

Hydrobiology of La Quebrada Lake, Cordoba, Argentina

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EXECUTIVE SUMMARY

La Quebrada Lake, is located 32 Km. northwest Cordoba City, in Central Argentina. The lake was formed by an artificial dam, and is at present the only reservoir for drinking water for about 30,000 people living in the surrounding areas of the populations of Rio Ceballos, Unquillo and Mendiolaza . Preliminary studies performed in 1997, alarmed about an increase in the eutrophication process that was detected, related mainly to algal bloomings (Cioccale et al 1998).

At present, the lake shows important periodical but sustained blooms of *Ceratium hirundinella* (Dinophyceae), occurring at water surface as reddish patches (Pierotto et al. 2000). This organisms are covered with plates, that are very difficult to eliminate. During the potabilization process those plates very frequently cause serious troubles, specially when they collapse the filters.

There has also been in the past few years a variation in dominance between eutrophication indicating strains of Cyanobacteria, like those belonging to the genera *Anabaena* and *Microcystis*. Preliminary observations indicate that *C. Hirundinella* becomes dominant under mesotrophic conditions, while Cyanobacteria in general are dominant under eutrophic to hypertrophic conditions. The trophic status of the lake can oscillate along the year, mainly because it is a turistic area and has a noticeable increase in population during spring and summer months, thus increasing the input of organic matter to the basin.

This contribution shows several data corresponding to samplings not only in the dam but also in its two tributaries. The studied parameters include physico-chemical, microbiological and mostly phytoplanktonic characteristics, according to manuals and identification keys (Bourrelly 1972; Parra et al. 1983). The most important bacterial inputs are in the entrance of the rivers, whose drainage basin collects several kinds of microbia from the several small surrounding populations.

Our results, based on nutrients concentration (phosphorous and nitrogen) and chlorophyll "a" point out that the dam would be placed within a mesotrophic stage moving towards eutrophic.

The lake is characterized by large primary production, low transparency, anaerobic processes in the hypolimnion that generate smelly gases, and recirculation of nutrients with a high charge on organic matter in the input drainages. Measured levels of oxygen concentration are low in

general.

La Quebrada Lake represents a serious concern for government officers in charge of the control and preservation of hydrological resources, and specially the Cooperativa Unquillo – Rio Ceballos, which is in charge of potabilizing water for human consumption in the affected area, and uses the lake as its only available reservoir.

INTRODUCTION

Algal blooms were observed since 1997 (Cioccale et al. 1998) at La Quebrada Dam. The duration and intensity of those blooms increased during the last two years, showing at present a Dinophyceae bloom (*Ceratium hirundinella*). These phenomena motivated the study and monitoring of the Lake in a co-operative effort between the Cooperativa de Aguas y Servicios Unquillo-Rio Ceballos and the University of Cordoba, through its Laboratory of Hydrobiology.

CONCLUSION

The microbiological study of affluent rivers (Colanchanga and Los Hornillos) showed high levels of bacterial contaminants during summer, lowering gradually in winter, as was also observed in 1999 (Pierotto, 2000).

Thermal stratification of water layers and the increase in organic matter due to algal blooms formed anoxic areas at the bottom of the lake, favored also by pH levels. The months with oxygen deficiency were the most troubled ones for potabilization because of the generation of bad smells in the treated water.

Our study was focused specially on the microalgae, considering them as excellent bioindicators. *Ceratium hirundinella* (Dinophyceae) (Fig. 1) caused the appearance of red spots on the water surface, with a maximal size during January and February 2001, but almost disappearing at the end of June 2001.

At this time it was replaced by Diatoms (Bacillariophyceae) like *Aulacoseira granulata* (Fig.2), *Melosira varians*, *Achnantes inflata*, *Achnantes linearis*, *Cymatopleura solea*, *Cymbella aspera*, *Cymbella cistula*, *Cymbella tumida*, *Epithemia adnata*, *Fragilaria capuchina*, *Gomphonema truncatum*, *Hantzschia amphioxys*, *Navícula cuspidata*, *Nitzschia sigmoidea*, *Nitzschia sinuata*, *Synedra ulna*, *Surirella robusta*, and *Pinnularia divergens*, and also some Chlorophyceae like *Cosmarium sp.*, *Closterium sp.*, and *Spirogyra sp.*

The above mentioned algae together with the Cyanobacterium *Microcystis aeruginosa* gave the water a greenish colour, alternating from time to time with the red spots. *M. aeruginosa* is well known as a toxin-producer when forming massive waterblooms.



Figure 1: Ceratium hirundinella.



Figure 2: Aulacoseira granulata.

The general conditions observed during the different seasons of the year, and specially the bioindicators here considered, are showing that the lake is passing by from a mesotrophic /

eutrophic status during spring and summer months to a oligotrophic status in winter and fall. These phytoplanktonic variations are illustrated in Figure 3.

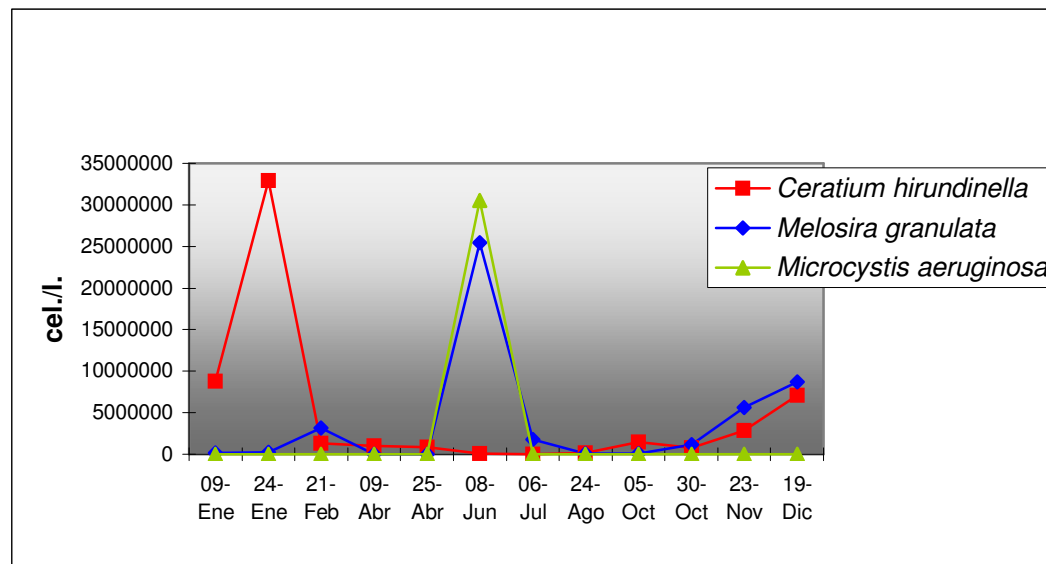


Figure 3: Evolution of phytoplanktonic populations at La Quebrada Lake

These high trophic levels, together with the microbiological contamination of the water, are severe alert signals considering that the reservoir provides drinking water to a population of about 30,000 inhabitants in the region.

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