Study the presence of toxic species of phytoplankton during the blooms period in the coastal water of Banias city(Eastern Mediterranean)

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Abstract

This research seeks to study the temporal and spatial changes of toxic phytoplankton in five stations with different environmental characteristics exposed to a variety of pollution sources in the coastal waters of Banias city, located on the eastern coast of the Mediterranean. The effect of the most important hydro chemical properties and various human activities on the abundance of toxic phytoplankton has been studied. There were differences in temperature and salinity, as the highest temperature and salinity were recorded in the area opposite the thermal station, and the lowest in the area which is rich in fresh springs. The highest abundance of phytoplankton was found atthe site affected by oil effluents discharged (780.10^3 cell/L).

The most abundant species were Diatoms:(Pseudo-nitzschia delicatissima, P.spp) were the dominant species were observed during the spring blooms of phytoplankton recorded at the early May. These species are poisonous, and their first appearance is in the coastal of Banias city.

Keywords : *Phytoplankton, Syrian coast, Mediterranean Sea, harmful blooms, toxic Phytoplankton.*

I. INTRODUCTION

The quantitative and qualitative composition of phytoplankton is influenced by physical and chemical factors of sea water, in addition to the influence of climate, water quality, runoff, and abundance of nutrients [1, 2] Where phytoplankton shows rapid responses to thesechanges, including the production of toxins that cause a range of symptoms such as food poisoning, diarrhea and memory loss [3]. Phytoplankton is the primary basis in the study of the marine food web, as it is considered the base of the food pyramid, which the life of all other marine organisms depends [4][5]. Although there are some studies that concerned with the study of phytoplankton and that were conducted in the Syrian coastal waters, the Syrian waters are considered poor for periodic studies interested in studying the biological diversity of phytoplankton. There were some studies that started in the Syrian coasts, which focused on studying the effect of some environmental factors on the distribution of phytoplankton, in Latakia city, in Banias city (Darwich, 1999), in Tartos city. All of these studies did not address the study of the toxic species of phytoplankton, so we focus for the first time on the study of toxic species of phytoplankton in the Syrian coastal waters during the spring blooms in the city of Banias.

II. MATERIALS AND METHODS

A. Description of sampling stations

Five stations were selected from coastal waters of Banias city as shown in Fig.1. These stations are subjected to different ecological conditions due to the human activities, sewage, oil effluents and thermal effects: St.1 is located about 100 meters of the coast and is subjected to oil effluents discharged from the oil charging and discharging company. St.2. is located at about 100 meters of the coast and is subjected to sewage effluents discharged. St.3.is located at about 100 meters of the Electrical power station and is subjected to thermal water discharge. St.4. is located at about 1 km of the coast and is relatively far from the human activities. St.5. is located at about 1 km of the coast and is rich in fresh springs.

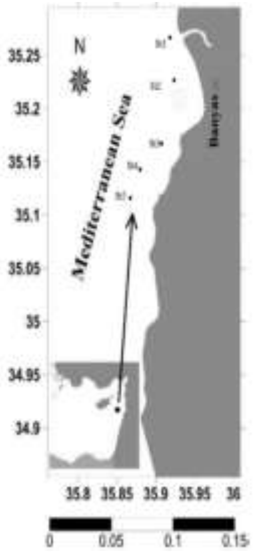

Fig 1: Locations of the studied stations in Banias coastal waters

B. Sampling methods & laboratory analyses

Three cruises were carried out during May 2019, water samples were collected using sampling net (length 176 cm, diameter of the holes 20mµ) from the sub-surface waters of different 5 stations during phytoplankton blooms of 2019 (2/5/2019), (14/5/2019), (30/5/2019) and preserved by adding the formula 4%. Phytoplankton was identified using light microscopy (LISS MICROSCOPE FACTORY), and species were determined based on international taxonomic references[6][7][8]. Water temperature and salinity were measured immediately in situ using a pH / Cond340i.

III. RESULT & DISCUSSION

A. Environmental parameters

During the period of study, the water temperature was ranging from 18.5 ºC during (2/5, St.5) and 25.3 ºC during (30/5, St.3). The salinity ranged from 35.5 □ during (2/5, St.5) and 37.3□ during (30/5, St.3) Fig.2

The highest values of temperature and salinity were recorded at the station affected of thermal waters discharged from the cooling systems of the Electrical power station, whereas the lowest values were recorded at the station which is rich in fresh springs (Golak, 2015) during the whole period.

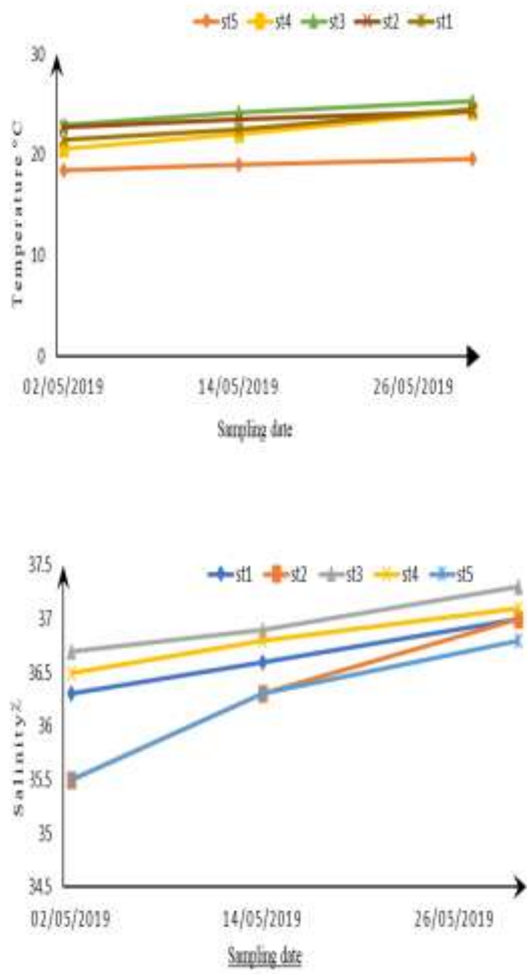

Fig.2. variations of the sea surface temperature and sea surface salinity in the coastal waters of Banias city during May2019

B. The abundance of the phytoplankton populations

The relatively high abundance was recorded at St.1 followed by St.2 in the middle of May, with the total counts of (780.10^3 and 242.10^3 cell/L, respectively) Fig.3. However, St.1 and St.2 sustained relatively high counts of phytoplankton during the whole period, this may be due to their subject to fractions of petroleum hydrocarbons and sewage discharge, which could promote the phytoplankton growth [5]Whereas St.4 sustained the lowest average total counts (30.10^3 cells/L), this may be due to their distance from pollution resources . The abundance of species in this study was higher than previous researches at the studied stations (23611 cells/L) (Darwich, 1999), which refers the increase effects of pollution at the studied.

These results indicate the occurrence of the spring blooms of phytoplankton known in the Mediterranean in such a period[5], (Hammoud, 1999,2002) (Darwich, 1999).

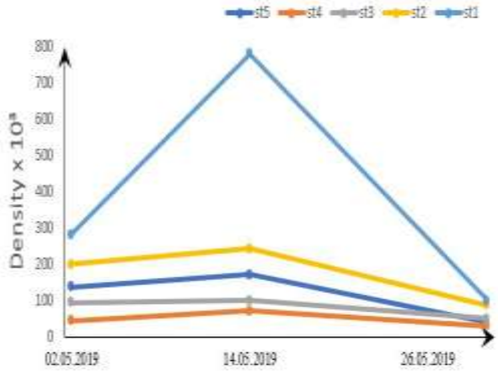

Fig.3. variations of the total phytoplankton density in the coastal waters of Banias city during May2019

C. The phytoplankton community structure

57 species were recorded in this study, belonging to Diatoms (35 species), and Dinoflagellates (22 species) Table.1

The diatoms were the most dominated group, forming about 85 % of the total counts of phytoplankton, followed by dinoflagellates that represented about 15 % of the total abundance.

the phytoplankton spring bloom at all stations (14.5) were formed by two main species of diatoms (*Pseudo-nitzschia delicatissima, Pseudo-nitzschia.spp*) the occurrence of *Chaetocheros curvisetus, Leptocylindrus minimus, Leptocylindrus danicus, Rhizosolina alata* were recorder at the end of spring bloom in 30.5 and show highest abundance at St.1 due to its exposure to oil pollution. all These species are uncommon during the spring blooms of phytoplankton which was not recorded in the previous study of this region.

The dinoflagellates: *Dinophysis caudata, Ceratium furca, Ceratium fusus, Alexandrium tamarense* appeared at the end of May 30.5, as their appearance coincided a rise with temperature water, this is agreed with the different studies at the studied area and different coastal water at the eastern part of Mediterranean.[9][10][5].

D. The occurrence of toxic microalgae

potentially harmful species were detected in this study in May (16 species), during early spring bloom at all sites, but their frequency and their density were the highest at St.1 and St.2 (14.5) (the most pollution sites), i.e. *Pseudo-nitzschia delicatissima, Leptocylindrus danicus, Chaetocheros curvisetus.*

All register toxic bloom of all recorded species in our study are known of their production of different toxins and transmitted by either molluscs or fish.Paralytic Shellfish Poisoning(PSP) is due to the consumption of bivalves or planktivorous fish while Diarrhetic Shellfish Poisoning(DSP), Amnesic Shellfish Poisoning(ASP), Neurotoxic Shellfish Poisoning(NSP), and Azaspiracid Shellfish Poisoning(AZP) Poisons (PSP,) which may cause death of many marine organisms including human[11][12][13]

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Table 1: List of phytoplankton species during May 2019 (Va = very abundant.16-100%: A =abundant .41-60%: Common.16-40%: R=rare.1-15%

Stations / Species					
Diatoms	St1	St2	St3	St4	St5
Achnanthes longipes	*	*	-	-	*
Biddulphia aurita	*	*	-	-	-
Cocconeis granii	*	*	-	-	-
Coscinodiscus radiatus	r	*	-	-	*
Chaetoceros affinis	c	c	c	c	c
Chaetoceros brevis	c	c	c	*	c
Chaetoceros comressum	*	*	*	*	*
Chaetoceros curvisetus	c	c	c	*	c
Chaetoceros decipiens	c	c	c	r	c
Chaetoceros danicus	r	r	-	r	-
Chaetoceros didymus	*	*	*	*	*
Chaetoceros Socialis	*	*	*	*	*
Fragilaria sp	r	-	-	-	-
Guinardia flaccid	c	c	c	*	*
Guinardia striata	c	c	*	*	*
Hemiaulus hauckii	-	-	-	-	-
Lauderia annulate	c	c	c	c	c
Leptocylindrus minimus	c	c	c	*	c
Leptocylindrus danicus	c	c	c	c	c
Licmophora abbreviata	c	c	c	r	c
Licmophora paradoxa	*	*	*	-	*
Navicula cryptocephala	c	*	-	r	*
Nitzschia draveillensis	c	c	c	*	c
Nitzschia acicularis	c	c	c	*	c
Pleurosigma normanii	*	*	-	-	-
Pseudo-Nitzschia delicatissima	va	va	va	a	va
Pseudo-Nitzschia spp	a	a	a	c	a
Rhizosolina alata	c	c	c	*	c
Rhizosolina calcar-avis	c	c	c	*	c
Rhizosolina hebetate	-	-	-	-	-
Rhizosolina setigera	*	*	-	-	-
Rhizosolina delicatula	c	c	c	r	c
Rhizosolina imbricata	r	r	r	*	r
Skeletonema costatum	*	*	*	-	-
Thalassiothrix frauenfeldii	r	-	-	-	-
Dinoflagellates					
Alexandrium tamarense	c	c	c	c	c
Alexandrium minutum	*	-	-	-	-
Ceratium candelabrum	r	r	-	-	-
Ceratium furca	c	c	c	r	c
Ceratium fusus	c	c	c	r	c
Ceratium lineatum	-	-	-	-	-
Ceratium macroceros	*	*	*	*	*
Ceratium tripos	-	-	-	-	-
Ceratium trichoceros	*	-	-	-	-
Ceratium longipes	*	-	-	-	-
Dinophysis acuta	*	-	-	-	-
Dinophysis caudata	c	c	c	*	c
Dinophysis rotundata	*	-	-	-	-
Gonyaulax polygramma	c	c	c	*	c
Protoperidinum claudicans	*	-	-	-	-
Protoperidinum conicum	*	-	-	-	-
Protoperidinum divergens	*	-	-	-	-
Protoperidinum depressum	c	c	c	c	c
Protoperidinum pellucidum	*	-	-	-	-
Prorocentrum lima	*	*	c	-	-
Prorocentrum micans	*	*	*	*	*
Prorocentrum minimus	*	*	*	*	*

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