List of Suggested Robustness Tests for the "New Reference Case" (RC) Hake Assessment

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November 2009

Note that each suggested test is followed by parenthesis containing a number and then a letter .The meaning of these are a follows:

> ***Number*** (1/2/3): This is the relative priority accorded to these tests in getting them run.
>
> ***Letter*** (H/M/L for High/Medium/Low); This reflects a first attempt at suggesting relative plausibilities for the assumptions underlying these tests.

These assignments are frequently but not always highly correlated. In some cases though, an L assignment reflects the fact that results hardly differed from the RC, so that there is little benefit from pursuing that test further.

A. Data input options

Catches

A.catches.1: Offshore trawl (pre 1978): Alternative choices for the central year of the period when the fishery changed from primarily *M. capensis* to primarily *M. paradoxus* (i. 1940, ii. 1950, iii. 1960, iv. 1965, v. 1970 and vi. 1975) (**1/H**)

A.catches.2: Including discards. Discarding by offshore and inshore trawlers is modelled as an increase in the commercial selectivity of 0.2 for ages 1 and 2 for *M. capensis* and *M. paradoxus*; the loss of fish from longlines is also included by doubling *F* from this fleet. (**2/M**)

CPUE

A.CPUE.1: Changes in efficiency the CPUE series because of the introduction of navigational aides; split series in 11994/995 (**1/H**)

A.CPUE.2: Include all offshore companies (or offshore vessels) in CPUE standardisation rather than only those companies operating since 1994. (2/M)

A.CPUE.3: Alternative depth stratification (**1/H)**

A.CPUE.4: Omit days with nominal CPUE=0. (**2/M**)

A.CPUE.5: Exclude West Coast most northern area. (**3/L** – as scarcely differs from RC)

A.CPUE.6: δ parameter 20% of the average CPUE for each species respectively (instead of 10%) (**3/L** – as scarcely differs from RC)

A.CPUE.7: Add drag duration as a co-variate (**3/L** – as scarcely differs from RC)

Surveys

A.survey.1: Calibration factor between old and new *Africana* gear (**2/M**)

A.survey.2: Sub-stratification of one south coast stratum for lower variance estimates. (**3/L**)

A.survey.3: Adjust survey estimates to take account of environmental co-variates. (**3/H** – as addressing this is a longer term project)

Age and length data

A.length.1: Ageing out by 1 year for *capensis* and *paradoxus* (**1/M**)

A.length.2: Ageing of capensis to be halved (**2/L**).

B. Model assumptions

Selectivities

B.sel.1: Alternative slope assumptions. (**1/H**)

B.sel.2: Alternative assumption re *M. capensis* offshore selectivity (RC: as inshore, shifted 10cm with slope of 1/3 of inshore slope) (**1/H**)

B.sel.3: Alternative assumption re south coast female *M. paradoxus* selectivity scaling factor. (**2/M**)

Natural Mortality

B.M.1: Alternative upper bounds on natural mortality at age (i. upper bounds of 0.5 and 0.3 on ages 2 and 5 respectively, ii. Upper bounds of 1.0 and 0.5 on ages 2 and 5 respectively). (**1/H**)

B.M.2: Gender-specific natural mortality. (**3/L**)

Stock-recruitment relationship

B.SR.1: Ricker stock-recruitment function. (**1/H**)

B.SR.2: Alternative σ_R values. (**1/H)**

B.SR.3: Fixed rather than estimated steepness values (to 0.7 for both species) (**1/H**)

B.SR.4: Alternative maturity at length combined with fixed lower *h* values. (**2/M**)

C. Others

C.others.1: Assessments commencing in 1978. (**1/H**)

C.others.2: Changes in past *K* values over time (30% linear decrease over 1980 to 2000) (**1/H**)

C.others.3: Forced rather than estimated current depletions. The RC's estimated depletions are 0.22 and 0.50 for *M. paradoxus* and *M. capensis*. Alternative values used are 0.1 and 0.4 for *M. paradoxus* and 0.3 and 0.1 for *M. capensis* (**1/H**)

C.others.4: Retrospective (2 yrs back only) (**1/na**)

C.others.5: Alternative weighting for age data (**2/M**).

This list does not currently include options related to uncertainties about stock structure and spawning potential computation. These are currently excluded because:

a) Consideration of the possibility of population extension into Namibia requires data on Namibian fishery catches and surveys. Acquisition of such data is being pursued but there are no reports of likely imminent availability. Furthermore genetic analyses have now confirmed the existence of more than a single reproductive unit for both M. capensis and M. paradoxus, off South Africa and Namibia, though these analyses need to be developed further given additional samples before any inferences about boundaries might be possible.

b) Female spawning biomass for a given length-specific maturity schedule is used as the default. Variations attempted on this in the past (e.g. to mimic older fish having greater spawning frequency or producing more viable eggs) had very little impact on results, probably primarily because of the generally high stock-recruitment steepnesses estimated/

Extra data perhaps to be included in updated Reference Case/Set

If timeously and satisfactorily available, the following could be included in an updated Reference Case/Set:

RC.1: Offshore trawl (1978-2009): Update of species-split algorithm given data for the last few years;

RC.2: Alternative inshore trawl catch species split (assume 20%? *M. paradoxus*);

RC.3: Inshore trawl CPUE series;

RC.4: Longline CPUE series;

RC.5: Information on the gender-split and species-split of the longline catches;

RC.6: Recent longline length distribution data.

RC.7: Recent *Nansen* surveys (the SA portion of the trans-boundary cruises)

RC.8: Other commercial length data

RC.9: Further age-length data

There is also a commitment to consider catch-effort data possibly amended after rewriting of the code that produces the data needed to GLM standardisation of CPUE and species-splitting of the catch for the offshore trawl fishery to check existing extracts. This process is targeted for completion by the end of 2009.