A Taxonomic Study of Phytoplankton in the Basin of the Great Al-Faw Port and the Estuary of the Shatt Al-Arab

Aqeel A. Abdulhussein Al-WaeliiD

Department of Marine Biology, Marine Science Centre, Univ. Basrah, Basrah, Iraq

Corresponding Author E-mail: aqeel.abdulhussein@uobasrah.edu.iq

Received 01/01/2025 Accepted 02/03/2025 Published 25/06/2025

Abstract

The study aimed to know the qualitative estimate of the phytoplankton community in the Great Al-Faw Port Basin, and to compare it with the phytoplankton present in the Shatt Al-Arab estuary considering it a newly formed geographical area. This study is the first in this area, this was done by identifying three sites for collecting samples, two sites within the Grand Al-Faw Port Basin, which are the western breakwater, which represents the first site, the Eastern breakwater, which represents the second site, and the Shatt al-Arab Estuary, which represents the third site, samples were collected seasonally from 2022. Additionally, some environmental factors were measured, which may be related to the spread and distribution of phytoplankton, the temperature were between 14.7-32 ˚C, salinity 39.6-41.6 PSU, pH 7.83-8.5, dissolved oxygen 5.5-8.4mg/l, turbidity 4.36-64.9 NTU, phosphate 0.4-0.9mg/l, nitrate 0.6-1.97mg/l, chlorophyll-a- 6.2-21.73mg/m3 and TDS 46.1-53.77ppm. The study identified 64 taxonomic unit (genera and species) from phytoplankton belonging to 5 Divisions of the three sites. The relative diversity index of genera showed, that Bacillariophyta was the most dominant compared to others, with 40 taxonomic unit (62.5%), followed by Dinophyta with 21 taxonomic unit (32.8%), Then Chlorophyta, Ochrophyta and Haptophyta the study recorded one species for each of them (1.5 %).

Keywords: Taxonomic, phytoplankton, Al- Faw port.

Introduction:

Phytoplankton play a pivotal role in shaping marine ecosystems, accounting for nearly 50% of global primary production, they have a direct impact as a food source for higher trophic levels such as zooplankton, shrimp larvae and fish, as well as their role in transporting energy and nutrients through the marine food web and carbon cycle and storing them in the deep sea as organic matter (Solenn *et al*. 2024). Identification of phytoplankton at a taxonomic level provides an understanding of the correct interpretation of the environmental conditions in which they grow, Phytoplankton are important organisms through which ecosystem processes and water quality can be

P-ISSN: 1812-237X, E-ISSN: 2788-5720, https://ijaqua.uobasrah.edu.iq/index.pip/iaqua

understood. Through the taxonomic definition of phytoplankton, opportunities can be obtained to link evolutionary processes with environmental conditions (Pacheco *et al*., 2020). The basic element that forms the base of the food chain pyramid in the ecosystem is phytoplankton, all organisms living in the aquatic environment depend on phytoplankton for their survival, and when there is an imbalance or disturbance in the productivity of phytoplankton, the food chain will be broken (Batten *et al*., 2019). Phytoplankton are an important and essential part of the natural ecosystem, which are found in several types in various water bodies such as seas, oceans, lakes, rivers, marshes, ponds, swamps and springs (Lundsor *et al*., 2020). Due to the creation of new environments and climate change, the composition of the phytoplankton community can change and this change may affect the food chain, so continuous monitoring of phytoplankton communities is required (Rahman, 2020). Phytoplankton can also show significant changes due to variations in biotic (fungal and bacterial proliferation) and abiotic (salinity, temperature, pH, nutrient and mineral concentration) factors. (Pacheco *et al*., 2020). The dynamics of phytoplankton in marine ecosystems are influenced by complex interactions between them, zooplankton, and other processes in the food web, as well as by the influence of many other physical, chemical, and biological factors (Kadeem *et al*., 2021).

This study is the first of its kind in this region, as it is a region of recent geographical formation, and studies in the estuary and the Arabian Gulf are rare, as it is a remote area that is often difficult to access and requires modern boats and financial costs that are often unavailable, in addition to geopolitical problems. The latest taxonomic study of phytoplankton was Al- Faw area, which is about 17 km away from the study area (the Grand Al-Faw Port and the Shatt Al-Arab estuary) carried out by Al-Waeli and Athbi (2021). Regarding the study of phytoplankton in the waters of the Arabian Gulf, the available information about it is scarce and limited, as previous studies were conducted for areas covering all or most of the Gulf waters for short periods. The study of Al-Kaisi (1976) relied on samples collected for a period of only two weeks in the winter of 1968, and despite the shortness of that period, it clarified important facts about the nature of the groups that make up the phytoplankton and their qualitative and quantitative distribution in different areas in the general waters of the Gulf, as 249 species were recorded in that study. Grace and Gibson (1978) studied the Arabian Gulf region for about two weeks in the spring, where about 100 species of phytoplankton were identified. Jamal and Bovlov (1979) also identified 110 species of phytoplankton from the northwestern Arabian Gulf, 70 of which represented the Bacillariophyta, 39 of the Dinophyta, and only one of the Cyanophyta.

Al-Handal *et al*. (1991) studied the phytoplankton of the group of Dinophyta algae in the northwestern region of the Arabian Gulf by selecting five stations within the Iraqi coastal waters, the study recorded 36 species, 24 of which were recorded for the first time in the region. Abdullah (1989) in his study of the Shatt Al-Basrah Canal identified 89 species of phytoplankton belonging to 48 genera, 69 species of Bacillariophyta algae , 10 species of Cyanophyta algae belonging to 9 genera, 7 species of Chlorophyta algae belonging to 6 genera, then the Euglenophyta algae which included only two species and one species of Dinophyta algae. As for the study of Al-Shawi (2010) on three stations in Khor Al-Zubair, it recorded 67 species of phytoplankton belonging to 41 genera, of which Bacillariophyta algae represented 52 species belonging to 31 genera, 10 species of Dinophyta algae belonging to 7 genera, 4 species of Chlorophyta algae belonging to two genera, and one species of Chrysophyta algae. the study aims to classify the phytoplankton in the basin of the Grand Al-Faw Port and compare them with species found in the Shatt Al-Arab Estuary.

Materials and Methods

Description of the Study Area

The Grand Al- Faw Port is located in the Ras Al-Bisha area of Al-Faw city, south of Basrah Governorate, at the end of the continental shelf of Iraq. Its total area is 54 km^2 and its depth is supposed to be 19 meters. The port consists of a western breakwater with a length of 16 km and an eastern breakwater with a length of 8 km (Figure 1). The breakwater is a large solid rocks that acts as a barrier that protrudes into the sea, protecting ships from currents and waves and preventing the erosion of the shelf and the deposition of silt in the navigation channel, sites were determined using (GPS) table(1).

Table 1. Coordinates of the study sites

Sites	North	East
Western breakwater-St1	29°. 87' 26" 79	48°. 65' 45" 86
Eastern breakwater-St2	29°. 77' 22".39	48°. 58' 26" 60
Shatt Al-Arab Estuary-St3	29°. 65' 17" 72	48°. 76' 10" 07

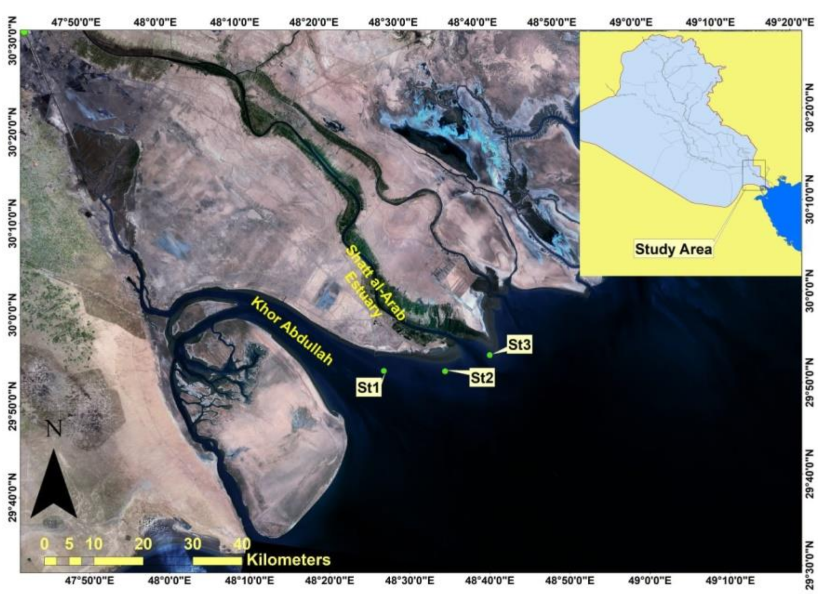

Figure 1. Map showing sample collection site.

Measure of parameters

Environmental parameters were measured in the field and in the laboratory. Temperature, salinity, pH, total dissolved solids and turbidity were measured in the field using a multi-meter, while the method described by Lind (1979) was used to measure dissolved oxygen, reactive phosphate and reactive nitrate were estimated according to APHA (2012), while chlorophyll-a- concentration was estimated according to the Lorenzen equation explained by Vollenweider (2011).

Collecting phytoplankton

Collected using net with 20 µm mesh size (wildco supply company/USA), dropped into the water and slowly pulled behind the boat for 15 minutes. The water is filtered and the last 100 ml is kept, fixed in 4% formalin and stored until examination.

Preparing slides for species identification

For non-diatoms algae, shake the sample well, then take one drop and place it on the slide, cover it with a coverslip and examine it under a light microscope, Zeiss type with a camera.

Preparation of Diatoms Slides

After cleaning the sample, 1 ml was taken from it and placed on the cover slide and left to dry, then a drop of Naphrax was placed on it and heated, then covered with a slide and examined under the microscope (Al-Handal and Wulff, 2008).
The following sources were used to classify phytoplankton: John and Robert (2015); Orlando (2016); Al-Shaheen (2016); Malgorzata *et al*. (2018); Al- Yamani and Saburova (2019).

Statistical analysis

To analyze the results statistically, the SPSS program ver. 20 (Al-Rawi and Khalaf Allah, 1980) was used under the probability level ($p<0.05$). As for finding correlations between environmental factors, the Pearson correlation (r) coefficient program was used.

Results

Table (2) Results of Pearson's correlation coefficient(R) showing the strength and weakness of the association between environmental variations.

Table 2. Pearson's correlation coefficient between environmental variables.

Variation	C °	Sal. psu	pH	DO mg/l	TUR. NTU	pO_4 mg/l	NO_3 mg/l	Chl.a mg/m³	TDS ppm
C.	1								
Sal.	.77*	1							
pH	-.181	- . 56	1						
DO	.94 *-	.7-	.71	1					

TUR.	.006-	. 57	.04	.17	1				
PO4	. 44	.15-	-.3	-.59	-.89**	1			
NO3	. 20	.22-	-.54	-.47	-.86**	.13	1		
Chl. a	-. 29	.53	.63	.56	- .8**	-.89**	-.99**	1	
TDS.	. 91**	. 53	-.6	-.97**	-.37	.75*	.58	-.56	1

The results of the statistical analysis showed that there were no significant differences between the sites, but significant differences were recorded between the seasons at the probability level ($p<0.05$) with regard to temperature. No significant differences were observed between the sites or between the seasons with regard to salinity and pH. Significant differences were also observed between the sites, but no significant differences were recorded between the seasons for dissolved oxygen. As for turbidity, the results of the statistical analysis showed that there were clear significant differences between the sites as well as between the seasons. No significant differences were recorded between the sites or between the seasons for reactive phosphates and chlorophyll -a-. As for reactive nitrate and total dissolved salts, significant differences were recorded between the sites, but no significant differences were recorded between the seasons Table (3).

Table 3. Seasonal variables of environmental factors in the Grand Al-Faw Port.

Var.	**Temp. °C**	**Sal. g/l**	**pH**	**Do Mg/l**	**TUR NTU**	**PO_4 mg/l**	**NO_3 mg/l**	**Chla. amg/m3**	**TDS ppm**
St1									
Winter	15.6	40	7.94	7.7	4.3	0.7	1.6	12.5	46.1
Spring	22.1	41.5	8.06	8.4	7.5	0.4	0.9	20.4	47.6
Summer	31.7	41.6	8.11	5.5	5.17	0.8	1.6	9.3	53.7
Autumn	26	41.4	7.9	6.1	8.73	0.6	1.7	8.6	51.1
St2									
Winter	16	40.1	8.1	7.6	5	0.6	1.5	11.7	46.8
Spring	21.6	41	7,83	8.2	7.5	0.3	0.6	21.73	47.5
Summer	31.3	41	8	5.62	6.12	0.9	1.7	8.1	53.11
Autumn	25.5	40.8	7.95	6.11	9	0.8	1.6	8.2	51.5
St3									
Winter	14.7	39.8	8.1	7.5	44.1	0.6	1.9	7.32	49.1
Spring	25	40	8	8.3	64.9	0.41	0.9	14.41	48
Summer	32	39.6	8.01	5.9	42.7	0.8	1.9	7.2	53.6
Autumn	26.8	40.5	7.91	5.9	47.7	0.6	1.9	6.2	51.5

The Qualitative study of phytoplankton

The study identified 64 taxonomic units (species and genus) belonging to 46 genera and belonging to five divisions: Bacillariophyta, which had dominance over the rest of the divisions, Dinophyta, Chlorophyta, Ochrophyta and Haptophyta.

The total number of Bacillariophyta was 40 taxonomic units belonging to 33 genera (62.5%), while the total number of Dinophyta was 21 taxonomic units belonging to 10 genera (32.8 %), while one species for each of the Chlorophyta, Ochrophyta and Haptophyta (1.5%) for each of them Figure (2).

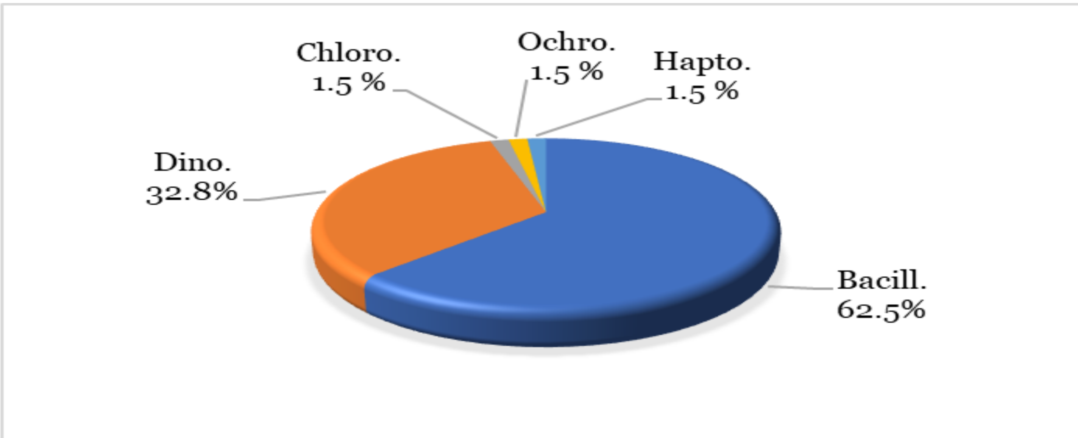

Figure 2. Percentages of phytoplankton divisions recorded during the study.

Phytoplankton recorded at each site

The western breakwater site represented the largest proportion of phytoplankton identified during the study, as the total number of them reached 47 taxonomic units, 29 taxonomic unit of Bacillariophyta, 16 taxonomy unit of Dinophyta, and one Species for each Ochrophyta and Haptophyta table (4). As for the Eastern breakwater site, the total number of phytoplankton recorded reached 40 taxonomic units, 26 taxonomic unit for Bacillariophyta, 13 for Dinophyta and one species of Ochrophyta table (5). The Shatt Al-Arab Estuary site recorded the lowest number of phytoplankton, as the total number reached 29 taxonomic units, 20 of which were Bacillariopyta, 8 Dinophyta, and one species of Chlorophyta table (6).

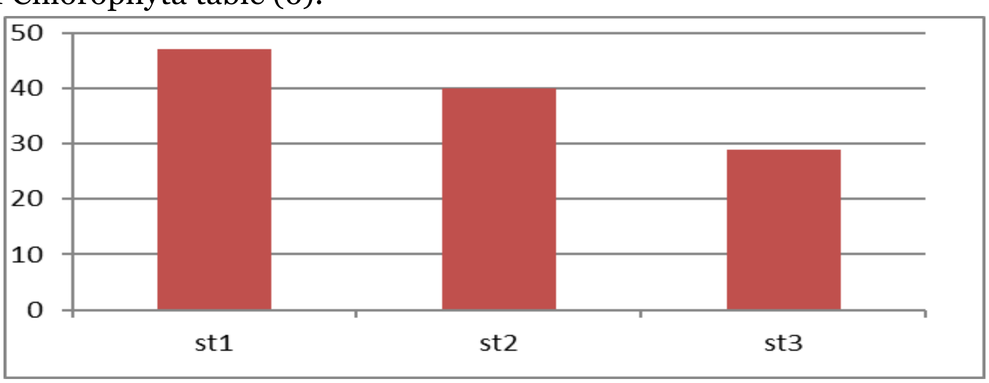

Figure 3. Phytoplankton recorded at each site.

Phytoplankton recorded in each season and for each site

The number of phytoplankton recorded at the western breakwater site in spring was 34 taxonomic units, which is the highest among all seasons, while the lowest number recorded during Summer was 15 taxonomic units. The eastern breakwater site recorded numbers ranging from 15-28 during autumn and spring, respectively, and the lowest numbers appeared at the Shatt al-Arab estuary site, as they ranged from 8-13 taxonomic units during Summer and spring, respectively, Figure (4).

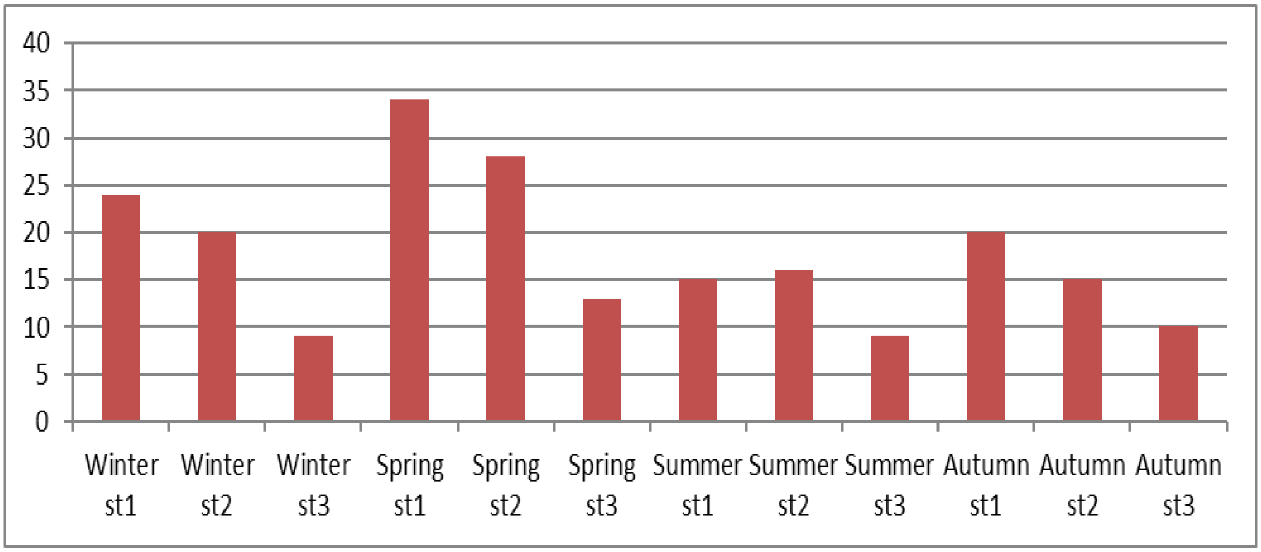

Figure 4. Phytoplankton recorded in each season and for each site.

Table 4. Phytoplankton identified at the western breakwater site for all seasons (+ Its means presence).

Phytoplankton	Winter	Spring	Summer	Autumn
Bacillariophyta				
Actinocyclu sp.	+	+		
Amphora sp.		+	+	
Asteromphalus sp.	+			+
Asterionellopsis sp.		+		
Bacteriastrum sp.		+	+	+
Chaetoceros sp.	+		+	+
Cerataulin sp.	+	+		
Cylindrotheca sp.	+	+	+	
Coscinodiscus sp.	+	+		+
Cyclotella sp.	+	+		+
Entomoneis sulcate	+			
Entomoneis sp.		+	+	

Guinardia sp.		+	+	
Hemiaulus sp.	+	+		+
Lauderi sp.	+			
Lampriscus sp.		+		
Leptocylindrus sp.			+	
Nitzschia sp.	+	+	+	+
Odontella sinensis	+			
Odontella mobiliensis:	+			
Odontella sp.		+		
Pleurosigma sp.	+	+	+	
Rhizosolenia sp.		+		+
Tabularia sp.		+		+
Thalassionema sp.	+	+	+	+
Thalassiosira eccentric	+	+		
Trieres sp.		+		
Surirella sp.	+	+		
Striatella sp.		+	+	
Dinophyta				
Alexandrium insuetum	+			
Alexandrium sp.		+		+
Ceratium furca		+	+	+
Ceratium sp.			+	
Diplopsalis lenticular		+		
Diplopsalis sp.	+	+		+
Dinophysis caudate		+		+
Protoperidinium subinerme		+		+
Protoperidinium punctulatum		+		
Protoperidinium cerasus	+	+		
Protoperidinium sp.	+		+	+
Pterosperma undulatum	+	+		
Prorocentrum micans		+		
Prorocentrum sp.		+	+	+
Scrippsiella trochoidea		+		+
Unarmored sp.	+			+
Ochrophyta				
Dictyocha fibula	+			
Haptophyta				
Phaeocystis sp.				+

Table 5. Phytoplankton identified at the Eastern breakwater site for all seasons.

Phytoplankton	Winter	Spring	Summer	Autumn
Bacillariophyta				
Amphora sp.		+	+	
Asterionellopsis sp.	+	+		
Bacteriastrum haylinum				
Bacillaria sp.	+	+	+	
Bacteriastrum delicatulum	+		+	
Bacteriastrum sp.			+	+
Chaetoceros sp.		+	+	
Coscinodiscus sp.	+	+		+
Cyclotella striata		+		+
Cyclotella sp.	+	+		+
Cylindrotheca sp.		+		
Entomonei sp.	+			
Fragilaria sp.	+	+		+
Guinardia sp.	+		+	+
Hydrosera sp.		+		
Hemiaulus sp.	+			
Mastogloia sp.	+	+		+
Nitzschia sp.	+	+	+	
Odontella sinensis		+		
Odontella sp.	+	+	+	+
Pleurosigma sp.	+	+		
Rhizosolenia sp.		+		
Surirella sp.		+	+	
Striatella sp.		+		
Thalassiosira eccentric	+	+	+	
Thalassionema sp.		+	+	+
Tabularia sp.	+		+	+
Dinophyta				
Alexandrium insuetum	+			
Ceratium furca		+	+	
Ceratium sp.			+	
Dinophysis acuta		+		
Diplopsalis lenticular		+		
Dinophysis caudate		+		+
Protoperidinium subinerme		+		

Protoperidinium sp.	+			+
Preperidinium meunieri	+			
Prorocentrum sp.	+	+		
Pyrophacus sp		+	+	+
Pyrodinium sp			+	+
Scrippsiella trochoidea		+		
Scrippsiella trochoidea				+
Ochrophyta				
Dictyocha fibula	+			

Table 6. Phytoplankton identified at the Shatt Al-Arab Estuary site for all seasons.

Phytoplankton	Winter	Spring	Summer	Autumn
Bacillariophyta				
Amphora sp.	+			
Asteromphalus sp.	+			
Bacillaria sp.				+
Bacteriastrum sp.				+
Cyclotella striata:		+		
Cyclotella sp.	+			+
Coscinodiscus sp.		+		
Entomoneis sp.		+		
Guinardia sp.			+	
Grammatophora sp.	+			
Nitzschia sp.	+			+
Odontella sinensis		+		+
Odontella sp.	+	+		
Peudo-nitzschia sp.			+	
Pleurosigma sp.			+	
Rhizosolenia sp.		+		+
Surirella sp.	+	+		
Thalassionema sp.	+	+		
Tabularia sp.		+		+
Trachyneis sp.		+	+	
Dinophyta				
Ceratium furca				
Dinophysis acuta	+			+
Diplopsalis lenticular			+	
Diplopsalis sp.		+		+

Dinophysis sp.		+		
Oblea rotunda		+		+
Protoperidinium sp.			+	
Prorocentrum micans			+	
Chlorophyta				
Pediastrum simplex			+	

Disscusion:

Phytoplankton are the main source of the food chain, and environmental factors have a great impact on the density and diversity of phytoplankton, and thus the study shows the extent of the influence of these factors on the quality of phytoplankton in the ecosystem of the studied area. Phytoplankton in saltwater ecosystems consist of different divisions of algae such as Bacillariophyta (diatoms) ,chlorophyta (green algae) , dinophyta (yellow or brown algae) and cyanophyta (blue bacteria) (Lundsor *et al*. 2022). The diversity of phytoplankton in marine waters is mainly related to fluctuations, weather conditions, water quality, wave intensity and flow velocity (Lundsor *et al*. 2020). The qualitative fluctuations of phytoplankton in saline ecosystems are primarily related to climatic conditions in general and temperature in particular (Silva, 2021) water temperature, which plays an important role in controlling the distribution and spread of phytoplankton, (Bindoff *et al*. 2019; Silva *et al*. 2021). The reason for the decrease in the diversity of phytoplankton during hot seasons is due to the increase in the rate of water evaporation, and thus the concentration of salts will increase above normal rates, which leads to stress on phytoplankton and thus affects their reproduction (Hewitt, 2018).

So we note from (Figure 4 and Tables 4,5,6), that the greatest diversity of phytoplankton was recorded during the spring, i.e. at the moderate temperatures, As noted from the results in Table (2) and through Pearson's correlation coefficient, temperature and chlorophyll were negatively correlated, because chlorophyll-a-expresses the amount of phytoplankton biomass, so the diversity of plankton increased in the spring, and this is consistent with most studies (Al-Waeli and Athbe 2021; Al-Shaheen 2016; Hassan *et al*. 2011).

Turbidity directly affects the photosynthesis process in the aquatic environment ، Factors that increase water turbidity include flow velocity, ship movement, and human activities (Rodrigues *et al*., 2018). The results Figure (3) showed that phytoplankton diversity recorded higher levels at the western breakwater and eastern breakwater sites compared to the Shatt Al-Arab estuary site. This may be due to several reasons, including the speed of strong water currents, increased turbidity of the water, and low light permeability at the Shatt Al-Arab estuary, which are among the most influential factors on the community structure in fast-flowing environments, because such environments usually have lower densities in terms of numbers, and most of them are of the attached type, compared to slow-flowing environments(Solenn *et al.* 2024; Silva *et al.* 2021).

Conclusion

• Spring is the best season in terms of phytoplankton diversity than other seasons.

• The study showed that the western and eastern breakwaters are better than the Shatt Al-Arab estuary in terms of phytoplankton diversity.

• As a result of the lack of water currents and waves and the low turbidity rates, the environment of the western and eastern breakwaters has become a suitable environment for the biological diversity of various living organisms such as zooplankton, snails, fish and even coral reefs, in addition to phytoplankton.

References

Abdullah, D. S. (1989). Primary productivity of phytoplankton and environmental factors affecting them in the Shatt Al-Basrah Canal. Mas. thesis, Coll. Agri., Univ. Basrah, 100 p.

Al-Handal, A. Y. and Wulff, A. (2008). Marine epiphytic diatoms from the shallow sublittoral zone in Potter Cove, King George Island, Antarctica. Botanica Marina, 51:411-435.

Al-Shaheen, M.G. (2016). Taxonomical and Ecological Study on the Diatoms Communities of Shatt Al-Arab River, Southern Iraq, Ph. D. Thesis. Coll. Sci. Univ. Basrah. 308 pp.

Al- Kaisi, K.A. (1976). Study on the phytoplankton of the Arabian Gulf. Second joint oceanographic assembly, edinbufgh, Sept. 31: 24-31p.

Al-Handal, A. Y.; Ghani, A. A. and Al-Saboonchi, A.A. (1991). Phytoplankton of Khor Al-Zubair lagoon, North West Arabian Gulf. J. Mesopot. Sci. Mar., 6(1):7-33.

Al-Rawi, K.M. and Khalaf, A.M. (1980). Design and analysis of agricultural experiments. Fac. Agric. Univ. Mos. Dar Al-Kutub Prin. Publ. 488 pp.

Al-Shawi, I. J. (2010). An environmental and taxonomic study of plankton in Khor Al-Zubair with an estimation of total petroleum hydrocarbon levels. Ph.D. thesis, Coll. Agri. Univ. Basrah, 187 pp.

Al-Waeli, A. A. and Athbi, A. M. (2021). New records algal species from the Shatt Al-Arab River, Southern Iraq, J. Mesopot. Sci. Mar. 36(1): 79-87 doi. org/10.58629/mjms.v36i1.19.

Al-Yamani, F. and Saburova M. (2019). Marine phytoplankton of Kuwait's water. Kuw. Insti. Scien. Resea. Vol. (2): 338p.

APHA, (2012). Standard method 2130: turbidity. Standard method for the examination of water and wastewater, 22nd edit . Ame. Publ. Heal. Assoc. URL.

Batten, S. D.; Abu-Alhaija R.; Chiba, S.; Edwards, M.; Graham, G. and Jyothibabu, R. (2019). Global Plankton Diversity Monitoring Program. Front Mar Sci 2019;6. https://doi.org/10.3389/ fmars.2019.00321.

Bindoff, N.; Cheung, W.; Kairo, J.; Arístegui, J.; Guinder, V.; Hallberg, R.; Hilmi, N. and Jiao, N. (2019).Changing Ocean, Marine Ecosystems and Dependent Communities. Camb. Univ. Pre., Camb., UK and New York, NY, USA,. 447–587 p. https:// doi.org/ 10.1017 / 978 100 915 7 9 64.007

Grice, G. D. and Gibson, V. R. (1978). General biological oceanographic data from the Arab Gulf and Gulf of Oman. Wood Hale oceanographic Institution. Massachusetts. Technical report, WHOI 38: 38- 78 p.

Hassan, F. M.; Talib, A. H.; Al-Kubaisi, A. A.; Taylor, W. D. and Abdulall, D. S. (2011). phytoplankton primary production//8*-+-in southern Iraq AL-Waeli et al. 14 marshes restoration. J. Bag. Sci. 8(1): 519-530. https://doi.org- /10.21123/bsj. 2011.8.1.

Hewitt B.; Lopez, K.; Gaibisels, A.; Murdoch, S.; Higgins, J.; Magnuson, A.; Paterson, J.; Rusak, H. and Sharma ,S.(2018). Historical trends, drivers, and future projections of ice phenology in small North Temperate Lakes in the Laurentian Great Lakes region. Water 10(1): 70 p. https://doi.org/10.3390/w10010070.

Jamal, A.H.H. and Bovlov, V. (1979). Introduction to the study of phytoplankton in the Arabian Gulf, Kuwaiti ministry of puplic works. Fisheries department. 101p.

John, D.W. and Robert, G.S. (2015). Freshwater algae of North America Ecology and Classification. Edi: 2nd Publi.: Acad. Pres. 769 pp.

Kadeem, Z.J.; Hassan, F.M. and Al-Obaidy, A.H. (2021). Monitoring of Phytoplankton in the Artificial Lake: Comparison Study..Ear. Environ.Sci. 779 (1): 1-7 Doi 10.1088/1755-1315/ 779/1/ 012125.

Lind, O.T.(1979). Hand book of common methods in limnology 2nd ed. London 109.

Lundsor, E.; Stige, L.C.; Sørensen, K. and Edvardsen, B. (2020) Long-term coastal monitoring data show nutrient driven redu--ction in chlorophyll. J. Sea Res., 164, 101925. https:// doi.org /10.1016 /j. seares.2020.101925.

Lundsor, E.; Eikrem W.; Stige L.C.; Sandra A.E. and Stadniczeñko G. (2022). Changes in phytoplankton community structure over a century in relation to environmental factors. J. Plank. Rese. 44(6). 854–871 p. https://doi.org/10.1093/plankt/fbac055

Malgorzata, P.; Emil, Z. and Ewa, S. (2018). Envelope development and variation in Terchelomonas hispida (Euglenophyta), 4(33): 305- 318 Doi: https://doi.org/-10.4490/algae.2018.33.11.9.

Orlando, N. (2016). River Algae. Edi. 1,Publi. Sprin.279 Doi: https://doi.org/-10.1007/978-3-319-31984-1.

Pacheco, D.; Rocha, A.C.; Pereira, L. and Verdelhos, T.(2020). Microalgae Water Bioremediation: Trends and Hot Topics. Appl Sci;10:1886. https://doi. org/10.3390/app10051886.

Rahman, K.M.(2020) Food and High Value Products from Microalgae: Market Opportunities and Challenges. In: Alam MA, Xu J-L, Wang Z, editors. Microalgae Biotechnol. Food, Heal. High Value Prod., Singapore: Springer Singapore; 2020, p. 3-27. https://doi. org/10.1007/978-981-15-0169-2_1.

Rodrigues, V.; Estrany, J.; Ranzini, M.; de Cicco, V.; Martín, J.; M. and Hedo, J.(2018). Effects of Land Use and Seasonality on Stream Water Quality in a Small Tropical Catchment. Sci. Total Environ. 622-623, 1553–1561. doi:10.1016/j.scitotenv.2017.10.028

Silva, E.; Counillon, F.; Brajard, J.; Korosov, A.; Pettersson, L.H.; Samuelsen, A. and Keenlyside, N.(2021).Twenty-one years of phytoplankton bloom phenology in the Barents, Norwegian, and north seas. Front. Mar. Sci., 8, 1–16p. https:// doi.org/ 10.3389/ fmars. 2021.746327.

Solenn, M.; Jenna M.; Joerg B.; Stephen J.B. and O'Leary Caroline C. (2024). Identification of phytoplankton isolates from the eastern Canadian waters using long-read sequencing. J. Plan. Rese. 527–541 p., https://doi.org/10.1093/plankt/fbae043.

Vollenweider, R.A. (1974). A manual on methods for measuring primary production in aquatic environments. 2nd Edition, IBP Handbook, No. 12. URL.

دراسة تصنيفية للهائمات النباتية في حوض ميناء الفاو الكبير ومصب شط العرب

عقيل عبدالصاحب عبدالحسين الوائليiD

قسم الاحياء البحرية، مركز علوم البحار، جامعة البصرة ،العراق

*Corresponding Author E mail : aqeel.abdulhussein@uobasrah.edu.iq

تاريخ الاستلام: 2025/01/01 تاريخ القبول: 2025/03/02 تاريخ النشر : 2025/06/25

المستخلص

هدفت الدراسة إلى معرفة التقدير النوعي لمجتمع العوالق النباتية في حوض ميناء الفاو الكبير ومقارنته مع العوالق النباتية الموجودة في مصب شط العرب باعتبارها منطقة جغرافية حديثة التكوين. تعد هذه الدراسة هي الأولى من نوعها في هذا الموقع، تم تحديد ثلاثة مواقع لجمع العينات موقعين ضمن حوض ميناء الفاو الكبير وهما كاسر الامواج الغربي والذي يمثل الموقع الاول وكاسر الامواج الشرقي والذي يمثل الموقع الثاني ومصب شط العرب والذي يمثل الموقع الثالث وقد تم جمع العينات فصليا من عام 2022. بالاضافة الى ذلك تم قياس بعض العوامل البيئية والتي قد تؤثر على انتشار وتوزيع الهائمات النباتية، وقد تراوحت درجة حرارة المياه بين 14.7- 32 °م، وتركيز الملوحة بين 39.6-41.6 PSU والاس الهيدروجيني 7.83- 8.5 والاوكسجين الذائب 5.5-8.4 ملغم/لتر والعكارة 4.36- 64.9 NTU والفوسفات الفعالة 0.4- 0.9 ملغم/لتر والنترات الفعالة 0.6- 1.97 ملغم/لتر والكلوروفيل -أ- 6.2- 21.73 ملغم/متر مكعب والاملاح الذائبة الكلية 46.1- 53.77 ppm شخصت الدراسة النوعية للهائمات النباتية 64 وحدة تصنيفية (جنس ونوع) تعود الى خمسة اقسام للمواقع الثلاثة، هي الطحالب الدايتومية Bacillariophyta وكانت لها السيادة على بقية الأنواع اذ شخص منها 40 وحدة تصنيفية وشكلت نسبة 62.5%، تلتها الداينوفايتا Dinophyta اذ شخص منها 21 وحدة تصنيفية وشكلت نسبة 32.8%، تلتها Chlorohyta وOnchphyta وHaptophyta اذ شخص نوع واحد لكل منهم وشكلت 1.5%.

الكلمات المفتاحية : التصنيف، الهائمات النباتية، ميناء الفاو الكبير.