The decision support system O’GAMELAG for the management of Mediterranean coastal lagoons

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Abstract

The monitoring programme the ‘Réseau de Suivi Lagunaire’ (RSL) monitors the eutrophication status of the coastal lagoons in the Languedoc-Roussillon region (S. France). During the last four decades these lagoons have been exposed to varying degrees of nutrient over-enrichment. As a result, the most eutrophied lagoons have shown regime shifts from rooted Magnoliophyta communities into systems dominated by dense phytoplankton or macroalgal blooms. However, a couple of lagoons that have been little impacted have remained oligo- to mesotrophic and are still home for marine Magnoliophyta. In order to support the lagoon managers in new innovative ways, the RSL has called for development of a decision support system for defining the maximal allowable N and P loadings to lagoons for achieving and maintaining good ecological status, according the E.U. Water Framework Directive (WFD). Hence, the WFD sets the targets for the desired state in these lagoons. We developed O’GAMELAG as a demonstrator based on a simulation program that communicates with databases. To improve accessibility for the lagoon managers it also comprises a user-friendly ‘human-engine’ interface, menu-selected output options including graphic representations and a methodological guide that can be consulted on-line during execution. The simulation model is based on the methodology provided by the LOICZ (Land-Ocean

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Interactions in the Coastal Zone) model, which calculates the fluxes of water, salt and nitrogen and phosphorus across different interfaces (Gordon et al., 1996, LOICZ report No5 http://www.loicz.org/products/publication/reports/index.html.en). It is based on the coupling of a simple hydrological and a biogeochemical model. The hydrological model focuses on water inputs from the catchment, exchanges between the lagoon and the sea, and between the lagoon and the atmosphere. The biogeochemical model calculates the distribution and dynamics of N and P in different compartments (water column, phytoplankton, macroalgae, meadows of marine Magnoliophyta, cultured bivalves and sediments). The development of O’GAMELAG has initiated a participative approach with the stakeholders, i.e. the lagoon managers in particular, for compiling the essential data bases for the external forcing (time series of water and nutrient flows from the catchments into the lagoon) for different lagoons and to analyse the water and N and P budgets during wet and dry years. The final aim of O’GAMELAG is to provide a tool to test the impact of different management scenarios, which can be combined with scenarios of climate change, on the water quality in the lagoon. By sensitivity analyses and simulation of hypothetical scenarios, the lagoon manager can get an idea of the resilience of these systems.

**Keywords:** Water Management, Ecosystem services, Decision making, Regime shifts, Desired State, Trajectories, Adaptation to climate, Stakeholder engagement, System dynamics, Simulation, Scenario analyses