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Checklist of Occurrences of Marine Crabs (decapods, crustaceans) and their Relationship to Environmental Factors in the Coast Al-Fao Port, Iraq

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Abstract - This work aimed to clarify the importance of the seasonal and spatial distribution of crab populations at two stations that were close in location but differed in their impact on environmental factors (pH, salinity, dissolved oxygen in the water, and water temperature). One station was located close to the coastal zone, and the other was located 5 km from the coastal zone, towards the middle of the sea. Study stations represent newly formed environments. A checklist of crabs associated with the coast of the Greater Faw Port presented, which presently comprises 20 crab species within 11 families (Macrophthalmidae, Camptandriidae, Pilumnidae, Portunidae, Matutidae Galenidae, Sesarmidae, Dorippidae, Ocypodidae, Dotillidae, and Grabidae) which were the most diverse and occurrence of families in the Arabian Gulf. Specimens of crab species *Metapograpsus messor* (Forskål, 1775), *Metapograpsus thukuhar* (Owen, 1839) and *Pilumnopeus serratifrons* (Kinahan, 1856) were encountered for the first time on the Iraqi coast. Samples were collected seasonally from January 2023 to February 2024. The crabs were hand-caught during the low tide period during the day among rocks in the coastal area. The study discussed how environmental changes are primarily linked to seasonal cycles, while they are more closely related to the presence and distribution of crabs near or far from the coast. Temperature was found to have the greatest influence on species presence, indicating that species prefer relatively cooler seasons. This may reflect the sensitivity of some species to changes in salinity concentration. The abundance of dissolved oxygen in the water also enhances the presence of some species, compared with previous studies conducted on the coast of the Al-Faw region.

قائمة مرجعية لتواجد السرطانات البحرية (عشريات الأرجل، القشريات) وعلاقتها بالعوامل البيئية في ساحل ميناء الفاو، العراق

ندى مفيد عبد اللطيف، خالد خصاف الخفاجي وصبا عباس كاظم
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المستخلص -هدف هذا العمل إلى توضيح أهمية التوزيع الموسمي والمكاني لتجمعات السرطانات في محطتين متقاربتين في الموقع، لكنهما تختلفان في تأثيرهما على العوامل البيئية (الرقم الهيدروجيني، والملوحة، والأكسجين المذاب في الماء، ودرجة حرارة الماء). تقع إحدى المحطتين بالقرب من المنطقة الساحلية، وتقع الأخرى على بُعد ٥ كم من المنطقة الساحلية، باتجاه منتصف البحر. تمثل محطات الدراسة بيئات حديثة التكوين. تم تقديم قائمة مرجعية للسرطانات المرتبطة بساحل ميناء الفاو الكبير، والتي تضم حاليًا 20 نوعًا من السرطانات ضمن 11 عائلة (Macrophthalmidae، Camptandriidae، Pilumnidae، Portunidae، Matutidae، Galenidae، Sesarmidae، Dorippidae، Ocypodidae، Dotillidae و Grabidae) وهي العائلات الاكثر تنوعًا وانتشارا في الخليج العربي.

عُثر لأول مرة على عينات من أنواع السرطانات (Forskål,1775) *Metapograpsus messor*، *Metapograpsus thukuhar* (Owen,1839) و *Pilumnopeus serratifrons* (Kinahan,1856) على الساحل العراقي. جُمعت العينات موسميًا من يناير ٢٠٢٣ إلى فبراير ٢٠٢٤. تم صيد السرطانات يدويًا خلال فترة الجزر خلال النهار بين الصخور في المنطقة الساحلية. ناقشت الدراسة كيف ترتبط التغيرات البيئية في المقام الأول بالدورات الموسمية، في حين أنها ترتبط ارتباطًا وثيقًا بوجود السرطانات وتوزيعها بالقرب من الساحل أو بعيدًا عنه. وُجد أن درجة الحرارة لها التأثير الأكبر على وجود الأنواع، مما يشير إلى أن الأنواع تفضل المواسم الأكثر برودة نسبيًا. قد يعكس هذا حساسية بعض الأنواع للتغيرات في تركيز الملوحة. كما أن وفرة الأكسجين المذاب في الماء تعزز وجود بعض الأنواع، مقارنةً بالدراسات السابقة التي أجريت على ساحل منطقة الفاو.

الكلمات المفتاحية: ميناء الفاو؛ كاسر الأمواج؛ السرطانات؛ العوامل البيئية.

Introduction

A breakwater built in a coastal area to protect against tides, currents, waves, and storms. It been built since ancient times to protect coasts, helping to isolate ships from marine hazards such as wind-driven waves (Graauw, 2022). The breakwaters are place parallel to the shore to reduce erosion. On beaches where coastal erosion threatens to erode beach materials, they aim to slow coastal erosion by waves and currents and prevent the movement of beach materials. Because of this role, they commonly referred to as Breakwater.

The breakwater in the Grand Fao Port reduced some erosion by blocking tidal currents and waves. There is also a need to develop strategies for managing coastlines, encourage sustainable coastal development practices, restore sediment pathways, and enact legislation to control ship traffic in commercial shipping areas, in order to protect the Iraqi coast. (Muttashar *et al*., 2024)

Research emphasized the need for robust coastal management strategies that encourage sustainable coastal development practices, the restoration of sediment paths, and the enactment of legislation to control vessel traffic in commercial shipping areas, to protect the Iraqi coast.

Marine invertebrates are important for maintaining balance and stability in coastal ecosystems, as they participate in the decomposition and recycling of organic matter in the marine coastal environment. Crabs and snails, two common marine invertebrates, are highly dependent on environmental factors in coastal areas, such as temperature, salinity, sediment type, and pollution levels. These factors influence their distribution, feeding, reproduction, and community structure. These organisms in the coastal environment influenced by the nature of the sediments, as well as the amount of pollution in the water and sediments. The most important environmental factors that clearly affect benthic invertebrates include temperature, pH, salinity, and dissolved oxygen (Al-Baghdadi *et al*., 2024).

The Arabian Gulf region is a wintering ground for migratory and local water birds. These birds found in large numbers and species, and they prefer to congregate in the intertidal zone, the same area where snails and crabs nest. The area gradually covered with water to a depth of approximately one meter. Many species of crustaceans, snails, oysters, and aquatic insects found in this area. The salt concentration in the water is relatively stable. Therefore, the environmental conditions in the region are suitable for completing their life cycles, especially marine species. Their abundance also affected by predation by other organisms (Aguilera *et al*., 2025).

The genus *Metopograpsus* (H. Milne Edwards, 1835) consists of several species. The most recent recorded species been estimated at seven in worldwide. In the present study, *M. messor*, *M. thukuhar* and other species are reported for the first time in the study area that it was previously recorded in other regions of the Arabian Gulf (Basson, *et al*., 1977) and UAE (Nobili, 1905). The primary reason for this is climate change resulting from global warming, which has led to species migration (Zhang and Chen, 2011). There are little studies on the occurrence and distribution of some Marine crabs species in the rocks of the coast Al-Fao area, south area of Basrah city.

Study Area:

The sampling area characterized by being a newly formed artificial area consisting of rocks taken from within Iraq, mountain rocks imported from outside Iraq, and manufactured cement blocks, which had a negative impact on the diversity and abundance of living organisms in this area. Samples were collected during the low tide period from 10 to 12 am in the field from both nearshore and farshore stations on a seasonal basis from January 2023-February 2024.

Water quality parameters such as water temperature (°C), pH, salinity (‰), and dissolved oxygen (mg/L) were measured seasonally using a digital multimeter (YSI-multimeter) from the breakwater coast of Al-Fao Port. The studied stations (A) consisted of two stations: the first close to land (Station 1), and the second further inland towards the sea (Station 2) from the breakwater coast of Al-Fao Port. The main sources and classification keys were followed to determine species, genera, and geographical distribution: Griffin and Tranter (1986); Wee and Ng (1995); Ng *et al*. (2008) and Naderlow (2017).

Data analysis

Based on the results of the normal distribution tests and the variance of individual occurrences, the data appear parametric, which helps clarify the hypotheses of normal distribution and homogeneity of variance. Therefore, one-way analysis of variance (ANOVA) used to compare the means of different species.

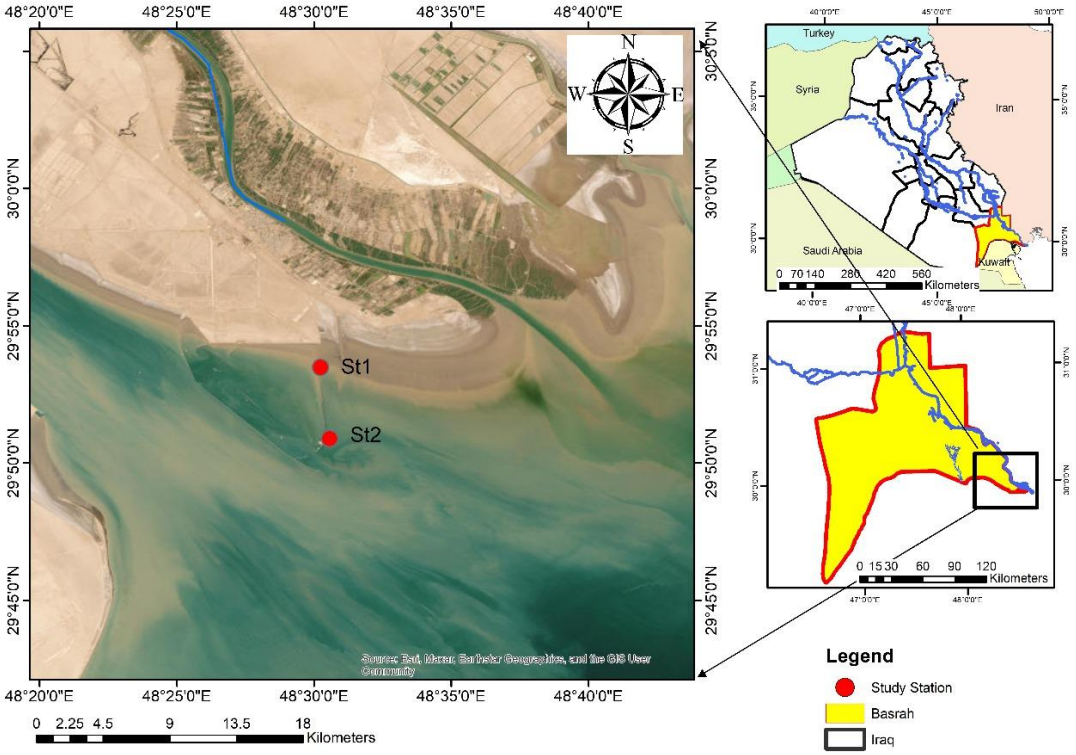


Figure1. Study stations in a breakwater at Al-Fao port region

Picture 1. Study stations in the breakwater

Results:

Environmental Parameters:

Environmental factors show slight differences between the near and far-coast areas, but differences are evident between the seasons. Regarding pH, the differences are very slight between the two stations for all seasons. The highest rate of 8.2 were recorded during winter for both stations and in summer for the second station, while the lowest rate was 8.0 during spring and autumn for the first station and autumn for the second station. Salinity recorded the highest rate (42.55, 42.9) ‰ during summer for the first and second stations, respectively, while the lowest rate was 39.2‰ during winter for the second station. Dissolved oxygen in the water ranged between 8.7 mg/L during summer for the first station and 10.5 mg/L during autumn for the second station. The temperature recorded its lowest rate of 17.2 °C during winter for the second station and its highest rate was 28.6 °C during summer for the first station. The results of the statistical analysis at a significance level of 0.05 showed significant differences between the two stations, with the strongest differences being between seasons with regard to pH. As for salinity, dissolved oxygen in the water, and its temperature, and the seasons were the main influencing factors, and no significant differences found between the stations. As shown in Table 1.

Table 1. Environmental parameter at the study seasons.

Stations	Season	pH	Salinity ‰	Dissolved oxygen mg/L	Water temperature °C
1 close to the coast	Winter	8.2	39.9	9.9	18.9
	Spring	8.0	40.5	9.5	21.9
	Summer	8.1	42.9	8.7	28.6
	Autumn	8.0	41.6	9.3	25.3
2 far from the coast	Winter	8.2	39.2	10.2	17.2
	Spring	8.1	40.1	10.1	20.1
	Summer	8.2	42.55	9.2	28.1
	Autumn	8.0	41.11	10.5	25.5

Taxonomy

Order: Decapoda Latreille, 1802
Family: Grapsidae MacLeay, 1838
Genus: *Metopograpsus* H. Milne Edwards, 1853
Metapograpsus messor (Forskål, 1775) and *Metapograpsus thukuhar* (Owen, 1839)
Genus: Pilumnidae Samouelle, 1819
Pilumnopeus serratifrons (Kinahan, 1856)

(Table 2) shows a list of recorded and identified species with their references. the total of 20 species of crabs species were identified during the in the this work and previous studies at Al-Fao coast (Picture 2). The collected samples included 20 species belonging to 11 families. The family Pilumnidae is represented by 5 species, and Macrophthalmidae and Camptandriidae were represented by three species, while the other eight families Portunidae, Galenidae, Epialtidae, Sesarmidae, Matutidae, Dorippidae, Dotillidae and Grabidae, each comprised only one species.

Table 2. Families and species List of the crab species recorded in the previous studied and this study at Al-Fao coast.

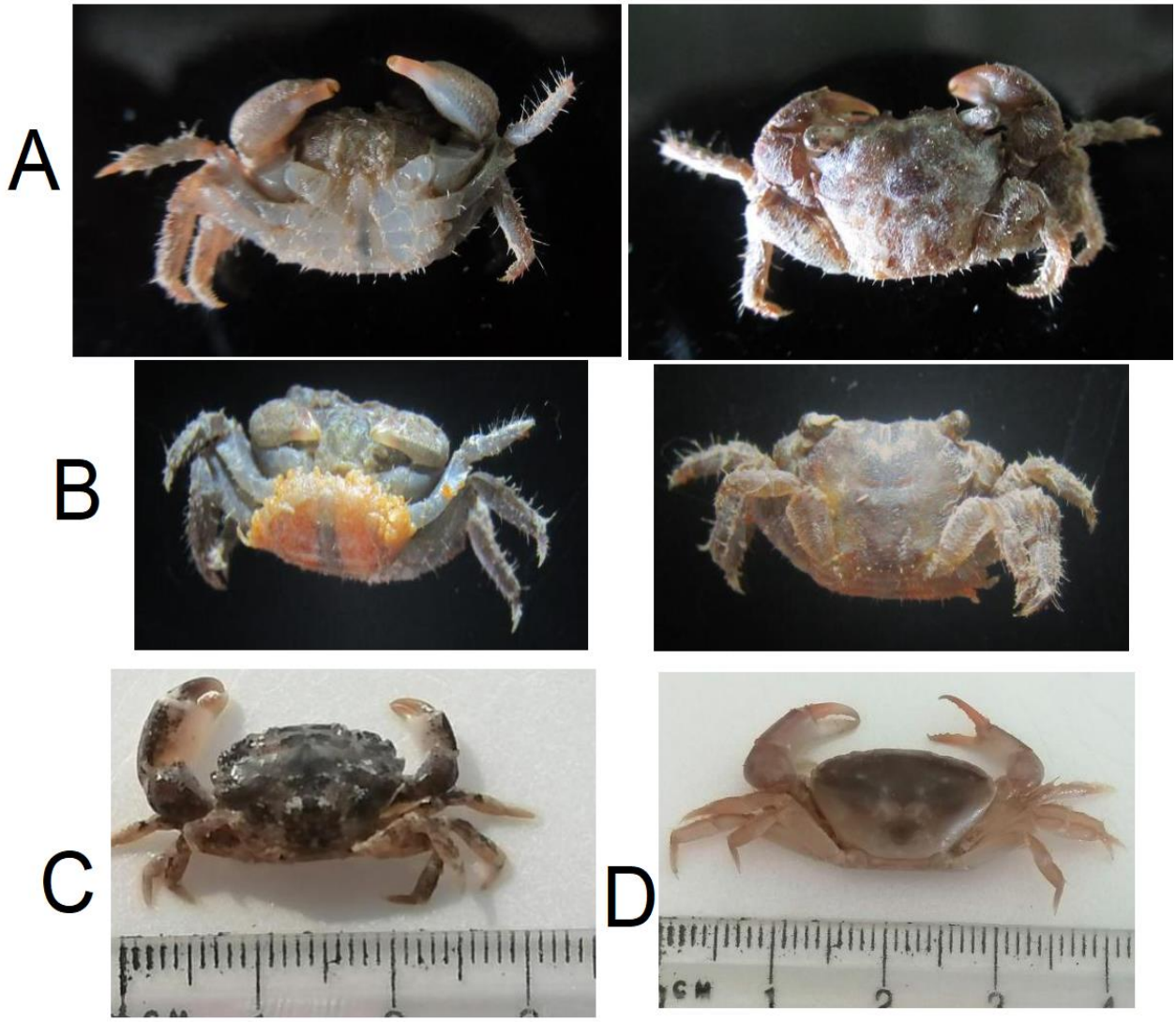
No.	Family	Species	References
1	Macrophthalmidae	*Ilyograpsus rhizophorae* (Barnard, 1955)	Yasser *et al*., 2020a
		Macrophthalmus Venitus dentipes (Lucas in Guérin, 1836)	Yasser *et al*., 2013
		Macrophthalmus laevis (A. Milne-Edwards, 1867)	Yasser *et al*., 2013
2	Pilumnidae	*Eurycarcinus integrifrons* (de Man,1879)	Naser, 2018
		Eurycarcinus orientalis (A. Milne Edwards, 1867)	Naser, 2019
		Pilumnus savignyi (Heller, 1861)	Yasser *et al*., 2020b
		Pilumnopeus convexus (Maccagno, 1936)	Al-Khafaji, *et al*., 2017f
		Pilumnopeus serratifrons (Kinahan, 1856)	Present study
3	Camptandriidae	*Leptochryseus kuwaitensis (Jones and Clayton, 1983)*	Ng *et al*., 2009
		Nasima dotilliformis (Alcock, 1900)	Ng *et al*., 2009
		Opusia indica (Alcock, 1900)	Ng *et al*., 2009

No.	Family	Species	References
4	Epialtidae	*Phalangipus persicus* (Griffin, 1973)	Yasser *et al*., 2021a
5	Portunidae	*Portunus segins*(Forskål, 1775)	Yasser *et al*., 2021c
6	Matutidae	*Matuta planipes* (Fabricius, 1798)	Al-Khafaji, *et al*., 2017e
7	Galenidae	*Halimede Tyche* (Herbst, 1801)	Al-Khafaji, *et al*., 2017d
8	Grabidae	*Metapograpsus Messor* (Forskål, 1775) *Metapograpsus thukuhar*	Present study Present study
9	Sesarmidae	*Nanosesarma sarii* (Naderloo & Türkay, 2009)	Naser *et al*., 2013
10	Dotillidae	*Ilyoplax Stevensi* (Kemp, 1919)	Yasser *et al*.,2021b
11	Dorippidae	*Dorippe Quadridens* (Fabricius, 1793)	Al-Khafaji *et al*., 2019

(Table 3) shows the presence and absence of species recorded at the two study stations during the work period. The species *M. dentipes* was present at both study stations in hand-caught and hand-netted catches for two stations in the Iraqi coast of the Al-faw area. The species was available during most seasons. *Eurycarcinus orientalis* and *Nasima dotilliformis* were the most common species. *Eurycarcinus orientalis* was absent only in spring at Station 1 and winter at Station 2, while *Nasima dotilliformis* was absent only in Station 1 during Autumn, and in Station 2 in winter. *P. convexus* and *Opusia indica* were common species caught and recorded at both study stations during winter, spring, and summer at Station 2. It is evident from the table that *Metapograpsus rasul* (Forskoll, 1775), *Metapograpsus thokowhar* (Owen, 1839), and *Pilumnopeus serratifrons* (Kinahan, 1856) were recorded for the first time from the Iraqi coast in this study.

Table 3. Presence and absence of the species recorded at two stations during the survey period

No.	Species	Station 1				Station 2			
		Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
1	*I. rhizophorae*	+	-	-	-	-	-	-	-
2	*M. dentipes*	+	+	+	+	+	+	+	+
3	*M. laevis*	-	-	+	+	+	-	+	+
4	*E. integrifrons*	+	+	+	-	+	+	-	+
5	*E. orientalis*	+	-	+	+	-	+	+	+
6	*Pilumnus savignyi*	+	+	-	-	-	-	-	-
7	*P. convexus*	+	+	+	-	+	+	+	-
8	*P. serratifrons*	-	+	-	+	-	-	+	+
9	*L. kuwaitensis*	-	-	-	+	+	-	-	+
10	*N. Dotilliformis*	+	+	+	-	-	+	+	+
11	*Opusia indica*	-	+	-	-	+	+	+	-
12	*P. persicus*	+	+	+	-	+	-	-	-
13	*Portunus Segnis*	+	+	+	+	-	-	-	+
14	*Matuta planipes*	+	+	-	-	+	-	-	-
15	*Halimede Tyche*	+	-	+	-	+	-	-	-
16	*M. Messor*	+	+	-	-	-	+	+	-
17	*M. Thukuhar*	-	-	-	-	+	+	+	-
18	*N. sari*	-	-	+	+	-	+	+	-
19	*Ilyoplax Stevensi*	-	+	+	-	-	+	+	-
20	*D. quadridens*	-	-	-	+	-	-	+	+



Picture 2. Group of plates of species collected from study area A: *M. Messor.* B. *M.Thukuhar* C: *P. serratifrons* D: *E. integrifrons.*

Correlation between the presence of marine crab species and environmental factors:

(Table 4) shows the relationship between the presence and absence of crab species and the environmental factors studied. Correlation analysis revealed significant relationships between the different crab species and the environmental factors: There is no clear effect of pH on the presence of species ($r = -0.068$; $P < 0.05$), salinity ($r = -0.764$; $P < 0.05$), dissolved oxygen (DO): ($r = 0.341$; $P < 0.05$), and temperature ($r = -0.731$; $P < 0.05$) while species decreased with increasing water temperature and salinity. Biodiversity increased slightly with increased dissolved oxygen.

Table 4. The correlations between environmental variables and species presence (presence = 1, absence = 0) in the study area; P>0.05

Environmental parameters	Presence and absence of marine crab species
pH	No significant correlation (ns)
Salinity ‰	moderate Negative correlation
Dissolved Oxygen (DO, mg/l)	positive correlation
Temperature (°C)	Negative correlation

Discussion

Temperature: This directly affects the activity and growth rate of invertebrates. Some species prefer certain temperatures, and sudden changes can disrupt the ecological balance. The pH value tends towards alkalinity for most seasons of the year, and this is one of the characteristics of marine waters (Abbas *et al*., 2020). We notice its effect on the presence and abundance of crabs, but it is not significant.

Water temperature plays a role in reflecting the disturbance of climatic conditions in the summer and autumn seasons, and the pH is an important factor for the efficiency of both coagulation and chlorination, which contributes to the variation in alkalinity, especially in the winter and autumn seasons (Mohammed *et al*., 2025).

Salinity plays a crucial role in species distribution. Most crustaceans, including crabs, cannot tolerate large changes in salinity, especially in unstable areas. Salinity increased significantly and was more stable at Station 2, which farthest from the coast and least affected by tides. Station 1, which more tidal, experienced tidal fluctuations and recorded less stable values for all environmental factors. This was due to its proximity to the erosion zone and its increasing impact from human activities, resulting in greater biodiversity and stable distributions of invertebrates and other living communities.

In addition, the study stations are located in a hot and dry desert climate, so most parameter values increased with increasing temperatures, leading to increased salt concentration in the water (Al-Hemidawi *et al*., 2020).

The study showed that despite the minor differences in most environmental factors between the two stations, impact on the extent of the organism's tolerance and adaptation to environmental conditions. We notice that the dissolved oxygen values at the second station, which is far from the coast, are slightly higher than they were at the first station, affected by the temperature that decreases as we move away from the land, which reflects its effect in supporting biological diversity and a more stable and regular distribution. Here, the importance of spatial environmental distribution and its direct impact on biological communities emerges.

The current study showed that 20 marine crabs, which caught by nets and by hand off the Iraqi coast at Al-Fao Port. Some species were recorded in previous recent studies (Nasser *et al.*, 2024), while Al-Khafaji *et al*. (2018) reported 18 species, *Macrophalmus* spp., *Eurycarcinus orientalis*, *Nasima dotilliformis*, *Leptochryseus kuwaitensis*, *Portunus siginsus*, and *Halimede tyche* were the most widespread species, found in large numbers at most sites and most seasons in both studies. This finding indicates that these species are well -established in the various habitats along the Iraqi coast. It also suggests that the environmental conditions of the two sites are conducive to their presence, particularly in terms of bottom habitat, food availability, and the absence of predators. Drekamar and Vessey (1982) stated that if a species occupies an area and reproduces there, it means that all its needs have met. The current study added three species:

Metapograpsus messor (Forskål, 1775), *Metapograpsus thukuhar* (Owen, 1839), and *Pilumnopeus serratifrons* (Kinahan, 1856), as the first records of the number of marine crabs reported in previous studies collected in the waters of the Iraqi coast (Al-Khafaji *et al.*, 2018; Nasser *et al.*, 2021). This ongoing change in the structure of the crab community on the Iraqi coast is certainly due to the ongoing migration activity of marine organisms from the Arabian Sea to the Arabian Gulf and to the northwest. The results indicate that environmental changes primarily linked to the seasonal cycle while the impact was limited to the location (near or far from the coast) and changes in environmental factors more linked to the presence and distribution of marine crabs near or far from the coast.

Correlation analysis results show that temperature had the most negative effect on species presence, indicating that species prefer relatively cooler seasons. Salinity also had a negative impact, which may reflect the sensitivity of some species to salinity changes. Dissolved oxygen has a relatively small positive effect, suggesting that the availability of oxygen may enrich the environment for the presence of some species. This confirmed by a study by Al-Baghdadi *et al*. (2025) on relationship between environmental factors and the abundance of benthic organisms in the Shatt al-Basra Canal.

Conclusions:

These results highlight the importance of studying seasonal and spatial environmental variation and its direct impact on the diversity of biological communities, which calls for focusing future studies on these coastal areas and giving them priority, as they are a new environment for biological communities, especially invertebrates, a key to protecting the coastal ecosystem.

The study confirmed that temperature had the greatest impact on species presence, indicating that species prefer relatively cooler seasons. This may reflect the sensitivity of some species to salinity changes. Oxygen availability may also enhance the presence of some species.

In addition to providing a reference list of crabs associated with the coast of the Grand Fao Port in southern Iraq, it currently includes 20 species in 11 families.

References:

Abbas, M. F., Al-Mayah, S.H. and Khalaf, T.A. 2020. Changes of Some Environmental Factors in the Iraqi Coastal Waters. Medico-legal Update, 20(3):164-172. https://faculty.uobasrah.edu.iq/uploads/publications/1591782463.pdf

Aguilera, M.A., Rojas, A., Manzur, T., Bulleri, F. and, Thiel, M. 2025. Rehabilitation of intertidalbiodiversity on breakwaters could be compromised by grazing pressure and environmental context. Ecological Engineering, Vol. 212. https://doi.org/10.1016/j.ecoleng.2024.107476.

Al-Baghdadi, N.M., Abbas, M.F., Al-Najare, G.A., Younis, K.H. and Karim, R.M. 2024. Monitoring Environmental Changes in the Shatt al-Arab River Using the Organic Pollution Index (OPI) and Two Species of Benthic Invertebrates *Melanoides tuberculata* and *Neritina violacea*. Egyptian Journal of Aquatic Biology & Fisheries, 28(3): 889 – 909. https://ejabf.journals.ekb.eg/article_361082.html.

Al-Baghdadi, N.M., Galo, A.M., Ahmed, M.H. and Al-Khafaji, K.K. 2025. Study of Benthic Macrofauna and Organic Pollution Indices in Southern Part of Shatt al-Basrah Canal, Basrah, Iraq . Egyptian Journal of Aquatic Biology & Fisheries, 29(2): 1723-1743. https://ejabf.journals.ekb.eg/article_421094.html.

Al-Hemidawi, F.N., Mohammed, A.H. and Al-Saad, H.T. 2020.Water Quality of Al-Dalmaj Marsh, Iraq. Mesopotamian Journal of Marine Sciences,35(1):13-24.https://www.mjms.uobasrah.edu.iq/index.php/mms/article/view/27/14.

Al-Khafaji, K. K., Mutlak, F. M., and Ukash, A.N. 2017d. New records of crabs: *Halimede tyche* (Herbst, 1801) (Crustacea: Decapoda) from Iraqi Coast, Iraq. International Journal of Marine Science, 7, 272-274. https://faculty.uobasrah.edu.iq/uploads/publications/1613014165.pdf.

Al-Khafaji, K.K., Mutlak, F.M. and Yaseen, A.T. 2017e. First finding of Matutid crabs: *Matuta planipes* Fabricius, 1798 (Crustacea: Decapoda) from Iraqi Coast and Garmat Ali River, Basrah Area, Iraq. International Journal of Aquaculture, *7*, 122-125.DOI: 10.5376/ija.2017.07.0019.

Al-Khafaji, K. K., Saoud, K. D., amd Al-Maliky, T.H. 2017f. First records of Pilumnid crabs *Pilumnopeus convexus* Maccagno 1936 (Crustacea, Decapoda, Pilumnidae) from Khor Al-Zubair Canal, south of Iraq. International Journal of Marine Science, *7*, 361-365. http://ijms.biopublisher.ca

Al-khafaji, K.K, and Saoud, K.D. 2018. study on occurrence and density of sesarmid and brachyuran crabs) Decapoda, Brachyura) in intertidal zone of Shatt Al-Arab River. Arthropods, 7(4): 87-93. https://www.researchgate.net/publication/332710998_A_study_on_occurrence_and_density_of_sesarmid_and_brachyuran_crabs_Decapoda_Brachyura_in_intertidal_zone_of_Shatt_Al-Arab_River_Basrah_Iraq#fullTextFileContent.

Al-Khafaji, K.K., Al-Maliky, T.H. and Al-Maliky, A.M.J. 2019.First record of the crab, Droippe quadridens (Fabricius, 1793) (Brachyura: Dorippidae), from the Iraqi coastal waters of the NW Arabian Gulf, with notes on the occurrence of seven species of crabs in the region. Arthropods, 8(4): 118-126. https://www.researchgate.net/publication/33685488

Basson, P.W., Burchard, J.A., Hardy, J.T. and P.A. 1977. Biotopes of the Western Arabian Gulf: Marine Life and Environments of Saudi Arabia, 284 pp. https://scispace.com/pdf/biotopes-of-the-western-arabian-gulf-by-philip-w-basson-john-3p6jgxm0o8.pdf

Drickamar, L.C. and Vessey, S.H. 1982. Animal Behavior: Concepts, processes and methods.Willard Grant Press. Boston, 510 pp. https://bpl.bibliocommons.com/v2/record/S75C2061338

Graauw, A.d. 2022. Ancient Port Structures - Parallels between the ancient and the modern. Méditerranée , Paléo-environnements, géoarchéologie, géohistoire, 56 pages.URL: https://journals.openedition.org/mediterranee/12715ISSN: 1760-8538

Griffin, D.J.G. and Tranter, H.A. 1986. The Decapoda Brachyura of the Siboga Expedition. Part VIII. Majidae. Siboga-Exped., 39(C4): 1-335. DOI: https://doi.org/10.5962/bhl.title.10267

Mohammed, I.K., Eassaa, A.M. and Al-Anber, L.J. 2025.Determination of Pollution's Sources for some Raw Water Supplies at Basrah Governorate. Mesopotamian Journal of Marine Sciences, 40(1): 57-70. https://www.mjms.uobasrah.edu.iq/index.php/mms/article/view/331/217

Muttashar, W.R., Al-Aesawi, Q.M., Al-Nasrawi, A.K.M.; Almayahi, D.S.B. and Jones, B.G. 2024. Coastline instability evaluation: multitemporal bathymetric mapping and sediment characteristics. Environmental Earth Sciences, 83(43):1-10. https://doi.org/10.1007/s12665-023-11375-3

Naderloo, R. .2017. Atlas of Crabs of the Persian Gulf. Springer International Publishing, Switzerland, 444 pp. https://doi.org/10.1007/978-3-319-49374-9

Naser, M.D., Alkhafaji, K.K.; Yasser, A.G. and Darweesh, H.S. 2013. New Record of *Nanosesarma sarii* (Naderloo and Turkay, 2009) (Crustacea: Decapoda: Brachyura: Sesarmidae) from Khor Al-Zubair, South of Iraq. Bulletin of the Iraq Natural History MuseumBull. Iraq Natural History Museum, 12(4): 35–41. https://repository.uobaghdad.edu.iq/articles/jnhm-101?page=2709

Naser, M. 2018. A New Record of *Eurycarcinus integrifrons* De Man, 1879 (Decapoda, Brachyura, Pilumnidae) from NW of the Persian – Arabian Gulf, Iraq. Journal of Biological Studies, 1: 9–13.

Naser, M. 2019. A New Record of *Eurycarcinus orientalis* A. Milne-Edwards, 1867 (Decapoda, Brachyura, Pilumnidae) from the Northwestern Part of the Persian-Arabian Gulf. Journal of Biological Studies, 4: 160–164.

DOI**:** https://doi.org/10.62400/jbs.v1i4.245

Naser, M.D., Yasser, A.G., Abdul-Sahib, I.M., Mohammed, D.S.; Abdul-Sahib, A.M. and Auda, N.M. 2024. New record of the cirriped Striatobalanus tenuis (Hoek, 1883) from breakwaters at Faw city, Iraq. Journal of Biological Studies, 7(2): 65-69. https://doi.org/10.62400/jbs.v7i2.9973

Ng, P.K.L.; Rahayu, D. and Naser, M.D. 2009. The Camptandriidae of Iraq with description of a new genus and notes on *Leptochryseus* Al-Khayat & Jones, 1996 (Crustacea: Decapoda: Brachyura). Zootaxa, 2312, 1– 26. https://doi.org/10.11646/zootaxa.2312.1.1

Ng. P.K.I., Guinot, D. and Davie, P.F. 2008. Systema Brachyurorum: An annotated checklist of extant brachyuran crabs of the world. The Raffles Bulletin of Zoology, 17: 1-286.

Nobili, G. 1905. Décapodes nouveaux des Cotes d'Arabie et du Golfe Persique (Diagnoses Préliminaires). Bulletin du Muséum National d'Histoire Naturelle, Paris 11, 11, 158–164.

Wee, D.P.C and Ng, P.K.L. 1995. Swimming crabs of the genera charybdis De Haan, 1833, and Thalamita Latereille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore. The Raffles Bulletin of Zoology, pp 1-128. https://lkcnhm.nus.edu.sg/wp-content/uploads/sites/11/app/uploads/2017/06/s1rbz.pdf

Yasser, A.G., AbdulSahib, I.M., Naser, M.D., Al-Khafaji, K.K. and Darweesh, H.S. 2013. Two Records of *Macrophthalmus* Desmarest, 1823 (Decapoda: Brachyura: Thoracotremata) from the NW of the Arabian Gulf. Arthropods, 2(3): 105–110.

Yasser, A.G., Naser, M.D. and Jabbar, I.M. 2020a. Far from the Persian-Arabian Gulf, *Ilyograpsus rhizophorae* Barnard, 1955 (Crustacea: Decapoda: Brachyura: Macrophthalmidae) as a New Record of Khur Al Zubair, Basra, Iraq. *EurAsian Journal of BioSciences*, 14: 7645–7649.

Yasser, A.G., Alkhafaji, K.S.; Darweesh, H.S. and Naser, M.D. 2020b. A New Record of the Hairy Crab *Pilumnus savignyi* Heller, 1861 (Pilumnidae Samouelle, 1819) from the Northwest of the Persian-Arabian Gulf. EurAsian Journal of BioSciences, 14: 7575–7577. https://faculty.uobasrah.edu.iq/uploads/publications/1612261866.pdf

Yasser, A., Naser, M., and Al-Khafaji, K. 2021a. Checklist of the marine Brachyura of the northwestern Persian-Arabian Gulf, with the new record of *Phalangipus persicus* Griffin, 1973 (Crustacea: Brachyura: Epialtidae MacLeay, 1838) from the Iraqi coast. Acta Aquatica Turcica, 17(4): 525-531. DOI:10.22392/actaquatr.895968

Yasser, A.G., Naser, M.D., and Al-Khafaji, Kh. Kh S. 2021b. A new record of dotillid crab *Ilyoplax stevensi* (Kemp, 1919) Crustacea: Brachyura: Dotillidae Stimpson, 1858) from Shatt Al-Basrah Canal, Iraq. Ukrainian Journal of Ecology, 11 (2):77-79. DOI:10.15421/2021_80.

Yasser, A.G., Naser, M.D. and Ghazi, A.H. 2021c. new record of blue crab *Portunus segnis* (Forskål, 1775) from the Iraqi coast. Bulletin of Basrah Natural History Museum, 7(1): 8-14.https://www.academia.edu/65699962/A_new_record_of_blue_crab_Portunus_segnis_Forsk%C3%A5l_1775_from_the_Iraqi_coast.

Zhang, X.M. and Chen, W. 2011. Trust, Relationship Commitment and Cooperative Performance in Supply Chain—An Empirical Study Based on Perspective of Knowledge Trading. Studies in Science of Science, 12, 1865-1874. https://www.scirp.org/reference/referencespapers?referenceid=2210260