

Strategic Management of Marine Ecosystems Using Whole-Ecosystem Simulation Modelling: The 'Back to the Future' Policy Approach

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Abstract

'Back-to-the-Future' (BTF) attempts to solve the 'fisheries crisis' by using past ecosystems as policy goals for the future. BTF provides an integrative approach to the strategic management of marine ecosystems with policies based on restoration ecology, and an understanding of marine ecosystem processes in the light of findings from terrestrial ecology. BTF employs recent developments in whole ecosystem simulation modelling that allow the analysis of uncertainty, tuning to past biomass estimates, and responses to climate changes. It includes new methods for describing past ecosystems, for designing fisheries that meet criteria for sustainability and responsibility, and for evaluating the costs and benefits of fisheries in restored ecosystems. Comparison of ecosystems before and after major perturbations, including investigation of uncertain ecological issues, may set constraints as to what may or may not be restored. Understanding how climate and ocean changes influence marine ecosystems may allow policies to be made robust against such factors. A new technique of intergenerational discounting is applied to economic analyses, allowing policies favouring conservation, as the same time as addressing economic standard discounting of future benefits. Automated searches maximise values of a range of alternative objective functions, and the methodology includes ways to account for uncertainty in model parameters. The evaluation of alternative policy choices, involving trade-offs between conservation and economic values, employs a range of economic, social and ecological measures. BTF policy also utilizes insight into the human dimension of fisheries management. Participatory workshops attempt to maximise compliance by fostering a sense of ownership among all stakeholders: ideally, collaboration by scientists, the maritime community, managers and policy-makers may build intellectual capital in the model, and social capital in terms of increased trust. BTF may help to reverse the shifting baseline syndrome by broadening the cognitive maps of resource users. Some challenges that have still be met include improving methods for quantitatively describing the past, reducing uncertainty in ecosystem simulation techniques and in making policy choices robust against climate change. Critical issues include whether past ecosystems make viable policy goals, and whether desirable goals may be reached from today's ecosystem. Examples are presented from case studies in British Columbia, Newfoundland and the Gulf of St Lawrence in Canada; the Gulf of California, Mexico; the Bali Strait and Komodo National Park in Indonesia; and the South China Sea.