The projected range of total sardine biomass

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Figure 1 shows the histogram of the projected range of future hydroacoustic survey estimates of sardine 1+ biomass that were simulated during the testing of OMP-08 (de Moor and Butterworth 2008) and Interim OMP-13 v2 (de Moor and Butterworth 2013). Assuming a single sardine stock hypothesis, the cumulative simulated probability of obtaining a survey estimate of sardine 1+ biomass of less than 750 thousand tons was simulated to be 21% under OMP-08 and 29% under Interim OMP-13 v2. Assuming a two sardine stock hypothesis, the cumulative probability of obtaining a survey estimate of sardine 1+ biomass of less than 750 thousand tons was simulated to be 86-87% under "*MoveE*[1]" and "*MoveB*[2]" and 24% under "*NoMove*[3]".

Historically (1984-2012) 62% of survey estimates of sardine 1+ biomass have been below 750 thousand tons (Figure 1), with 6 out of the past 7 years being under this threshold.

There exists a general protocol for OMPs for South African fisheries which cater for unanticipated events and can lead to the initiation of a review of an OMP ahead of schedule (see Appendix 2 of Rademeyer *et al.* 2008). An "Exceptional Circumstance" in this light would be if realised survey estimates of abundance are appreciably outside the bounds predicted during the OMP testing, where the norm would typically be 90% to 95% PI.

The lower 5%ile of the distribution is 311 thousand tons under OMP-08, 275 thousand tons under Interim OMP-13 v2 assuming a single stock hypothesis, 323 thousand tons under Interim OMP-13 v2 assuming a two stock hypothesis and *NoMove*, and 22-23 thousand tons under Interim OMP-13 v2 assuming a two stock hypothesis and *MoveB* or *MoveE*. The lower 10%ile of these distributions increase to 472, 404, 450 and 32-33 thousand tons, respectively.

The November 2012 survey estimate of 345 thousand tons was thus in the lower 6%ile of OMP-08 projections, lower 7.5%ile of Interim OMP-13 v2 projections assuming a single stock hypothesis and

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[1] Future movement of "west" stock recruits to the "south" stock switches between increasing or decreasing towards an equilibrium proportion based on whether a favourable or unfavourable environment exists on the south coast.

[2] Future movement of "west" stock recruits to the "south" stock is based on a relationship with the ratio of "south" to "west" stock 1+ biomass.

[3] No future movement of "west" stock recruits to the "south" stock.

lower 6%ile of Interim OMP-13 v2 projections assuming a two stock hypothesis with no future movement.

Figure 2 shows the distributions of survey estimates of sardine 1+ biomass that were simulated for Novembers 2012[4], 2013 and 2014 and show the beginning of the divergence in projections for the difference hypotheses.

References

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Rademeyer, R.A., Butterworth, D.S. and Plaganyi, E.E. 2008. A history of recent bases for management and the development of a species-combined Operational Management Procedure for the South African hake resource. African Journal of Marine Science 30(2):291-310.

[4] Projections start in November 2011.

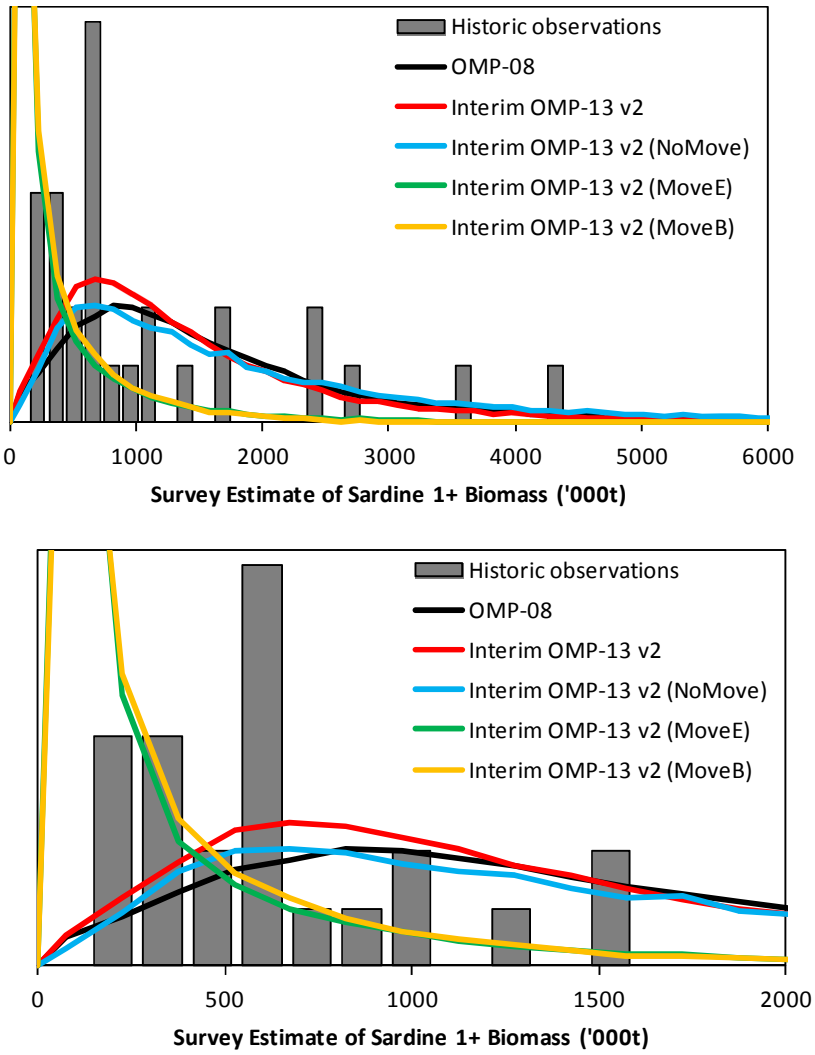

Figure 1. The histogram of simulated future survey estimates of 1+ biomass under OMP-08 (assuming a single sardine stock) and Interim OMP-13 v2, assuming either a single sardine stock or a two stock operating model with different movement hypotheses. The bar graph shows the histogram of historic (1984-2012) hydroacoustic survey estimates.

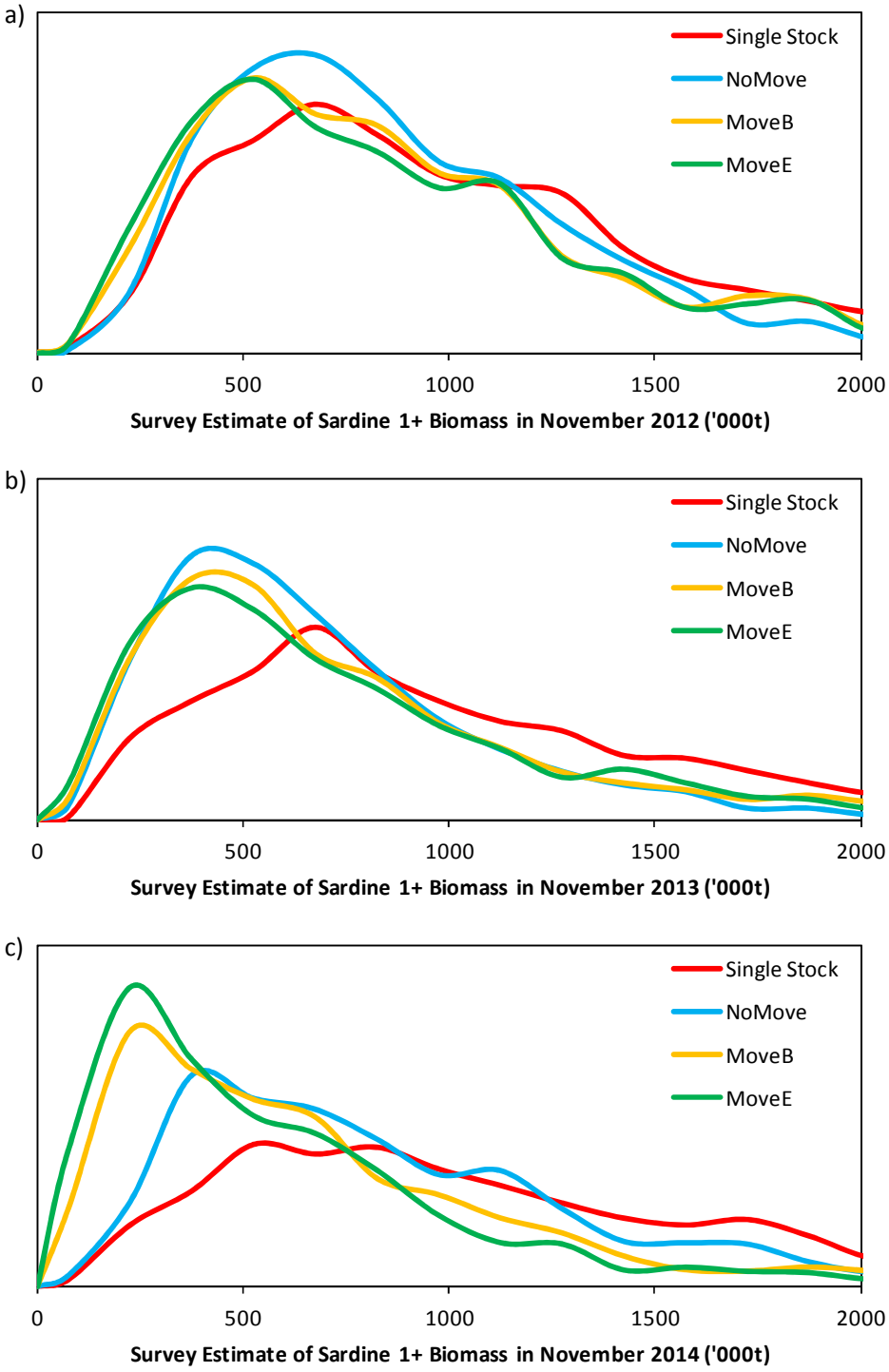

Figure 2. The histogram of simulated future survey estimates of 1+ biomass in a) November 2012, b) November 2013 and c) November 2014 under Interim OMP-13 v2, assuming either a single sardine stock or a two stock operating model with different movement hypotheses. The observed survey 1+ biomass in November 2012 was 345 000t.