DIVERSITY AND ABUNDANCE OF BENTHIC MACROINVERTEBRATES IN TECOCOMULCO LAKE, A WETLAND IN HIDALGO, MEXICO

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Introduction

The benthic macroinvertebrates are used as indicators of quality water and environmental assessment (Giacometti & Berbosa, 2006), these parameters can be inferred by invertebrate community structure. Biotic interactions in a lake are frequently narrow, and some environmental properties as conductivity and salinity gradient determine the macroinvertebrates distribution among wetlands (Scheibler & Ciocco, 2010). Vegetation presence is an important factor that increase the diversity and abundance of macroinvertebrates since plants constitute refuges for macroinvertebrates and fish larvae (Schultz & Dibble, 2011). The aim of this study was to assess the diversity and abundance of macroinvertebrates in the Tecocomulco lake

Materials and methods

Study area

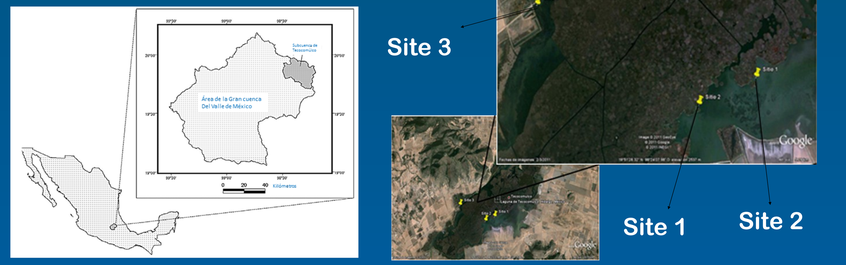


Fig. 1. Tecocomulco lake. Spatial distribution of sampling sites: Sites 1 and 2 are placed in limnetic zone; and site 3 is located in litoral zone.

Tecocomulco is a wetland in Hidalgo, Mexico, at north of the Great Basin of Mexico. The basin includes 5 municipalities of the Hidalgo state and one in Puebla state. A mean altitude of 2,515.30m between coordinates 19°33'N & 98°21'W. The study area got the denomination of the site RAMSAR in September 29th of 2003 due to three classification criteria (1, 2 y 4). This lake is considered de last relict of the ancient lacustrine system of the basin of Mexico Valley. Fish, amphibians and aquatic bird's refuge in it. Finally, it is a basing regulatory to aquifers recharge of the region (Ficha informativa de los humedales RAMSAR, 2003).

Methods

Three study sites were selected in different strategic places of the lake, trying to include different ecologic conditions (fig. 1). Sampling were performed in two seasons: wet season in May of 2011 and January of 2012 and dry season in August and November of 2011.

Sampling and data analysis

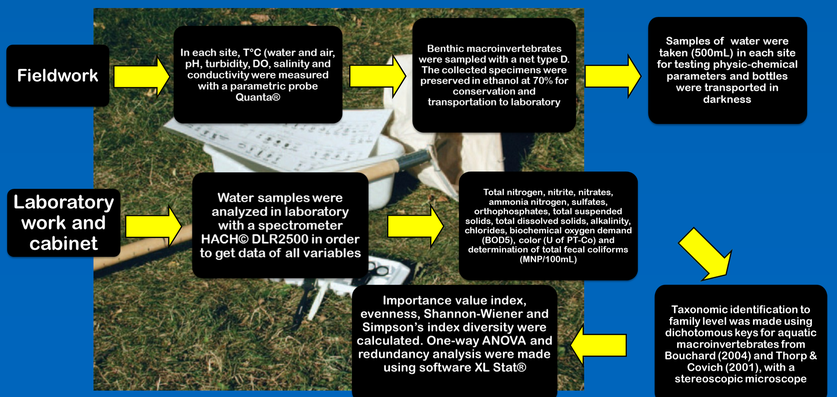
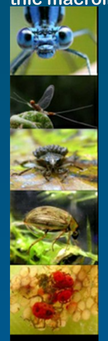


Fig. 2. Process of sampling and analysis of fieldwork, laboratory and cabinet work.

Results

Taxonomic richness was highest in site 3 which presented the widest quantity of families of benthic macroinvertebrates. Site 1 and 2 were less diverse than site 3 (fig. 3).



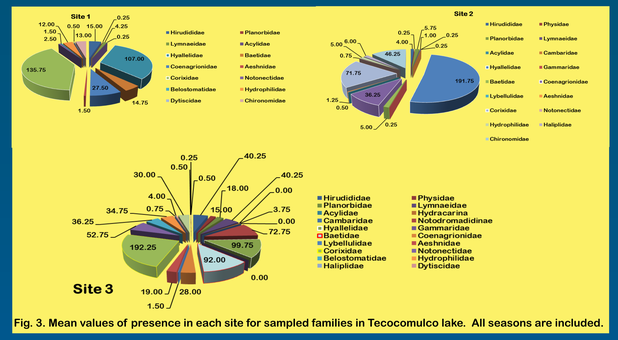


Fig. 3. Mean values of presence in each site for sampled families in Tecocomulco lake. All seasons are included.

Families Hyalellidae and Corixidae had high importance value in all sampled sites due to their abundance and frequency. These were remarkably constant taxa during all seasons and sampling sites (fig. 4) Other groups as Baetidae and Lymnaeidae showed lower importance values, fluctuating in space and time.

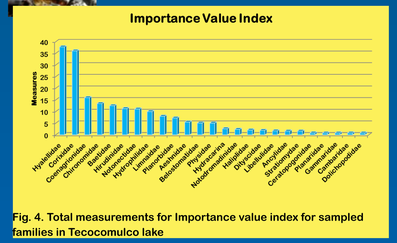


Fig. 4. Total measurements for Importance value index for sampled families in Tecocomulco lake

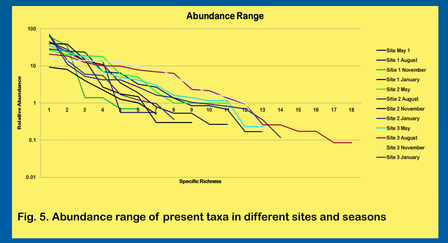


Fig. 5. Abundance range of present taxa in different sites and seasons

Abundance range presented components of low stability en sites 1 and 2, then the slope in this sites were mostly steep to difference of site 3 that shown slopes less steep due to abundance and frequency was most balanced to difference of previous sites mentioned (fig. 5).

Diversity index of Shannon-Wiener indicates significant differences between site 3 and site 1 (fig. 6). Mean values in each season also presented significant differences in treated sites. This reflects the maximum diversity that was observed in site 3. Temporal differences between sites were observed. So in order to have a good representation of the principal taxa, it is necessary to sample in site 3.

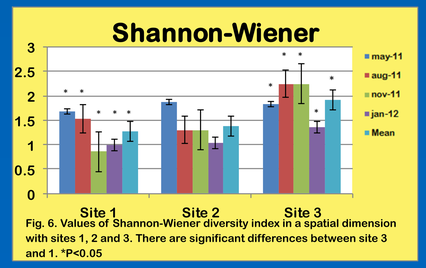


Fig. 6. Values of Shannon-Wiener diversity index in a spatial dimension with sites 1, 2 and 3. There are significant differences between site 3 and 1. *P<0.05

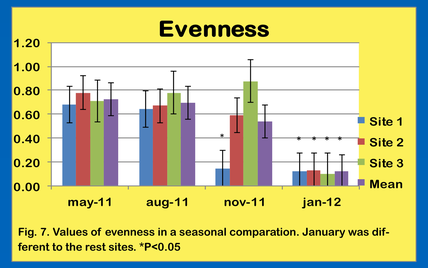


Fig. 7. Values of evenness in a seasonal comparation. January was different to the rest sites. *P<0.05

Evenness was assess by a seasonal parameter and indicated a significant difference in January with May, August and November, with this last month, January was equal to November in site 1. There is an equally abundance and frequency in January (fig. 7), then this month shown a homogeneity in taxa that presented in general with all his sites, to difference with other months that had an unequally family diversity.

Simpson index presented a significant seasonal differences between January and May. This differences are important to know in what month is most probable to found a particular taxa. Fig. 8 indicates that in months August and November is probable to found the maximum diversity, also this characteristic it presents in site 3.

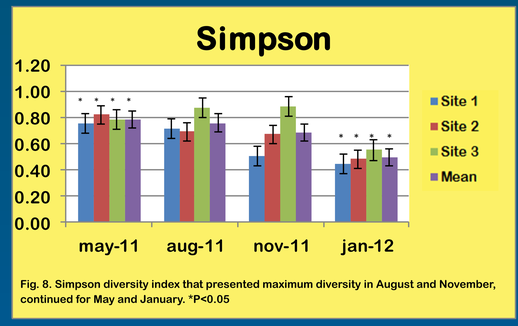


Fig. 8. Simpson diversity index that presented maximum diversity in August and November, continued for May and January. *P<0.05

Temporal and spatial habitats were characterized by biotic and abiotic parameters, site 3 (right axis) shown a relationship with most taxa as Chironomidae, Coenagrionidae, Hyalellidae, among others that have habitats in plants as *Najas guadalupensis* and *Potamogeton foliosus* and *Lemna gibba*. Abiotic parameters have an importance in the environmental influence as ammonia, Chlorides and Nitrogen. Sites 1 and 2 had a narrow relation with Gammaridae, Acylidae and Cambaridae, Lymneidae and Haliplidae (left axis), with sulfates and nitrites (fig. 9).

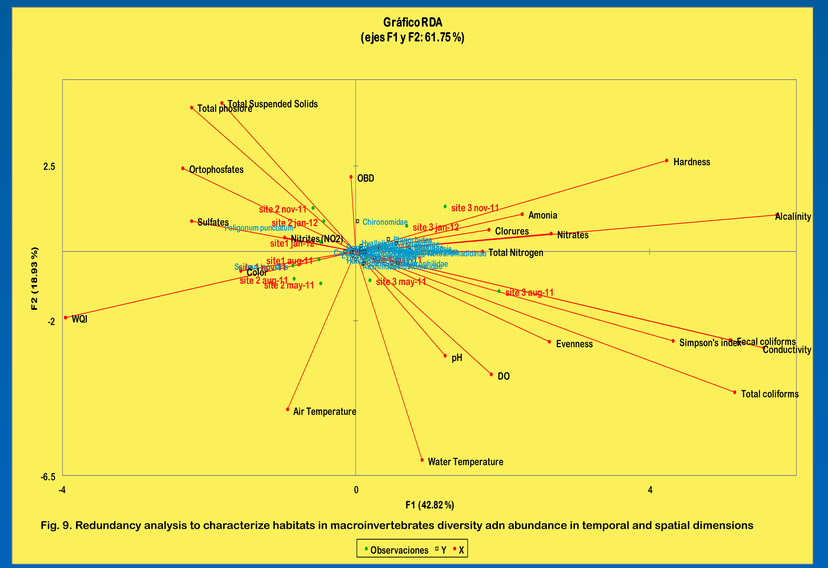


Fig. 9. Redundancy analysis to characterize habitats in macroinvertebrates diversity adn abundance in temporal and spatial dimensions

Conclusions

Spatial diversity and abundance of macroinvertebrates were influenced by plants as *Lemna gibba, N. guadalupensis* and *P. foliosus*. Temporal diversity and abundance were influenced by concentration of abiotic factors as orthophosphates, sulfates, alkalinity, conductivity and nitrogen compounds, that generates distinct conditions which allowed develop and growth taxa in an environmental with a great amount of resources, so as differences between habitats.

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