The use of diatoms (Bacillariophyta) as indicators of water quality in an intermittent, urban and highly polluted river in Bolivia

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The Rocha River is born at the foot of the Eastern Andes (2685 m asl) and discharges into the Caine River (2527 m asl), after 70 km of crossing the city of Cochabamba and semi-rural surrounding areas. Its basin is inhabited by ca. 1.3 million people dedicated to agriculture, plastic, paper, tannery/leather, poultry industries. The discharge peak is reached in the rainy season (November-March, ca. 3 m3s-1) while during the dry season (April-October) it is only ca. 0.5 m3s-1. The river is contaminated by agricultural, factory and domestic waste. Especially during the dry season, it turns dark green and emits strong sewage odors. The present study intends to provide a monitoring tool for this river, useful for recovery and management practices. Sampling took place during the dry (2 dates) and rainy (1 date) seasons in 2008 at 6 stations in an agricultural/semiurban zone and 3 in urbanized areas. Epilithic samples were obtained by brushing rocks and oxidized in the laboratory with nitric acid to produce permanent slides using Naphrax mounting medium. Microscope identifications at 1000X were made using specialized literature. Water chemistry was measured *in situ* and in the laboratory. The Shannon diversity index and the Specific Polluosensitivity Index (IPS) were calculated and both species counts and IPS values were analyzed using CCA (Canonical Correspondence Analysis). The diatom community along the river was composed of 276 species and varieties. The most specious genera were Nitzschia, Gomphonema, Navicula, Ulnaria, Pinnularia and Fragilaria, which together comprise 77% of the total diatom community. Species composition varied at each of the 9 stations along the three sampling dates. There is no underlying river or land use typology, but localities associated with agriculture had higher species numbers, while sites associated with urban development had a lower number of taxa. 41% of the taxa were unknown, hindering the calculation of the IPS, which nevertheless shows a low (agricultural sites) and the lowest (urban sites) quality for both dry and rainy seasons. Despite the lower number of taxa used in the index calculation, the categorization correlates well with water chemistry (R2 adjusted=0.45), being temperature, BOD5 and orthophosphates the variables showing the highest correlations with taxa and index values. Thus, diatoms are a useful tool for monitoring the Rocha River and could be applied to other rivers in the semiarid region of the Bolivian Andes.

Adaptive Management Approach to Climate Change in Temporal Saline Wetlands in the Mediterranean Region

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Temporal saline shallow wetlands are characteristic systems of the center of the Iberian Peninsula, where climate patterns and specific geomorphological features allow to settle down these lagoons in some specific areas. Their outstanding importance is determined by the ecosystem services they provide, as well as their ecological peculiarity associated to the fluctuating behaviour and a huge level of well-adapted biodiversity to the fluctuating conditions. The hydroperiod is governed by rainfall and evapotranspiration, and saline levels are associated to the water volume. However, severe effects of climate change in the Mediterranean region, like longer droughts and temperature average increases, together with threats and impacts from human practices, have modified their structure and reduced their adaptive capacity to environmental changes. Therefore, a new management approach based on the adaptation reinforcement was developed in order to preserve wetland resilience and ecosystem services, thus ensuring their particular ecological processes. Management measures were designed for the saline lagoons of the "La Mancha Húmeda" Biosphere Reserve, inlands the Iberian Peninsula, as testing sites. Some actions were based on the withdraw of external disturbances and main alteration causes, by promoting more sustainable agricultural practices compatible with the conservation of natural values of wetlands in their influencial area. For the specific wet areas, measures were focused on the restoration of their natural ecological patterns and structure. Reintroduction of native adapted vegetation communities and watershed management were contemplated in order to protect the area from droughts and desertification, ensure water supply, and enhance wetlands sink effect by increasing carbon fixation and reducing natural greenhouse gas emissions. The measures enhanced the role of reducing water requirements for agriculture in an increasingly dry context, and strengthened the role of wetlands in climate change mitigation and regulation. Other ecosystem services like sediment and nutrient retention, water purification, shoreline stabilisation and reservoirs of biodiversity could also be improved with the implementation of this new management approach, though some other values could be weakened, so a strategical focus should consider the different services and uses wetlands offer.