Study of Algal Flora of the 15th Khordad Dam

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Abstract

Algae have been described as more than 1800 genera and 2100 species which are different in terms of the biology, size, structure, and physiology. In this study, the phytoplankton populations of 15 khordad dam reservoir in Qom Province were determined. Four sampling sites were selected for this study. Sampling was carried out from January 2014 to June 2015 to assess algal flora and frequency of phytoplanktons. The results showed that Phytoplankton assemblage comprised several taxa from Diatomaceae (41.1%), Dinoflagellaceae (32.5%), Chlorophyceae (23.2%) and Cyanophyceae (3.2%). Among identified taxa, *Cyclotella* from Diatomaceae, *Peridinium* from Dinoflagellaceae, *Chlorella* from Chlorophyceae and *Oscillatoria* from Cyanophyceae being the predominant genera in each phylum. The maximum and minimum frequencies were recorded at one meter depth in west side edge during June and at five meter depth in the east side edge of the reservoire during December, respectively.

Keywords: Frequency, Algal flora, Phytoplankton, 15thKhordad dam

Introduction

Pyhtoplanktons are unicellualr or multicellular organisms that grow and propogate using sunlight, minerals and organic matter suspended in water which in turn are foodstock for other organisms. Algae are aquatic and photoautotrophic protists able to turn non organic to organic matter through photosynthesis. Algae have a special position in the biosphere and because of their presence in various habitats from air to underground waters have occupied an expansive area in comparison with other plants. Algae are prominent in bodies of several water reservoirs which occupy more than 70% of the Earth's surface (Gholami and Jamaloo et al., 2007; Mohammadi and Heidari, 1992; Mohammadi, 1999). Some species of algae cause problems with taste or smell in drinking water (Hedieh Loo, 2011). In fact, 80% of the disease worldwide are attributed to unhealthy water (Afsharzadeh et al., 2003). So far, many studies have been carried out to identify phytoplanktons and investigate their variability, propagation, and population in Iran and arround the world. 15th Khordad dam is located in 34°7' 47"-72" and 50°61'30"-50" N in the west of Sang Siahkooh village, Delijan, Markazi Province of Iran, 80km for from Qom to Isfahan Road on Labshoor Qomrood river. The lake behind this dam which started to reserve water in 1997 contains 220 milion m^3. Average annual percipitation is 160mm suggesting a dry region

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in the country. 15th Khordad dam is the first storage dam in Iran built on a saline river to procure urban drinking water. The aim of the present study was investigating algal flora of 15th Khordad dam and identifying and determining disperssion of various algal taxa in different regions of the dam and at different times of the year.

Materials an Methods

Sampling

In order to determine the concentration of algal flora, samples were collected from different depths and at different distances and location in the dam resrvoire. Water contents of the sampling bottles were kept in sampling containers which were transported in ice during the hot days for analysis within almost 24 hours. Equal volume of formalin solution 8% was used to stabilize the 1 litter samples. A total of 32 samples at two different depths were obtained from water near dam crest, coaslines, and lake center (Tashiee, 2013).

$$\text{No/ml} \ \frac{C \times 1000mm^3}{A \times D \times F}$$

Biological Assays

The type and concentration of algae were determined through biological assays. Samples were filtered through 0.8µm Whatman paper and then the paper filters were washed with 1 ml distilled water in a beaker. The washed content was then put on a simple slide or Sedjwick rafter slide and the algal flora were analyzed and counted using a microscope with monitor (Model: NLCD-120) with 10x or 40x magnification based on a counting protocole [13]. Sedjwick rafter slides which are usually used for counting planktons provide for $1000mm^3$ or 1mm in volume of the specimen. In samples with a great number of planktons (10 or more in each field) field counting was used instead of linear counting. Planktons were counted randomly in the fields 1 whiple grade. The number of fields counted depends on the density of the planktons. The number of planktons in 1ml volume of the sample was caculeted using the following equation:

Where C is the number of organisms counted, A is the area of the field (area of the whiple) in mm^2, D is the depth of each field (the depth of S-R slides) in mm^2, and F is the number of fields counted. The number of cells in each mm^2 was divided or multiplied by the correction factor and the results were obtained for the diluted or conentrated samples. The algae were determined in samples using the references books and monograph for algae (Yaghmaeeyan and Feiz Bakhsh, 2002; 2004; Madkour et al., 2010; Abed at al., 2014; Shah et al., 2008; Kolayli and Shahin, 2009, WHO). Statistical Package for Social Sciences (SPSS) was used for analysis of the repetitive data.

Results

Four taxa of algae, namely, Diatomceae, Cyanophyceae, Chlorophyceae, and Dinoflagellceae were determined in the samples obtained from reservoire near the west and east coastlines, behind the dam crest, and the lake center at one m and five meter depths during January, Feburary, March, April, May, and June. Table 1 shows list of algal groups and their mean number in samples from different regions of the 15th Khordad dam reservoir. Figure 1 shows the graph of the mean algae numbers counted in the samples obtained from different regions of the 15th Khordad dam. As the Figure

suggests, the most frequent algae belonged to Diatomceae, Dinoflagellceae, and Chlorophyceae taxa in that order while the least frequent algae belonged to Cyanophyceae taxa. The largest numbers of Diatomceae were counted near the west coast line water and lake center, respectively. The counts for dam crest water and east coast water were almost the same. Figure 2 represents the mean algae count in 15th Khordad dam in six different months. As the Figure shows, the number of algae increases as we get close the warm months of the year. In fact, the largest number of algae were observed during June, May, April, March, February, and January. The mean of algal counts observed at depths 1m and 5m of the reservoire shows in Figure 3, where the number of algae counted in depth 1m was more than those in depth 5m. Tukey HSD test shows that there is a significant difference between the number of algae in the edge of west side, the edge of east side, behind the dam era of Cyanophyceae, 6 genera of Chlorophyceae, 1 genus of Xanthophyceae, and 1 genus belonged to Dinoflagellceae. The highest frequency of occurance was 282390 per cm^2 in July. These findings confirm the results of the present study. According to our findings, the growth of algae depends on nutrients temperature and flow rate. Mohebbi et al. (2012) studied phytoplangton population and its character-

Table 1. List of algal groups and their mean number in samples from different regions of the 15th Khordad Dam reservoir

Algal group	West side edge		Behind dam crest		Center of the dam reservoir		East side edge	
	Depths 1m	Depths 5m	Depths 1m	Depths 5m	Depths 1m	Depths 5m	Depths 1m	Depths 5m
Chlorophyceae	1653	759	1624	734	1600	714	1577	704
Cyanophyceae	243	103	222	96	211	93	202	87
Diatomceae	3329	1217	3276	1144	3270	1138	3206	1122
Dinoflagellceae	2504	980	2477	963	2446	954	2412	940

Table 2. Tukey SHD test for location

Location (I)	Location (J)	Mean Difference (I-J)	Std. Error	Sig.	%95 Confidence Interval	
					Lower Bound	Upper Bound
Western Side	Behind the Dam Crest	54.490*	1.8464	.000	49.47	59.34
	Center of the Reservoire	3.723*	1.8464	.000	29/980	39.467
	Eastern Side	67.432*	1.8545	.000	62.668	72.196
Behind the Dam Crest	Western Side	-54.490*	1.8464	.000	-59.234	-49.747
	Center of the Reservoire	-19.767*	1.8625	.000	-24.552	-14.982
	Eastern Side	12.942*	1.8705	.000	8.136	17.747
Center of the Reservoire	Western Side	-34.23*	1.8464	.000	-39.467	-29.980
	Behind the Dam Crest	19.67*	1.8625	.000	14.982	24.552
	Eastern Side	32.709*	1.8705	.000	27.903	37.514
Eastern Side	WesternSide	-67.432*	1.8545	.000	-72.196	-62.668
	Behind the Dam Crest	-12.942*	1.8705	.000	-17.747	-8.136
	Center of the Reservoire	-32.709*	1.8705	.000	-37.514	-27.903

istics in Aras dam through sampling from three stations (dam crest, center, and sides) along the dam reservoire to determine and count pyhto-planktons and the relevant fluctuations in their population during different seasons. Similarly, abundance of the taxa during spring time and its difference in the western side station were more because of the wind direction.

As a conclusion it revealed Chlorophyceae, Xanthophyceae, Chrysophyceae, Diatomceae,

Table 3. Tukey HSD test analysis for the effect of various sampling months on species

Month (I)	Month (J)	Mean Difference (I-J)	Std. Error	Sig.	%95 Confidence Interval Lower Bound	%95 Confidence Interval Upper Bound
January	February	-37.927*	2.3754	.000	-44.696	-31.158
	March	-102.051*	2.3556	.000	-108.764	-95.338
	April	-217.835*	2.3280	.000	-224.469	-211.201
	May	-343.657*	2.2945	.000	-350.196	-337.119
	June	-481.442*	2.2651	.000	-487.897	-474.987
February	January	37.927*	2.3754	.000	31.158	44.696
	March	-64.124*	2.3462	.000	-70.810	-57.438
	April	-179.908*	2.3185	.000	-186.515	-173.301
	May	-305.730*	2.2848	.000	-312.242	-299.219
	June	-443.515*	2.2553	.000	-449.42	-437.088
March	January	102.051*	2.3556	.000	95.338	108.764
	February	64.124*	2.3462	.000	57.438	70.810
	April	-115.784*	2.2981	.000	-122.333	-109.235
	May	-24.606*	2.2642	.000	-248.059	-235.154
	June	-379/391*	2.2344	.000	-385.759	-373.24
April	January	217.835*	2.280	.000	211.201	224.469
	February	179.908*	2.3185	.000	173.301	186.15
	March	115.784*	2.2981	.000	109.235	122.333
	May	-125.822*	2.2355	.000	-132.193	-119.452
	June	-263.607*	2.2053	.000	-269.891	-257.322
May	January	343/657*	2.2945	.000	337.119	350.196
	February	305.730*	2.2848	.000	299.219	312.242
	March	241.606*	2.2642	.000	235.154	248.059
	April	125.822*	2.2355	.000	119.452	132.193
	June	-137.785*	2.1699	.000	-143.968	-131.601
June	January	481.442*	2.2651	.000	474.987	487.897
	February	443.515*	2.2553	.000	437.088	449.942
	March	379.391*	2.2344	.000	373.024	385.759
	April	263.607*	2.2053	.000	257.322	269.891
	May	137.785*	2.1699	.000	131.601	143.968

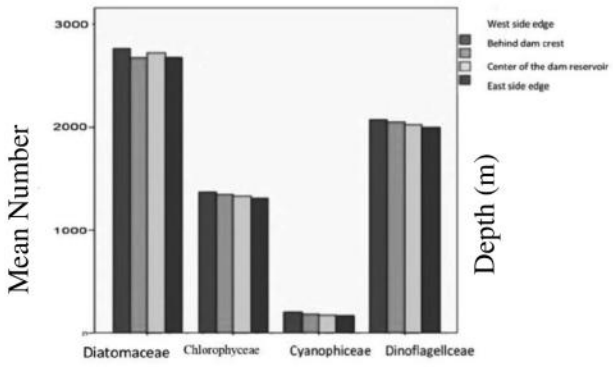

Fig. 1. Mean algae number in samples from different regions of the 15th Khordad dam reservoir

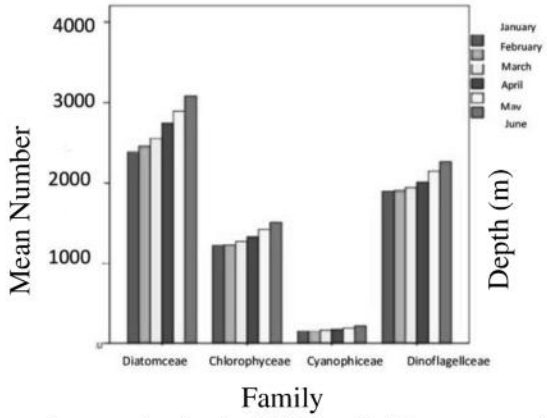

Fig. 2. Mean algae number in the 15th Khordad Dam reservoir in 6 different months

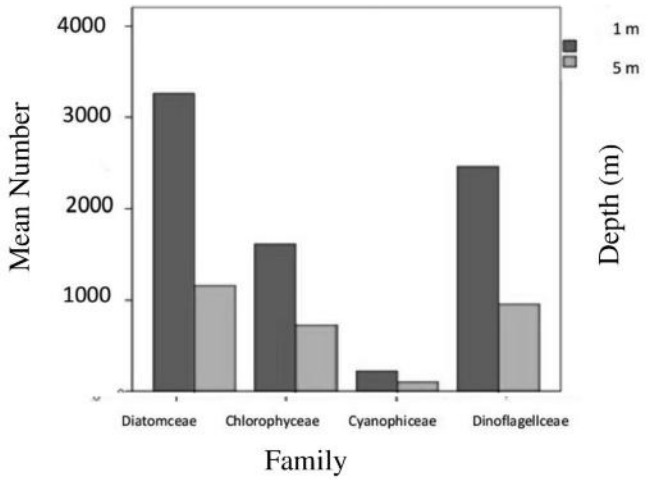

Fig. 3. Mean algae number in the 15th Khordad Dam reservoir at depths 1 and 5 m

Dinoflagellceae, Euglenophyceae, Rhodophyceae, and Cyanophyceae were probable to be present in the 15th Khordad dam reservoire. Analysis of data showed the presence of Chlorophyceae alga (23.2%): *Cosmarium* Corda ex Ralfs, *Tetraspora* Link ex Desvaux, *Oocystis* Nägeli ex A. Braun, *Chlorella* Kützing, *Brachimonas* Bohlin, *Pediastrum* Meyen, *Closterium* Nitzsch ex Ralfs, *Pandorina* Bory and *Ankistrodesmus* Corda, genera; Cyanophyceae (3.2%): *Chroococcus* Nägeli, *Oscillatoria* Vaucher ex Gomont and *Anabaena* Bory ex Bornet and Flahault, genera; Dinoflagellceae (32.5%) belonging to *Peridinium* Ehrenberg and *Ceratium* F. Schrank, genera and Diatomceae (41.1%): *Cymbella C. Agardh, Cyclotella* Kützing, *Synedra* Ehrenberg and *Diatoma* Bory. On the other hand, no instances of Rhodophyceae, Chrysophyceae, Xantophyceae and Euglenophyceae algae were observed in the study. Also the study revealed that the disperssion of algae in the 15th Khordad dam reservoire was not the same under different conditions and there was variability under the factors such as the depth, place, and seasons of sampling.

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