USE OF AN ECOTOXICOLOGICAL MODEL (AQUATOX) AND BIOINDICATORS FOR THE MANAGEMENT OF AQUATIC ECOSYSTEMS IN AGRICULTURAL BASINS IN LATIN AMERICA AND CARIBBEAN

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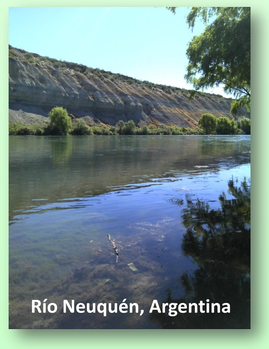
INTRODUCTION

Aquatic ecosystems are subject to different impacts from agricultural, urban and industrial sources.

The management of impacted ecosystems requires tools capable to predict their current state and to analyze the possible evolution simulating different scenarios. The present communication propose a combination of physico-chemical parameters and macroinvertebrates data, selected as bioindicators (Rosenberg et al., 2008), integrated in a mathematical model to evaluate the state of the catchment areas.

Mathematical models through sensitivity and uncertainty analysis allow to select indicators that represent the current state, as well as to propose possible management policies and enable the subsequent monitoring.

During 2014 to 2017 Argentina, Chile, Guatemala, Nicaragua & Uruguay through the ARCAL_RLA 7019 project monitored nutrients, pesticides phytoplancton and macroinvertebrates, for modelling the selected regions with AQUATOX (EPA Park and Clough, 2014).



RESULTS

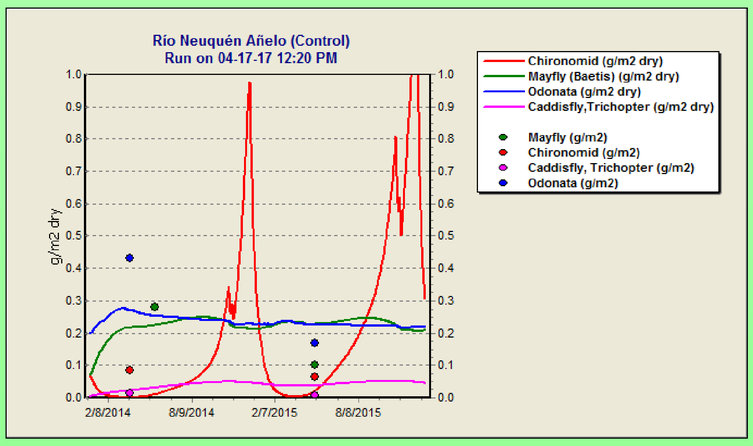
Lake Atitlán in Guatemala is affected by agricultural activities and by nutrients inflow from San Francisco and Quiscab River, which has favored phytoplankton blooms, the appearance of pathogenic organisms (*Salmonella*) and damaged water quality.

The Tipitapa River, in Nicaragua with a mean annual flow of 6.5 m3/s has been impacted by agricultural activities related to cotton and sugar cane in past decades, and in the present by floodings for rice culture. The presence of persistent pesticides has been reported in the river´s water and sediments.

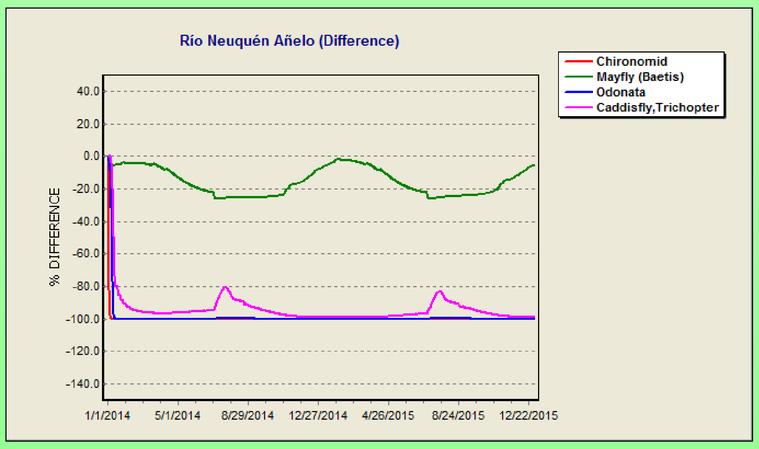
In Chile, the Tijeral River basin has an annual average flow of 1.78 m^3/s. Fruits, vegetables growth and forestry activities are conducted in the region impacting it due to pesticide´s use. The results obtained from 4 seasonal samplings indicate a perturbed system and the preliminary modeling indicates a regular trophic state. AQUATOX seems to yield an accurate simulation of the life cycles of the species under study. Particularly, odonates proved to be the group that would better reflect the changes of ecosystem quality when chlorpyrifos is applied.

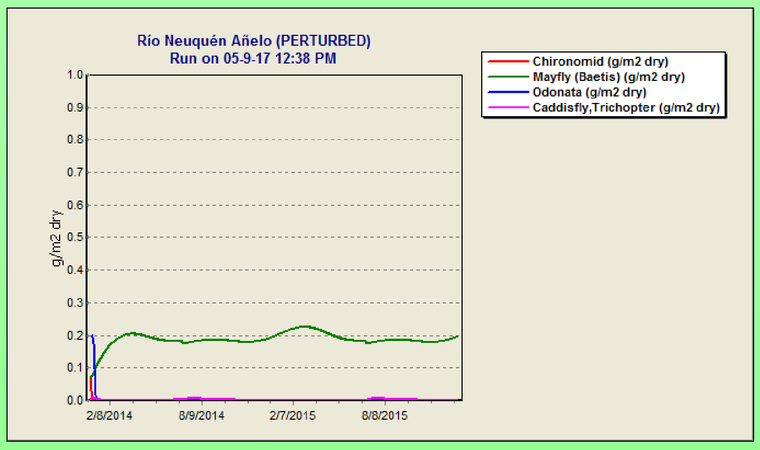
In Uruguay, the results from 12 samplings of Santa Lucía river in the period indicate that it is an ecosystem impacted by productive activities. The findings of glyphosate and atrazine residues and the occurrence of algal blooms in summer represent the input data for the model under study. The model is able to predict in different scenarios of increased or decreased nutrients and pesticides loads which will be the trophic state and ecological impacts in order to identify useful indicators of the state of the river.

Neuquén River in Argentina along its regulated section with constant flow of 12 m^3/s, has suffered an increase in the chemicals input during the last years. System modeling indicates that the current trophic status of the river is good, but that future development scenarios will affect the status of the water. Although available macroinvertebrates data are insufficient, Chironomidae, Trichoptera and Odonata taxa adequately reflects the dynamics of the ecosystem impacted by chlorpyrifos showing good properties as management bioindicators.



AQUATOX calibrated macroinvertebrates





AQUATOX predicted impact of 2 µg/L chlorpyrifos scenario in macroinvertebrates

CONCLUSIONS

Even with different degrees of progress, the calibrated model adequately reproduces the impacts of agricultural activities on the aquatic ecosystems under study. Macroinvertebrates and phytoplankton appeared to be good bioindicators because they are sensitive to the variations proposed as measures of pollution. The recommendations gathered are feasible to incorporate into management plans that must be addressed by decision makers. Therefore, the methodology used until now should continue to be implemented with new sampling and validation, aiming that other countries may adopt this system to predict their environmental status.

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