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Water quality changes in a naturalized historical reservoir: the Pantano de Elche, Spain

Ignacio Melendez-Pastor, María Belén Almendro-Candel, Irene Amorós, Jose Navarro-Pedreño, Ignacio Gómez, and Fuensanta García-Orenes

University Miguel Hernández of Elche (UMH). Department of Agrochemistry and Environment. Av/Universidad s/n. Edificio Alcudia. 03202 Elche, Spain. Contact e-mail: imelendez@umh.es

The “Pantano de Elche” is an historical XVII century reservoir located in the lower course of the Vinalopó River (SE Spain). The watershed of the Vinalopó River is the largest one of the province of Alicante, a highly urbanized area with intensive agriculture, severe processes of land degradation and poor-quality coastal rivers and streams. The original reservoir basin (71 ha) was clogged by sediment in few decades and the current area is a protected wetland with extensive reed marshes and a recently drained water body next to the dam.
We are studying the influence of this naturalized historical reservoir in water quality parameters of the Vinalopó River. A long-term water quality monitoring approach is being developed and we present an initial quantification of the mass balance for suspended solids and nitrates (winter to summer). Monthly water samples have been taken at the upper point of the reservoir basin, intermediate areas of the reed marsh, the boundary between reed marsh-water body, and the outlet of the dam. Physical-chemical parameters (e.g., temperature, electrical conductivity, pH, total suspended solids, and nitrates) have been analysed in situ or within 12 hours after the field sampling. Water flow was estimated by measuring water speed in cross-sections of the river bed at the inlet to the basin. The study area was mapped with QGIS and aerial ortophotographies in order to delineate the extent of the marshes and the water body. Statistical analyses (e.g., descriptive, ANOVA) were performed with SPSS.
The water quality of the study area is greatly affected by diffuse agriculture pollution and the addition of soluble salts from saline and gypsiferous soils. Electrical conductivity of water samples was high (∼18.5 mS/cm) for all locations. The pH ranged from 8.0 to 7.7 in the marsh and increased up to 8.3 at the outlet of the dam. The values of chemical oxygen demand (COD), total suspended solids (TSS) and nitrates exhibited a similar pattern, with a reduction across the marshes and an important increase after the water body. COD values ranged from 90 to 117 mg/L in the study area. TSS values changed from 41, 11 and to 17 mg/L and nitrates changed from 22, 2 and to 9 mg/L. Mean water flow was 1.2 m3/s. An initial mass balance of TSS and nitrates was computed and revealed an important retention capability of the marshland. The initial TSS flux at the upper point of the reservoir basin (4.2 t/d) decreased up to 1.1 t/d at the boundary between reed marshes-water body. In a similar way, the nitrates flux decreased from 2.2 t/d to 0.2 t/d at the end of the marshes. The net retention of suspended solids and sediments in the marshland contrasted with a notable increase of TSS (1.7 t/d) and nitrates (0.9 t/d) fluxes at the outlet of the dam. The development of phytoplankton in the water body contributed to the increase of the TSS while the increase of nitrates flux was related with diffuse agriculture pollution from surrounding areas.