Lighting the 'grey zone': how can we integrate human dimensions in decadal-scale prediction systems?

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The world-wide development of the blue economy will likely result in an ever more intense penetration of human activities into the marine realm. Marine ecosystems are already exposed to unprecedented levels of pollution and resource extraction, as well as heavily impacted by climate change. There is thus an urgent need for science-based approaches to be put in place for the sustainable management of marine resources and ecosystems while ensuring lasting ocean-based benefits to society. Time scales from seasonal to decadal coincide with decisions of particular relevance to the adjustment of practices and infrastructure to ensure long-term sustainability. These time scales are targeted by decadal predictions, a rapidly developing field with an increasing number of applications for the management of living marine resources. The transition towards the sustainable management of marine ecosystems should, however, not rely only on the development of coupled physical-ecological prediction systems, but should ideally integrate humanity. It calls for the development of socio-ecological model systems with the human dimension as a system component and actor of governance.

This workshop aims to bring together scientists from across different disciplines (natural sciences, social science, psychology, economics and policy) sharing a common interest in tackling the challenge of expanding decadal prediction systems to include the socio-ecological dimension. The workshop is structured around three pillars : (1) modelling the natural system (focus on decadal predictions), (2) integrated modelling for marine socio-ecological systems and (3) scenarios used in both modelling approaches. It will assess present capabilities and identify major blockages, and suggest strategies for the successful integration of the human dimension into decadal prediction systems.

Objective:

Define best practices/standards for integrating the human dimension into decadal prediction systems for fisheries and aquaculture management.

While human activity is a major driver of climate and environmental changes in the Anthropocene, it is still absent from most model systems. With model systems increasingly evolving into **decision support tools**, next-generation decadal prediction systems should **integrate the human dimension**. Because the 'Lighting the Grey Zone' workshop targets participants from different disciplines, it is important to **create a common language**, including metrics and indicators used by different science communities. The "Grey Zone" refers to the decadal prediction horizon and tackling it requires particular modelling approaches. An introduction to modelling techniques and related issues will be part of the workshop. The technical introduction will not be limited to the modelling of physical/chemical/biological systems, but will also address the human dimension. Specific topics to be discussed in the workshop include:

- How to deal with the **mismatch of scales** between the global scale of the Earth System Models used to generate decadal predictions and the regional scale required by decision makers and stakeholders for actionable predictions? Again, both the technical climate science side of this question (downscaling), and the requirements for regional-specificity and modelling of the human dimension will be discussed.

- How can human behaviour be integrated into decadal prediction systems based on **ensemble methods** and providing probabilistic information? Decision makers and the general public need tools (and education) to understand and use this information and its inherent uncertainty.

Outcomes and expected impact:
The workshop will suggest a strategy and produce guidelines on how to integrate human dimensions with coupled physical-biogeochemical/ecological prediction systems. It will also consider different modelling approaches (qualitative, participatory, quantitative, scenario-based) to achieve this. These will feed into a perspective paper, the key output of the workshop. The strategy will be structured around a particular topic, such as **the ocean and food security**, but with broader relevance to modelling the grey zone to support decision-making for marine social-ecological systems.