

Integrated modelling of goods and services provided by aquaculture to coastal systems

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ABSTRACT

Modelling coastal systems is a complex task as coastal areas are flooded by various water resources from both terrestrial and marine systems and because they are subject to numerous human pressures (e.g. pollution, overexploitation). One European task is to manage in a sustainable manner the use of the coastal system from a growing demand of space from various activities and the exploitation of coastal resources. Tools such as integrated assessment using ecosystem approach and Marine Spatial Planning (MSP) are developed to help decision makers in managing the coastal areas.

The ecosystem approach for aquaculture was applied in the FORWARD project (<http://polislitoralriiformosa.pt/forward.php>) to encourage sustainable development of renewable resources in the Ria Formosa (Portugal). Bivalve aquaculture is a good example of activity that can provide goods and services for coastal systems by reducing the eutrophication symptoms, offering seafood as an alternative to wild fish capture and hence as a measure to reduce the fishing pressure, and through the creation of jobs linked to the industry.

The project aimed to deliver management guidelines based on an interdisciplinary research at local and system scales, including hydrodynamics, watershed discharges, ecological processes occurring in the coastal areas and economics. The research approach was based on developing and adapting tools both to analyse and optimise carrying capacity of the Ria Formosa. These tools were integrated into a modelling framework including models for terrestrial water and nutrient balance, coastal hydrodynamics, coastal ecosystems and aquaculture production. In addition, best environmental practices (BMPs) and product certification were also reviewed.

The results from the modelling framework matched observed data from the Ria Formosa, including current aquaculture production. Social aspects and governance cannot be simulated with mathematical models but are indispensable for sustainable development of aquaculture. The interdisciplinary nature of the FORWARD project also revealed challenges with large potential impacts for aquaculture, especially groundwater nutrient inputs and biosecurity risks, which should be addressed by further research. The modelling framework proved useful for testing different management scenarios, and to help engage stakeholders in the application of decision support tools.