Some Insights into the Selection of the Central Shift Year from *M. capensis* to *M. paradoxus* Dominance in the Assessment of the Hake Resource

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April 2010

INTRODUCTION

The Reference Set of Operating Models used for the testing of the existing hake OMP included three choices for the central shift year from a primarily *M. capensis* to a primarily *M. paradoxus* fishery: 1940, 1950 and 1957. The reasons later years were excluded is that they led to poorer fits to the data, and also to what was considered to be an unrealistically high ratio of the then current biomass of *M. capensis* to *M. paradoxus*.

For the new assessment methodology (MCM/2010/FEB/SWG-DEM/05) neither of these considerations particularly favour any choice for the central shift year between 1940 and 1970. The Reference Set proposed in MCM/2010/FEB/SWG-DEM/05, needing to fully cover the plausible range, suggested that the previous three years chosen be changed to 1950, 1958 and 1965. For central choices for other Reference Set variables, these correspond to current depletions of the *M. paradoxus* spawning biomass ranging from 0.13 to 0.24 (MCM/2010/FEB/SWG-DEM/10). Given that this leads to a wide-ish range of perceptions about the current conservation status of the *M. paradoxus* population, it is important to check whether other information might allow some discrimination within this range.

IMPLICATIONS OF THE DEPTHS OF TRAWLING OPERATIONS

Leslie and Glazer (MCM/2010/FEB/SWG-DEM/14) present information on the (recent) *M. capensis* : *M. paradoxus* species ratio in catches by depth range. Their tables 1 (for offshore commercial catches) and 2 (for surveys) are to be contrasted with Table 1 of this document, which reports the species ratio for the cumulative catch to 1977 (after which data-based estimation replaces assumption) for alternative choices for the central shift year.

If from Table 1 one notes, for example, that a central shift year choice of 1970 corresponds to a *M. capensis* overall proportion of 0.81, and contrasts this to the commercial catch information in table 1 of MCM/2010/FEB/SWG-DEM/14, the coarse inference is that West Coast catches would have had to be restricted to less than some 200m depth until 1977 if the choice of a central shift year of 1970-(with a current *M. paradoxus* spawning biomass depletion of 0.37) is to be considered plausible.

The above is not an “exact” result, however, because although the dependence of estimates of current species depletion on the choice of the central shift year are primarily influenced by the species ratio for this cumulative catch, there is also some subsidiary dependence on how this ratio changes over time.

To investigate this further, guided by Leslie and Glazer (MCM/2010/FEB/SWG-DEM/14) who report that depths of fishing in 1949 already indicate a substantial proportion of *M. paradoxus* in the West Coast catch, results are given in Table 2 for the current spawning biomass depletions that follow for the Reference Set (for central variable choices apart from the central shift year) for modifications of the ogive-based approach for splitting the catches by species from 1917 to 1977. Instead of setting the *M. capensis* ratio at the commencement of the fishery to 100% as in Reference Set runs, these modifications rather set these initial values higher as indicated in that Table.

Since there was relatively little hake catch made prior to 1949, results in Leslie and Glazer (MCM/2010/FEB/SWG-DEM/14) for the *M. capensis* proportion of the hake catch in that year provide some guidance as to the relative plausibility of the various depletion estimates in Table 2. In particular Leslie and Glazer infer a West Coast *M. capensis* proportion in 1949 of between 11 and 37%. This suggests that only the scenarios considered in the two rightmost columns of Table 2 are realistic, which in turn implies that the current spawning biomass depletion for *M. paradoxus* is no more than 16%.

In terms then of the Reference Set suggestions of central shift years of 1950, 1958 and 1965, with a corresponding *M. paradoxus* depletion range of 0.13 to 0.24, these results suggest that the higher values in this range are less plausible. In particular then, this analysis provides no support for moving the central shift year range proposed for the Reference Set towards higher values.

Table 1: West and South coasts cumulative (1917-1977) *M. capensis* proportion in the offshore trawl catches for a series of choices for the central year of the *M. capensis* to *M. paradoxus* shift.

	West Coast	South Coast
1940	0.28	0.62
1945	0.31	0.62
1950	0.35	0.62
1955	0.43	0.62
1958	0.49	0.62
1960	0.54	0.62
1965	0.67	0.63
1970	0.81	0.70
1972	0.87	0.76

Table 2: Estimated *M. paradoxus* and *M. capensis* current spawning biomass depletions for a series of initial *M. capensis* proportions in the offshore trawl catches for different central shift years.

Central shift year		Initial *M. capensis* proportion				
		WC: 100% SC: 100%	WC: 80% SC: 100%	WC: 60% SC: 100%	WC: 40% SC: 100%	WC: 40% SC: 80%
1958	B^{sp}_{2009}/K^{sp}: *M. paradoxus*	0.15	0.16	0.16	0.14	0.14
	B^{sp}_{2009}/K^{sp}: *M. capensis*	0.54	0.54	0.56	0.57	0.57
1965	B^{sp}_{2009}/K^{sp}: *M. paradoxus*	0.24	0.24	0.25	0.16	0.15
	B^{sp}_{2009}/K^{sp}: *M. capensis*	0.61	0.59	0.51	0.55	0.55
1970	B^{sp}_{2009}/K^{sp}: *M. paradoxus*	0.37		0.34	0.10	0.10
	B^{sp}_{2009}/K^{sp}: *M. capensis*	0.63		0.58	0.56	0.55