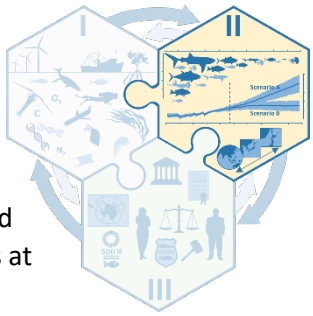
Grand Challenge II

Improving scenarios, predictions and projections of future ocean-human systems at multiple scales



The Challenge: To incorporate understanding of the drivers and consequences of global change on marine ecosystems and human societies at multiple scales into models to project and predict future states.

The SCOR review of IMBER was completed in December 2021 and has endorsed a Grand Challenge II focus on three research priorities with key deliverables to be achieved by the IMBeR community.

Grand Challenge II Priorities – 2022-2025

1. *Integration of data systems and approaches for predictions and projections*
2. *Development of predictive models and projections for use at regional scales*
3. *Development of alternative scenarios linking natural and human systems*

1. Development of integrated data systems and approaches for predictions and projections

Parameterising and constraining models is a crucial requirement for developing future projections and has been an important activity of IMBeR and its regional programmes. There has been a rapid expansion of the volume of marine data in recent years through the development of remote and autonomous observation systems. There is also an increasing need to include social science processes in developing projections to provide information to inform decision making. Under this objective we aim to bring together the data observing, analysis and modelling communities to advance integrated approaches for predictions and projections. While management structures are in place for environmental data at regional and global scales, social science data lack such structures. We will develop links with key management and observation groups (e.g., IODE, OBIS, SOOS and GOOS) and – as an IMBeR specific activity – support the development of a social science data set with focus on integration natural and human systems (synergy with GCIII, IC4 and Human Dimensions Working Group).

Key deliverables include:

1. An assessment of the types of social science data (disciplines, scales, methods) currently available and required for use in regional/local projections and their accessibility.
2. The development of approaches for integration of natural and human systems data for model validation and assessment.

2. Development of predictive models and projections for use at regional scales

IMBeR science achievements contributed to highlighting the importance of developing models and projections that can inform decision-making on appropriate time and space scales. Environmental changes are already occurring in many marine ecosystems and further major changes are expected in the coming decades. Decision-makers need information on how regional and local ecosystems are likely to be affected by change in multiple environmental stressors and the consequences for human communities. This objective will coordinate approaches across IMBeR regional programmes for the development of higher resolution coupled models, to downscaling projections and regional scenarios. This will also draw activities developed under objective 1 by fostering the integration of environmental observations and social science data into predictive models for regional socio-ecological model systems.

Key deliverables include:

3. Best practices for downscaling approaches developed for regional system modelling and projections.
4. Pathway for the integration of social processes in regional system models and projections.

3. Development of alternative scenarios to bridge the gap between physical climate sciences and humanities

The development of global and regional models for delivering climate change projections at the scale relevant for decision making and management requires the on-going development of appropriate scenarios. To foster the integration of the physical with the socio-ecological dimensions, scenarios need to be developed incorporating economic, social and cultural data. The development of appropriate multi-scale scenarios requires analyses of processes and interactions over a wide range of spatial and temporal scales. This also requires approaches for co-developing and communicating scenarios for potential futures (e.g. Ocean System Pathways (OSPs) or storylines). This objective will examine how global or regional drivers (e.g., fisheries supply chains and global food security) influence communities that depend on local fisheries. Activities will also assess data relating to locally specific value systems that underlie livelihood practices and other human activities, resource use, wellbeing and governance systems.

Key deliverables include:

5. Generation of approaches to provide multi-scale storylines for local communities.
6. Development of coupled socio-ecological models in local areas and regions.

Progress to these three priorities

The development of integrated socio-ecological model systems represents a large community effort. It will rely on IMBeR internal resources (e.g. GCs, regional programmes, IC3&4 and working groups) reinforced by interactions with relevant external initiatives/programmes such as (e.g., FISHMIP, OceanPREDICT). GCII activities include dedicated special sessions at international conferences, the ClimECO summer school and IMBIZO 7. Research results are be made accessible through scientific publications and as fact sheets to be released to stakeholders and policy makers.

Innovation Challenge 3 – To Advance Understanding of Ecological Feedback in the Earth system; This activity led a major session at the Future Oceans 2 - Open Science Conference (2019). It is considering current knowledge and modelling the role of ecological processes in ocean biogeochemical processes and carbon budgets and the wider role in the Earth system.

Challenge connections and delivery

This Grand Challenge is linked to the other IMBeR Grand Challenges, which guide activity in the four IMBeR Regional Programmes and thematic Working Groups. The focus on the development of integrated socio-ecological model systems relies on a tight integration of activities in particular with GCIII, IC4 and the Human Dimensions Working Group.

IMBeR is an international network that facilitates interdisciplinary marine research within three interconnected Grand Challenges in order to achieve sustainable ocean governance for the benefit of society. Sign up to IMBeR via http://www.imber.info to benefit from networking, mentoring and collaborative opportunities with world-class natural and social scientists, practitioners and researchers.

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