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Research Article

Seasonal Variations of Phytoplankton Blooms in Suat Uğurlu (Samsun - Turkey)

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Abstract: The seasonal variations in phytoplankton blooms in Suat Uğurlu Reservoir were studied between July 1992 and December 1993. In certain months, the species *Asterionella formosa* Hassal, *Cyclotella planctonica* Brunthaler, *Melosira granulata* (Ehr.) Ralfs *(Bacillariophyta); Pediastrum simplex* Meyen, *Pandorina morum* Borry *(Chlorophyta)* and *Ceratium hirundinella* (O F. Müller) Schrank *(Dinophyta)* produced blooms in the lake.

During the study period, the measured N/P ratio in the water varied from 10.3 mg/lt to 62.5. In accordance with these variations, *P. simplex, P. morum* and *C. hirundinella,* which consume high levels of phosphate, produced blooms in summer, whereas the blooms in winter were produced by *A. formosa, C. planctonica* and *M. granulata,* which consume more nitrate than phosphate.

Key Words: Phytoplankton, Seasonal Variation, Bloom, Dam Lake.

Suat Uğurlu Baraj Gölü'nde (Samsun - Türkiye) Fitoplankton Aşırı Üremelerinin Mevsimsel Değişimi

Özet: Suat Uğurlu Baraj Gölü fitoplankton aşırı üremelerin mevsimsel değişimi Temmuz 1992 - Aralık 1993 tarihleri arasında incelendi. *Asterionella formosa* Hassal, *Cyclotella planctonica* Brunthaler, *Melosira granulata* (Ehr.) Ralfs *(Bacillariophyta); Pediastrum simplex* Meyen, *Pandorina morum* Borry *(Chlorophyta); Ceratium hirundinella* (O.F. Müller) Schrank *(Dinophyta)* türleri belirli aylarda aşırı çoğalmalara neden oldu.

Araştırma süresince gölde N/P oranı 10.3-62.5 arasında değişti. Bu oranın değişimine paralel olarak Yaz aylarında fosfatı daha fazla kullanan *P. simplex, P. morum, C. hirundinella;* Kış aylarında ise nitratı daha fazla fosfatı daha az kullanan *A. formosa, C. planctonica* ve *M. granulata'* nın aşırı çoğaldığı tespit edildi.

Anahtar Sözcükler: Fitoplankton, Mevsimsel değişim, Aşırı çoğalma, Baraj Gölü.

Introduction

Some phytoplanktonic species of micro-algae produce water blooms in favourable conditions. These micro-algae reduce water quality by producing toxic substances. As a result, they cause the death of aquatic invertebrates and fish and a drop in the energy flow of aquatic ecosystems. Biotic substances produced by micro-algae species are also detrimental to human health, especially in reservoirs that are the source of drinking water (1).

Although there have been several Studies of phytoplankton in reservoirs in Turkey in recent years (2-4), there have been comparatively few studies of toxic algae. In this study, the seasonal variations of toxic micro-algae, which produce phytoplanktonic blooms in Suat Uğurlu Reservoir are described.

Materials and Methods

Suat Uğurlu Reservoir is located in the north-eastern part of Turkey on Yeşilırmak River (lon.: 36°

40' E, lat.: 41° 10' N). The total area of the reservoir surface is 9.7 km^2 and the avarage depth is 18 m (max.: 36 m.). The annual averages and 95 % confidence limits of temperature, dissolved oxygen, pH and hardness of the surface water are 21 (15.4) ± 4.07° (min.: 5, max.: 24), 4.2 (8.4) ± 0.70 mgl-1 (min.: 6.2, max.: 10.4), 1.3 (8.1) ± 0.13 (min.: 7.7, max.: 9.0) and 4.9 (19.4) ±3.91 mgl-1 CaCO3 (min.: 16.2, max.: 23.2), respectively (5).

Two sampling stations were selected for study the seasonal variations of phytoplankton blooms in the reservoir (Figure 1). Samples were collected monthly from these stations with a 2-litre- capacity Hydro-Bios water sampler between July 1992 and December 1993. For species identifications and counts, the cells were stained by adding 2 drops of lugol and transferred into counting chambers. The microalgal species were identified and counted with an inverted microscope (6). The remaining parts of the water sample was filtered through Whatman GF/A glass fibre filter paper and the residue on the filter paper was used to identify the micro - algae with the exception of *Bacillariophyta. Bacillariophyta* members were identified on permanent slides prepared according to the method of Round (7).

Analyses of N and P from the sample of surface water from Station II were performed by the Local Central Food Laboratory according to standard methods (8).

The taxonomic identification of the micro algae was carried out using the monographs of Cleve-Euler (9) and Huber - Pestalozzi (10-12). The micro algae were classified according to the system of Round (1).

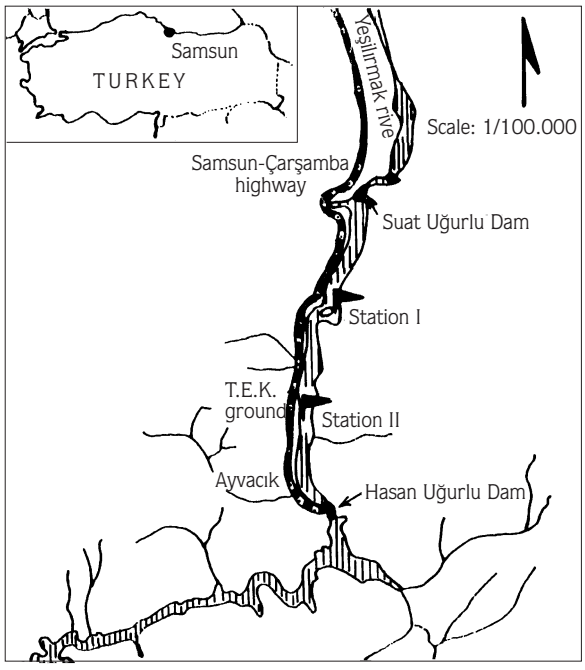

Figure 1. Map of Suat Uğurlu Reservoir (▶: Sampling station).

Results

During the years 1992 and 1993, six species of algae producing blooms were determined. The species were *Asterionella formosa* Hassal, *Cyclotella planctonica* Brunnthaler, *Melosira granulata* (Ehrenberg) Ralfs, *Pediastrum simplex* Meyen, *Pandorina morum* Borry and *Ceratium hirundinella* (O. F. Müller) Schrank.

The phytoplankton blooms of Suat Uğurlu Reservoir can be separated into four seasonal groups. The seasonal varitaions of the phytoplankton blooms are shown in Figures 2 and 3.

Summer:

July 1992 - August 1992: *A. formosa* was the dominant species at both stations in July. In this month, the number of *A. formosa* comprised 1225 cells m^{-1} at Station I and 3226 cells ml^{-1} of Station II. The quantity of *P. simplex* and *C. hirundinella* increased in August, while *A. formosa* decreased. In August, the number of *P. simplex* cells was 2546 ml^{-1} and the number of *C. hirundinella* cells was 851 ml^{-1} at Station I, while at Station II the numbers were 3423 ml^{-1} and 2414 cells ml^{-1}, respectively.

June 1993 - August 1993 : *A. formosa* was the dominant species at both stations in June. In July, *A. formosa* and, in August, *P. simplex* were found to be the dominant species.

Autumn:

September 1992 - November 1992: *P. simplex* remained the dominant species at both stations in September. In October, *P. simplex* was still dominant, while *C. hirundinella* was subdominant, but in November the subdominant species were *M. granulata* at Station I and *C. planctonica* at Station II.

September 1993 - November 1993: *P. simplex* was also the dominant species during the autumn months of 1993. In this period, *C. hirundinella* and *C. planctonica* were the subdominant species.

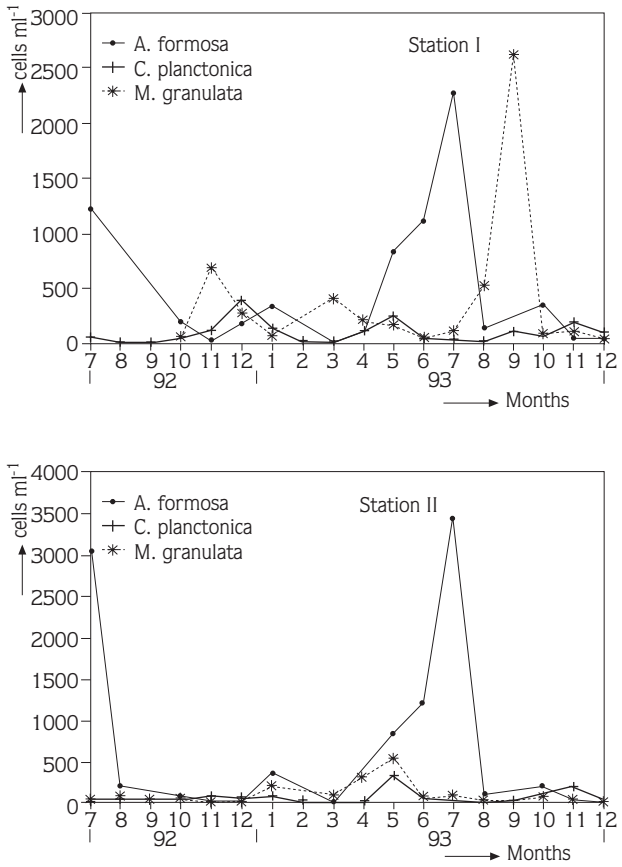

Figure 2. The seasonal variations of A. formosa, C. planctonica and M. granulata at the sampling stations.

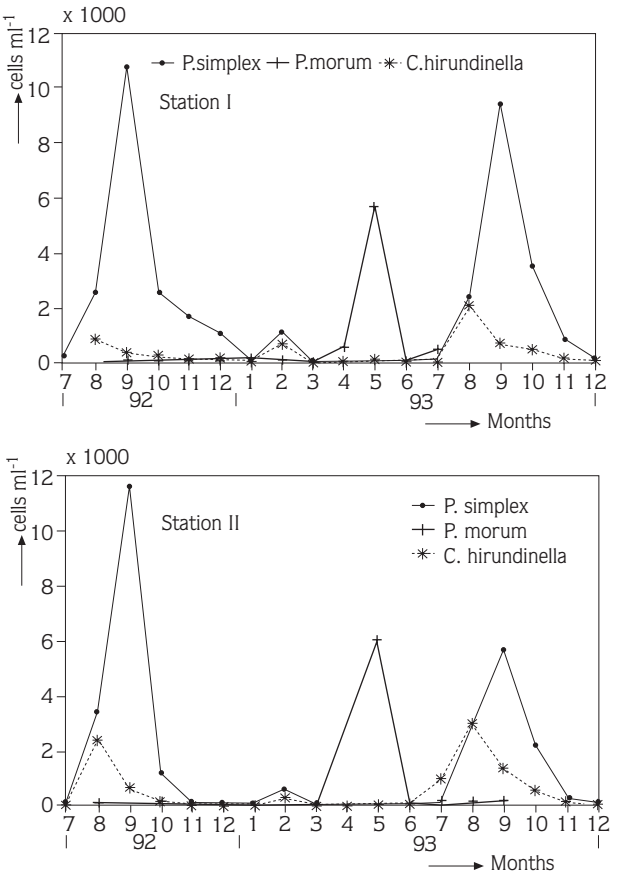

Figure 3. The seasonal variations of *P. simplex*, *P. morum* and *C. hirundinella* at the sampling stations.

Winter:

December 1992 - February 1993: *P. simplex* was found to be dominant and *C. planctonica* and *M. granulata* were the subdominant species in December. While the number of *P. simplex* cells was 1062 ml^{-1}, *C. planctonica* comprised 396 cells ml^{-1} and M. granulata 256 cells ml^{-1} at Station I; at Station II, the numbers were 128 cells ml^{-1}, 51 cells ml^{-1} and 25 cells ml^{-1}, respectively. In January, *A. formosa* was the dominant species at both stations. *C. planctonica and P. morum* at Station I and *M. granulata* at Station II were the subdominant species. *P. simplex* and *C. hirundinella* were the dominant species again in February.

December 1993: *P. simplex* and *C. planctonica* remained the dominant species.

Spring:

March 1993 - May 1993: *M. granulata* was dominant and *P. simplex* subdominant in March. The number of *P. morum* cells was 564 ml^{-1}, *M. granulata* 204 ml^{-1} and *C. planctonica* 104 cells ml^{-1} at Station I; at Station II, the numbers were 13 cells ml^{-1}, 326 cells ml^{-1} and 26 cells ml^{-1} in April, respectively. *P. morum* was dominant, *A. formosa* and *C. planctonica* subdominant in May.

The physical and chemical properties of lake water have been described in a previous paper (6). The seasonal variations in the N/P ratio of the lake water at Station II are shown in Figure 4. The N/P rate, which has a significant effect on blooming species in lake waters, began to increase in May, and reached a peak of 62.5 in July. The lowest N/P ratio 10.3, in October. This rate was the lowest in the October - May period.

Discussion

C. planctonica and *M. granulata* showed slight increases in March and April. Although these species are

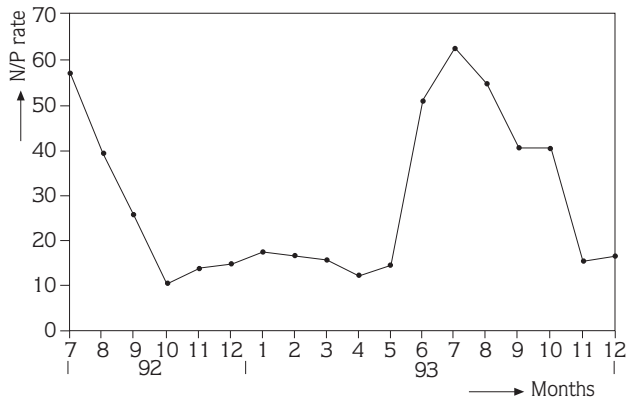

Figure 4. The seasonal variations of teh N/P ratio of the surface water at Station II.

known to be characteristic of oligotrophic lakes, they have also been found in eutrophic lakes (13). *A. formosa* was detected practically throughout the research period and was the dominant organism in January, June and July. It has been reported that *A. formosa* requires a high level of silica and is quite a tolerant species (4). *A. formosa* , which is dominant in certain months in Suat Uğurlu Reservoir, has been found to be the characteristic species of mesotrophic European lakes (1, 14).

P. simplex was dominant during the August - September period and subdominant in the other months. *Pediastrum* species are also characteristic of mesotrophic lakes (14). *P. morum* was the dominant species during the spring months. This species also produces blooms in the mesotrophic Kurtboğazı Reservoir (2) and the eutrophic Bafra Fish Lakes (15).

C. hirundinella was detected throughout the study period, reaching a peak in the late summer and autumn months. This species usually prefers eutrophic lakes, but it was reported that this species can also occur in mesotrophic lakes too (13, 14).

Round (1) reported that nitrate and/or phosphate limit the growth of algae and that the rate of N/P is important with regard to variation in diatom composition. The rate of N/P is approximately 16/1 for algae (16). Suat Uğurlu reservoir the rate of N/P varied from 10.3 to 62.5 The reason for this higher rate may be the location of the research area between the urban areas of Çarşamba and Ayvacık and the excessive use of fertilizer in the surrounding agricultural area.

In oligotrophic lakes, phosphate is exhausted first while nitrate remains in large quantities. In eutrophic lakes, which contain more phosphate than nitrate, the opposite is true. During the growth season of algae, nitrate may become completely exhausted while only some of the phosphate is used. The N/P ratio in the surface water column during this period is an indicator of nutrient levels (16). In Suat Uğurlu Reservoir, in accordance with the variations in the N/P ratio, *P. simplex, P. morum* and *C. hirundinella,* which consume high levels of phosphate, produced blooms in summer, whereas the blooms in winter were produced by *A. formosa, C. planctonica* and *M. granulata,* which consume more nitrate than phosphate.

References

1. Round, F.E., The ecology of algae. 653 pp., Cambridge University Press., (1984).
2. Aykulu, G., Obalı, O., Phytoplankton Biomass in the Kurtboğazı Dam Lake. Commun. Fac. Sci. Univ. Ank., Tome 24, Serie C2, 29-45, (1981).
3. Gönülol, A., Studies on the phytoplankton of the Bayındır Dam Lake. Commun. Fac. Sci. Univ Ank., ISSN 0256-7865, Serie C, Tome 3, 21-38, (1985).
4. Altuner, Z., Gürbüz, H. Tercan Baraj Gölü fitoplankton topluluğu üzerinde bir araştırma. X. Ulusal Biyoloji Kongresi, 18-20 Temmuz, Erzurum- 31-140, (1990).
5. Tosun, F., Tarımda Uygulamalı İstatistik Metotları Ders Notları, O.M.Ü. Ziraat Fakültesi Ders Not No: 1, sayfa 58, 66-67, (1993).
6. Lund, J.W.G., Kipling, E.D., Le Creen, The inverted microscope method of estimating algal numbers and the statistical basis of estimation by counting. Hydrobiol., 11, 143-170, (1958).
7. Round, F.E., An investigation of two benthic algal communities in Malharm Tam, morkshire. J. Ecol., 41: 174-197, (1953).
8. APHA, AWWA, WPCF., Standard Methods for the Examination of Water and Was Water, 18th Edition, Washington DC, USA, (1992).
9. Cleve-Euler, A., Die Diatomeen von Schweden und Finnland. 458 pp., Verlag Von J. Cramer, (1968).
10. Huber-Pestalozzi, G., Das Phytoplankton des Susswassers Systematik und Biologie, V. Teil Chlorophyceae (Grunalgen) Ordung: Volvocales. 744 pp., E. Schweizerbarth' sche Verlagsbuchandlung (Nagele u. Obermiller), Stuttgart, (1974).
11. Huber-Pestalozzi, G., Das Phytoplankto des Susswassers Systematik und Biologie, III. Teil: 2 Auflage Pyrrophyta 310 pp., E. Schweizerbarth'sche Verlagsbuchhandung (Nagele u. Obermiller), Stuttgart, (1976).

12. Huber- Pestalozzi, G., Das Phytoplankton des Susswassers Systematik und Biologie, Part 7, Teil 1: Komarek, J und B. Foot.: Chlorophyceae (Grunalgen), ordnung Chlorococcales. 1044 pp. E. Schweizerbarth'sche Verlagsbuch handlung (Nagele u. Obermiller), Stuttgart, (1983).

13. Hutchinson, G.E., A treatise on limnology Vol: II Introduction to lake biology and the limnoplankton. 1115 ppp., John Wiley and Sons. Inc., New York, London, Sydney, (1967).

14. Cirik, S., Cirik, Ş., Limnoloji.- 135 s., E.Ü. Su Ürünleri Yay. No: 21, (1991).

15. Gönülol, A., Çomak, Ö. Bafra Balık Gölleri (Balık Gölü, Uzun Göl) fitoplanktonu üzerinde floristik araştırmalar III - Chlorophyta. Doğa - Tr. J. of Botany, 17, 4, 227-236, (1993).

16. Kor, N., Kirlenmenin ekolojik Yönleri, Çevre Bakanlığı Yayınları, Tercüme, 105s., (1978).