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Study of the Biomass of Some Macroinvertebrates in Khor Al Zubair, Southern Iraq

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ABSTRACT

In the current study, the relationship between length and weight (or biomass) of some marine invertebrates prevalent in the Khor Al-Zubair area, located in southern Iraq, was analyzed. The primary objective of this study was to estimate the biomass of organisms using allometric relationships between length and weights. Barnacle and crab samples were collected for further analyses; an estimation of biomass was conducted; length was accurately measured, followed by the determination of wet, dry, and organic matter weights. According to the average lengths, the average weights of the dominant species in Khor Al Zubair, barnacles, and crabs, were recorded at the selected study stations along the Khor Al Zubair waterway. According to the annual average biomass ($\bar{B}$) as a function of dry weight and organic matter weight, positive correlations were recorded between length, dry weight, ash, and organic matter. The length, wet and dry weights, ash content, and organic matter were calculated for each animal, and the results showed that the longer the animal, the higher the weight. The biomass of barnacles and crabs was calculated for 50 samples each, as a function of length and average dry weight. The highest crab biomass was recorded at station 1 (61.274 g/m2/yr), and the barnacle biomass as a function of average length and dry weight was 269.338 g/m2/yr at the first station. The results indicate that barnacles had the highest biomass in Khor Al-Zubair.

INTRODUCTION

Biomass is the mass of living organisms in a given area or ecosystem at a specific point in time, whether in liquid, gaseous, or solid form **(Lambden & Johnson, 2013)**. The importance of biomass in ecology lies in understanding the processes that drive changes in ecosystems, and it can be used to understand seasonal patterns, food relationships, life history, secondary production, and biological interactions, including feeding relationships between functional groups and nutrient or food energy budgets of food webs and their components **(Novack, 2008)**. Invertebrates in ecosystems have been studied to understand the distribution of biomass among various taxonomic groups, including arthropods, annelids, nematodes, and mollusks **(Bazairi, 2003)**. Benthic invertebrates live on or in bottom sediments or on solid substrates, whether living or dead. They have the potential to use macroinvertebrate community structures as indicators of aquatic system health **(Duran & Sueckes, 2007)**. Macroinvertebrates are good bioindicators of pollution because of their ecological diversity and ability to tolerate pollution and environmental disturbances **(Thani & Valerkis, 2012)**. Aquatic macroinvertebrates are often preferred for biological monitoring because different species of aquatic macroinvertebrates have suitable environmental conditions for their survival **(Masikini *et al*., 2018)**. Barnacles belong to the order Cirripedia and are found in all marine environments, including the intertidal zones. Their size ranges from 2- 3cm, and they live on hard surfaces, such as rocks, and on substrates, such as ship hulls and mollusk shells **(Alcaraz, 2003)**.

MATERIAL AND METHODS

Study area

The current study included three stations distributed along the Khor Al-Zubair waterway (Fig. 1). Khor Al-Zubair is located in the city of Basra, southeast of the city of Umm Qasr **(Al-Ramadan, 1986a)**. It is a hypersaline lagoon with a very high salinity that may reach 50 parts per thousand, with sandy clay soil and silty clay beaches affected by tidal phenomena that reach 5.12m **(Al-Ramadan, 1986b; Al-Badran *et al*., 1996)**. The first station is a fishing boat anchorage station near the Shatt al-Arab Regulator. The second station is characterized by the presence of pipes and a sunken ship, which was chosen to observe the numerous invertebrates attached to them. The third station is the mangrove station, characterized by the movement of workers, fishermen, and visitors (Table 1).

Samples were collected from the Khor Al Zubair sediments in the ebb tide area. A medium-sized boat (cruiser) was used to collect some samples because of the difficulty of walking or moving on the Khor Al Zubair sediments during ebb tides. The random square method was used to select the sampling sites. The sample was taken after determining an area of $0.0625m^2$, equivalent to 1/16 of a square meter. Squares of lengths of 10 and 50cm were used, and eight replicates were selected for each station. The macroinvertebrates present were photographed, identified, and counted to calculate their density and general diversity. The samples were initially washed with water in the laboratory and carefully cleaned of clay and other materials in two stages. Sieves with different diameters were used for this purpose. In the first stage, a sieve with an opening diameter of 2000 micrometers was used to isolate macroinvertebrates, including worms, crustaceans, and soft-bodied organisms larger than 2mm. In the second stage, the water filtered from the first sieve was passed through another sieve with 500 micrometer holes to isolate smaller invertebrates.

Barnacles were isolated and placed in bottles containing a small amount of water, to which 4% formalin was gradually added. The length, dry weight, and organic matter weight were measured. Another group of crustacean samples, such as crabs, was isolated after being collected with a scoop and hand-picked. They were frozen without the addition of preservatives to accurately measure their weights and lengths. They were placed in separate plastic containers with water, mud, and algae and transferred to the laboratory for biomass analysis.

Table 1. Coordinate table for study stations

30°13'27.3 "N 47°51'46.4 "E	Station 1
30°13'39.8 "N 47°51'06.7 "E	Station 2
(30°19'21.0 "N 47°49'05.2"E	Station 3

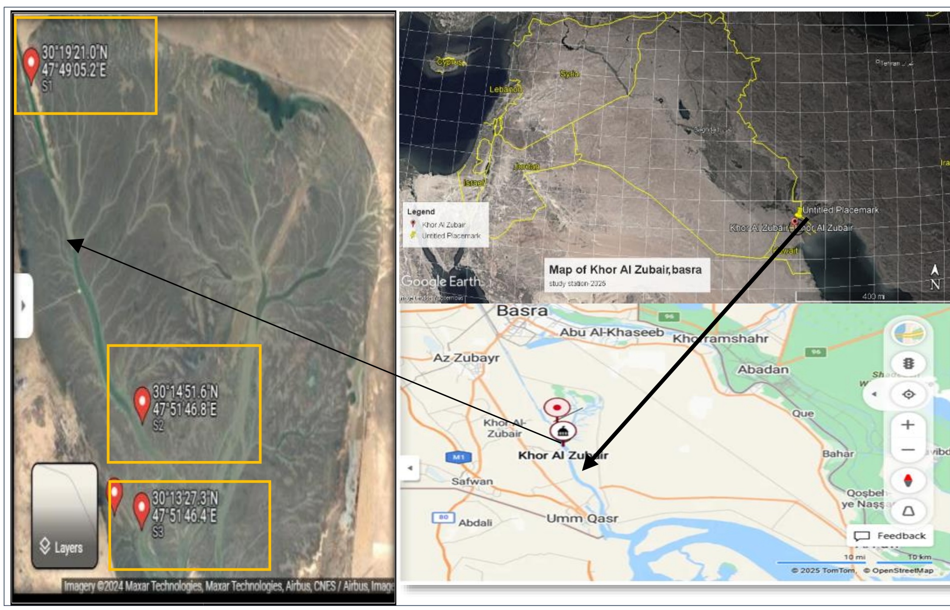

Fig. 1. Map of the study stations in Khor Al Zubair

The biomass ($\bar{B}$)

The biomass ($\bar{B}$) of barnacles and crabs was calculated during the study period in terms of dry weight and organic matter weight using the following formula:

$$\bar{B} = \bar{N} \times \bar{W}$$

¯N = the average number of individuals over time (m^2/year)

¯W = average weight gain of individuals (gm)

RESULTS AND DISCUSSION

Relationships: Weight and length

All weights were calculated for 50 animals of varying lengths. The results for barnacles showed a significant positive correlation between length and dry weight (r=0.996), length and ash weight (r=0.991), and length and organic matter (r=0.956). Data were also recorded on the relationships between dry weight and ash weight (r=998), dry weight and organic matter weight (r=0.974), and ash weight and organic matter weight (r=0.959) (Table 2) (Fig. 2)

Table 2. Correlation coefficient between crab length and weights

Variables	*length*	*organic matter*	*Ash weight*	*dry weight*
barnacle length(mm)	**1**	0.956	0.992	0.991
organic matter (gm)	0.956	**1**	0.959	0.974
Ash weight(gm)	0.992	0.959	**1**	0.998
dry weight(gm)	0.991	0.974	0.998	**1**

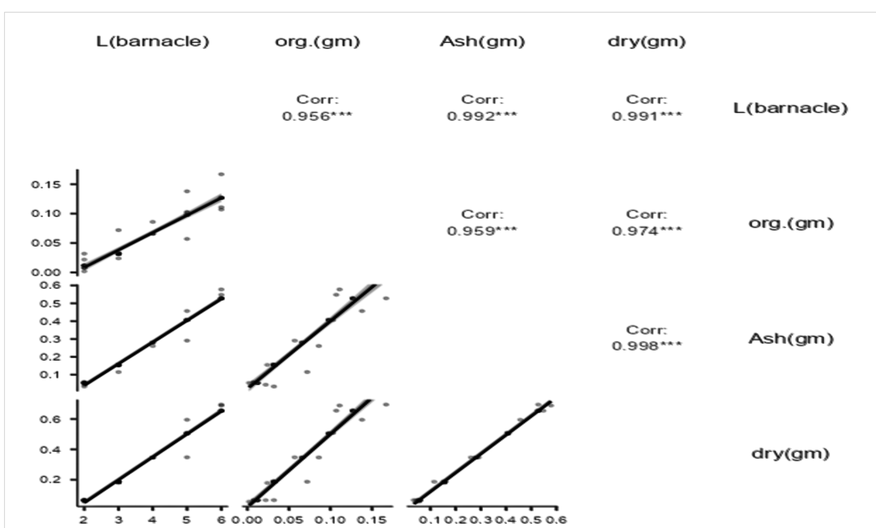

Fig. 2. Allometry of barnacle length and weight

The results were recorded for 50 animals for both the barnacles and crabs. The results of the barnacle study showed that length was strongly positively linearly correlated with all weights. The minimum dry weight was 0.066g at 2mm, and the maximum was 0.665g at 6mm diameter. A positive correlation was observed between dry weight and barnacle length (r= 0.991). The minimum and maximum ash weights were 0.034g at 2mm and 0.578g at 6mm, respectively. A strong positive relationship was found between the weight of ash and the length of barnacles, with a correlation coefficient of 0.992. The results also recorded a minimum organic matter weight of 0.002mg at 2mm, and a maximum organic matter weight of 0.0167g at 6mm, with a positive correlation of r= 0.956 (Fig. 4).

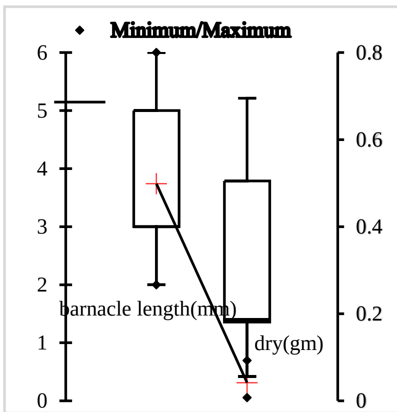

Fig. 3. Min. and max length & dry weight of barnacle

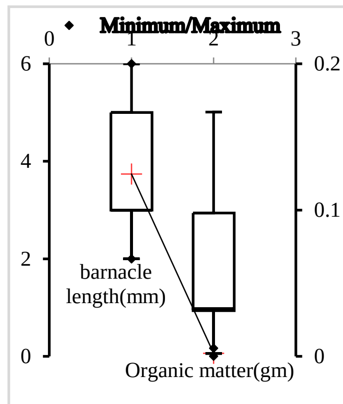

Fig. 4. Min. and max length & organic matter weight of barnacle

The results for crab showed a significant positive correlation between length and dry weight (r =0.990), length and ash weight (r =0.987), and length and organic matter (r =0.934). Data were also recorded with a relationship between dry weight and ash weight (r =997), dry weight and organic matter weight (r =0.946), and ash weight with a positive relationship with organic matter weight (r =0.917) (Table 3)

Table 3. Correlation coefficient between crab length and weights

Variables	*length*	*Ash weight*	*dry weight*	*organic matter*
crab length(mm)	**1**	0.987	0.990	0.934
Ash weight(gm)	0.987	**1**	0.997	0.917
dry weight(gm)	0.990	0.997	**1**	0.946
organic matter(gm)	0.934	0.917	0.946	**1**

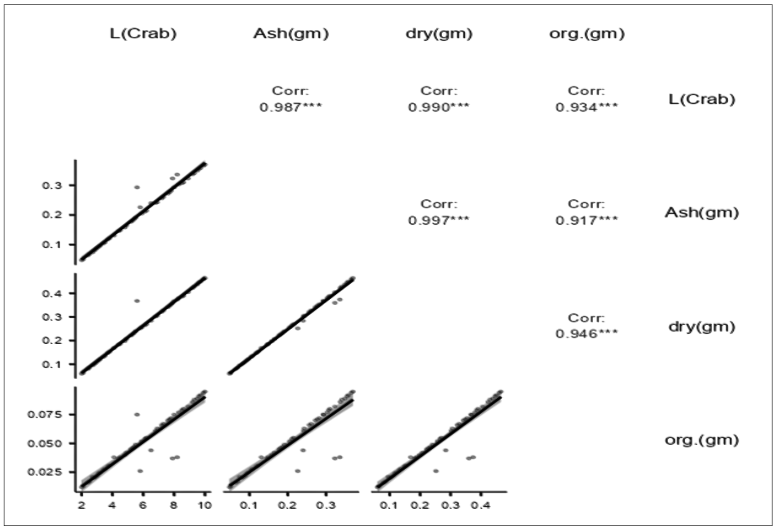

Fig. 5. Allometry of crab length and weight

The results of the crab recorded a minimum dry weight of 0.06g at a length of 2mm and a maximum dry weight of 0.438g at a length of 9.5mm (Fig. 6). The minimum ash content was recorded with 0.013g at a length of 2.1mm. The maximum ash content was 0.092g at a length of 9.7mm. The minimum weight of organic matter was recorded as 0.208g at a length of 2.1mm, and the maximum weight was 0.358g at a length of 2.1mm (Fig. 7).

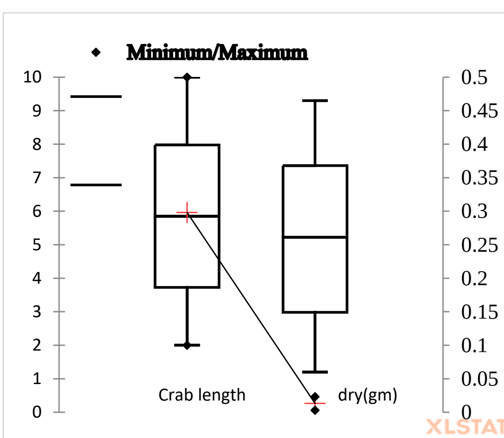

Fig. 6. Min. and max length & dry weight of crab

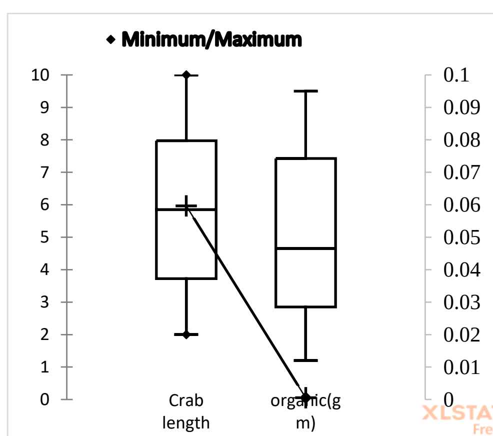

Fig. 7. Min. and max length & organic matter weight of crab

The biomass (¯B)

The results for the biomass (¯B) recorded the highest average of the biomass barnacles at the second station 269.3386 g/m²/year, while the lowest average biomass of barnacles was at the third station, with an average of 153.8885 g/m²/year (Fig. 8). The results showed a significant relationship between the average biomass and average weight of barnacles ($P \leq 0.05$). The results for the biomass (¯B) recorded the highest annual rate of crabs at the first station with a value of 61.72 g/m²/year and 50%, while the lowest rate of live mass of crabs was at the third station with 27.87525 g/m²/year (Fig. 9). The results showed a significant relationship between average biomass and average crab weight ($P \leq 0.05$).

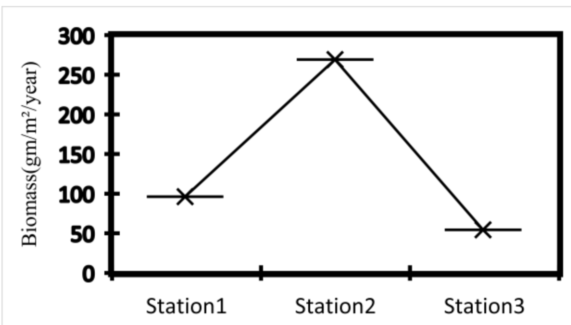

Fig. 5. The biomass (¯B) of barnacles at the study station

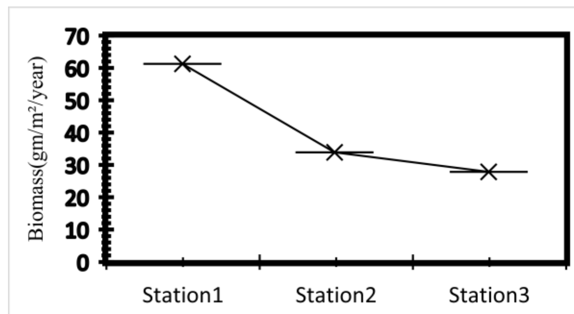

Fig.6. The biomass (¯B) of crab at the study station

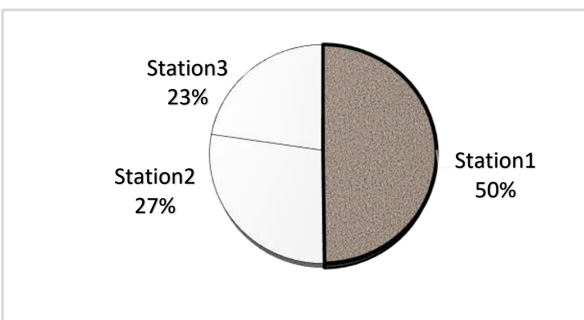

Fig. 7. % of biomass of crabs at study stations

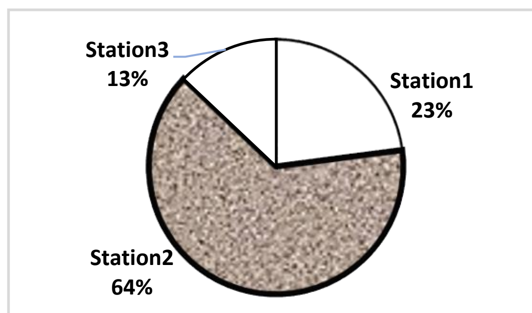

Fig. 8. % of biomass of barnacles at study stations

The first station recorded the highest barnacle biomass (50%) compared to the second station. This is due to the availability of substrates at this station, as barnacles are attached to rocks and solid objects **(Sultan, 1987)**. This may be ascribed to the high temperature in the first area, where there are only rocks for them to stick to, and they are more exposed to direct sunlight, as shown by the statistical results of the present study. In contrast, the second station had barnacles sticking to a sunken ship, which provided them with some shade and reduced the sun's heat **(Akbar, 2012)**. Statistical data at the first station recorded an inverse correlation between barnacle abundance and environmental temperature (r=-0.773) and significant differences ($P \leq 0.05$). The results of the study recorded a low weight in young crabs in winter due to the lack of need for food because their activity and movement decrease in this season **(Youssef, 1981)**, and the highest rate of crabs was recorded at the first station. Crabs also showed an inverse relationship with temperature (r=-0.603) ($P \leq 0.05$).

REFERENCES

Akbar, M.M.; Ali, N.A. and Mazhar, A.H. (2012**).** The effect of some environmental factors on the density of adult barnacles *Balanus amphitrite* at the water intake of Al-Najibiya Electric Power Station/Basra Governorate, Basra Research Journal, 38 (4):119-129

Albadran, B.; Al-Beyati, F. and Abdullah, Y. (1996**).** Heavy mineral distribution in the lower part of the Shatt al-Arab River. South Iraq. Marina Mesopotamica. 11(1): 17-26.

Alcaraz, M.; Saiz, E., Calbet, A.; Trepat, I. and Broglio, E. (2003**).** Estimating zooplankton biomass through image analysis. Mar. Biol. 143, 307–315

Al-Ramadan, B.M. (1986a**).** Introduction to Marine Physics in Khor Al-Zubair, Iraq. Classification of Khor Al-Zubair. Proceedings of the First Symposium on the Marine Nature of Khor Al-Zubair, Publications of the Marine Science Center, University of Basra, No. (7): 11-20 pp.

Al-Ramadan, B.M. (1986b**).** Current System in Khor Al-Zubair. Proceedings of the First Symposium on the Marine Nature of Khor Al-Zubair, Publications of the Marine Science Center, University of Basra, No. (7): 55-84 pp.

Bazairi, H.; Bayed, A.; Glemarec, M. and Hily, C. (2003**).** Spatial organization of macrozoobenthic communities in response to environmental factors in a coastal lagoon of the NW African coast Merjazerga, Morocco. 26: 457-471.

Duran, M. and Suicmez, M. (2007). Utilization of both benthic macroinvertebrates and physicochemical parameters for evaluating water quality of the stream Cekerek (Tokat, Turkey) Journal of Environmental Biology, 28(2): 231-236.

Lambden, J. and Johnson, P. T. J. **(**2013**)** Quantifying the biomass of parasites to understand their role in aquatic communities. Ecol Evol 3, 2310–2321

Masikini, R.; Kaaya, L.T. and Chicharo, L. (2018**)** Evaluation of Ecohydrological Variables in Relation to Spatial and Temporal Variability of Macroinvertebrate Assemblages along the Zigi River - Tanzania. Ecohydrology and Hydrobiology, 18, 130-141. https://doi.org/10.1016/j.ecohyd.2018.03.004

Novack-Gottshall, P. M. (2008**).** using simple body-size metrics to estimate fossil body volume: empirical validation using diverse paleozoic invertebrates. Palaios 23, 163– 173.

Sultan, I. N. (1987**).** Population dynamics, secondary production, and burrowing nature of the crab *Sesarma boulengeri* in the Shatt al-Arab. Master's thesis, College of Science, University of Basra, 170 pp.

Thanee, I. and Phalaraksh, C. (2012**).** Diversity of Aquatic Insects and Their Functional Feeding Groups in Anthropogenically Disturbed Streams in Mae Sot District, Tak Province, Thailand. Chiang Mai J. Sci. 39(3): 399- 409.

Youssef, Y, Y. (1981**).** A study on seasonal changes in physical and sexual functions, chemical content, and oxygen consumption in the crustacean *Sesarma boulengeri*. Master's thesis, College of Science, University of Basra, 170 pp.