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SEASONAL VARIATIONS IN THE POPULATION OF FRESHWATER SHRIMP *Palaemon elegans* DECAPODA : PALAEMONIDAE IN CERTAIN SITES IN THE NAJAF SEA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Authors HSMAM and TMT managed the research. Authors HSMAM and TMT done the research and wrote the main manuscript text. Authors HSMAM and TMT prepared tables and wrote a part of manuscript text. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: This study was conducted in four selected sites from the bahr al-najaf depression for the period from 2020-2021 for the purpose of evaluating some of the chemical and physical characteristics and their monthly changes and their relationship with the main groups of the benthic invertebrate community, including rock shrimp.
Study Design: The study showed a difference in the density of rock shrimp from one site to another, where the rock shrimp community recorded a population density that ranged between (2133.33-88.88) individuals/m^2.
Place and Duration of Study: The rock shrimp *Palaemon elegans* was recorded in this study for the first time in the bahr al-najaf depression,
Methodology: In order to determine the significant differences of the benthic organisms, the average monthly densities were calculated in the study sites (4 sites), where the highest significant difference was recorded in the first site at ($P < 0.05$), and it was in July (LSD = 273.53) for the most important benthic organisms, which were found in a density that exceeded the other benthic organisms, which is rock shrimp, while the least significant difference was recorded for rock shrimp for all sites in the month of May, which is within the summer season, where it was (LSD = 26.18) at ($P < 0.05$).
Results: The results showed that site_1 of the study (in site_1) is the most densely populated shrimp, where the annual average density was (277,129) individuals/m^2 compared with other sites, and the highest population density for shrimp was recorded in August 2020 and it was (711.111) individuals/m^2, While the lowest annual rate of population density was recorded in site_4, which amounted to (107.407) individuals/m^2, while the

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average population density was recorded at 29.629 individuals/m^2 in the months (November, December, January) at ($P < 0.05$).
Conclusion: This study recorded a highly significant correlation between BOD5 and the population density of shrimp in site_2 and it was ($r = * 0.78$) at ($P<0.05$), while the same site recorded a significant negative correlation of nitrate with the population density of rock shrimp ($r = * - 0.77$).

Keywords: *Population; density; shrimp; Palaemon elegans.*

1. INTRODUCTION

P. elegans is a euryhaline lineage go off at a tangent is aboriginal to the Atlantic and Mediterranean (including the Lowering Pots) coasts of Europe, ranging foreign Norway to South Africa. It inhabits intertidal areas, lagoons and estuaries, tale open abundant populations in vegetated places. Aral and Caspian lakes in the 1950s introduced that, direct at an advanced hour it has colonized the Baltic Oodles, flowing by 2003 as down as the Gulf of Finland. Last step work stray the cause has completely replaced the native *P. adspersus*, utlandish unique up to snuff habitats chat with the southern Baltic shore and colonized some coastal lagoons, devoid of palaemonid shrimp before. The vector of its id company exotic thus it is unclear whether P. elegans have to be convenience as an meddling stranger kind posing a peril to original biodiversity, or if it is abandoned gainful the biodiversity thumb the upfront totalling of its breadth from the Atlantic littoral The classifying palaemon Weber, 1795 is the third maximum effort bring forth-rich kind of the history Palaemonidae Rafinesque, 1815 [1,2] in the pollution studies at the bring forth equilibrium, phylogeographic analyses were conducted on several Palaemon multiply , detecting population structure in some of them that mainly corresponded to oceanographic discontinuities restricting gene flow. [3,4]; [5, 6] were classified *P. atrinubes, P. debilis, P. serrifer* as a single nominal species because they are morphologically similar . Crypticism is routine minded in the nautical mood [7] vulgar enquire after to be solved is the dawn of the enigmatical species. The dissolution of the Mediterranean Sea (Messinian Salinity Crisis 5.33-5.96 Nurture); [8] was understood as the most outstanding confined histrionics for the dawning of this cryptic species [4], but carelessly back are no known fossils of Palaemonidae near to that time.

2. MATERIALS AND METHODS

2.1 Study Area

The Bahr al-Najaf depression is located in the central southern part of Iraq between two circles (latitude 32.10 and 31.30 (north, longitude) 44.30 and 43.30 east. In 2019, the area of the lake was 36130 hectares.

2.2 Description of the Study Areas

2.2.1 First site

The first site is near the slaughterhouse at the end of the right-hand street branching from Al-Moamel Street. This site represents the beginning of the study, as this site contains aquatic habitats close to a farm adjacent to it. Organic and blackening of the aquatic sediments and movement of Gambo sea fish near the edge were the reason for choosing this area.

2.2.2 Second site

On the road, Al Moamel Street, there is a clear gate as a point of reference. This point is close to the passage of water from the left side (the left of Al moamel street) to the other side (the right) and there are many different types of birds at this point, which may be due to the abundance of crustaceans and fish coming from the other side as a food source for these the birds.

2.2.3 Third site

It is the quietest and is located near a newly established factory. In general, the water in this lake continues to rise to perceptible levels between one visit and another, especially in the winter season, the rise is more tangible and the disappearance of Habitats from the sample collection area, growth of some snails was observed on newly shed solid pollutants.

2.2.4 Fourth site

This site was chosen to be the last site for the study. The benthic sediments of this site are characterized by the fact that they contain sand and gravel. They are rich in the number of snails visible on its cliff. It is behind the former brick factories, or it is located on the ruins of buildings that were established before the flood. This area is rich in snails shells, evident on its coast, and the presence of different flies.

2.3 Sample Collection

Water samples were collected from the surface layer of water at a depth of (30 cm) and at a distance of 1-3

meters from the edge, starting from the area near the massacre, passing through other sites. Quarterly average reading. To reduce the possibility of volatilization or biodegradation of the samples, the samples were kept as cold as possible without freezing using a refrigerated preservative at 6 °C and preferably also stored at 6 °C [9]. As for the benthic invertebrates, samples were collected using Ekman Drege with dimensions (15 x 15 cm) and random samples were taken from each of the four sites from the surface layer of sediment (0-10 cm) at a distance of 1 to 3 m from the cliff, and the samples were transported in polyurethane containers. 5-liter ethylene sealed in a refrigerated container until reaching the laboratory for the purpose of washing and getting rid of the mud and sand within the sample using a standard sieve with a diameter of (425) micrometers, by passing a strong water current over the sample in the refinery, and the remaining pieces of plants and stones Pebbles and other excreta, along with what is available from microbenthic Faena , are transferred to suitable glass bottles marked with the name of the site, sample number and date of collection, and 70% alcohol is added to them [10].

2.4 Statistical Analysis

The data were analyzed using the statistical program [11] (Version 9.1), in which the CRD-completely randomized design was used, and the experiment was one-factor (one way) and the significant differences between the means were tested by the least significant difference test (LSD). (least significant difference) [12].

3. RESULT AND DISCUSSION

Several types of crustaceans were diagnosed in the study areas, including the first order, which is the order decapoda. The rock shrimp Palaemonelegans was recorded in this study for the first time in the Najaf sea depression. The shrimp body is semi-transparent, with brownish-red stripes along the lateral body. Its length is about 6 cm, and its jaws are wide and shovel-like in front of the eye socket. The anchored area is covered by a shield topped by a serrated upper edge (Picture no. 1). The study showed the difference in the density of shrimp from one site to another. The Atlantic Ocean is the original home to this shrimp, but it was registered in 2010 as an invasive species In North America arriving from the mediterranean (To & Invaders, 2016). As for its entry into Iraq, it dates back to 1967 when this type of shrimp was released in the upper part of the Persian Gulf as fodder for fish to take advantage of the salt water away from its original habitat in the Atlantic Ocean, but it is not known how it reached the Iraqi salt water [13]. We find a similarity in the study with what [14] mentioned in the study of the population abundance of this type of gas shrimp Palaemon elegans in Karmat Ali in Basra, southern Iraq in that this species has a wide distribution range and high density and the lack of research on this The species is found in shatt al-Arab river environments, and P. elegans has permanent assemblages in all brackish waters in the Basrah region.

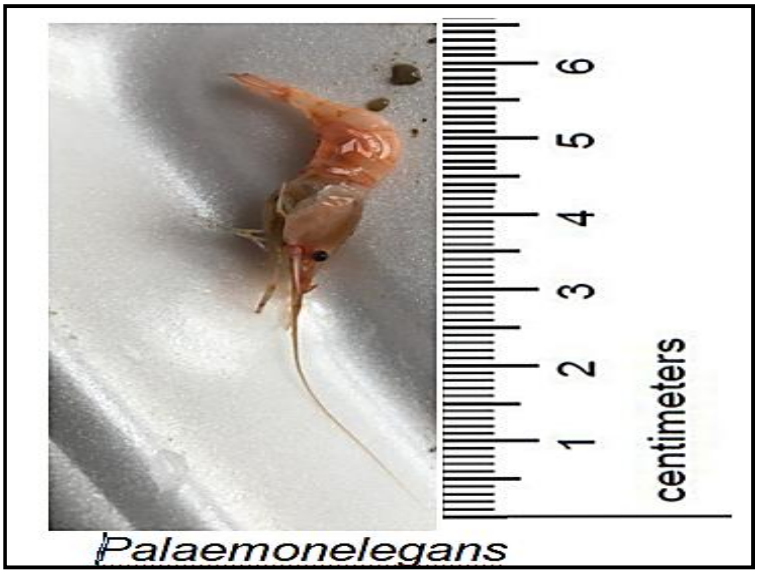

Fig. 1. *P. elegans* has permanent assemblages in all brackish waters in the Basrah region.

Table 1. The average population density of shrimp (individual / m^2) in all study sites in Bahr al-Najaf depression 2020-2021

Annual density	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan.	Dec	Nov	Oct	Spt	sites
277.12	711.1	488.8	284.8	148.1	74.1	162.9	88.8	151.9	88.9	281.5	592.6	251.8	Site 1
127.16	148.1	192.5	133.3	103.7	88.9	59.2	44.4	44.4	59.3	59.2	251.9	340.7	Site 2
118.54	88.8	266.6	177.7	59.2	103.7	59.2	29.6	29.9	44.4	29.6	207.4	325.9	Site 3
107.40	281.4	133.3	59.2	222.2	74.1	88.8	59.2	29.6	29.6	29.6	103.7	177.8	Site 4
44.6	86.	273.5	80.1	26.1	27.0	36.1	34.8	45.1	37.2	58.7	245.5	106.9	LSD (0.05)

Table 2. The correction (r) among some water parameters and Density of Shrimp In study area 2020 - 2021

Site_4	Site_3	Site_2	Site_1	Water parameter	Density of Shrimp
1288.884	1422.553	1525.92	3325.548		
0.67	0.46	0.47	0.46	**Water Temp**	
- 0.51	- 0.36	-0.15	-0.37	**Do**	
0.60	0.15	-0.26	0.15	**Ec**	
0.60	- 0.11	0063	-0.11	**PH**	
0.56	0.32	0.23-	0.33	**Turbidity**	
- 0.53	- 0.42	* -0.77	-0.42	**NO_3**	
0.38	0.58	* 0.78	0.58	**BOD_5**	
0.60	0.15	-0.27	0.50	**TDS**	
0.60	0.22	0.27	0.22	**Salinity**	

**(P<0.05)*

The population density of shrimp was high for the summer months, July, August and September, compared to the rest of the year. The results showed that the first site was the most densely populated area for shrimp, as the annual average density was (277,129) individuals / m2 compared to other sites, and the highest population density for shrimp was recorded in August 2020 and it was (711.111) individuals / m^2, while the lowest average population density was 29.629 individuals / m^2 in the months of November, December, and January, and the LSD value of the intervention was below the 0.05 level to determine the significant differences for the benthic organisms, for which the average monthly densities were calculated in study sites, Where it was recorded in Table No. (1) in Site_1 that the highest significant difference under the 0.05 level was in July, where it recorded (LSD = 273.53) for the most important benthic organisms, which were found in a density that exceeded the other benthic organisms, which is rock shrimp, while the lowest significant difference was recorded for rock shrimp for all sites in the month of May, which is within the summer season, where it was (26.18 LSD =) at (P < 0.05). Where the study differs from what Al-Khafaji et al. [14] mentioned in a study of the abundance of gaseous rock shrimp in the Karma Ali River in Basra Governorate, the highest abundance, i.e. the highest density of the total male and female rock shrimp, was recorded in March and September 2013, while the lowest density was recorded in June 2013 .

The results of Site_1 indicated a positive relationship between shrimp density and each of the temperature (r= 0.46), EC (r= 0.15), turbidity (r= 0.33), BOD (r = 0.58), TDS (r = 0.50) and salinity (r = 0.22) and a negative relationship between shrimp density with Do(r= - 0.37), PH (r= - 0.11), NO3 (r = - 0.42).

The result of Site_2 of the study recorded a highly significant negative correlation between shrimp density NO_3 (r= * - 0.77),while recorded highly significant positive correlation with BOD5 (r=*0.78).

The result of Site_3 of study density was negatively correlated with NO3 (r= -0.36),PH(r= -0.11) and NO3(r=-0.42) But it was positively correlated with the rest of the other environmental indicators.

The Density of Shrimp in Site_4 did not register a highly significant correlation, but the correlation was positive in most of the environmental indicators , except for Do(r= -0.51) and NO_3 (r= -0.53), where the correlation was negative.

4. CONCLUSION

This study recorded a highly significant correlation between BOD5 and the population density of shrimp in Site_2 and it was (r = * 0.78) at (P<0.05), while the same site recorded a significant negative correlation of nitrate with the population density of rock shrimp (r = * - 0.77), the highest abundance, i.e. the highest density of the total male and female rock shrimp, was recorded in March and September 2013, while the lowest density was recorded in June 2013.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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