Resumen

Los procesos biogeoquímicos relacionados con la dinámica de nutrientes, isótopos estables, ácidos grasos marcadores y el plancton fueron estudiados en un lago salino de la Pampa Argentina. El amonio fue el compuesto inorgánico nitrogenado dominante (~ 83% de la suma nitrato + nitrito + amonio), lo que se debió mayoritariamente a la inhibición de los procesos de nitrificación por parte del elevado pH. La materia orgánica particulada representó el mayor ingreso autóctono de materia orgánica a través del río. Una conexión hidrológica completa entre las cuencas de los lagos Chasicó y Los Chilenos ocurrió con una fuerte escorrentía del Río Chasicó en enero de 2008. El incremento de carbono orgánico disuelto de 2000 μM a partir de marzo y hasta septiembre de 2008, estuvo factiblemente relacionado con el incremento en la resuspensión sedimentaria o con la regulación top-down de la biomasa bacteriana, especialmente a cargo del microzooplancton. La signatura de $\delta^{13}C$ fue principalmente un buen indicador de la productividad primaria y de la fuente de carbono, mientras que el $\delta^{15}N$ indica principalmente el nivel trófico y carnivoría. Varios factores biológicos y fisicoquímicos estuvieron asociados también con la dinámica de isótopos estables. La variación estacional en los ácidos grasos del mesozooplancton estuvo relacionada con la de su presa, aunque el microplancton y el nanoplancton mostraron una menor estacionalidad debido a la alta variabilidad del seston. La combinación de isótopos estables, junto con la extraordinaria acumulación del ácido graso 20:4(n-3) en los ésteres de cera y la correlación del 20:4(n-3) con el 18:4(n-3) ($r=0,77$; $p<0,001$) permiten inferir la biosíntesis en el copépodo

calanoideo *Boeckella poopoensis*. Los isótopos estables y los ácidos grasos biomarcadores son técnicas complementarias de gran resolución en el estudio de redes tróficas. Las larvas de *Odontesthes bonariensis* estuvieron compuestas por los ácidos grasos de membrana 16:0 y 22:6(n-3) y su composición altamente estable indica un metabolismo de lípidos altamente selectivo y/o habilidades para sintetizar ácidos grasos. La vulnerabilidad de la laguna Chasicó fue evaluada bajo diferentes escenarios de cambio climático. Durante el periodo de muestreo, la temperatura del agua fue adecuada para la reproducción de *O. bonariensis* y para mantener una adecuada relación entre los sexos. Temperaturas climáticas más altas, sin embargo, podrían distorsionar severamente la estructura poblacional. El calentamiento global podría fortalecer los efectos de la eutrofización (Ej. florecimientos tóxicos o anoxia). Las cianobacterias están favorecidas por el cambio climático por su mejor adaptación a temperaturas más elevadas. Algunas especies de cianobacterias son tóxicas, este grupo de microalgas posee generalmente un bajo valor nutricional para niveles tróficos superiores y podría desacoplar redes tróficas. El cambio climático amplificará probablemente la intensidad de las sequías o inundaciones. Las inundaciones pueden perjudicar el desarrollo de *O. bonariensis* debido al crecimiento sub-óptimo a bajas salinidades y las sequías podrían incrementar también la salinidad del lago y la concentración de nutrientes. Para reducir algunos de los efectos del cambio climático en las poblaciones de *O. bonariensis* en la laguna Chasicó, perspectivas de manejo integrado de cuenca basadas en un enfoque ecohidrológico son propuestas.

Abstract

The biogeochemical processes behind the dynamic of nutrients, stable isotopes and lipid dynamic and their relations with plankton were studied in a salt lake of the Argentinean Pampa. Ammonium was the main inorganic nitrogenous compound (~83%) and its dominance may be largely due to high pH inhibition of nitrification processes. Particulate organic matter was the major allochthonous input of organic matter through the river. Full hydrological connection between the watersheds of the Chasicó and Los Chilenos lakes occurred with stronger runoff during the strong runoff of the River Chasicó in January of 2008. The increase in dissolved organic carbon of 2000 μM from March to September of 2008 was likely related to enhanced sedimentary resuspension or to a top-down regulation of bacterial biomass, especially by the microzooplankton. The signature of $\delta^{13}C$ was mainly good indicator of primary productivity and the carbon source and $\delta^{15}N$ indicated principally the trophic level and carnivory. Several biological and physicochemical factors were related to the stable isotope dynamic. The fatty acid seasonal variation in the mesozooplankton fraction was related to its prey, although the microplankton and nanoplankton showed less seasonality due to the high variability of seston. The combination of stable isotopes, together with the extraordinary accumulation of the fatty acid 20:4(n-3) in the wax esters and the correlation of the 20:4(n-3) with the 18:4(n-3) ($r= 0.77$. $p<0.001$) infers fatty acid biosynthesis in the calanoid copepod *Boeckella poopoensis*. The stable isotopes and the fatty acid biomarkers are complementary techniques of high resolution in the study of trophic webs. The larvae of

Odontesthes bonaerensis were composed by the membrane fatty acids 16:0 and 22:6(n-3) and the high stable composition indicate high selective lipid metabolism and/or their ability to synthesize fatty acids. The vulnerability of the Lake Chasicó was assessed under different climate change scenarios. During the sampling period, the water temperature was adequate for *O. bonariensis* reproduction and to sustain an adequate sex ratio. Climate-driven higher temperatures, however, may severely distort population structure. Global warming may strengthen the effects of eutrophication (*e.g.* toxic blooms or anoxia). Cyanobacteria are favored by climate change because of their better adaptation to higher temperatures. Some cyanobacteria are toxic, this group of microalgae has low nutritional value for higher trophic levels and could decouple trophic webs. Climate change is likely to amplify the intensity of droughts or inundations. Floods can endanger *O. bonariensis* development due to its sub-optimal growth at low salinity and droughts could increase lake salinity and also temperature and nutrient concentration. In order to reduce some of the effects of climate change on the *O. bonariensis* population in Lake Chasicó, integrated basin management perspectives based on an eco-hydrological approach are proposed.

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