Pre-Assessment Considerations of Round Herring (Red Eye) Population Dynamics

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An assessment of the South African Round Herring (*Etrumeus whiteheadi*) resource, referred to as Red Eye, is due to be carried out this year. In preparation for this assessment, the following data have been noted and key assumptions are proposed.

1) A time series of estimates of annual biomass from November 1988 to November 2009 are available, together with CVs.

- The assumption is made that these estimates of biomass ARE comparable. Coetzee and Merkle (2009) compared visually survey effort and biomass, noting too the general correlation between increased survey recruitment (which should be less biased with survey effort) and subsequent increased survey biomass, and concluded that the increase in biomass for the duration of the time series was 'real' and not correlated to the increase in survey effort.
- The estimated constant of proportionality (multiplicative bias) for the November survey will take account of all forms of bias, including bias due to the use of a target strength from a species other than red eye.
- The survey estimates of biomass are assumed to measure the relative 1+ red eye biomass. The November survey length frequencies (Figure 1) indicate that some recruits (<12cm L_c) are picked up by the survey, but the numbers are low. The weight of these recruits would presumably be small (see 9) below) and their contribution to the total biomass therefore small.

2) Roel and Melo (1990) report that, although older fish appear to be reproductively active throughout the year, the smaller, more abundant fish are reproductively active for just a short period in the winter. Thus peak spawning occurs in June.

- The annual year modeled for red eye will therefore be assumed to run from 1 June to 31 May, with SSB (if required for a stock recruitment relationship) being calculated at 1 June. In addition, the (just turned) 1-year olds at 1 June will be assumed to correspond with the May survey estimates of recruitment.

3) A time series of estimates of annual recruitment numbers and biomass is available from May 1988 to May 2009, together with CVs.

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- As red eye recruits tend to be distributed inshore, overlapping with sardine and anchovy recruits, the effect of an increase in survey effort offshore would be less and therefore this time series of recruitment estimates are also considered comparable. In addition, the multiplicative bias for this survey is expected to be less, as a greater coverage of the stock is assumed compared to the November survey.

4) Annual catch tonnage (from June-May each year) and associated RLFs are available.
5) A plus-group of 5 will be assumed based on unpublished results of Y. Geja and D. Durholtz which found no males older than 4, though females up to 8 years old.
6) Maturity-at age: Using gonad stage data, the level of 50% maturity was found to range from between 12.5-13.5cm L_c in August 1986 to 14cm L_c in November 1987 (Roel and Melo 1990). When using histology, 50% maturity was found to be attained at 14.5cm L_c while all were mature by 19cm L_c in November 1987 (Roel and Melo 1990). More recent results suggest all males in November are mature by age 2 (L_c = 16cm) and all females are mature by age 4 (L_c = 18cm), with 50% maturity attained by 0.8yrs for males (L_c = 13.1cm) and 1.5 years for females (L_c = 14.5cm) (Y.Geja and D.Durholtz unpublished data).

- Basing the maturity of SSB on the female data only and using the input of a proportion mature of 1 at "June" age 4 and a proportion mature of 0.5 at "June" age 2, a logistic curve gives the following:

  Proportion mature at age 1 in June (i.e. 5 months old in November) = 0.01.

  Proportion mature at age 2 in June = 0.50.

  Proportion mature at age 3 in June = 0.99.

  Proportion mature at age 4+ in June = 1.

It is evident that in order to obtain the proportion mature close to 1 at the age of 4, a very steep slope is required. This may not be realistic? The corresponding proportions mature for males are 0.06, 1, 1, and 1 respectively.

7) Natural mortality will be fixed at 1.3years^{-1} (Y. Geja and D. Durholtz unpublished data).

- Time permitting, the effect of increasing natural mortality to 1.5 or decreasing to 1.1 will be examined.

8) Length-at-age data are available from November 2005 and 2006, giving von Bertalanffy parameter estimates of $L_\infty = 20.6$, $K = 0.39$, $t_0 = -2.0$ in 2005, and $L_\infty = 21.7$, $K = 0.35$, $t_0 = -2.0$ in 2006 (see Figure 2)
9) Data from November 2005 to 2009 are available to formulate a length-weight relationship (Y. Geja and D. Durholtz unpublished data)

The time series of biomass indices and CVs and catch data are requested.

References

Coetzee, J., and Merkle, D. 2009. The extent to which recent redeye acoustic survey abundance indices may be biased by greater survey effort. Unpublished MCM Document MCM/2009/Redeye Fishery Task Team/03. 5pp.

Roel, B.A., and Melo, Y.C. 1990. Reproductive Biology of the Round Herring *Etrumeus Whiteheadi*. South African Journal of Marine Science. 9:177-187.

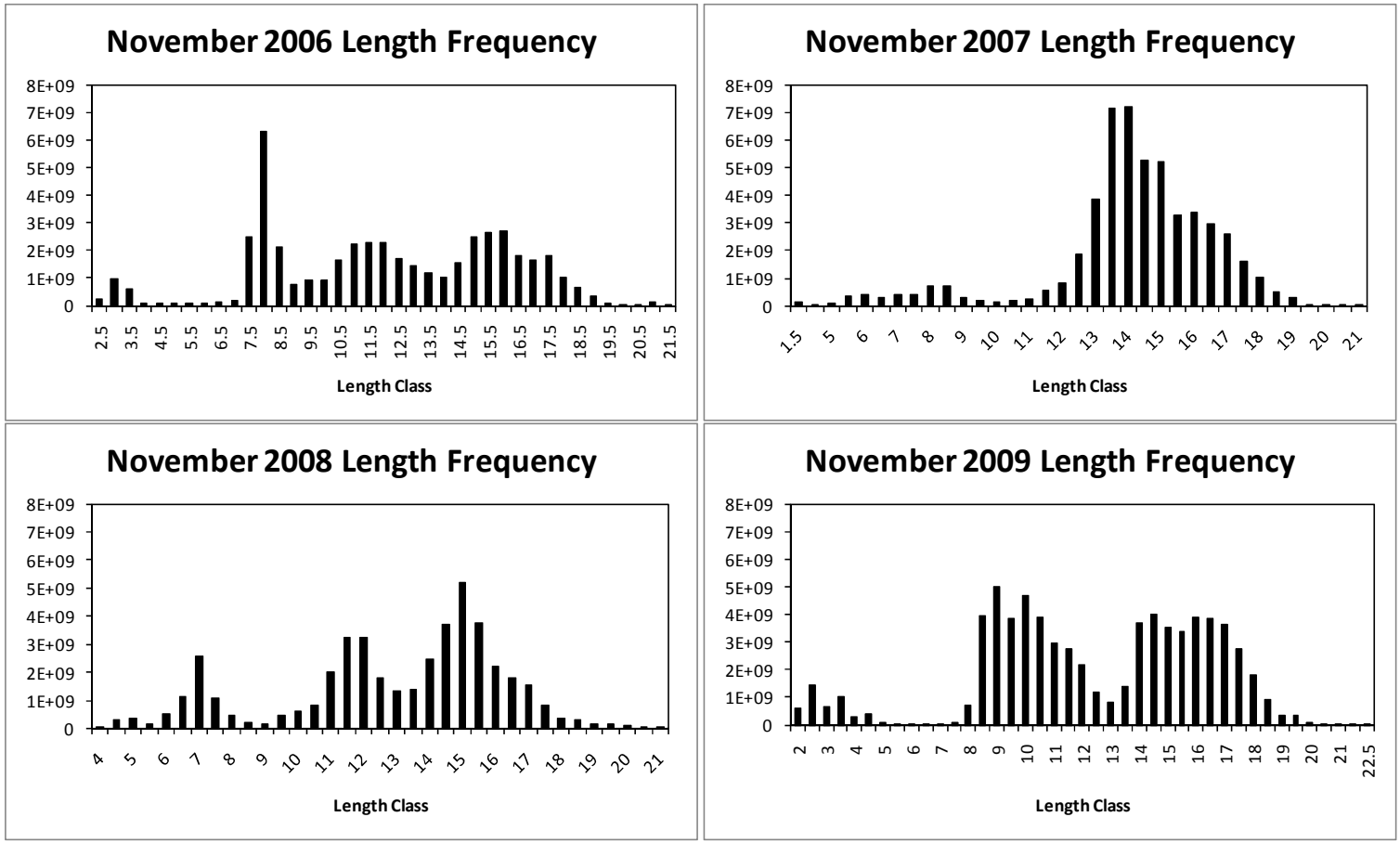

Figure 1. The length frequencies from the November hydroacoustic surveys in 2006 – 2009, from Janet Coetzee.

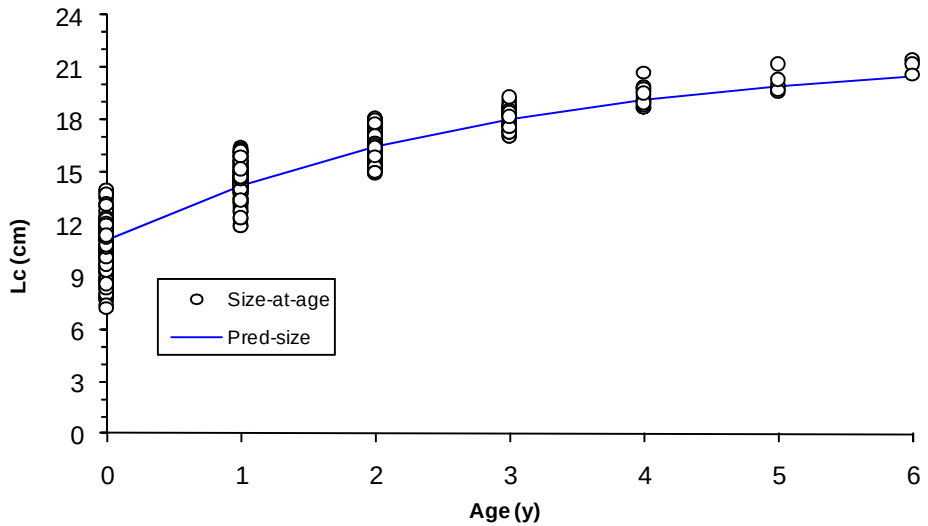

Figure 2. The von Bertalanffy growth curve fitted to data from the November 2006 survey, from Yonela Geja