable water quality, predation, and competition and these factors may not adequately explain the absence of the species studied by the researcher.

The present study agreed with Saoud, (2005), when the presence of *S. a. annandalei* species was not recorded during January, February, March and April during the year 1998. For some months, he explains the occurrence of large changes that are inappropriate for invertebrate living in the Shatt al-Arab environment.

The presence of *S. quoianum* species in thousands per 0.25 square meters is normal during the study of the population density of the species on the banks of the Pacific Coast estuarine marshes (Davidson, 2008).

Calculate the density within the vertical distribution pattern:

The results showed that there were significant differences in the total densities between the different sections of the intertidal zone where *S. a. annandalei* is living.

In the present study, the environmental factors had an effect on the distribution of the species within the vertical pattern. The first section did not uniquely accommodate the high densities of the animal. This is not consistent with a study of Saoud, (1987); Saoud, (1997) who concluded that the high density was in the section far from water. It is known that this species is the same as the rest of *Sphaeroma tidae*. They are highly saline and are found in near-shore environments within the tidal zone and under rocks, ponds or trees (Wilkinson, 2000).

The present results indicate different locations within the intertidal zone, depending on the food, protection, hiding and moisture suitable (Ali *et al*., 2007).These nests were found among contaminated organisms, inside empty barnacles and under rocks (Davidson, 2008).

Lampert (1984) also showed a number of internal and external factors that control functional responses in aquatic invertebrates, including body size, activity, temperature and salinity, as well as physiological conditions such as reproduction, moulting and feeding. In Al-Sharish station, the highest values recorded during February in the first section away from the water were continuous rainfall during this period, which has a great role in making the earth moist and suitable for making nests. The concentration of ammonium ion in water was high in the same month. While the highest value was recorded during November in the middle section II and the highest values were recorded during April and May in the third section near the water during the hot summer months. While it is not present in the first section during the summer months.

While at Al-Salhiya and Duwaib stations, we note the highest values recorded during April, May, July and September in the first section away from the water, due to the large presence of rocks and concrete blocks and the remains of wrecked vessels and the remains of fishermen's wood in the river bank, which provides a moist and soft environment suitable for nests in the Rivers banks.

It is also known that this species of organisms make networks of complex burrows within the sandstone of the edges of the shoreline, and this is consistent with what Mohammad, (2014) had found in his study on the individuals of *S. a. Annandalei* in Lake Razaza and with the study of Davidson, (2008) who found that individuals of this species establishes networks of burrows from the surfaces of sub-tidal and inter-tidal areas consisting of plants, mud or mud, wood, rocks and they work a network of burrows to house and avoid predators and thus they are the formation of large quantities of sand that may contribute to the acceleration of desertification in the region. This is consistent with the studies of Chilton, (1919) Higgins, (1956); Talley *et al.* (2001).

The highest value was recorded at Al-Salhiya and Duwaib stations during October and November in both the second and third sections near the water. It was not recorded in most of the month in the third section as we notice the highest density appeared in the first section away from the water. Because these two stations are close to the sea.

The immersion of water in the tidal area with water is greater than Al-Sharish station, which is located ahead of Al-Salhiya and Duwaib. According to the results, temperature has the most important role in the distribution of this species within the vertical pattern and this is confirmed by Saoud (1997). When he showed that the temperature mainly affect the respiratory rates of this species of crustaceans and because it is a tidal animals, these animals need to adapt quickly to environmental changes such as high temperature, salinity and dehydration to maintain its life. Pollution did not play a role in the disappearance of this species in the tidal area, where the animal was found in the current study stations such as Al-Sharish and Al-Salhiya stations, despite the presence of pollution, especially pollution resulting from the residues of the population and agricultural activities (Mohammad, 2014) when the presence of this animal was recorded in Lake Razzaza, where the level of water has been reduced and contaminated by the sewage channel coming from the City of Karbala with the water of agricultural areas around the City of Karbala in addition to human activities such as boats used for either fishing or transport from shore to the newly emerging islands inside the lake.

Conclusions

The results of the study showed a numerical dominance of this species in the three stations and was different from the previous results in the Shatt al-Arab if the highest abundance in the Duweab station.

The results confirmed the abundance of species with the availability of suitable environmental conditions such as heat, salinity and abundance of organic matter.

Recommendations

Conducting a separate study of this kind of isopoda, which resides in the tidal area in the Shatt al-Arab to build a database of these important invertebrates to understand their behavior and distribution.

Study the effect of salinity rise on the prevalence of this species in Shatt Al- Arab water due to the lack of fresh water coming from the Tigris, Euphrates and Karun waters and the high saline water coming from the waters of the Arabian Gulf. Use information on the composition of communities in environmental monitoring programs

They are important environmental tools in describing spatial and temporal changes in the freshwater environment. Work on not changing the environment of the Shatt al-Arab River and its branches because it represents a natural environment for the abundance and distribution of this species by not putting pollutants directly into the water of Shatt al-Arab and its branches as a negative impact on the abundance and density of the species in the water environment.

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