Theme Session C
Modelling human behaviour in models of marine ecosystems

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Introduction and general overview of presentation

1) Introduction

Humans have become major players in marine ecosystems. Consequently, there is growing recognition that integrated approaches to the evaluation of scenarios and management strategies for ocean uses should include representations of how humans affect and interact with various components of marine ecosystems. Progress in such integrated approaches should help progress our understanding of the factors driving the dynamics of these interactions. The aim of the session was to assess the current state of the art and open research questions on including human dimensions in models of marine and coastal ecosystems, and to identify future challenges in this respect. The session was open to presentations of recent work on representing decisions of individual resource users in marine fisheries and other uses, as part of applied bio-economic models, as well as conceptual models of human use of natural resources, and how these may assist in developing quantitative representations of the economic and social behaviour of resource use in integrated modelling approaches. Contributions were invited on the following questions:

- What economic and social drivers of resource use can be captured in integrated modelling approaches?
- What tools are available for representing decisions of individual resource users in models of marine fisheries and other ocean and coastal use?
- What determines the required spatial and temporal resolution in integrated modelling approaches of natural resource use?

This report gives a brief overview of the session presentations and discussions. A key question which was raised in the session discussion was whether human behaviour can and should be modelled at all, as part of marine ecosystem models. Presentations at the session illustrated the diversity of the research that is currently being undertaken with this objective. Models are being developed using a wide range of methods and tools, to represent a large variety of behaviours and decision-making processes, at a number of different scales. The session also identified a number of challenges in further developing approaches to include human dimensions in marine ecosystem models.

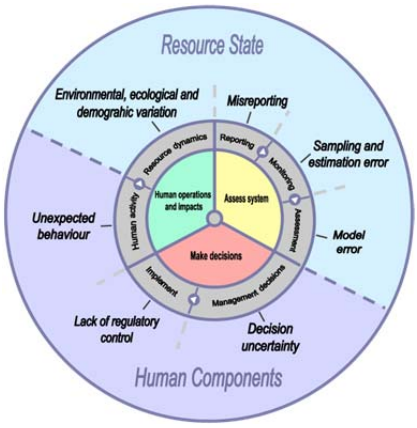

Figure 1 – Schematic diagram of the management cycle and sources of error or variation that can inhibit the successful execution of fisheries management. Source: Fulton et al. 2011.

2 Can human behaviour be modelled (as part of models of marine ecosystems)?

The question was raised of whether human behaviour can and should be modelled at all, as part of marine ecosystem models. One argument raised in favour of doing so was that there is a large body of research in areas such as economics, behavioural economics or marketing, that is readily modelling human behaviour (albeit with varying levels of success). Moreover, the objections to modelling human decision-making and behaviour often seem to be the same as those encountered by research attempting to model biological systems. In particular, the complexity of the systems under study, and the associated, large levels of uncertainty, are often stressed, as well as the risks that modelling approaches sometimes involve of developing "tunnel views" which lead to misunderstandings and/or misrepresentations of the systems considered. The discussion recognized that, as in other research domains, these issues should be acknowledged, and should drive the choice of modelling approaches and tools, as well as the use of the models and their results.

A number of specificities of the application domain were however highlighted, which may raise specific issues that also need to be considered. This includes the potential effects of the modelling research on the research object itself: in some cases, model predictions could be self-fulfilling or self-defeating as stakeholders see the results and act in response to them, or even ant. In addition, stakeholders may anticipate such dynamics and this may affect the ways in which they behave, particularly as regards the provision of information on which the research is based. This may be an important dimension to consider in interpreting the information that underlies the development of empirical models of human behaviour. In addition, the question of the stability of behavioural traits was also discussed. The question of how quickly and why people's preferences, fashions, customs, technologies, etc. change was acknowledged as an important one that warrants further research.

3 Diversity of the research

The presentations at the session illustrated the large diversity which characterizes this research domain. This diversity is in terms of:

(i) The types of behaviour that are being modelled, from the individual decisions to fish in difficult sea conditions, fishing location and targeting choices, discarding behaviour, investment strategies, quota trading, gear switching, or misreporting, through to collective decision-making processes including coordination strategies regarding harvesting pressure. Models can thus include a wide range of elements or building blocks, including economic variables such (prices, costs, etc.), social and institutional variables (such as property rights regimes, rules, regulations, norms, customs) as well as a range of evaluation criteria including profits, resource rents, moral considerations, or distributional issues.

(ii) The scales at which these studies are carried out, in terms of social units, from individual people, to firms, fishing fleets, value chains, markets, governance systems and institutional dynamics, but also in terms of spatial and temporal scales (from local, short-term processes to long-term system-wide dynamics).

(iii) The modelling approaches and tools, which can be broadly separated into empirical modelling, relying heavily on empirical data (e.g. Random Utility Modelling approaches such as choice experiments, or location choice multinomial models), and structural modelling providing formal descriptions of decision-making processes. The latter include optimisation models that assume an underlying minimizing or maximizing behaviour (e.g. optimisation models such as Dynamic State Variable models, or dynamic programming), Agent-Based Models, which involve rule-based representations of individual behaviour, as well as a range of qualitative modelling techniques allowing to describe the structure of individual and/or collective decision-making processes. In addition to these modelling tools it is important to mention the qualitative research tools (e.g. qualitative surveys, focus groups) that are applied in a wide variety of studies, and provide valuable information that can be used in developing the above models

4 Challenges in introducing human dimensions in integrated ecosystem models

The session identified a number of challenges which relate to:

- The breadth of decision-making / behaviour that should be considered: so far the emphasis seems to lie on modelling short-term behaviour of fishers. However, there are many more categories of decisions that can and need to be included
- Dealing with multiple scales: decisions take place at multiple temporal, societal, and spatial scales, with interactions between the scales.
- Integrating qualitative factors in models: Many decisions are influenced by qualitative factors like customs, social acceptability, and legitimacy. How do we include them in a quantitative model?
- Importance of institutions: Institutions are pervasive in understanding how societies work. Recent progress in institutional economics may help develop modelling approaches to capture these factors. Think of issues like property rights, transaction costs, social norms, and so on.
- Stability of traits: How stable are risk preferences or social norms? How long do the outcomes of a choice experiment remain valid? When do we need to redo the survey to update the model?

- Dealing with anticipation and feedback: Anticipation and feedback (the effect of research results on behaviour) are to some extent related. As regards anticipation we can be certain that the myopic model is unrealistic, but the same may be said for the common knowledge assumption in game theory. How do we find a middle ground? How much anticipation is realistic and how do we model it? Feedback may be more difficult to deal with, except where the research is carried out in an adaptive management framework.

5 Conclusion about the session

The session evoked a good discussion about the state-of-the-art and the outlook for modelling human behaviour in models of marine ecosystems. As conveners we summarized this discussion in a document that will hopefully serve as a starting point for future work. This work will contribute to integrated ecosystem assessments that ICES will focus on in the new science plan. We had positive response from the speakers and the audience, and the session resulted in the formation of a steering group that will organize a bigger symposium on this topic. That symposium will hopefully have a slightly broader scope than the mainly fisheries oriented talks and posters that were presented in the session.

6 References

Fulton EA, Smith ADM, Smith DC & van Putten IE (2011) Human behaviour: the key source of uncertainty in fisheries management. Fish and Fisheries 12, 2–17