

Some more hake CMP robustness test results: original natural mortality-at-age vectors and decreasing carrying capacity

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Introduction

Results are shown for three robustness tests, which owing to time constraints have been conducted for the Reference Case OM (RS02) only.

1. The original natural mortality-at-age vectors from the Rademeyer 2017 model for the two hake species are used instead of the ones estimated by the predation model. These mortality-at-age vectors are fixed at 0.75 for lower ages and 0.375 for higher ages.
2. Carrying capacity for both species decreases linearly by 30% between 1980 and 2000. Carrying capacity before 1980 is at the 1917 value, while carrying capacities after 2000 are at 70% of their 1917 values.
3. Carrying capacity for both species decreases linearly by 30% between 2018 and 2022. Carrying capacities after 2022 are at 70% of their 1917 values.

Results

Figures illustrating performance statistics, TAC for the next four years and population trajectories are given for the three robustness tests, in each case compared with the Reference Case OM (RS02). These are shown for the agreed six CMPs (two caps on the TAC x three values of the *b* control parameter).

Discussion

In terms of *M. paradoxus* abundance risk, lower 5%iles for spawning biomass after 25 years are slightly lower for the original natural mortality vector, and slightly higher for a decrease in carrying capacity in the recent past (Figures 1a and b).

For a decrease in carrying capacity in the future, the average TAC over the next 25 years does drop substantially under the feedback control of the CMPs; this drop is greater for the more aggressive CMP variants, with the result that the lower 5%ile for the *M. paradoxus* spawning biomass after 25 years is virtually variant-independent, and only slightly below the values for the Reference Case OM (Figure 1c). CPUEs and TACs drop through the mid-2020s, while effort is projected to increase over that period, but all return to close to their levels for the Reference Case OM after about 2030 (Figure 3c).

Performances over the next four years are hardly different from those for the Reference Case OM for all three tests.

Overall, all six CMP variants appear to show adequately robust performance for these three tests.

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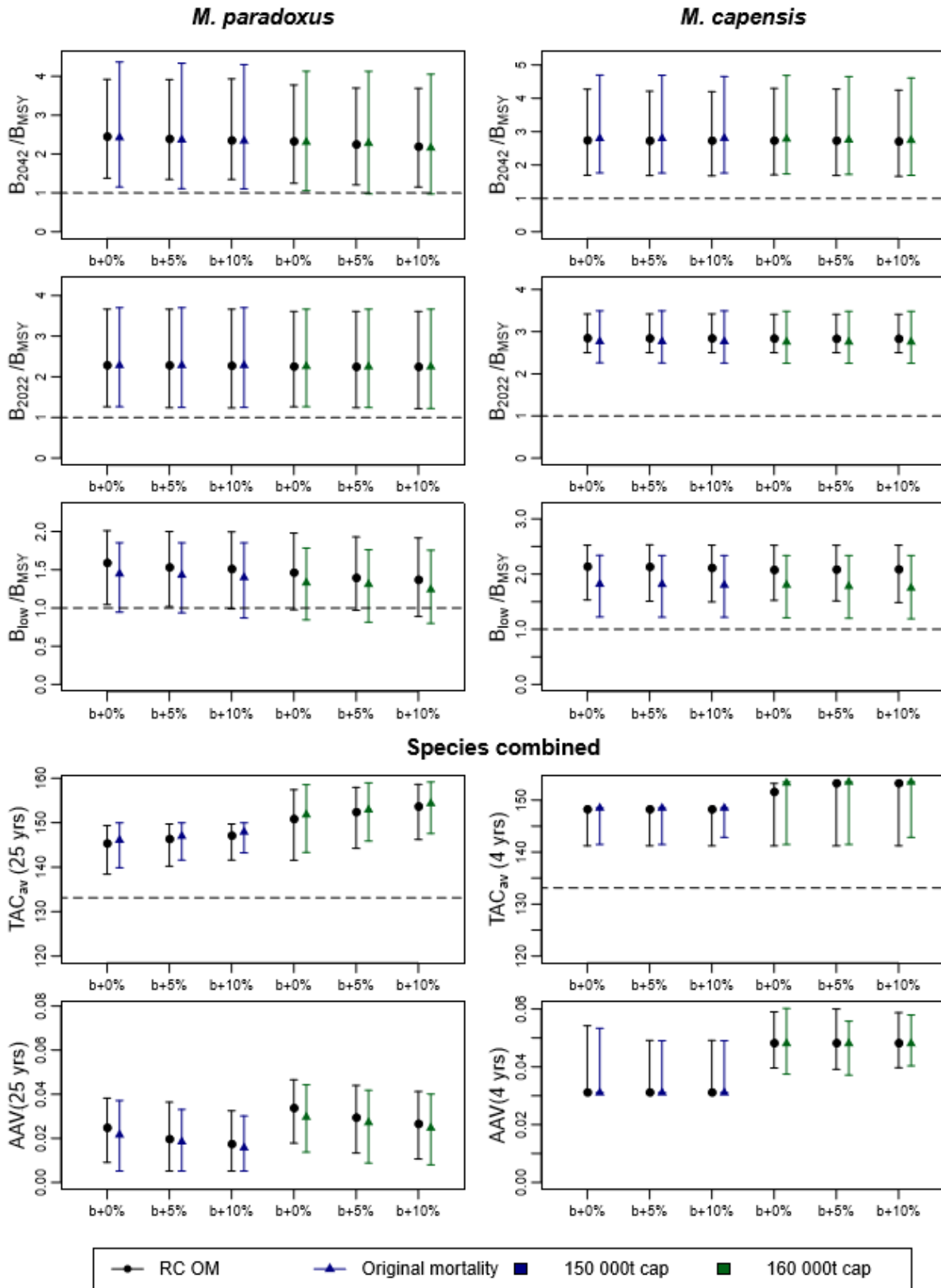


Figure 1a: Zeh plots of the performance statistics for the robustness test using the **original mortality-at-age vector**. The statistics are B^{SP}/B_{MSY} for 2042 and 2022 (i.e. at the planned end of OMP2018 application), $B^{SP}(low)/B_{MSY}$ (the lowest value of this statistic in the projection period to 2042), TAC_{av} (the average catch over the projection period (25 years) and over the next four years) and AAV (the average inter-annual proportional change in catch over the projection period (25 years) and over the next four years). Medians and 90% probability intervals are shown.

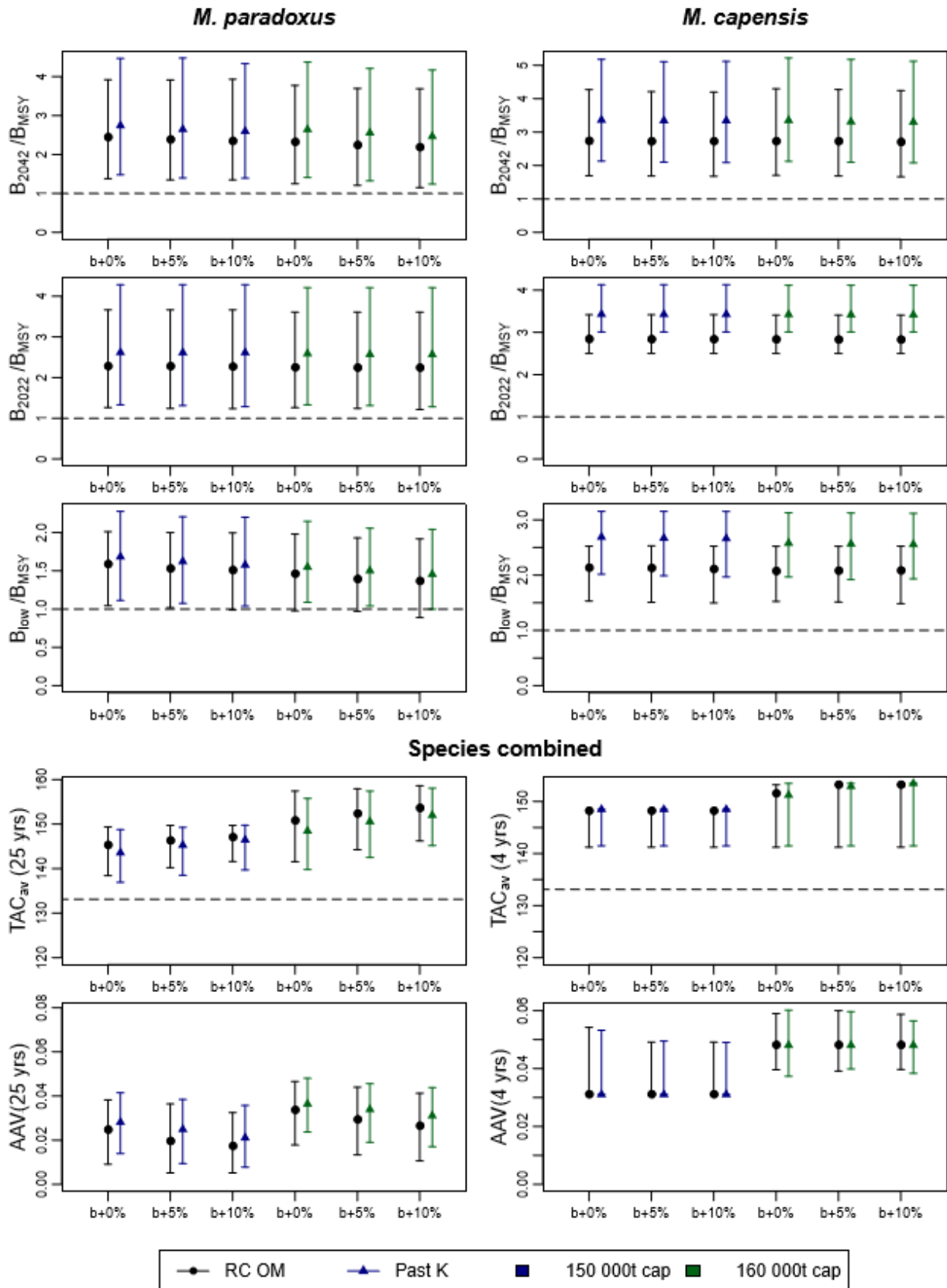


Figure 1b: Zeh plots of the performance statistics for the robustness test that decreases K values in the past.

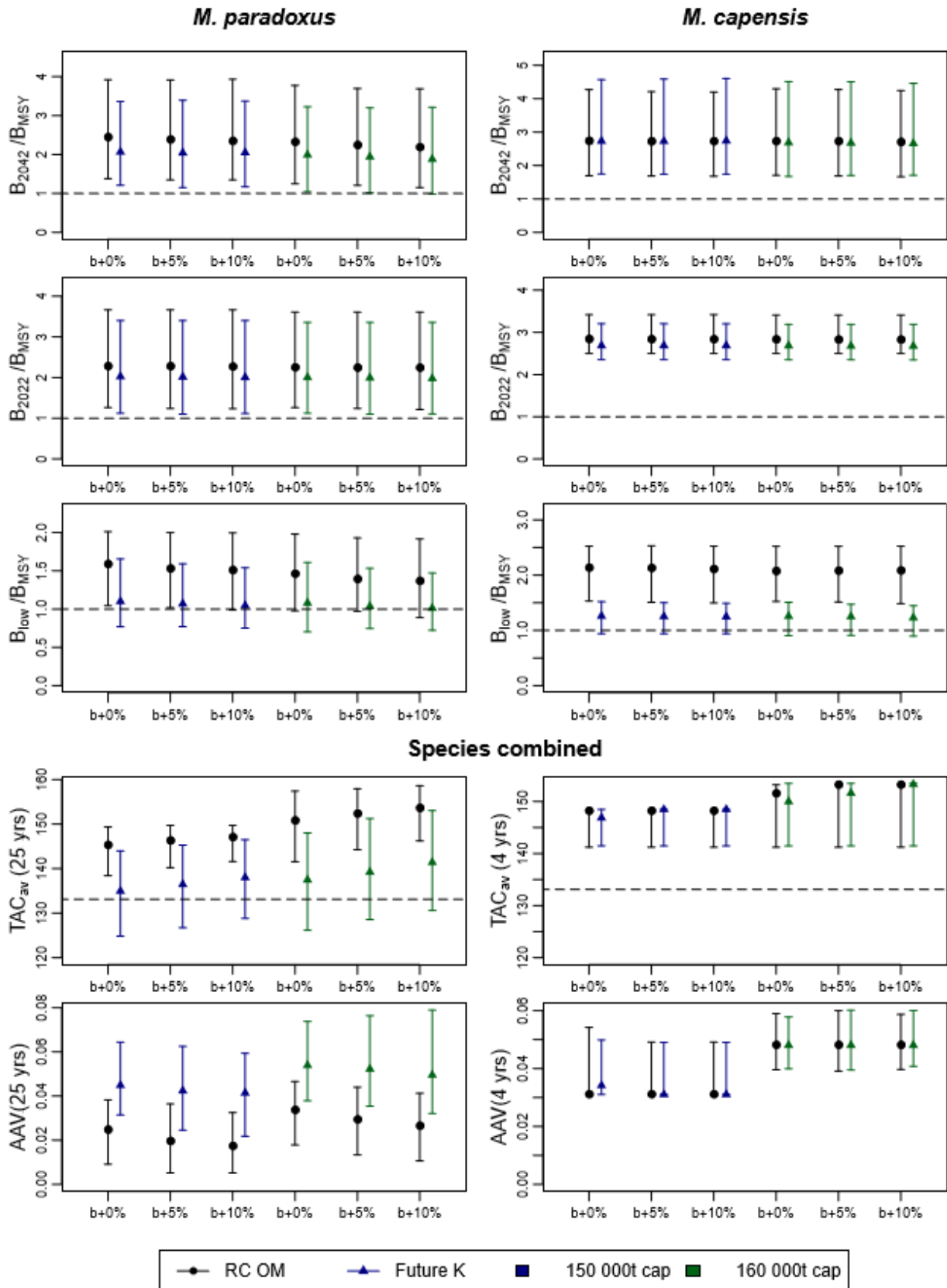


Figure 1c: Zeh plots of the performance statistics for the robustness test that decreases K values in the future.

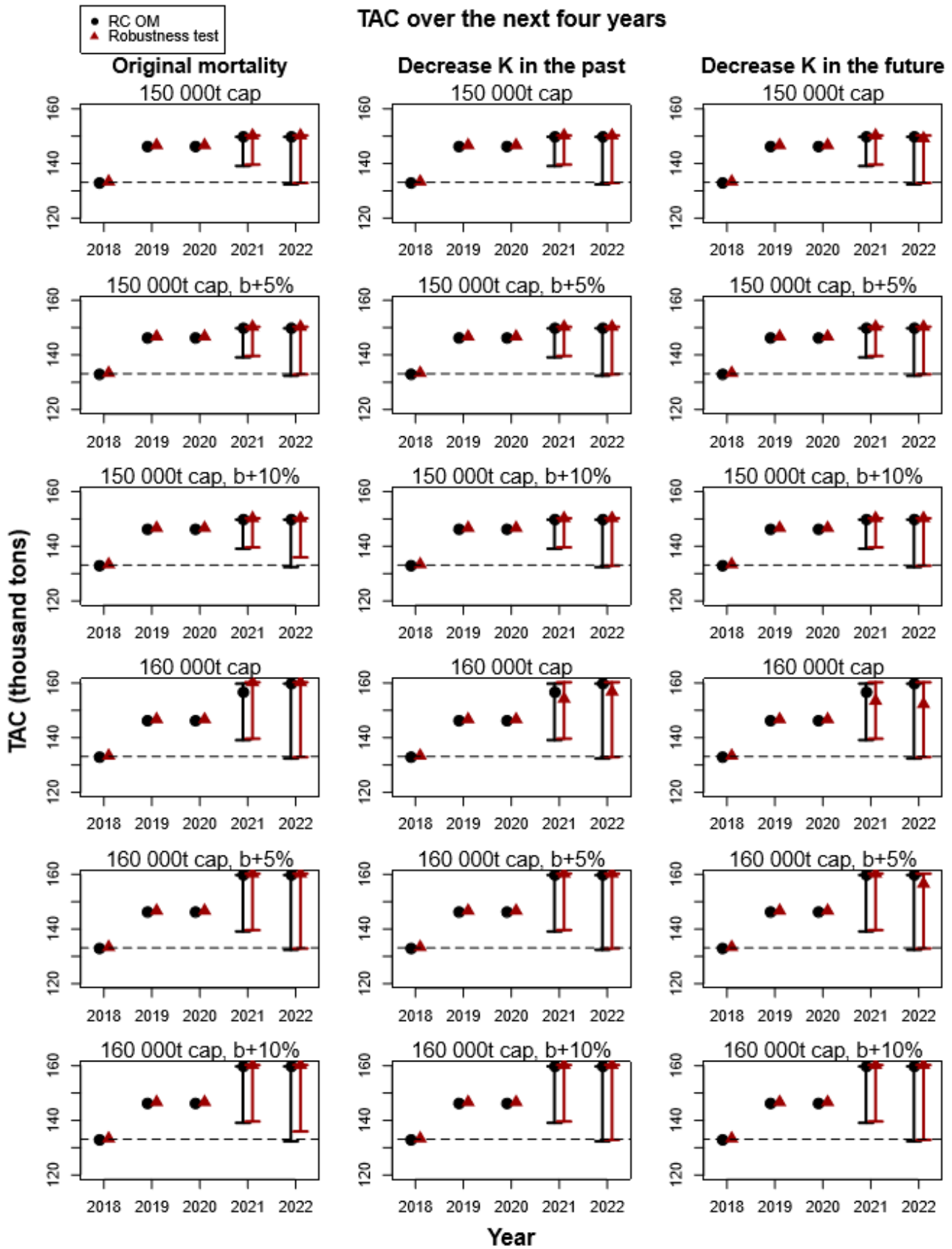


Figure 2: Median estimates and 90% probability intervals for the projected catch for each of the next four years (i.e. the planned life span of OMP2018) for the Reference Case OM and the three robustness tests.

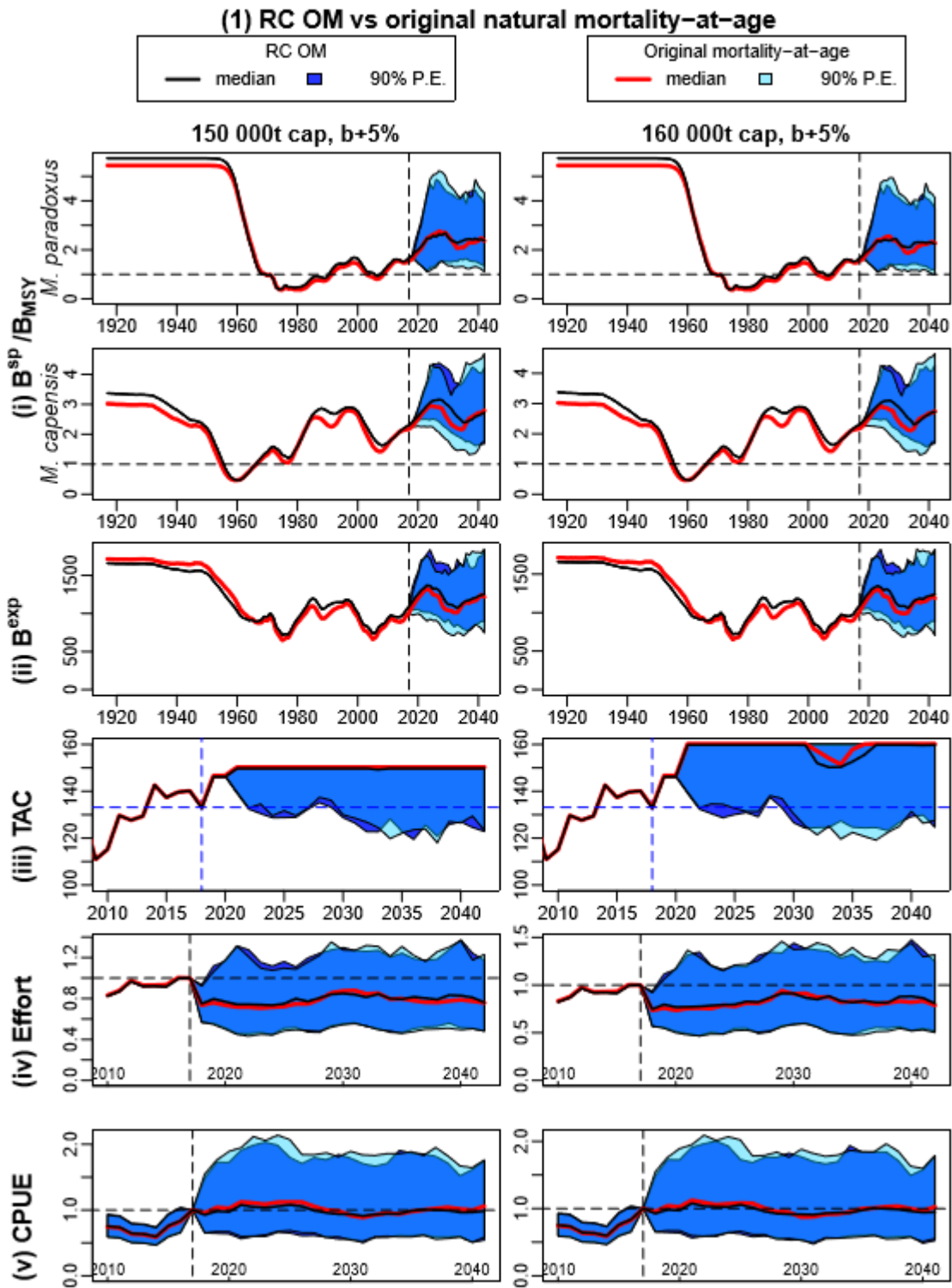


Figure 3a: A selection of trajectories are shown for the Reference Case OM (black line and dark blue shading for the median trajectory and 90% P.E.) and the robustness test that uses the **original mortality-at-age** vectors (red line and light blue shading).

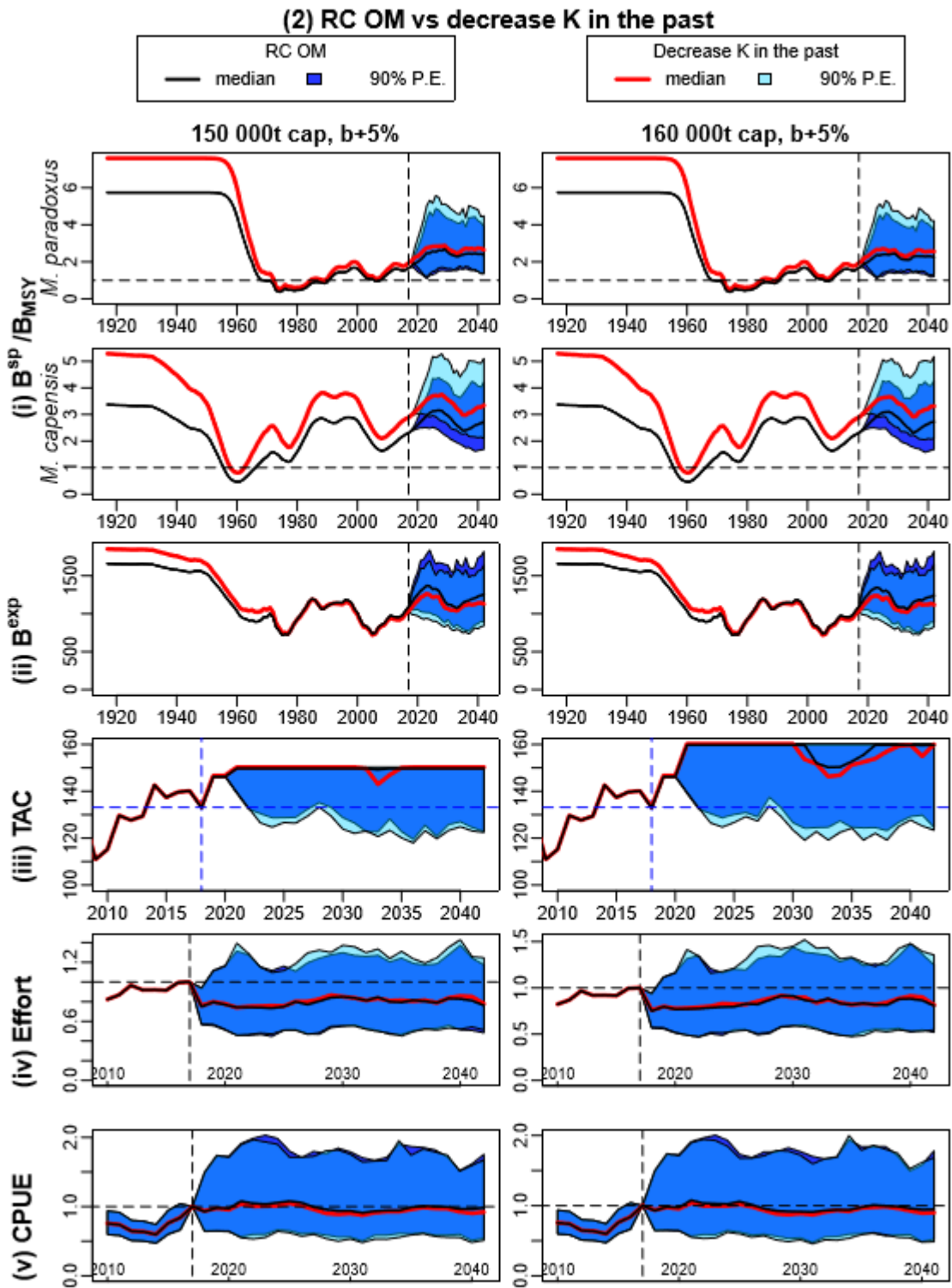


Figure 3b: A selection of trajectories are shown for the Base CMP (black line and dark blue shading for the median trajectory and 90% P.E.) and the robustness test that **decreases K in the past** (red line and light blue shading).

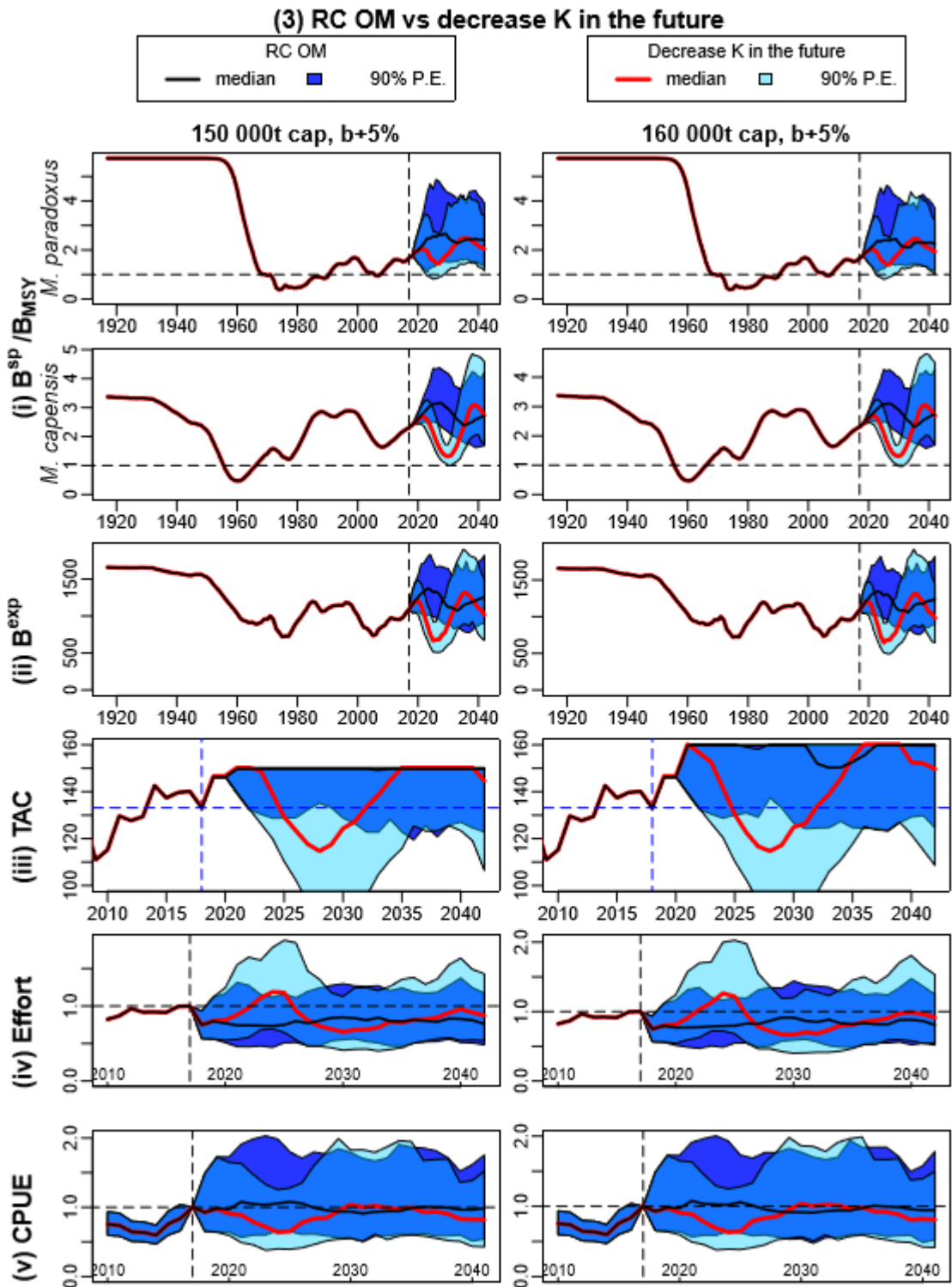


Figure 3c: A selection of trajectories are shown for the Base CMP (black line and dark blue shading for the median trajectory and 90% P.E.) and the robustness test that **increases K in the future** (red line and light blue shading).