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**ГИДРОХИМИЧЕСКАЯ И МИКРОБИОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА ОЗ. БАБЬЕ, РАСПОЛОЖЕННОГО В Г. КИЕВЕ**

Исследована сезонная динамика количественного развития бактериопланктона (общей численности, содержания сапрофитных (на РПА), протеолитических и амилитических бактерий с посевом на молочный и крахмальный агары) в связи с физико-химическими условиями в оз. Бабье, расположенного в г. Киеве. Выявлено, что на сезонные изменения некоторых гидрохимических и микробиологических показателей существенно влияли стремительные изменения метеоусловий, что свидетельствует о потенциальной уязвимости водоема относительно к влиянию природных и антропогенных факторов.

*Ключевые слова: озеро Бабье, физико-химические условия, сезонная динамика бактериопланктона*

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**HYDROCHEMICAL AND MICROBIOLOGICAL CHARACTERISTIC OF THE BABYNE LAKE LOCATED IN KYIV CITY**

Seasonal dynamics of the quantitative development of bacterioplankton (total number, saprophytic, proteolytic and amylolytic bacteria number) has been investigated. The physical and chemical conditions in the lake Babyne (Kyiv) have also been noted. We have revealed that the rapid changes in weather conditions cause seasonal changes in some hydrochemical and microbiological parameters, which shows the potential vulnerability of the lake to the impact of natural and anthropogenic factors.

**Keywords:** Babyne Lake, physical and chemical conditions, the seasonal dynamics of bacterioplankton

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**DIVERSITY OF THE PHYTOPLANKTON IN THE COASTAL WATERS OF OMAN (ARABIAN SEA)**

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The Center of the Marine Science and Fisheries since December 2013 are started the complex monitoring investigations of the marine ecosystem in the Omani coastal waters. For the research period (9 months) the 231 phytoplankton names (186 – to the species level and 44 to genus level) were identified, which belonged to 11 Classes and to one composite group - Small flagellates. Additionally, 10 species have been identified from net samples. The five classes of microalgae – Ebriophyceae, Euglenophyceae, Prasinophyceae, Prymnesiophyceae, Rhaphidophyceae, for the Omani coastal waters were identified in first time. Totally the check-list of phytoplankton, mentioned for the region earlier and identified within our monitoring, includes 409 scientific names, only 255 names that were identified in the region earlier (before our research period). The list of toxic species includes 25 names, 16 toxic species were identified early and 9 – in the first time.

**Keywords:** monitoring, coastal zone of Oman, microalgae, species richness

The Sultanate of Oman works toward sustainable adaptive management of marine resources and conservation of biological diversity of the Gulf of Oman (Arabian Sea). However in recent decades,

frequent “red tides” have become a serious environmental problem, causing hazards to human health, impairment of water quality, and hence losses to economy and tourism.

Reports on the species composition of phytoplankton on the basis of studies carried out in coastal Oman are very few and covers a short period of time (from 1986) [3]. More detailed studies of phytoplankton were made in Bandar Khayran, Gulf of Oman in 2002 [2] and 2008 [1] years.

Most of the ‘red tides’ are caused by harmful microalgae including toxic species. It is therefore particularly important to continuously monitor the status of the phytoplankton communities. Therefore, the complex monitoring investigations of the marine ecosystem are started since December 2013 in the Omani coastal waters by The Center of the Marine Science and Fisheries.

In the works of Al-Khashmi and Al-Abri are lists the toxic and HAB species, however, the classification was performed by [4], so it was necessary to revise this list on the basis of current data (according to IOC-UNESCO Taxonomic Reference List of Harmful Microalgae: <http://www.marinespecies.org/hab/>).

### Material and methods

Water samples (500 ml) near Muscat and on the stations Ashkarah, Sohar, Doqum, Khasab were collected since December 2013 till August 2014 once a month at 1, 15 and 30 m depths.

Samples taking near Muscat from December to April were concentrated using inverse filtering through the membrane-type filter of pore size 2 µm and fixed by Lugol's solution, the cells were counted in the counting chambers: large cells in chambers 0.74 ml volume and small cells in chambers 0.2 ml volume. Since April, were concentrated using Utermöhl sedimentation chambers (10 ml). Other samples were fixed by the formaldehyde solution 4 % and were concentrated using Utermöhl sedimentation chambers (2 – 5 ml). For the investigated period 33 samples taken near Muscat and 27 samples (60 in total) from other regions were processed.

### Results and discussion

The check-list of phytoplankton, mentioned for the region earlier and identified within monitoring, includes 409 scientific names, 332 identified to species level and 77 to genus and higher levels. Only 267 names (198 species level and 52 genus level) that were identified in the region earlier (before our research period). Therefore the list of species is not complete and investigations of the phytoplankton taxonomic composition must be continuous.

For the research period (9 months) on 5 stations of Omani coastal waters the 231 phytoplankton names were identified, which belonged to 11 Classes and to one composite group – Small flagellates (table 1.). The Bacillariophyceae and Dinophyceae classes had the highest species richness, their share in total had 205 names. Other classes were represented by a small number of the names because of their poor knowledge and the complexity of their species identification.

Table 1

The taxonomic composition of the phytoplankton samples by the main Classes in the Omani waters (from December 2013 to August 2014)

N	Classes	species	genus and higher	Total
1	Bacillariophyceae	103	19	122
2	Chlorophyceae	0	1	1
3	Cryptophyceae	1	2	3
4	Cyanophyceae	1	4	5
5	Dictyochophyceae	3	0	3
6	Dinophyceae	69	14	83
7	Ebriophyceae	2	1	3
8	Euglenophyceae	0	1	1
9	Prasinophyceae	2	1	3
10	Prymnesiophyceae	4	1	5
11	Rhaphidophyceae	1	0	1
	Undefined Small Flagellates	0	0	1
	Total	186	44	231

The five classes of microalgae – Eubryophyceae, Euglenophyceae, Prasinophyceae, Prymnesiophyceae, Rhaphidophyceae, for the Omani coastal waters were identified in first time. From all name of microalgae, 186 have been identified to the species level and 44 to genus level.

Additionally, 10 species have been identified in net samples. From all 196 species (186 + 10), 129 species were identified for the first time in Omani waters and 66 were identified in the region earlier period. However, 62 of them require additional studies for clear species identification.

Along with the water warming the species richness in samples increased from 16-24 at the beginning of the year (December–January) and reached maximum during bloom on March 6 (up to 50 taxa in the sample, see figure). After this, gradually was decreasing to minimum at June, and then a new increasing of the species richness was beginning due to increasing number species of the dinoflagellates, which reached level of diatoms.

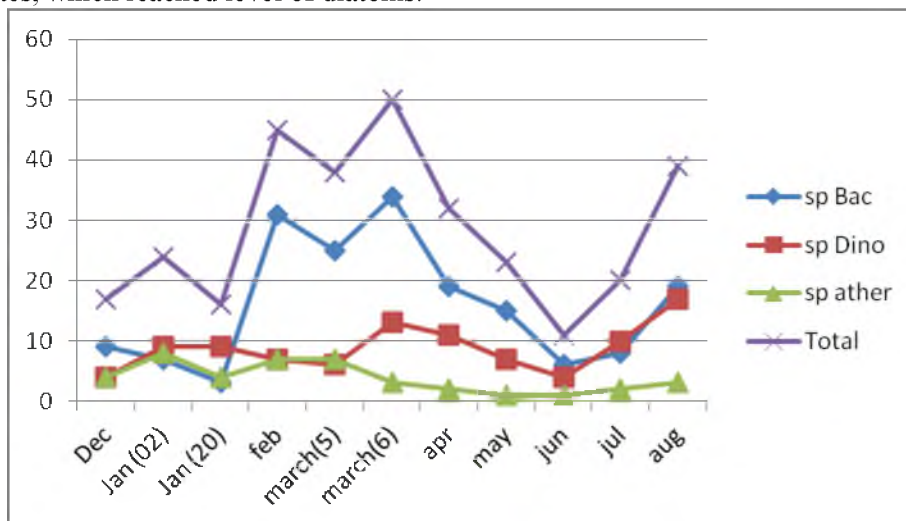


Figure. The seasonal dynamics of the number species of the Bacillariophyceae (Bac), Dinophyceae (Dino) and other (all rest taxa) microalgae in the surface layer, near Muscat

The list of toxic species includes 25 taxons (Table 2) (<http://www.marinespecies.org/hab>), 16 toxic species were identified early and 9 - in the first time. During the research period the highest species richness was identified in diatoms and dinoflagellates while the remaining groups were represented slightly.

Table 2

Check-list of the toxic species identified in Omani waters

N	Class	Species	Mus-cat	Ashkarah	Docum	Khasab	Sohar	yes/not record before
1	Bacillariophyceae	<i>Pseudo-nitzschia delicatissima</i>	+	+	+	+	-	-
2	Bacillariophyceae	<i>Pseudo-nitzschia pungens</i>	+	-	+	+	+	+
3	Bacillariophyceae	<i>Pseudo-nitzschia seriata</i>	+	+	+	+	+	-
4	Dinophyceae	<i>Alexandrium cohorticula</i>	-	-	-	-	-	+
5	Dinophyceae	<i>Alexandrium pseudogonyaulax</i>	-	-	-	-	-	+
6	Dinophyceae	<i>Amphidinium klebsii</i>	-	-	-	-	-	+
7	Dinophyceae	<i>Cochlodinium polykrikoides</i>	-	-	-	-	-	+
8	Dinophyceae	<i>Dinophysis acuminata</i>	-	-	-	+	-	+
9	Dinophyceae	<i>Dinophysis caudata</i>	-	-	-	+	-	+
10	Dinophyceae	<i>Dinophysis miles</i>	*	-	-	-	-	+
11	Dinophyceae	<i>Dinophysis ovum</i>	-	-	-	-	-	+

Table continuation								
12	Dinophyceae	<i>Gonyaulax spinifera</i>	+	-	-	+	-	+
13	Dinophyceae	<i>Gymnodinium catenatum</i>	-	-	-	-	-	+
14	Dinophyceae	<i>Lingulodinium polyedrum</i>	*	-	-	-	-	+
15	Dinophyceae	<i>Phalacroma mitra</i>	-	-	-	-	-	+
16	Dinophyceae	<i>Prorocentrum concavum</i>	-	-	-	-	-	+
17	Dinophyceae	<i>Prorocentrum cordatum</i>	+	+	+	+	-	+
18	Dinophyceae	<i>Protoceratium reticulatum</i>	-	-	-	+	+	+
19	Dinophyceae	<i>Karenia mikimotoi</i>	+	-	+	+	+	-
20	Dinophyceae	<i>Pyrodinium bahamense</i>	-	-	-	+	-	-
21	Dinophyceae	<i>Karenia cf. brevis</i>	-	-	-	+	+	-
22	Dinophyceae	<i>Karenia cf. seliformis</i>	-	-	-	+	-	-
23	Dinophyceae	<i>Karenia papilionacea</i>	-	-	-	+	+	-
24	Prymnesiophyceae	<i>Phaeocystis pouchetii</i>	-	+	-	-	-	-
25	Raphidophyceae	<i>Heterosigma akashiwo</i>	+	+	+	+	+	-

\* - in added samples

Diatom species richness dominated during all months except January and July, when the highest species richness was identified for dinoflagellates. The species richness of Diatom was maxima at 6 March, when the bloom event has been detected. The species richness of Dinoflagellates was maxima in August.

### Conclusion

For the first time the analysis of the taxonomic composition of phytoplankton in coastal waters of Oman was made. The check-list of phytoplankton for the particular region mentioned earlier and identified within monitoring, includes 409 scientific names. Only 255 names were identified before our research. During monthly monitoring for the 9 month research period, on 5 stations of Omani coastal waters, the 231 phytoplankton names were identified. They belonged to 11 Classes and to one composite group - Small flagellates.

From the determined variety of microalgae, 186 have been identified to the species level and 44 to genus level. Additionally, 10 species have been identified in the net samples. From all 196 species (186 + 10), 129 species were identified for the first time in Omani waters and 66 were identified in the region earlier period. The list of toxic species includes 25 taxons, 16 toxic species were identified early and 9 – in the first time.

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### РАЗНООБРАЗИЕ ФИТОПЛАНКТОНА В ПРИБРЕЖНЫХ ВОДАХ ОМАНА (АРАВИЙСКОЕ МОРЕ)

В центре рыбохозяйственных исследований с декабря 2013 года начался постоянный мониторинг за состоянием сообществ фитопланктонан в прибрежных водах Омана. За период исследований (9 месяцев) на 5 станциях были определены 231 наименование микроводорослей, принадлежавших к 11 классам и одной сборной группе – мелких жгутиковых. Пять классов микроводорослей – Ebtiorphyceae, Euglenophyceae, Prasinophyceae, Prymnesiophyceae, Rhaphidophyceae, были указаны впервые для побережья Омана. Из всего количества микроводорослей, 186 были определены до уровня вида и 44 до уровня рода и выше. Кроме того, 10 видов были определены в сетных пробах. Чек-лист видов фитопланктона, упоминавшиеся раньше и определенные нами в период мониторинга, включает 409 наименований (255 наименований были определены до наших исследований). В прибрежье Омана было определено 25 токсичных видов, 16 – указывали ранее, и 9 – впервые.

*Ключевые слова:* мониторинг, побережье Омана, микроводоросли, видовое богатство

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### РІЗНОМАНІТТЯ ФІТОПЛАНКТОНУ У ПРИБЕРЕЖНИХ ВОДАХ ОМАНУ (АРАВІЙСЬКЕ МОРЕ)

У центрі рибогосподарських досліджень з грудня 2013 року почався постійний моніторинг за станом угруповань фітопланктону у прибережних водах Оману. За період досліджень (9 місяців) на 5 станціях було виявлено 231 найменування микроводоростей, які належать до 11 класів та однієї збірної групи - дрібних джгутикових. П'ять класів микроводоростей – Ebtiorphyceae, Euglenophyceae, Prasinophyceae, Prymnesiophyceae, Rhaphidophyceae, були визначені вперше для узбережжя Оману. Из усієї кількості микроводоростей, 186 були визначені до рівня виду та 44 – до рівня роду й вище. Крім того, 10 видів були визначені в мережних зразках. Список видів фітопланктону, згаданих раніше і визначених нами в період моніторингу, включає 409 назв (255 – були визначені раніше наших досліджень). Из 25 токсичних видів, які були визначені нами біля узбережжя Оману, 16 були відомі раніше, а 9 – були виявлені у цьому районі вперше.

*Ключові слова:* моніторинг, узбережжя Омана, микроводорості, видове багатство