2016 Horse Mackerel projections

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SUMMARY

The projections conducted in 2015 are updated to include the further data now available. The results are somewhat more positive than previously as a result of the CPUE for 2015, although still low, being higher than that for 2014. Nevertheless, given the range of interpretations possible for these low CPUE data, the projections continue to point to the need for an effort restriction to be applied to the midwater trawl fishery.

FISHERIES/2016/SEP/SWG-DM/51 provides a full description of the current stock assessment model for the South African Horse Mackerel. FISHERIES/2016/SEP/SWG-DEM/51 provides updated 2016 assessment results for a number of model variants.

The assessment models, as used in assessments and MP testing since 2014, assume q_{aut} = 0.75 and h = 0.75. These values were selected as they fall in the middle of the bounds defined by the original Reference Set used for MP testing. The 2016 assessment model is further extended below to allow for better fits to the midwater CPUE data for 2014 and 2015 (which are particularly low). The model assumes either that these low CPUE values are due to reduced fishing catchability, or that extra mortality of fish occurred at the start of 2014. Thus

Variant 1) $q = q_1$ for years up to and including 2013

$q = q_2$ for years 2014 and 2015

q = either a) q_1 for 2016+ (i.e. reverts to normal for 2016+) [**VAR1**a], or

b) q_2 for 2016+ (i.e. remains at the lower estimated q_2 value into the future [**VAR1b**].

Variant 2) Extra mortality occurs at the start of 2014 (numbers-at-age in 2014 reduced by an estimated additional proportion M^{extra}). This extra mortality is a once-off event [**VAR2**].

Note Variant 0) [**VAR0**] refers to the Base Case model without any further extension to allow for a better fit to the low recent CPUE values.

Projections

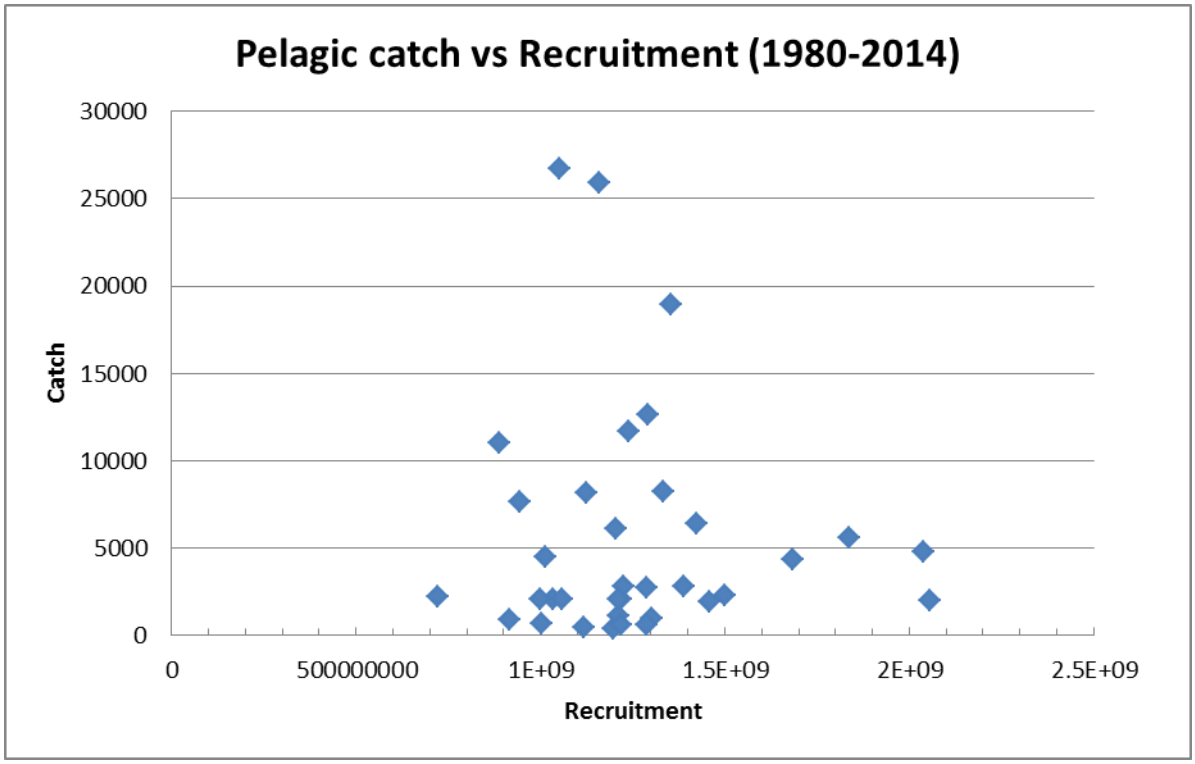
This document reports the results of horse mackerel projections under the alternative management options (termed OMPs). These are at this stage identical to those that were specified last year by the DWG, and take account of the range of uncertainties about whether the recent downturn in the midwater CPUE reflects a catchability reduction or a one-off additional mortality

METHODS

The rules to compute future simulated catches under various management approaches are set out below.

Catch Rules:

1) **Pelagic Catches**



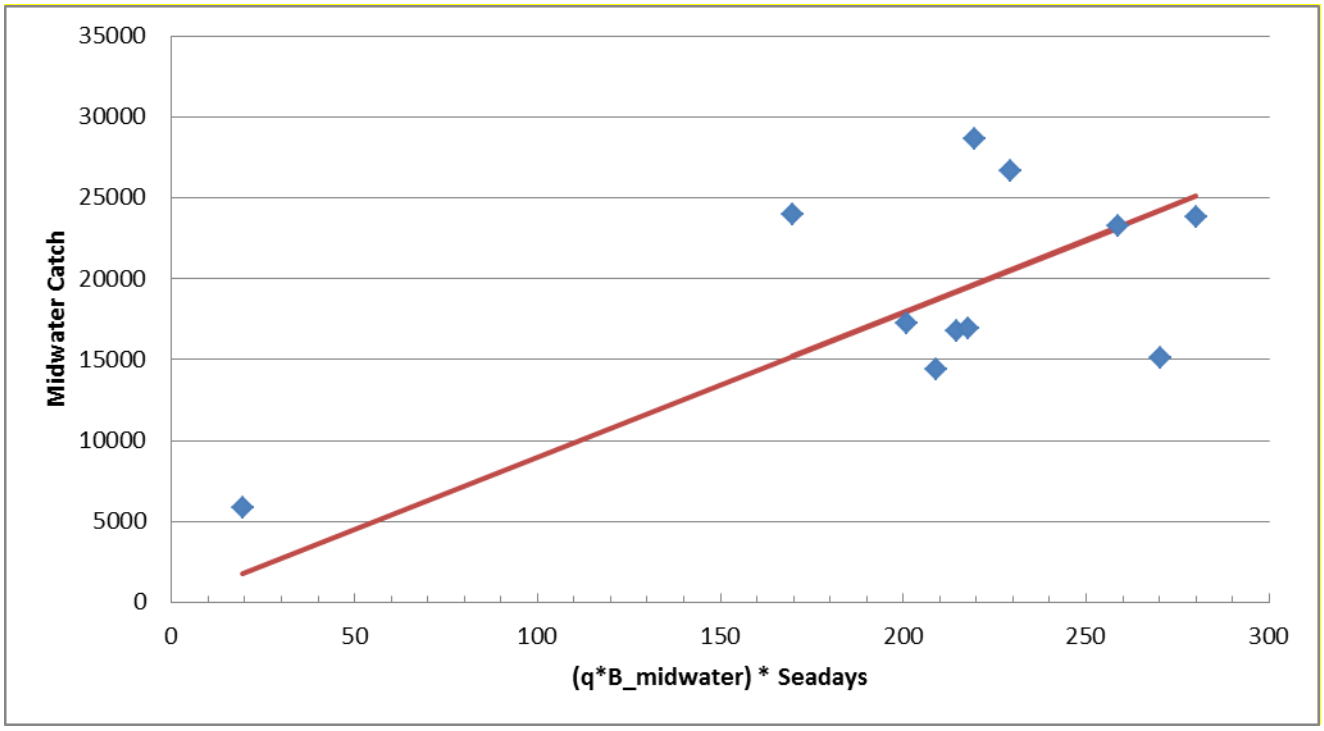
- No clear relationship between pelagic catches and recruitment.
- Set pelagic catches by drawing at random with replacement from the set of pelagic catches for the period 2000-2015, except that a value in excess of $PUCL_{y+1}$ below is reduced to $PUCL_{y+1}$.
- $PUCL_{y+1}$=12 000 - C_y^{pel} - C_{y-1}^{pel}.

2) Incidental trawl/Demersal catches – constant proportion of HM biomass

The average over a recent 5 period (2000-2014) of 12500/Bexp = 0.07697 = $\bar{F}_{trawl}$

Future demersal catches = $\bar{F}_{trawl}$ * B_{exp}^{dem}

3) Midwater directed catches – use both catch and effort limitation



Initial catch (C_1) set at [38658, 20000 or 10 000].

The plot above shows the observed (diamonds) midwater catches plotted against:

$$q * B_{exp}^{mid} * Seadays\_used.$$

[The data were provided by Larvika Singh, DAFF)].

A linear regression was fitted to these data, such that

$$C = k.(q * B_{exp}^{mid} * Seadays_{used})$$

This results in a $k = 89.555$.

The standard deviation of the residuals about the regression line, σ , is 5474 t.

Secondary catch calculated such that

$$C_2 = k(q * B_{exp}^{mid} * Seaday_{limit}) + error$$

where $error \sim N(0, \sigma^2)$,

and where $q * B_{exp}^{mid}$ will be the future midwater CPUE values, and $Seaday_{limit}$ value is fixed at [150, or 250].

The final catch is the **lesser** of C_1 or C_2.

A minimum lower bound on midwater catch of 2000 is imposed.

Operating Models (underlying assessments)

These reflect the assessment alternatives presented in [FISHERIES/2016/SEP/SWG-DEM/52].

VAR0: No extra q or extra mortality to explain recent low CPUEs

VAR1a: Once off low catchability in 2014 and 2015 (then return to normal in 2016)

VAR1b: A drop in catchability in 2014 and 2015 which continues into the future

VAR2: Once off mortality event in 2014

OMPs explored

RC OMP: Midwater initial catch C_1 = 38658

$Seaday_{limit}$ = 250

Midwater catch lower bound 2000

OMP2: $Seaday_{limit}$ = 150 (else as RC OMP)

OMP3a: No seaday restriction, midwater C_1 = 38658

OMP3b: No seaday restriction, midwater C_1 = 20000

OMP3c: No seaday restriction, midwater C_1 = 10000

OMP3d: No seaday restriction, midwater C_1 = 0

[Note that the lower midwater catch bound of 2000 applies throughout].

RESULTS

The results for the various OM/OMP combinations are shown in plots arranged as follows:

Figure 1: **VAR0** – RC OMP, OMP3a-d.

Figure 2: **VAR1a** – RC OMP, OMP3a-d.

Figure 3: **VAR1b** – RC OMP, OMP3a-d.

Figure 4: **VAR2** – RC OMP, OMP3a-d.

DISCUSSION

The results are similar to, but somewhat more positive than, than similar computations reported last year in FISHERIES/2015/NOV/SWG-DEM/49. This is as is to be expected given that CPUE in 2015, though still low, is higher than for 2014.

Under the $Seaday_{limit}$ = 250 restriction, performance is adequate (at least in the short term) for all operating models. However, once that effort restriction is removed, under **VAR2** certainly the midwater catch would need to be restricted to certainly no more than 20000 tons to avoid undue resource reduction.

These results thus continue to point to the need to maintain an effort limitation in the fishery.

Figure 1: OM **VAR0** (no modelling assumptions to take into account low recent CPUE). Results are shown for RC OMP.

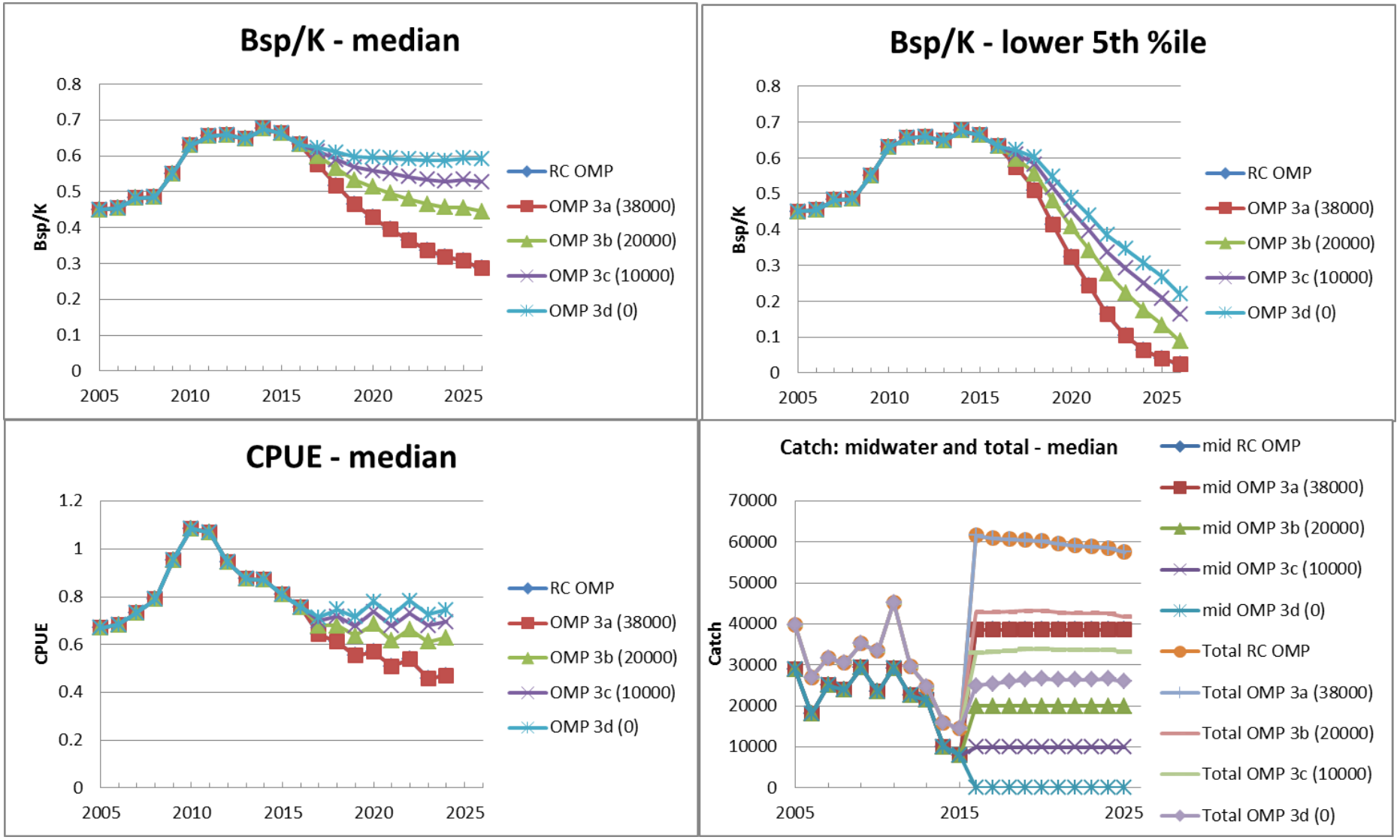


Figure 2: OM **VAR1a** (low catchability in 2014 and 2015 only). Results are shown for RC OMP.

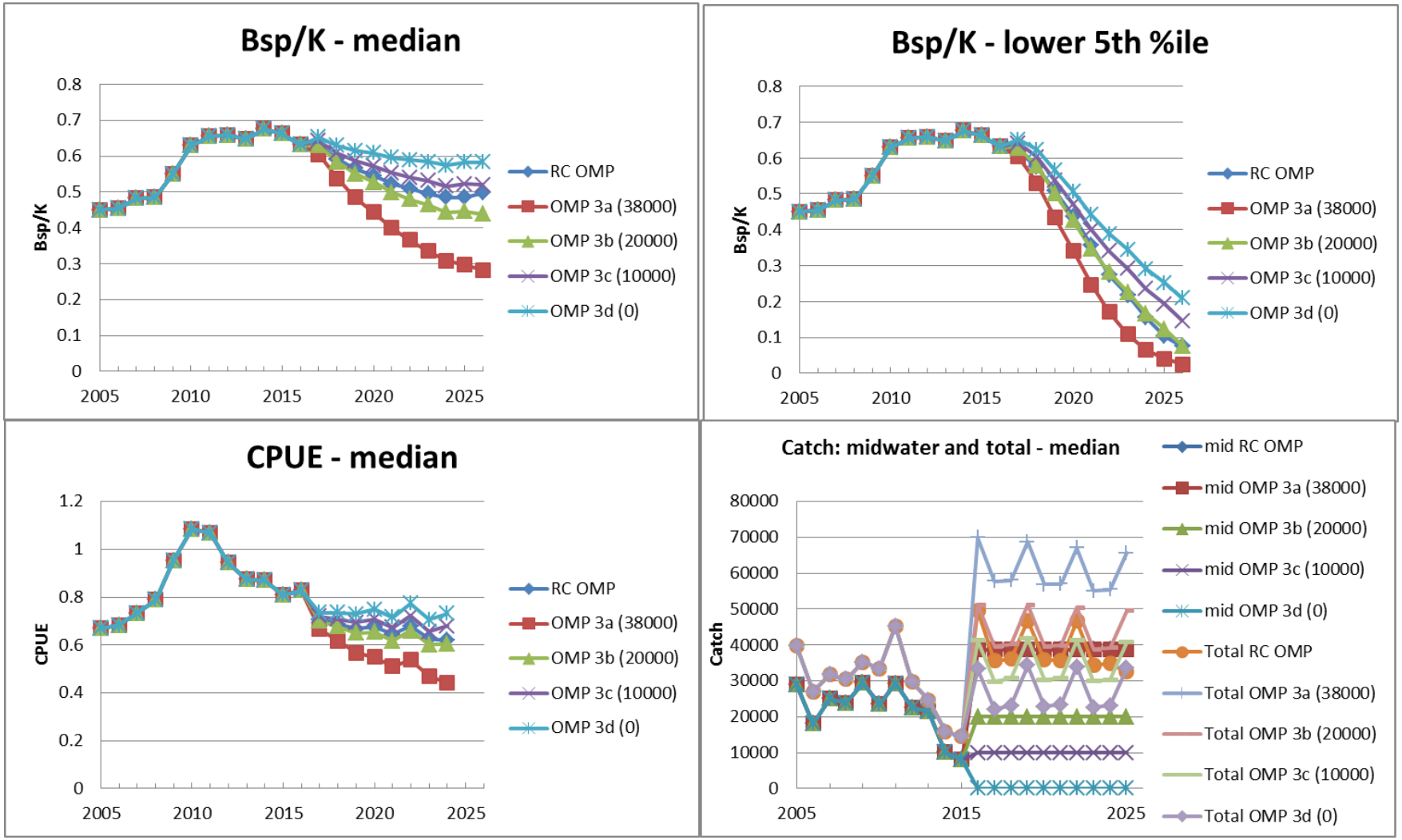


Figure 3: OM **VAR1b** (low catchability continues into the future). Results are shown for RC OMP.

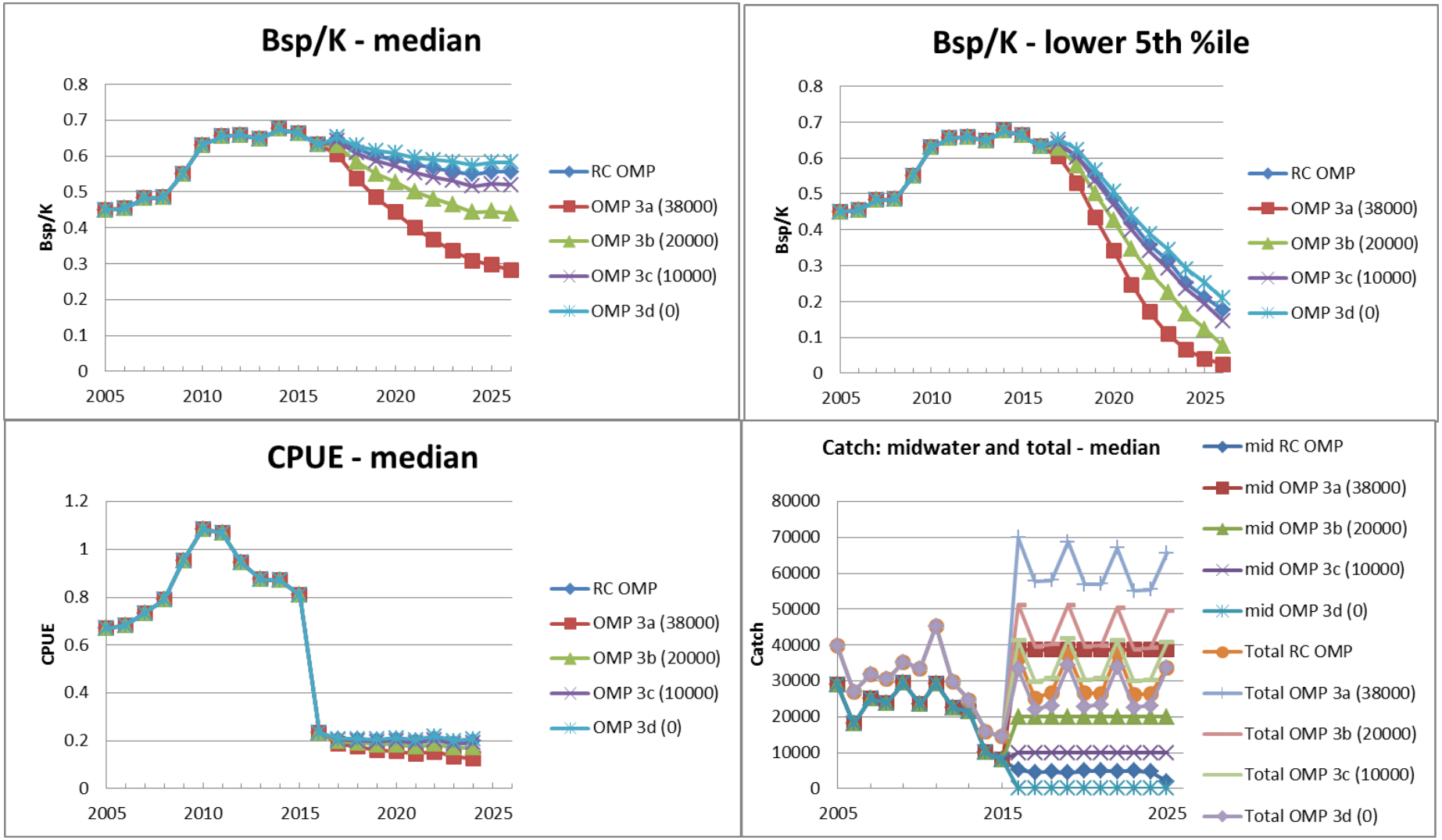


Figure 4: OM **VAR2** (once off mortality event in 2014). Results are shown for RC OMP.