Extracts From BENEFIT Workshops of Recommendations and Panel Comments Regarding the West Coast Rock Lobster

BENEFIT / NRF STOCK ASSESSMENT WORKSHOP NOVEMBER 2001

Recommendations

E.1 (H, 6). The data should be examined for spatial structure.
E.2 (H, 6). A rock lobster working group meeting (or workshop) is needed at which all information on an areal basis can be collated and results of an initial data exploration presented.
E.3 (H, 6). Replacement yield trajectories, biomass trajectories, and results for a zero TAC and longer time horizons should be presented to assist in understanding the behavior of the OMP.
E.4 (H, 6). Assumptions about changes in productivity based on a delay-difference model should be examined.
E.5 (H, 6). OMPs based on a fishery that harvests males only and the associated implications, should be developed and evaluated.
E.6 (H, 6). The problems with the tagging database needed to examine the impact of time-at-large on somatic growth should be rectified.
E.7 (M, 6). The areal assessments conducted in the early 1990s should be re-examined and perhaps extended using new data.
E.8 (M, 6). Regional stock assessments should be conducted based on the results of the above three analyses.
E.9 (M, 6). An attempt should be made to modify the Shepherd form of OMP to perform better for robustness tests that involve changed future levels of recruitment.
E.10 (M, 6). Variants of models that force recruitment to generally lie above the replacement line and which estimate additional selectivity parameters should be considered.
E.11 (M, 6). Re-code the assessment software using the ADMB package.
E.12 (L, 6). The relationship between egg production and size should be investigated further, perhaps using information for similar species such as *Jasus edwardsii*.

Comments by the review panel

The panel commended the quality of the science presented on South African rock lobster. The panel was pleased to note the progress with reconciliation of code, and the good performance shown by the "Shepherd" OMP. The panel reiterated the importance of exploring spatial structure in the historical data and approaches to stock assessment that allow for variation in population dynamics regionally, as it believes this to be the most promising avenue to resolve many of the current uncertainties in the assessment.

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Recommendations

D.1 (H, 3.4). The workshop agreed that there are no biological reasons that justified continued closure of the EoH area to lobster fishing and that making allocations in the area are likely to have clear socio-economic benefits.

D.2 (H, 5). Dis-aggregation of catch and CPUE data have confirmed the need for a spatially-explicit assessment of the resource. Efforts to examine other disaggregated data (e.g. catch-at-length) should continue for assessment purposes.

D.3 (H, 5). The methods in BEN/DEC02/WCRL/3 and in BEN/DEC02/WCRL/9 should be compared by applying them to the same dataset.

D.4 (H, 5). The development and parameterization of a spatially-explicit size-structured operating model should continue. This should include estimating trends in somatic growth for each of the three areas on which the preliminary analyses in BEN/DEC02/WCRL/5 were based.

D.5 (H, 5). Conduct additional analyses to identify whether the procedure in BEN/DEC02/WCRL/2 really has eliminated the "time-at-large effect".

D.6 (H, 5). A GLMM should be applied to the "new" database using the original moult period definitions, and also definitions wider than proposed in BEN/DEC02/WCRL/2, to assess whether the "time-at-large effect" had really been removed by the BEN/DEC02/WCRL/2 approach.

Comments by the review panel

The panel noted that considerable work had been done to address the recommendations from the November 2001 BENEFIT workshop. As before, the panel was impressed by the efforts by MCM, UCT and OLRAC scientists to prioritize research activities based on the recommendations identified during the BENEFIT workshops. The panel noted, however, that there had been inadequate time to fully review all the material on West Coast rock lobster submitted to the workshop due to time constraints and that this needed to be considered when preparing material for species previously reviewed when planning future BENEFIT workshops.

The panel noted that the exploration of spatial patterns in the data and of the results of spatially-structured age-aggregated assessments confirmed the importance of moving to a spatially-explicit assessment framework in future. It re-iterated the importance of continued work to disaggregate data spatially and to develop appropriate spatially-explicit assessment methods, within the confines of management-related priorities. When developing spatially-explicit assessments, consideration should be given to how the different areas included in the model are linked. For example, one plausible model is that there may be a common larval pool that "feeds" all of the areas.

REFERENCES

BEN/DEC02/WCRL/2: The male West Coast rock lobster revised growth database (Glazer and Butterworth)

BEN/DEC02/WCRL/3: The use of mixed linear ("random effects") models to standardize the male west coast rock lobster somatic growth trend with time in a manner that allows for differences in magnitude and fluctuations in trend between locations (Brandão and Butterworth)

BEN/DEC02/WCRL/5: Initial results of a surplus production modeling approach for three spatially disaggregated components of the West Coast rock lobster resource (Johnston and Butterworth)

BEN/DEC02/WCRL/9: Further annual somatic growth rate estimates for male West Coast rock lobsters based on a moult probability model (Bergh, Barkai and Jappie)

APPENDIX

BEN/DEC02/WCRL/1: Recommendations arising from the BENEFIT 2001 workshop concerning the South African West Coast rock lobster (Johnston and Butterworth)

Appendix

Recommendations arising from the BENEFIT 2001 workshop concerning the South African West Coast Rock Lobster

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The following represent the agreed recommendations arising from the discussions held at the November 2001 BENEFIT workshop. Each recommendation was ranked High (H), Medium (M) or Low (L) by the workshop participants based on the importance of the recommendation in terms of its likely impact on management decisions, and its feasibility. Brief comments on progress made follow each recommendation.

1 (H). The data should be examined for spatial structure.

BEN/DEC02/WCRL/4 presents a spatial analysis of hoopnet and trap CPUE data. The data were examined for six Areas: Areas 3, 4, 5, 6, 7 and 8, with Area 3 being the most northern, and Area 8 being the most southern (refer to the map in Figure 1 of BEN/DEC02/WCRL/5). Results showed the following:

- CPUE trends for each area appear to be similar for both trap and hoopnet gear types.
- CPUE in more recent times (1992-2000) is much lower than previously (1981-1991) for Areas 4 and 5 (even with the reduction in size limit which occurred in 1992).
- This trend is reversed for Area 8 (and to a lesser degree for Areas 3 and 7).
- Area 6 is somewhat intermediate, showing neither a strong increase nor decline in CPUE over time.
- Ignoring the northern most Area 3 the authors conclude that there does seem to have been some trend down the coast of resource depletion, with the greatest depletion in the northern Areas and the least in the more southern region, where Areas 7 and 8 show a recent increase subsequent to the effect from the size limit reduction in 1992.

2 (H). A rock lobster working group meeting (or workshop) is needed at which all information on an areal basis can be collated and results of an initial data exploration presented.

No specific meeting has been held for this purpose, but the matter has been discussed at a number of rock lobster Working Group meetings (see 1 and 8 of this document).

3 (H). Replacement yield trajectories, biomass trajectories, and results for a zero TAC and longer time horizons should be presented to assist in understanding the behaviour of the OMP.

BEN/DEC02/WCRL/7 deals with this topic. Figure 1 thereof compares projected TACs, biomass above 75mm, replacement yields, and MSY values for a number of different OMPs. Projections under a zero harvest are included. These results are for the reference case set of future assumptions as currently defined.

4 (H). Assumptions about changes in productivity based on a delay-difference model should be examined.

No progress made. (Item 8 below was considered a pre-requisite for this.)

5 (H). OMPs based on a fishery that harvests males only, and the associated implications, should be developed and evaluated.

BEN/DEC02/WCRL/7 deals with this topic. Key results are as follows:

- The percentage females in both the trap and hoopnet commercial catches are currently very small (less than 2%).
- As so few females are estimated to be caught in the future, switching to a male-only fishery will have virtually no impact on the resource.
- Future changes in egg production are estimated to be primarily determined by the somatic growth rate scenario assumed.

6 (H). The problems with the tagging database needed to examine the impact of time-at-large on somatic growth should be rectified.

This has been thoroughly investigated, and results are presented in BEN/DEC02/WCRL/2. Results analyzed using random effects models are presented in BEN/DEC02/WCRL/3.

7 (M). The areal assessments conducted in the early 1990s should be re-examined and perhaps extended using new data.

8 (M). Regional stock assessments should be conducted based on the results of the above three analyses.

BEN/DEC02/WCRL/3 presents a summary of areal assessments conducted in the past. These include the following:

- An assessment which estimated egg production of the southern grounds (Areas 3-8) of the resource compared to the more nothern areas. This study concluded that under a worst case scenario, the lowest the egg production values in the southern grounds would reach under a 75mm minimum carapace size limit is 41% of pristine levels.
- Estimates of sustainable yield and current status of sub-stocks of West Coast rock lobster were produced. Two types of models were fitted to data for each Area (a surplus production model and a size-structured model). These results showed that fits to the CPUE data for Areas 3, 4, and 5+6 appear to be rather poor. It was also estimated that the MSY for the resource as a whole (for 89mm legal size) is around 5000-6000 MT, whereas the sum of the individual area MSY's are about 4000 MT for the size-structured and 5000 MT for the surplus production models. [Note that these MSY estimates correspond to the historic high somatic growth rate!]

The rock lobster Working Group decided to split the resource into three areas for further "areal assessments". BEN/DEC02/WCRL/5 presents initial surplus production analyses for these three areas based upon the Schaefer-like model with surplus production function $rB(1-B/K)^{\nu}$. The three areas to be modeled separately are Zones 3+4+5+6 (termed Area 3-6), Zone 7 (termed Area 7) and

Zone 8 (termed Area 8). Data for these 3 areas are also combined to form the "West Coast as a whole" (termed "Combined" scenario). A surplus production type model, which takes into account changes in the surplus production due to changes in somatic growth, is fitted to CPUE data for each of the three areas, as well as for the combined area. Results showed the following:

- The best fit to data is for Area 8, although a very large value of r is estimated (r = 0.5, the upper bound imposed).
- The biomass estimates for Area 8 seem unrealistically high.
- Heavy current depletion is indicated for Areas 3-6 and 7.
- Results of these disaggregated analyses, when summed over the three Areas, reflect an overall resource status somewhat (but not much) better than for a comparable analysis aggregated over all the Zones.

9 (M). An attempt should be made to modify the Shepherd form of OMP to perform better for robustness tests that involve changed future levels of recruitment.

No further progress made. This item will be pursued early in 2003 when the present OMP revision process reaches the stage of simulation testing of candidate management procedures.

10 (M). Variants of models that force recruitment to generally lie above the replacement line and which estimate additional selectivity parameters should be considered.

Some progress has been made – see BEN/DEC02/WCRL/6. Here the authors compare two alternate models of the resource, both of which are able to explain the observed data with a similar degree of precision. Model 1 is very similar to the current assessment model of the resource, and estimates that there has been substantial depletion of biomass since the pristine state (current egg production is estimated to be only 21% of the pristine level). Model 1 places no constraint on recruitment to lie above the replacement line, and the resultant stock-recruit function shows that recruitment lies below the replacement line for a long period. Model 2 on the other hand, imposes a constraint on recruitment to lie on or above 80% of the replacement line. Model 2 also has five further estimable parameters (associated with female selectivity functions). Model 2 estimates there to have been relatively little depletion of the female spawning biomass, and estimates current egg production to be about 70% of pristine. Model 2 also estimates both the trap and hoopnet female selectivity to be very small for large female lobsters – i.e. Model 2 suggests that a large "cryptic" biomass of female lobsters is present. The plausibility of this scenario needs further debate.

11 (M). Re-code the assessment software using the ADMB package.

Johnston has made no progress on this substantial exercise as yet, but investigations into use of alternate minimisation routines (more easily implemented than the ADMB conversion and possibly quicker than AMOEBA) such as a Fletcher algorithm is underway.

12 (L). The relationship between egg production and size should be investigated further, perhaps using information for similar species such as *Jasus edwardsii*.

No progress made.