Supplementary material

Designing river water quality policy interventions with scarce data: the case of the Middle Tagus Basin, Spain

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# Water Quality Model

The model assumes steady state conditions, perfect horizontal and vertical mixing in a cross section of the river, and pollutant transport and reaction mechanisms. Rivers are discretized in reaches where continuity and equilibrium equations are applied. Reach length is adapted to ensure homogeneity within each reach, resulting in lengths ranging from 1 to 20 km.

Among the modelled pollutants (Figure S1), nitrogen can enter the system in the form of ammonium and nitrate. Ammonium may nitrify with oxygen consumption and nitrate may denitrify. Carbonaceous matter (described by its BOD5) can be decomposed with oxygen consumption. Dissolved oxygen can be consumed by nitrification and organic matter decomposition and may be replenished through reaeration from the atmosphere. Phosphate may decay.

Decay

PO4

Dissolved Oxygen (DO)

NH4

NO3

N2

Descomposition

Organic matter

(BOD5)

Atmosphere

Nitrification

Denitrification

Reaeration

**Figure S1.** Modelled pollutants and processes.

All these changes are modelled by first-order reactions:

$\frac{d}{dt}C=-K\_{c}·C$ (2)

where *C* is the concentration of a component in the column of water and *K*c the first-order evolution constant that is calibrated (Thomann and Mueller 1987, Chapra 2008). The evolution constants in the model are:

|  |  |
| --- | --- |
| *K*a | Reaeration |
| *K*d | Organic matter decomposition |
| *K*n | Nitrification |
| *K*dn | Denitrification |
| *K*p | Phosphate decay |

A detailed description of the model can be found in the manual of the RREA model (Paredes-Arquiola 2018).