Model/Empiricist Integration Workshop Report

1-3 March 2016, Plymouth

Paul Somerfield and Jess Heard

To deliver the overall and specific aims of the Marine Ecosystems Research Programme successfully it was recognised from the outset that integration is key. MERP integration workshops bring together individuals and groups from across the MERP community, providing a space to discuss key issues within areas of work and to connect different groups across the consortium. An action agreed during the two-day MERP integration workshop held at Cheadle House, Manchester, 17-18 November 2015 was to hold a further integration workshop bringing people together for discussions around the data needs of, and outputs from, each particular model being used within MERP. The aim was to link members of modelling groups with those working on, for example, process rates, parameters and patterns in size spectra. This workshop took place at the Plymouth Marine Laboratory, 1-3 March 2016. The agenda may be viewed at the end of this report.

The key aims of the workshop were to:

- Improve direct interaction and dialogue between model developers and empiricists
- Identify over-arching questions/hypotheses we can test by combining the models and data in novel ways

Prior to the meeting, modelling groups updated summaries of their models and shared the information on the MERP sharepoint.

The first morning of the workshop consisted of interactive sessions, at which consortium members could gain a close look at, and some experience of, different models. Members could choose between ERSEM and Strath2E in the first session, and between EwE and Mizer in the second. In the afternoon and the following morning a round-robin approach was adopted, whereby different groups of members could have detailed discussions with those responsible for all the different models employed in MERP, including ERSEM, EwE, FishSums, Mizer, PDMM, SSSM and Strath2E.

Following these interactive sessions, further sessions were intentionally flexible so that discussion and break out needs identified during the interactive sessions could be addressed, helping to promote exchange of knowledge, data and understanding.

Outcomes and next steps:

Module 1 will move towards delivering synthesised data in the near future, probably via the sharepoint. Data management was discussed, and a new data management plan (e.g. clarifying the types of data to be sent to BODC) will be delivered shortly. A workshop bringing together those using existing data and generating new data is being planned for September.

Module 2 will continue the field programme, moving from a focus on patterns in the field to more experimental work later in the year. Data will initially be made available on the sharepoint. There is now a clearer understanding of which data is relevant to which models, and plans are being developed to enhance information flows.

Modules 3, 4 (and 6) held a detailed integration and planning meeting, which developed a separate report available in Appendix 1 and on the MERP website. GES indicators on which MERP will focus were chosen as:

- Marine bird abundance
- Seal abundance
- Cetacean abundance
- Lifeform indicator
- Zooplankton biomass
- Fish abundance and biomass
- Proportion of large fish (LFI)
- Size composition of fish community (Typical Length, replacing LFI)
- Physical damage to benthos
- Winter nutrient concentration
- Chlorophyll concentration
- Water column turbidity.

Some focussed work on informing recovery trajectories, in response to the MERP Defra policy briefing held in February, was planned. Plenary discussion led to agreement in principal to align MERP work with the SSB scenarios (changes in N/P and fishing pressure) in developing future projections which will feed into evaluations of consequences for ecosystem services. The need to crystallise the various models by the autumn is recognised, and to agree forcings rapidly (within 6 weeks or so). Discussion to these ends are ongoing, and there is now a much clearer set of links among modelling groups (including SSB), data providers and data users.

Those working on ecosystem services had the opportunity to refresh their knowledge of the outputs of various models, and to discuss progress with various members of the consortium.

Overall the workshop was considered to be very successful, developing links among partners, sharing knowledge and ideas, and clarifying the next steps to be undertaken. A shared focus on the chosen indicators and the developing scenarios will allow the consortium to move towards its stated goal of developing a system linking data and models to consider the consequences of change brought about by possible management measures in terms of the services the marine ecosystem underpins.

Appendix 1

Report from combined MERP Module 3 & Module 4 workshop on model ensemble analysis and synthesis

2 March 2016

Attendance:

Hayley Bannister (Sheffield)
Paul Blackwell (Sheffield)
Michael Heath (Strath)
Sheila Heymans (SAMS)
Axel Rossberg (Cefas/QMUL)
Sevrine Sailley (PML)
Natali Serpetti (SAMS)
Douglas Speirs (Strath)
Michael Spence (Sheffield)
Johan van der Molen (Cefas)

Agenda:

1. Welcome
2. Results from ensemble modelling so far
3. Linking simulated size-spectrum elasticities to data
4. Differential analysis of driving mechanisms in models
5. Quantifying relaxation time scales and uncertainty for Defra
6. Issues arising
7. Closing

Minutes:

1. The meeting was co-chaired by AR and PB. The chairs welcomed the participants, thankful that all contributors to the MERP Model Ensemble were able to join. HB observed the workshop for her interest in model uncertainty and its communication.

2. Participants discussed the outcomes of the first round of MERP Ensemble modelling. With respect to bottom-up effects, models were found to exhibit trophic amplification coefficients between 0.0 and 0.3. It was found that, due to the complex structure of top-down cascades, a corresponding univariate quantification is more difficult for these. Yet, the ensemble delivered an important first outcome: for all ensemble members that span a sufficiently large range of species body-sizes (EwE, SSSM, PDMM, StrathE2E) top-down cascades were strongly attenuating: overexploitation of large fish (> 1 kg maturation size) did not lead to practically measurable effects on zooplankton or phytoplankton abundance. This result was one of several examples of policy-relevant MERP outputs discussed in a recent (23 Feb 2016) meeting among representative of MERP and Defra in London.

3. Different routes to obtaining reliable empirical values for trophic amplification coefficients within MERP were discussed. The workshop agreed that archive data obtained through Module 1, spanning large spatial and temporal scales, appear promising in conjunction with ongoing measurements within Module 2.

4. Participants agreed to postpone work to analyse the mechanisms causing discrepancies in trophic amplification coefficients among models to after empirical data for these coefficients was available, do avoid empirically unfounded deterioration of diversity amongst models in this process.

5. At the recent MERP/Defra meeting in London, Dominic Pattinson (Defra) pointed out the policy need for estimates of the time it takes to reach new, improved environmental states as a result of

reduce fishing effort under the revised Common Fisheries Policy, and of current scientific uncertainty of this time. The information will be needed for indicator assessments to be drafted by the end of the year. The workshop decided to address this question using the MERP Model Ensemble. Outlines of a common protocol for interrogating ensemble members were developed by the workshop. The workshop's choice of the protocol was determined by the need for a simple set of rules applicable to all models, while maintaining sufficient realism to generate the policy-relevant information to the required accuracy. Outlining the protocol in brief, models will be run with fixed fishing mortalities representative of the period 1985-1999 until they reach a dynamic attractor or fixed point. Then all fishing mortalities are then reduced by a fixed proportion, chosen to be representative of the relative changes in fishing mortalities between 1985-1999 and ICES proposal for FMSY published in 2015, for stocks where this data is available. Model simulations are then continued and values of approximations of UK MSFD indicators (e.g. LFI) in the models tracked throughout the simulations. The times are recorded when these reach values close to, e.g. within 10% of, the new equilibrium values. The outputs for these relaxation times are integrated using dedicated statistical methods developed within Module 4. A detailed protocol will be prepared by AR and circulated among model operators for comments.

6. The question arose for which UK MSFD indicators next to LFI it could be interesting to determine their relaxation times. The workshop obtained a recent list of UK MSFD indicators and identified among these those which one or more MERP model can represent to some approximation (irrespective of the question whether they are affected by changes in fishing mortality rates).

These where

- Marine bird abundance
- Seal abundance
- Cetacean abundance
- Lifeform indicator
- Zooplankton biomass
- Fish abundance and biomass
- Proportion of large fish (LFI)
- Size composition of fish community (Typical Length, replacing LFI)
- Physical damage to benthos
- Winter nutrient concentration
- Chlorophyll concentration
- Water column turbidity

7. The workshop agreed to continue work in Modules 3 and 4 through correspondence.

Marine Ecosystems Research Programme

Model/Empiricist Integration workshop Agenda

1-3 March 2016, Plymouth

The key aims of the workshop are to:

- Improve direct interaction and dialogue between model developers and empiricists
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1st March, Day 1

9:00 Welcome and introduction

Morning sessions: Hands on Model play session

Interactive sessions giving everyone a chance to get hands on experience working with MERP models. Participants will be able to interact with two of the following models: ERSEM, StrathE2E, MIZER and EwE (short model summaries of these are available at http://www.marine-ecosystems.org.uk/Research/Ecosystem_Models

9:15-11:00 Session 1: ERSEM or StrathE2E

11:00 – 11:30

11:30 13: 15 Session 2: MIZER or EwE

13:15 – 14:15 Lunch

Afternoon: Model round robin

Each model will have a different station. Participants will circulate in small groups (2-3 people with similar research expertise) to discuss synergies and how to work together. 45 mins with each model.

Models included: ERSEM, EwE, FishSums, MIZER, PDMM and SSSM, StrathE2E

Throughout the day future discussion topics and breakout sessions will be identified as they arise and will be built into the agenda for the latter part of the meeting.

14:15-15:45 Round robin 1 and 2

15:45 Break

16:00-17:30 – Round Robin 3 and 4

2nd March, Day 2

9:00 Welcome back, feedback from day before, any adjustments to agenda needed

9:15-10:00 Round Robin 5

10:00-10:45 Round Robin 6

10:45 Break

11:15-11:45 Feedback from round robins, planning of breakout sessions.

11:45-12:45 A practical introduction to Bayesian inference – Mike Spence and Paul Blackwell

The aim of this session is to show empiricist how to make robust statements about uncertainty when giving modellers inputs.

13:00 Lunch

Afternoon: Plenary and breakout sessions

Plenary sessions followed by structured breakout groups, potential topics along with those suggested during the meeting:

- Refining data (including addressing suitable metrics)
- Exchanging and working with data
- Developing hypotheses and gaining a deeper understanding of what data exist. A two way conversation to help both theorists and empiricists understand how they can work together.
- Linking models to Ecosystem services: which model for which service
- Using Bayesian analysis across MERP
- Agreeing common scenarios (representatives from each model)
- Incorporating issues such as population consequences of anthropogenic influences into the models
- Process modelling

14:00-16:00 Plenary/Breakout sessions

16:00 Break

16:30-17:30 Breakout sessions

Suggestions for plenary or breakout sessions in advance of the workshop are very welcome - please contact Jess Heard jessh@pml.ac.uk)

3rd March

9:00 Morning: Plenary and breakout sessions continued

Feedback and open discussion

Final sessions will likely focus on data exchange, playing with data and discussion of potential problems with data. Here we would really like to drill down to the use of the data while all modellers and empiricists are still in the same room.

12:00 Next steps, future meetings etc