RLRAG 41 Agenda Item 6: Australian Lobster Model (OzLob) development - March 2024

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Progress since last RAG

- Estimated initial biomass from forward projections.
- Implemented changes in the model structure to include additional variables (initial density-dependent mortality).
- Engaged with South Australia to move forward with Australia-wide discussions and development of OzLob.
- Development of additional output graphs, including selectivity (to be used in proposed on-going model development work).

Recommendations for on-going model development

- **Work on the base model**
  - Continue to refine initial conditions estimates.
  - Test addition of CPUE from fishery independent data (survey).
  - Work on updating the selectivity parameters.
- **Work on the projection model** (*highest priority*)
  - Include testing of both biological and management scenarios. Example of biological scenario is different levels of recruitment into the future. Example of management scenario would be setting different TACs.
  - This will allow us to test specific scenarios and get an estimate of biomass and egg production into the future.
  - It will also allow the harvest strategy rules to be incorporated in the model run, similar to the current setup for quick TAC setting.

Background

A new age- and length-based stock assessment model has been developed for use in the Western Rock Lobster Fishery (WRLF) by Prof. André Punt (CSIRO & University of Washington) and Dr. Simon de Lestang (Department of Primary Industries and Regional Development (DPIRD), Western Australia). This model is called the Australian Lobster Model (OzLob) and has deliberately been developed as a 'generalised' model – this means it can be applied to several different fisheries, as opposed to a custom-made model only fit for one fishery in one jurisdiction.

A collaboration between DPIRD and IMAS has allowed the testing and development of OzLob for the Victorian Western Zone SRL fishery. A similar process is occurring simultaneously for Tasmania's SRL fishery. DPIRD has been investigating the use of Stock Synthesis on lobster populations in Australia as part of the model selection process. Stock Synthesis is an 'off-the-shelf' integrated age- and length-structured stock assessment, developed and supported by NOAA.

The aim during development is that one stock assessment model is used across all (Southern) Rock Lobster fisheries in Australia.

In this update, the comparisons with the current model outputs are displayed graphically. Quantitatively comparing the two outputs is premature at this point as further work is required to align the starting state of the fishery for the two models and produce comparable unfished biomass estimates.

The updated model is using all length-frequency, catch, and effort data available and so we have a full comparison to the current model.

This model run utilises similar initial conditions to the current model, and running the projection model has allowed us to understand that our estimate of virgin biomass is reasonable. To test our virgin biomass estimate was within reasonable bounds, we ran the projection model forward for 40 years with zero fishing to reach maximum biomass.

The projection model requires further work, as currently there are several parameters that are unable to be fixed - e.g. recruitment. The projection model also requires harvest strategy scenarios to be able to be run for TAC-setting processes, or management scenario testing. This will be developed over the next few months.

Model development has just started for Tasmania. Klaas and I are scientific members of the Tasmanian Rock Lobster Harvest Strategy Working Group.

Updated Graphs and Comparison to current model outputs:

Egg Production

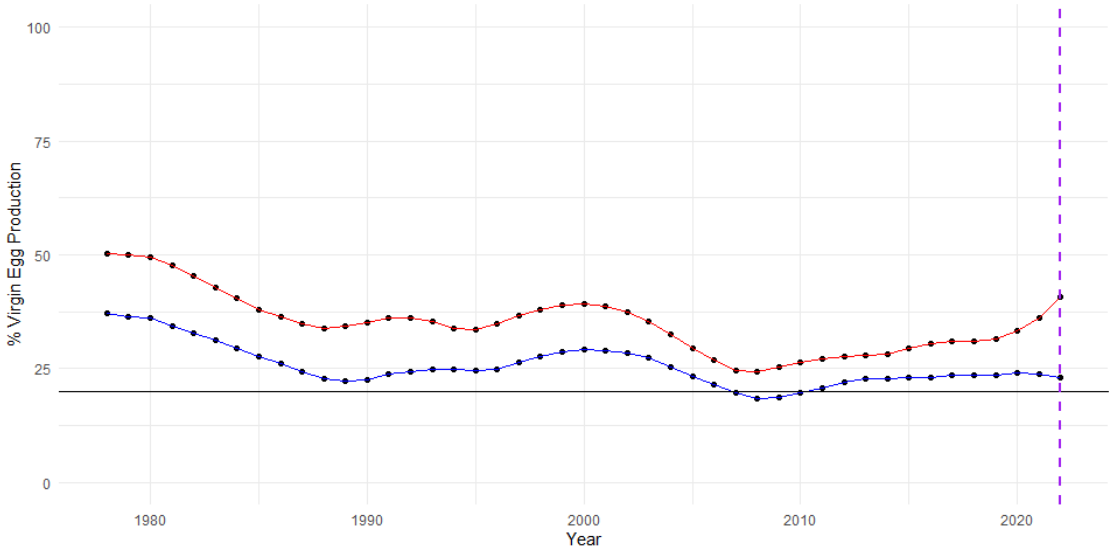

Figure 1: % Virgin egg production over time – a comparison of % egg production between the new (red) and current (blue) models. The purple dashed line shows the last season for data input into the model.

Figure 1 shows a % of virgin egg production in the Western Zone Rock Lobster fishery in Victoria over time. The graph shows estimated % egg production (as a % of virgin egg production) from both the current (blue) model, and OzLob (red). Estimated % virgin egg production is consistently higher in OzLob compared to the current model, however trends are consistent between the two models. comparative estimated egg production (% of virgin egg production) between OzLob (red), and the current model (blue).

There is a general increase in egg production estimates in the last three years of the model.

Biomass estimates

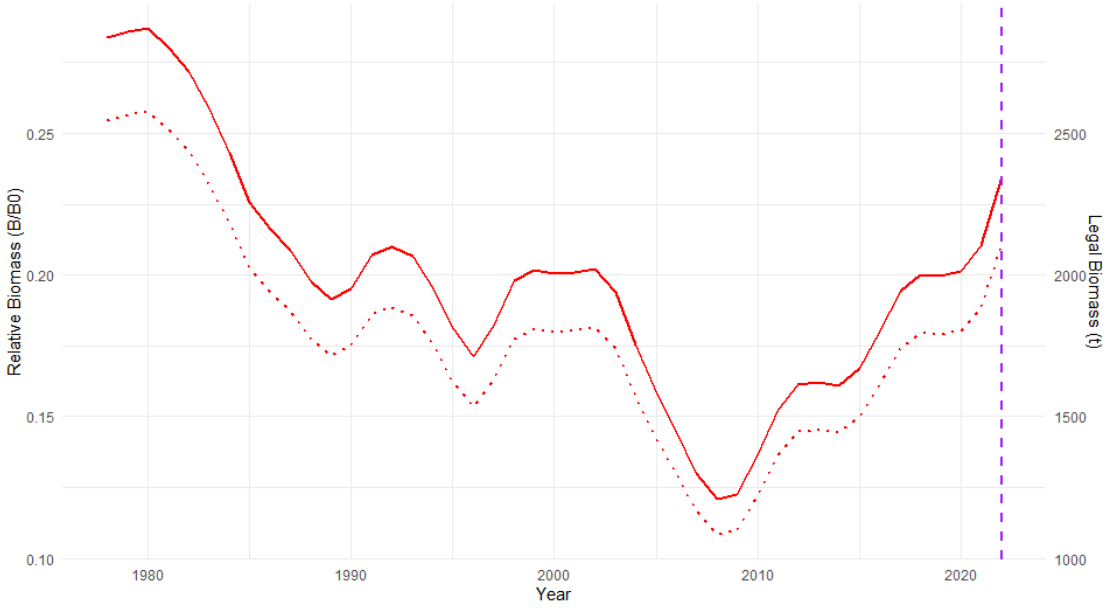

Figure 2: Estimated relative legal biomass (B0/Bcurrent) and current legal biomass (t) for the Western Zone Rock Lobster fishery in Victoria as estimated from OzLob.

Current biomass estimates and relative biomass (to B0) show a steady increase in biomass since 2010. Relative biomass is currently estimated to be 0.21, with biomass estimated to be around 2348 tonnes. These estimates may change with further model development, and are only included for comparison to the current model.

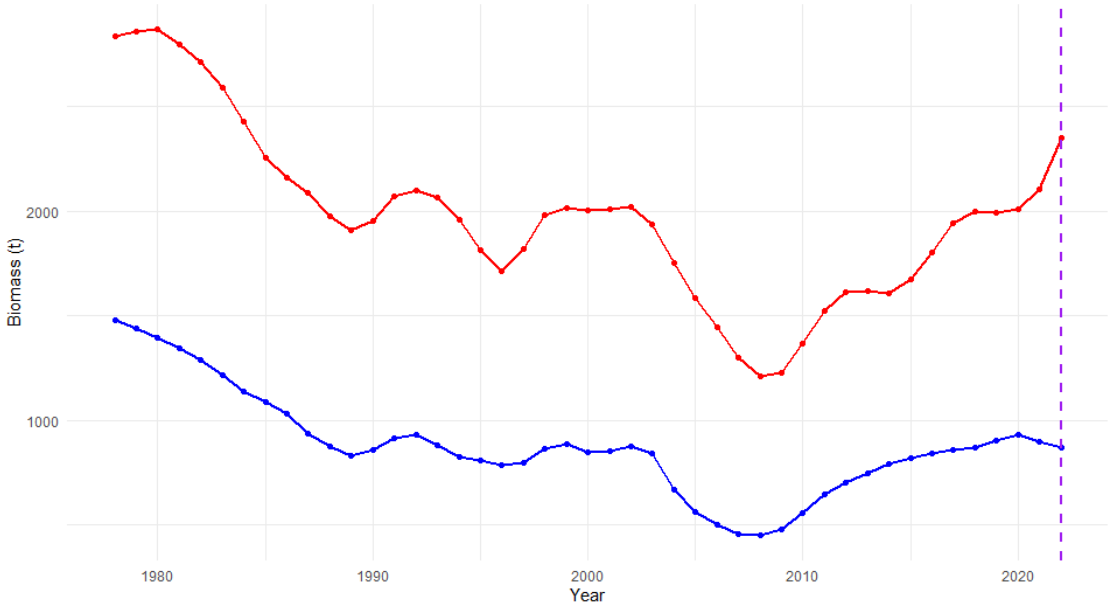

Figure 3: Biomass estimates of legal (mature) sized lobsters in the new (red) and old (models).

Biomass estimates from OzLob (red) and current (blue) models are relatively different in this running of the model (Figure 2), although they follow similar trends. There is an up-tick in the final year of the model (*2022*), similar to in the egg production estimates (Figure 1). The main reason behind the difference in estimated biomass within the lobster population is likely to be the differing estimates of virgin biomass. To account for this, a biomass index was calculated (biomass / mean biomass) to more accurately compare estimates from the current model and OzLob.

When the comparative biomass index is plotted (Figure 4), it is clear that the two models are estimating the same trends in population biomass, giving confidence in OzLob model outputs.

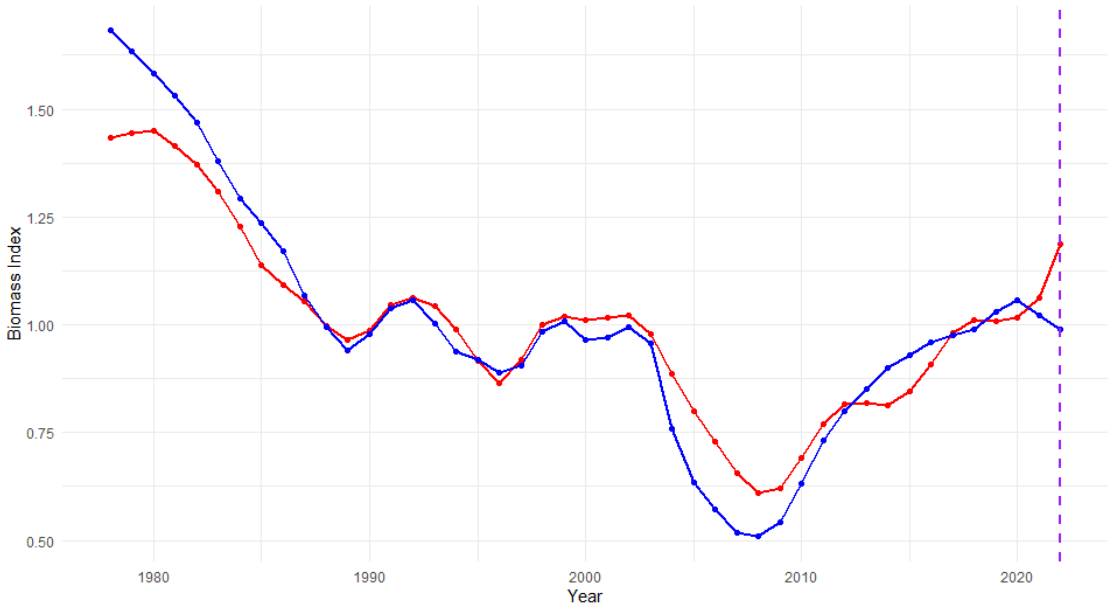

Figure 4: Comparative biomass index between the current (blue) model and OzLob (red) showing trends in population biomass over time in the Western Zone Rock Lobster fishery.

Recruitment

OzLob estimates of recruitment over time also show a dip in mean recruitment over time (Figure 5). The blue dashed line shows mean recruitment in the period *1978 - 2019*, and the black dashed line shows mean recruitment in the period *2000-2019*. Estimates of recruitment in the last three years of the model are unlikely to be informative.

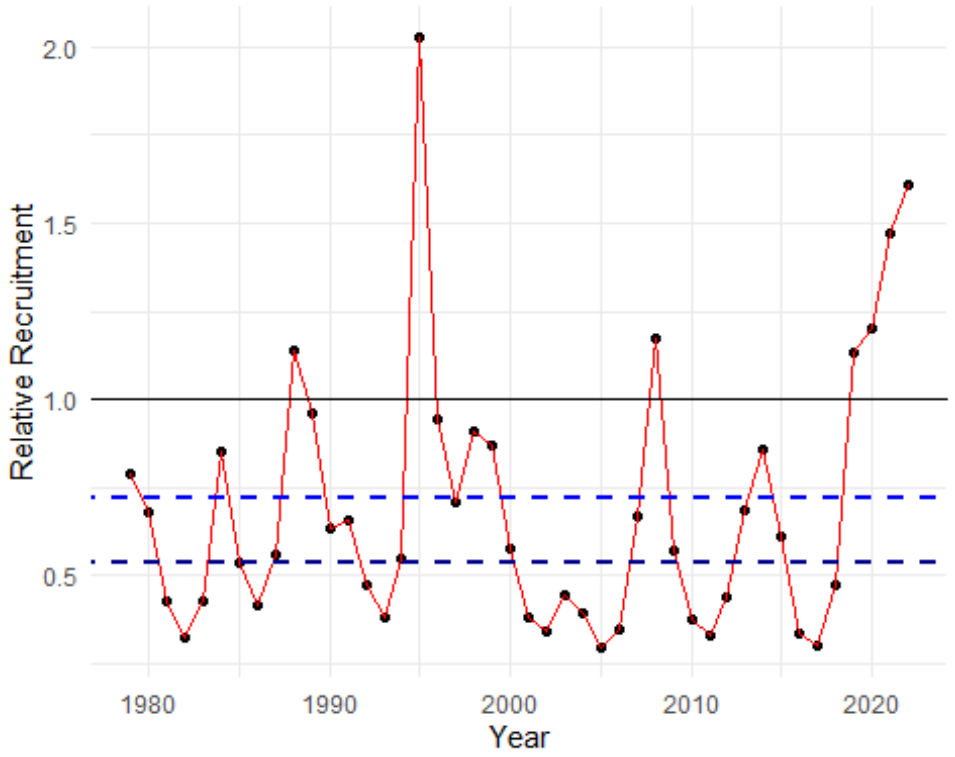

Figure 5: Model estimated relative recruitment through time in the Western Zone Rock Lobster fishery. The blue dashed line shows mean estimated recruitment from *1978-2019* and the black dashed line shows mean estimated recruitment from *2000-2019*.