Aquaculture is the fastest growing food production system in the world and is an important ecosystem service of coastal zones. Numerical modelling can help us to understand ecosystem functioning and the ecological resilience of marine environments, which are critical components for building effective marine spatial planning processes. Modelling tools such as scenario building allow us to objectively explore management alternatives. In addition, the opportunity to couple optimization techniques to ecosystem models provides a framework for making objective and transparent management decisions. Objective scientific knowledge and transparent decisions are requisite for engaging different stakeholders, a key social goal of sustainable aquaculture. In this presentation I will present examples of my research tailored to understanding ecosystem functioning and addressing critical aspects of aquaculture management. These examples will highlight the importance of adopting an ecosystem approach to aquaculture in order to maintain the sustainability of coastal areas.