Summary of 2013 hake assessment to provide Operating Models for testing OMP-2015, and of the existing OMP-2011

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1. Data

The following data are used in the 2013 hake assessment:

Catches

- four fleets: offshore trawl, inshore trawl, longline, handline
- species-split carried out external to the model:
  - i. Offshore trawl: - pre-1978: (no depth information) assume proportion of *M. capensis* follows a a logistic function
    - post-1977: using size-based species proportion-by-depth relationship
  - ii. Inshore trawl fleet: assumed 100% *M. capensis*
  - ii. Longline fleet: assumed 100% *M. capensis* on the SC, and 30% *M. capensis* on the WC.
  - iii. Handline fleet: assumed 100% *M. capensis*.

CPUE

- two historic species-aggregated offshore trawl CPUE series (SC (1969-1977), WC(1955-1977))
- four GLM-standardised offshore trawl CPUE series (WC/SC, *M. paradoxus*/*M. capensis*), split by species based on same size-based species proportion-by-depth relationship as for the catches (1978-2012).

Commercial length distribution

- species-aggregated offshore trawl CAL (1975-1999, 2005-2013)
- inshore trawl CAL, assumed 100% *M. capensis* (1981-2000, 2007-2012)
- longline CAL, species aggregated pre-2000 (1994-1997), species-disaggregated thereafter (2000-2010).

Survey biomass estimates

- two surveys on the WC (summer (1985-2012) and winter (1985-1990)) and two surveys on the SC (spring (86-87, 2001-2008) and autumn (1988-2011))
- longest series: WC summer and SC autumn
- species disaggregated, gender-aggregated
- since 2003 alternation of gear on the research vessel requires the use of a calibration factor

Survey length distribution

- species-disaggregated (same years as survey biomass estimates above)
- in some years, sex-disaggregated

Age-length keys

- species and sex-disaggregated (1990-2008)

2. POPULATION ASSESSMENT MODEL

- age-structured production model
- two species
- gender-disaggregated
- where data are gender and/or species aggregated, disaggregated model estimates are combined prior to fitting
- estimates growth curves internally, fitting to age-length information under the assumption of time-invariant length-at-age distributions
- different selectivities on the WC and SC to reflect the different age/length structure
- natural mortality at age vectors input for each species
- generalised Ricker stock-recruitment relationship assumed with shape parameter either fixed or estimated

Major uncertainties

- pre-1978 species-split of the offshore trawl catches
- natural mortality at age specifications
- stock-recruitment relationship

Stock-status in terms of female spawning biomass across 12 assessments in Reference Set

- *M. capensis* well above MSY level (41-80% of unexploited level and 136-357% of MSY level in 2013)
- *M. paradoxus* below MSY level (9-22% of unexploited level and 37-128% of MSY level in 2013)

3. OMP-2011

- Objectives: - *M. paradoxus* recovery to MSY level no slower than intended under OMP-2007
  - lower 2.5%ile for *M. paradoxus* Bsp should not decrease below 2007 level
  - lowest 2.5%ile for the lowest TAC anticipated as high as possible
  - maximal inter-annual changes normally between +10% and -5%
- for each species a composite abundance index *J* is developed from a weighted average over CPUE/survey and WC/SC
- empirical harvest control rule for each species adjusting previous year's TAC based on a combination of the slope of *J* over time and the difference of a recent average *J* value from some target level
- constraint on interannual change in TAC: +10%, -5% with further penalty if *J* falls below a threshold level for either species
- output species-aggregated TAC provided by sum of TACs computed under control rules for each species separately