Supplementary Table 1. Median Absolute Relative Errors (MAREs) for experiment 3. The leftmost column “Base” column reports the MAREs and, for the remaining columns, the MARE for the cases concerned is divided by the MARE for “Base”.

(a) Time-invariant selectivity in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Increase-then-decreasing; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.075 | 1.13 | 1.09 | 1.09 | 1.04 | 1.03 | 1.03 | 1.10 | 1.12 | 1.13 | 1.03 | 1.09 |
| SSB2018 | 0.091 | 1.16 | 1.13 | 1.13 | 1.00 | 1.03 | 0.95 | 1.61 | 1.47 | 1.44 | 0.99 | 1.23 |
| Depl2018 | 0.095 | 1.04 | 1.14 | 1.15 | 0.99 | 0.98 | 1.09 | 1.50 | 1.48 | 1.46 | 1.02 | 1.36 |
| RBC2018 | 0.087 | 1.19 | 1.23 | 1.24 | 1.00 | 1.04 | 1.00 | 1.61 | 1.43 | 1.43 | 1.08 | 1.28 |
| Increasing; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.085 | 1.12 | 1.11 | 1.10 | 1.00 | 0.98 | 1.00 | 1.14 | 1.19 | 1.19 | 1.00 | 1.03 |
| SSB2018 | 0.117 | 1.30 | 1.50 | 1.46 | 1.07 | 1.12 | 1.06 | 2.14 | 1.59 | 1.58 | 1.05 | 1.28 |
| Depl2018 | 0.114 | 0.99 | 1.11 | 1.08 | 0.96 | 0.95 | 0.98 | 1.51 | 1.36 | 1.35 | 0.93 | 1.13 |
| RBC2018 | 0.107 | 1.29 | 1.50 | 1.46 | 1.04 | 1.12 | 1.10 | 2.11 | 1.69 | 1.62 | 1.12 | 1.38 |
| Constant; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.081 | 0.98 | 1.05 | 1.03 | 0.98 | 0.98 | 0.98 | 1.10 | 1.09 | 1.06 | 0.98 | 1.05 |
| SSB2018 | 0.098 | 1.16 | 1.30 | 1.29 | 0.99 | 0.99 | 1.06 | 1.74 | 1.47 | 1.47 | 0.98 | 1.40 |
| Depl2018 | 0.104 | 1.11 | 1.17 | 1.16 | 0.96 | 1.14 | 1.20 | 1.64 | 1.27 | 1.27 | 1.08 | 1.54 |
| RBC2018 | 0.094 | 1.15 | 1.22 | 1.19 | 1.00 | 1.00 | 1.02 | 1.71 | 1.50 | 1.48 | 1.07 | 1.40 |
| High initial; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.083 | 0.95 | 1.06 | 1.06 | 1.00 | 1.02 | 0.98 | 1.01 | 1.04 | 1.05 | 1.00 | 1.01 |
| SSB2018 | 0.096 | 1.12 | 1.35 | 1.25 | 1.08 | 1.10 | 1.28 | 1.51 | 1.85 | 1.42 | 1.15 | 1.49 |
| Depl2018 | 0.113 | 1.02 | 1.16 | 1.12 | 1.00 | 1.00 | 1.20 | 1.30 | 1.59 | 1.23 | 1.23 | 1.40 |
| RBC2018 | 0.094 | 1.09 | 1.28 | 1.25 | 1.04 | 1.08 | 1.19 | 1.45 | 1.76 | 1.48 | 1.06 | 1.38 |
| Increase-then-decreasing; Depl2018=0.5 (base) | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.092 | 1.19 | 1.16 | 1.16 | 1.10 | 1.11 | 1.10 | 1.23 | 1.06 | 1.06 | 1.12 | 1.12 |
| SSB2018 | 0.099 | 1.50 | 1.06 | 1.06 | 0.98 | 1.03 | 0.95 | 2.22 | 1.42 | 1.42 | 1.02 | 1.45 |
| Depl2018 | 0.083 | 1.24 | 1.12 | 1.12 | 0.98 | 1.01 | 1.08 | 1.74 | 1.40 | 1.40 | 0.95 | 1.39 |
| RBC2018 | 0.094 | 1.38 | 1.05 | 1.05 | 0.97 | 1.05 | 0.97 | 2.16 | 1.45 | 1.45 | 1.00 | 1.48 |
| Increasing; Depl2018=0.5 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.121 | 1.25 | 1.25 | 1.21 | 1.05 | 1.08 | 1.03 | 1.47 | 1.40 | 1.36 | 1.03 | 1.07 |
| SSB2018 | 0.138 | 1.84 | 1.40 | 1.39 | 1.00 | 1.09 | 1.04 | 2.60 | 1.81 | 1.78 | 1.04 | 1.32 |
| Depl2018 | 0.090 | 1.44 | 1.16 | 1.16 | 0.96 | 1.08 | 1.08 | 2.27 | 1.39 | 1.37 | 0.94 | 1.23 |
| RBC2018 | 0.135 | 1.72 | 1.41 | 1.36 | 1.00 | 1.08 | 1.00 | 2.52 | 1.71 | 1.67 | 1.07 | 1.30 |
| Constant; Depl2018=0.5 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.108 | 1.13 | 1.25 | 1.25 | 1.01 | 1.01 | 0.81 | 1.19 | 1.24 | 1.24 | 0.99 | 1.02 |
| SSB2018 | 0.119 | 1.55 | 1.33 | 1.33 | 1.00 | 1.05 | 0.92 | 2.28 | 1.53 | 1.53 | 0.95 | 1.48 |
| Depl2018 | 0.090 | 1.34 | 1.23 | 1.23 | 0.97 | 1.15 | 1.06 | 1.96 | 1.24 | 1.24 | 0.99 | 1.64 |
| RBC2018 | 0.112 | 1.49 | 1.25 | 1.25 | 1.01 | 1.07 | 0.91 | 2.24 | 1.48 | 1.48 | 1.01 | 1.46 |
| High initial; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.087 | 1.35 | 1.23 | 1.25 | 1.05 | 1.14 | 1.02 | 1.38 | 1.30 | 1.30 | 1.07 | 1.12 |
| SSB2018 | 0.111 | 1.56 | 1.62 | 1.47 | 0.97 | 1.15 | 1.06 | 2.06 | 2.03 | 1.64 | 1.06 | 1.54 |
| Depl2018 | 0.093 | 1.26 | 1.39 | 1.28 | 0.95 | 1.27 | 1.23 | 1.73 | 1.56 | 1.44 | 1.19 | 1.72 |
| RBC2018 | 0.108 | 1.36 | 1.47 | 1.37 | 0.94 | 1.01 | 1.02 | 1.86 | 1.77 | 1.52 | 0.97 | 1.40 |

(b) Time-varying selectivity in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Increase-then-decreasing; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.077 | 1.06 | 1.09 | 1.08 | 1.03 | 1.02 | 1.04 | 1.14 | 1.11 | 1.14 | 0.99 | 1.12 |
| SSB2018 | 0.109 | 1.01 | 1.02 | 1.00 | 1.01 | 1.07 | 1.09 | 1.37 | 1.17 | 1.17 | 1.08 | 1.18 |
| Depl2018 | 0.104 | 1.02 | 1.03 | 1.01 | 0.97 | 0.97 | 1.09 | 1.39 | 1.24 | 1.24 | 1.07 | 1.24 |
| RBC2018 | 0.106 | 1.02 | 1.00 | 0.99 | 1.02 | 1.08 | 1.08 | 1.38 | 1.13 | 1.13 | 1.10 | 1.19 |
| Increasing; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.095 | 1.09 | 1.02 | 1.00 | 1.00 | 1.04 | 0.96 | 1.06 | 1.11 | 1.11 | 0.97 | 1.02 |
| SSB2018 | 0.146 | 1.06 | 1.17 | 1.16 | 1.05 | 1.06 | 0.95 | 1.65 | 1.33 | 1.30 | 0.96 | 1.08 |
| Depl2018 | 0.118 | 1.15 | 1.12 | 1.08 | 1.02 | 1.02 | 1.04 | 1.65 | 1.38 | 1.34 | 1.01 | 1.13 |
| RBC2018 | 0.138 | 1.07 | 1.15 | 1.13 | 1.05 | 1.04 | 0.97 | 1.66 | 1.31 | 1.30 | 1.00 | 1.06 |
| Constant; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.083 | 1.05 | 1.08 | 1.07 | 0.99 | 1.00 | 1.04 | 1.09 | 1.14 | 1.14 | 0.97 | 1.06 |
| SSB2018 | 0.117 | 1.14 | 1.09 | 1.09 | 1.05 | 1.06 | 1.10 | 1.55 | 1.30 | 1.30 | 1.11 | 1.30 |
| Depl2018 | 0.109 | 1.03 | 1.00 | 1.00 | 0.98 | 1.01 | 1.17 | 1.53 | 1.17 | 1.17 | 1.13 | 1.37 |
| RBC2018 | 0.113 | 1.06 | 1.17 | 1.16 | 1.01 | 1.00 | 1.13 | 1.51 | 1.25 | 1.25 | 1.09 | 1.30 |
| High initial; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.082 | 1.01 | 1.04 | 1.03 | 0.99 | 0.99 | 1.03 | 1.06 | 1.08 | 1.07 | 1.01 | 1.04 |
| SSB2018 | 0.116 | 1.10 | 1.28 | 1.12 | 1.05 | 1.17 | 1.14 | 1.44 | 1.65 | 1.35 | 1.05 | 1.27 |
| Depl2018 | 0.104 | 1.10 | 1.30 | 1.23 | 0.99 | 1.15 | 1.28 | 1.48 | 1.78 | 1.35 | 1.28 | 1.44 |
| RBC2018 | 0.111 | 1.06 | 1.26 | 1.11 | 1.02 | 1.16 | 1.21 | 1.42 | 1.64 | 1.41 | 1.04 | 1.35 |
| Increase-then-decreasing; Depl2018=0.5 (base) | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.103 | 1.05 | 0.99 | 0.99 | 1.07 | 1.05 | 0.88 | 1.06 | 0.95 | 0.95 | 0.91 | 1.04 |
| SSB2018 | 0.120 | 1.24 | 1.04 | 1.04 | 0.99 | 1.05 | 0.99 | 1.92 | 1.10 | 1.10 | 0.96 | 1.32 |
| Depl2018 | 0.092 | 1.14 | 1.04 | 1.04 | 0.97 | 1.02 | 1.06 | 1.65 | 1.21 | 1.21 | 1.07 | 1.29 |
| RBC2018 | 0.110 | 1.28 | 1.11 | 1.11 | 1.08 | 1.12 | 1.01 | 1.94 | 1.18 | 1.18 | 1.01 | 1.36 |
| Increasing; Depl2018=0.5 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.126 | 1.27 | 1.29 | 1.28 | 1.05 | 1.04 | 1.01 | 1.44 | 1.28 | 1.27 | 1.01 | 1.09 |
| SSB2018 | 0.155 | 1.62 | 1.47 | 1.43 | 1.15 | 1.20 | 1.03 | 2.42 | 1.51 | 1.51 | 1.02 | 1.17 |
| Depl2018 | 0.089 | 1.62 | 1.16 | 1.15 | 1.03 | 1.01 | 1.18 | 2.51 | 1.30 | 1.28 | 1.09 | 1.20 |
| RBC2018 | 0.149 | 1.54 | 1.33 | 1.32 | 1.11 | 1.16 | 1.02 | 2.37 | 1.55 | 1.50 | 1.01 | 1.19 |
| Constant; Depl2018=0.5 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.104 | 1.15 | 1.30 | 1.30 | 1.08 | 1.07 | 0.92 | 1.28 | 1.32 | 1.32 | 0.96 | 1.08 |
| SSB2018 | 0.135 | 1.39 | 1.19 | 1.19 | 1.08 | 1.17 | 0.98 | 2.07 | 1.29 | 1.29 | 0.99 | 1.44 |
| Depl2018 | 0.090 | 1.37 | 1.09 | 1.09 | 1.10 | 1.14 | 1.26 | 2.14 | 1.28 | 1.27 | 1.27 | 1.58 |
| RBC2018 | 0.130 | 1.34 | 1.21 | 1.21 | 1.05 | 1.13 | 0.99 | 2.00 | 1.34 | 1.34 | 0.97 | 1.49 |
| High initial; Depl2018=0.25 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.096 | 1.26 | 1.09 | 1.14 | 1.07 | 1.09 | 0.90 | 1.27 | 1.27 | 1.18 | 0.94 | 0.98 |
| SSB2018 | 0.127 | 1.38 | 1.43 | 1.26 | 1.05 | 1.21 | 1.09 | 1.90 | 1.57 | 1.34 | 1.11 | 1.41 |
| Depl2018 | 0.104 | 1.15 | 1.32 | 1.15 | 1.04 | 1.18 | 1.22 | 1.54 | 1.50 | 1.29 | 1.26 | 1.49 |
| RBC2018 | 0.127 | 1.25 | 1.32 | 1.16 | 1.06 | 1.06 | 1.01 | 1.67 | 1.54 | 1.35 | 1.09 | 1.39 |

Supplementary Table 2. Median Absolute Relative Errors (MAREs) for experiment 5. The leftmost column “Base” column reports the MAREs and, for the remaining columns, the MARE for the cases concerned is divided by the MARE for “Base”.

1. Selectivity is time-invariant in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Time-invariant selectivity in the OM; catch series 1 | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.092 | 1.19 | 1.16 | 1.16 | 1.10 | 1.11 | 1.10 | 1.23 | 1.06 | 1.06 | 1.12 | 1.12 |
| SSB2018 | 0.099 | 1.50 | 1.06 | 1.06 | 0.98 | 1.03 | 0.95 | 2.22 | 1.42 | 1.42 | 1.02 | 1.45 |
| Depl2018 | 0.083 | 1.24 | 1.12 | 1.12 | 0.98 | 1.01 | 1.08 | 1.74 | 1.40 | 1.40 | 0.95 | 1.39 |
| RBC2018 | 0.094 | 1.38 | 1.05 | 1.05 | 0.97 | 1.05 | 0.97 | 2.16 | 1.45 | 1.45 | 1.00 | 1.48 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.098 | 1.19 | 1.33 | 1.33 | 1.05 | 1.08 | 0.96 | 1.16 | 1.22 | 1.22 | 0.98 | 1.03 |
| SSB2018 | 0.101 | 1.44 | 1.25 | 1.25 | 1.02 | 1.16 | 1.09 | 2.04 | 1.62 | 1.62 | 1.04 | 1.52 |
| Depl2018 | 0.083 | 1.15 | 1.08 | 1.08 | 0.94 | 1.07 | 1.18 | 1.69 | 1.60 | 1.60 | 1.01 | 1.49 |
| RBC2018 | 0.097 | 1.33 | 1.18 | 1.18 | 1.01 | 1.10 | 1.08 | 1.88 | 1.67 | 1.67 | 1.07 | 1.54 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.098 | 1.15 | 1.43 | 1.43 | 0.99 | 1.10 | 0.96 | 1.14 | 1.32 | 1.32 | 1.00 | 1.11 |
| SSB2018 | 0.094 | 1.43 | 1.58 | 1.59 | 1.00 | 1.21 | 1.22 | 2.05 | 2.29 | 2.25 | 1.15 | 1.53 |
| Depl2018 | 0.079 | 1.16 | 1.34 | 1.38 | 0.99 | 1.10 | 1.20 | 1.49 | 2.12 | 2.12 | 1.14 | 1.42 |
| RBC2018 | 0.091 | 1.31 | 1.40 | 1.42 | 0.99 | 1.16 | 1.04 | 1.79 | 2.30 | 2.27 | 1.19 | 1.45 |
| Time-invariant selectivity in the OM; catch series 2 | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.121 | 1.25 | 1.25 | 1.21 | 1.05 | 1.08 | 1.03 | 1.47 | 1.40 | 1.36 | 1.03 | 1.07 |
| SSB2018 | 0.138 | 1.84 | 1.40 | 1.39 | 1.00 | 1.09 | 1.04 | 2.60 | 1.81 | 1.78 | 1.04 | 1.32 |
| Depl2018 | 0.090 | 1.44 | 1.16 | 1.16 | 0.96 | 1.08 | 1.08 | 2.27 | 1.39 | 1.37 | 0.94 | 1.23 |
| RBC2018 | 0.135 | 1.72 | 1.41 | 1.36 | 1.00 | 1.08 | 1.00 | 2.52 | 1.71 | 1.67 | 1.07 | 1.30 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.117 | 1.30 | 1.64 | 1.61 | 1.02 | 1.10 | 0.92 | 1.57 | 1.99 | 1.81 | 0.98 | 1.13 |
| SSB2018 | 0.144 | 1.86 | 1.61 | 1.53 | 1.05 | 1.12 | 1.05 | 2.62 | 1.95 | 1.88 | 1.08 | 1.40 |
| Depl2018 | 0.095 | 1.40 | 1.40 | 1.38 | 0.97 | 1.00 | 1.08 | 2.20 | 1.55 | 1.50 | 0.99 | 1.45 |
| RBC2018 | 0.134 | 1.81 | 1.57 | 1.48 | 1.05 | 1.08 | 1.05 | 2.52 | 2.00 | 1.97 | 1.11 | 1.51 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.117 | 1.34 | 1.63 | 1.63 | 0.97 | 1.12 | 0.96 | 1.61 | 3.20 | 3.09 | 0.97 | 1.20 |
| SSB2018 | 0.149 | 1.80 | 1.97 | 1.95 | 1.01 | 1.18 | 1.01 | 2.42 | 3.14 | 3.11 | 1.08 | 1.55 |
| Depl2018 | 0.095 | 1.35 | 1.64 | 1.64 | 0.97 | 1.07 | 1.01 | 1.89 | 2.53 | 2.49 | 1.08 | 1.48 |
| RBC2018 | 0.141 | 1.75 | 1.88 | 1.88 | 1.00 | 1.11 | 1.04 | 2.25 | 2.96 | 2.90 | 1.12 | 1.59 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Time-invariant selectivity in the OM; catch series 3 | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.108 | 1.13 | 1.25 | 1.25 | 1.01 | 1.01 | 0.81 | 1.19 | 1.24 | 1.24 | 0.99 | 1.02 |
| SSB2018 | 0.119 | 1.55 | 1.33 | 1.33 | 1.00 | 1.05 | 0.92 | 2.28 | 1.53 | 1.53 | 0.95 | 1.48 |
| Depl2018 | 0.090 | 1.34 | 1.23 | 1.23 | 0.97 | 1.15 | 1.06 | 1.96 | 1.24 | 1.24 | 0.99 | 1.64 |
| RBC2018 | 0.112 | 1.49 | 1.25 | 1.25 | 1.01 | 1.07 | 0.91 | 2.24 | 1.48 | 1.48 | 1.01 | 1.46 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.104 | 1.15 | 1.96 | 1.96 | 1.07 | 1.06 | 0.91 | 1.22 | 1.79 | 1.79 | 1.05 | 1.19 |
| SSB2018 | 0.123 | 1.41 | 2.01 | 2.01 | 1.01 | 1.08 | 0.94 | 1.92 | 2.00 | 2.00 | 0.91 | 1.33 |
| Depl2018 | 0.090 | 1.17 | 1.64 | 1.64 | 0.98 | 1.09 | 1.11 | 1.69 | 1.89 | 1.89 | 1.14 | 1.35 |
| RBC2018 | 0.115 | 1.33 | 1.84 | 1.84 | 1.04 | 1.05 | 0.95 | 1.86 | 2.05 | 2.08 | 0.95 | 1.27 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.109 | 1.09 | 260.66 | 250.07 | 0.98 | 1.01 | 0.88 | 1.17 | 286.96 | 289.59 | 0.89 | 1.21 |
| SSB2018 | 0.117 | 1.45 | 401.32 | 389.27 | 1.02 | 1.22 | 1.01 | 1.90 | 428.62 | 434.68 | 1.12 | 1.60 |
| Depl2018 | 0.090 | 1.06 | 6.34 | 6.26 | 0.93 | 1.02 | 1.12 | 1.55 | 6.01 | 6.01 | 1.10 | 1.49 |
| RBC2018 | 0.111 | 1.36 | 355.26 | 343.17 | 1.01 | 1.18 | 1.01 | 1.77 | 363.27 | 372.70 | 1.09 | 1.47 |
| Time-invariant selectivity in the OM; catch series 4 | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.087 | 1.35 | 1.23 | 1.25 | 1.05 | 1.14 | 1.02 | 1.38 | 1.30 | 1.30 | 1.07 | 1.12 |
| SSB2018 | 0.111 | 1.56 | 1.62 | 1.47 | 0.97 | 1.15 | 1.06 | 2.06 | 2.03 | 1.64 | 1.06 | 1.54 |
| Depl2018 | 0.093 | 1.26 | 1.39 | 1.28 | 0.95 | 1.27 | 1.23 | 1.73 | 1.56 | 1.44 | 1.19 | 1.72 |
| RBC2018 | 0.108 | 1.36 | 1.47 | 1.37 | 0.94 | 1.01 | 1.02 | 1.86 | 1.77 | 1.52 | 0.97 | 1.40 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.098 | 1.24 | 2.02 | 2.35 | 0.98 | 1.06 | 0.89 | 1.26 | 2.20 | 2.40 | 0.94 | 1.12 |
| SSB2018 | 0.111 | 1.38 | 2.79 | 2.83 | 1.00 | 1.14 | 1.06 | 1.73 | 3.34 | 3.78 | 1.12 | 1.46 |
| Depl2018 | 0.091 | 1.02 | 2.21 | 2.02 | 1.02 | 1.01 | 1.22 | 1.39 | 2.69 | 2.76 | 1.20 | 1.65 |
| RBC2018 | 0.107 | 1.28 | 2.38 | 2.32 | 0.98 | 1.07 | 1.02 | 1.55 | 2.89 | 3.21 | 1.09 | 1.50 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.104 | 1.21 | 3.44 | 3.44 | 0.99 | 1.07 | 0.99 | 1.25 | 348.55 | 740.79 | 0.91 | 1.34 |
| SSB2018 | 0.115 | 1.48 | 5.50 | 5.66 | 1.14 | 1.14 | 1.16 | 1.91 | 497.92 | 1087.35 | 1.20 | 1.83 |
| Depl2018 | 0.092 | 1.03 | 2.62 | 2.75 | 0.92 | 1.07 | 1.20 | 1.38 | 5.27 | 6.11 | 1.17 | 1.79 |
| RBC2018 | 0.114 | 1.30 | 4.22 | 4.57 | 1.05 | 1.10 | 1.08 | 1.74 | 443.30 | 868.06 | 1.21 | 1.77 |

1. Selectivity is time-varying in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Increasing-then-decreasing catch series | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.103 | 1.05 | 0.99 | 0.99 | 1.07 | 1.05 | 0.88 | 1.06 | 0.95 | 0.95 | 0.91 | 1.04 |
| SSB2018 | 0.120 | 1.24 | 1.04 | 1.04 | 0.99 | 1.05 | 0.99 | 1.92 | 1.10 | 1.10 | 0.96 | 1.32 |
| Depl2018 | 0.092 | 1.14 | 1.04 | 1.04 | 0.97 | 1.02 | 1.06 | 1.65 | 1.21 | 1.21 | 1.07 | 1.29 |
| RBC2018 | 0.110 | 1.28 | 1.11 | 1.11 | 1.08 | 1.12 | 1.01 | 1.94 | 1.18 | 1.18 | 1.01 | 1.36 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.102 | 1.09 | 1.28 | 1.29 | 1.05 | 1.06 | 0.84 | 1.06 | 1.24 | 1.28 | 0.84 | 1.07 |
| SSB2018 | 0.119 | 1.32 | 1.16 | 1.17 | 1.02 | 1.07 | 1.03 | 1.81 | 1.39 | 1.40 | 1.04 | 1.22 |
| Depl2018 | 0.090 | 1.10 | 1.08 | 1.08 | 0.99 | 1.01 | 1.17 | 1.54 | 1.48 | 1.50 | 1.21 | 1.31 |
| RBC2018 | 0.119 | 1.19 | 1.09 | 1.11 | 1.06 | 1.08 | 1.01 | 1.67 | 1.29 | 1.32 | 1.01 | 1.15 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.102 | 1.09 | 1.40 | 1.40 | 0.99 | 1.06 | 0.86 | 1.07 | 1.24 | 1.24 | 0.89 | 1.02 |
| SSB2018 | 0.117 | 1.30 | 1.41 | 1.43 | 1.05 | 1.26 | 0.98 | 1.65 | 1.93 | 1.93 | 0.98 | 1.35 |
| Depl2018 | 0.092 | 1.00 | 1.18 | 1.22 | 1.03 | 1.03 | 1.14 | 1.24 | 1.79 | 1.79 | 1.17 | 1.19 |
| RBC2018 | 0.118 | 1.13 | 1.24 | 1.28 | 1.04 | 1.12 | 0.99 | 1.49 | 1.75 | 1.76 | 0.98 | 1.21 |
| Increasing-then-decreasing catch series | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.126 | 1.27 | 1.29 | 1.28 | 1.05 | 1.04 | 1.01 | 1.44 | 1.28 | 1.27 | 1.01 | 1.09 |
| SSB2018 | 0.155 | 1.62 | 1.47 | 1.43 | 1.15 | 1.20 | 1.03 | 2.42 | 1.51 | 1.51 | 1.02 | 1.17 |
| Depl2018 | 0.089 | 1.62 | 1.16 | 1.15 | 1.03 | 1.01 | 1.18 | 2.51 | 1.30 | 1.28 | 1.09 | 1.20 |
| RBC2018 | 0.149 | 1.54 | 1.33 | 1.32 | 1.11 | 1.16 | 1.02 | 2.37 | 1.55 | 1.50 | 1.01 | 1.19 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.129 | 1.29 | 1.46 | 1.44 | 1.08 | 1.14 | 0.88 | 1.52 | 1.72 | 1.63 | 0.91 | 1.10 |
| SSB2018 | 0.164 | 1.73 | 1.56 | 1.52 | 1.10 | 1.28 | 0.93 | 2.31 | 1.70 | 1.61 | 1.03 | 1.17 |
| Depl2018 | 0.098 | 1.54 | 1.21 | 1.15 | 1.06 | 1.13 | 1.03 | 2.22 | 1.54 | 1.53 | 1.10 | 1.20 |
| RBC2018 | 0.160 | 1.59 | 1.45 | 1.41 | 1.03 | 1.22 | 0.98 | 2.17 | 1.68 | 1.66 | 0.97 | 1.10 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.116 | 1.44 | 1.78 | 1.78 | 1.05 | 1.26 | 0.96 | 1.65 | 2.89 | 2.89 | 0.98 | 1.19 |
| SSB2018 | 0.170 | 1.70 | 1.86 | 1.86 | 1.07 | 1.27 | 0.93 | 2.20 | 2.99 | 2.99 | 0.96 | 1.27 |
| Depl2018 | 0.101 | 1.41 | 1.37 | 1.33 | 1.09 | 1.22 | 1.13 | 1.89 | 2.15 | 2.15 | 1.11 | 1.34 |
| RBC2018 | 0.166 | 1.49 | 1.61 | 1.61 | 1.10 | 1.19 | 0.95 | 2.01 | 2.46 | 2.46 | 0.96 | 1.28 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| Constant catch series | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.104 | 1.15 | 1.30 | 1.30 | 1.08 | 1.07 | 0.92 | 1.28 | 1.32 | 1.32 | 0.96 | 1.08 |
| SSB2018 | 0.135 | 1.39 | 1.19 | 1.19 | 1.08 | 1.17 | 0.98 | 2.07 | 1.29 | 1.29 | 0.99 | 1.44 |
| Depl2018 | 0.090 | 1.37 | 1.09 | 1.09 | 1.10 | 1.14 | 1.26 | 2.14 | 1.28 | 1.27 | 1.27 | 1.58 |
| RBC2018 | 0.130 | 1.34 | 1.21 | 1.21 | 1.05 | 1.13 | 0.99 | 2.00 | 1.34 | 1.34 | 0.97 | 1.49 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.103 | 1.20 | 1.97 | 1.97 | 1.07 | 1.15 | 0.98 | 1.31 | 1.83 | 1.83 | 0.94 | 1.19 |
| SSB2018 | 0.150 | 1.27 | 1.64 | 1.66 | 0.99 | 1.02 | 0.93 | 1.65 | 1.64 | 1.64 | 0.92 | 1.13 |
| Depl2018 | 0.096 | 1.16 | 1.59 | 1.59 | 1.09 | 1.09 | 1.25 | 1.62 | 1.78 | 1.78 | 1.23 | 1.30 |
| RBC2018 | 0.137 | 1.24 | 1.71 | 1.71 | 1.02 | 1.05 | 0.93 | 1.55 | 1.67 | 1.67 | 0.93 | 1.15 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.107 | 1.14 | 275.04 | 254.63 | 1.07 | 1.17 | 0.98 | 1.24 | 288.34 | 288.34 | 0.91 | 1.30 |
| SSB2018 | 0.140 | 1.27 | 321.25 | 312.42 | 1.02 | 1.09 | 0.97 | 1.59 | 356.00 | 356.00 | 0.95 | 1.32 |
| Depl2018 | 0.095 | 1.17 | 5.86 | 5.81 | 1.12 | 1.18 | 1.21 | 1.48 | 5.62 | 5.62 | 1.17 | 1.52 |
| RBC2018 | 0.141 | 1.16 | 256.21 | 243.03 | 0.99 | 1.02 | 0.89 | 1.37 | 281.05 | 281.05 | 0.88 | 1.27 |
| High initial catch series | | | | | | |  |  |  |  |  |  |
| Data from year 1 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.096 | 1.26 | 1.09 | 1.14 | 1.07 | 1.09 | 0.90 | 1.27 | 1.27 | 1.18 | 0.94 | 0.98 |
| SSB2018 | 0.127 | 1.38 | 1.43 | 1.26 | 1.05 | 1.21 | 1.09 | 1.90 | 1.57 | 1.34 | 1.11 | 1.41 |
| Depl2018 | 0.104 | 1.15 | 1.32 | 1.15 | 1.04 | 1.18 | 1.22 | 1.54 | 1.50 | 1.29 | 1.26 | 1.49 |
| RBC2018 | 0.127 | 1.25 | 1.32 | 1.16 | 1.06 | 1.06 | 1.01 | 1.67 | 1.54 | 1.35 | 1.09 | 1.39 |
| Data from year 6 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.100 | 1.32 | 1.90 | 2.18 | 1.08 | 1.05 | 0.96 | 1.33 | 1.92 | 2.15 | 1.01 | 1.05 |
| SSB2018 | 0.153 | 1.07 | 2.24 | 2.28 | 1.03 | 1.06 | 0.86 | 1.34 | 2.43 | 2.45 | 0.94 | 1.16 |
| Depl2018 | 0.104 | 0.90 | 2.08 | 1.77 | 1.08 | 1.00 | 1.15 | 1.20 | 2.43 | 2.39 | 1.21 | 1.38 |
| RBC2018 | 0.147 | 1.05 | 1.98 | 1.96 | 1.03 | 1.05 | 0.88 | 1.19 | 2.20 | 2.18 | 0.94 | 1.08 |
| Data from year 11 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.105 | 1.16 | 3.07 | 3.16 | 1.05 | 1.07 | 1.03 | 1.30 | 9.28 | 105.68 | 0.95 | 1.33 |
| SSB2018 | 0.157 | 1.19 | 4.00 | 4.09 | 1.08 | 1.14 | 1.01 | 1.46 | 10.13 | 133.97 | 1.00 | 1.39 |
| Depl2018 | 0.099 | 1.09 | 2.82 | 2.61 | 1.10 | 1.09 | 1.20 | 1.39 | 3.95 | 4.50 | 1.27 | 1.55 |
| RBC2018 | 0.165 | 1.00 | 2.97 | 3.08 | 1.00 | 1.01 | 0.88 | 1.23 | 7.81 | 96.94 | 0.84 | 1.21 |

Supplementary Table 3. Median Absolute Relative Errors (MAREs) for experiment 7. The leftmost column “Base” column reports the MAREs and, for the remaining columns, the MARE for the cases concerned is divided by the MARE for “Base”.

1. Time-invariant selectivity in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| CV = 0.3; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.092 | 1.19 | 1.16 | 1.16 | 1.10 | 1.11 | 1.10 | 1.23 | 1.06 | 1.06 | 1.12 | 1.12 |
| SSB2018 | 0.099 | 1.50 | 1.06 | 1.06 | 0.98 | 1.03 | 0.95 | 2.22 | 1.42 | 1.42 | 1.02 | 1.45 |
| Depl2018 | 0.083 | 1.24 | 1.12 | 1.12 | 0.98 | 1.01 | 1.08 | 1.74 | 1.40 | 1.40 | 0.95 | 1.39 |
| RBC2018 | 0.094 | 1.38 | 1.05 | 1.05 | 0.97 | 1.05 | 0.97 | 2.16 | 1.45 | 1.45 | 1.00 | 1.48 |
| CV = 0.3; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.108 | 1.12 | 1.20 | 1.20 | 1.09 | 1.10 | 0.99 | 1.14 | 1.24 | 1.24 | 1.02 | 1.06 |
| SSB2018 | 0.149 | 1.01 | 1.04 | 1.04 | 1.04 | 1.06 | 1.11 | 1.18 | 1.11 | 1.11 | 1.06 | 1.08 |
| Depl2018 | 0.105 | 1.02 | 1.04 | 1.04 | 1.00 | 1.00 | 1.17 | 1.05 | 1.20 | 1.20 | 1.22 | 1.24 |
| RBC2018 | 0.131 | 1.02 | 1.14 | 1.14 | 1.01 | 1.02 | 1.22 | 1.39 | 1.21 | 1.21 | 1.15 | 1.18 |
| CV = 0.3; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.092 | 1.22 | 1.24 | 1.24 | 1.06 | 1.17 | 0.91 | 1.23 | 1.22 | 1.22 | 0.95 | 1.10 |
| SSB2018 | 0.096 | 1.76 | 1.14 | 1.14 | 1.04 | 1.16 | 1.06 | 2.42 | 1.38 | 1.38 | 0.97 | 1.82 |
| Depl2018 | 0.088 | 1.25 | 1.05 | 1.05 | 0.92 | 1.14 | 1.06 | 1.94 | 1.37 | 1.37 | 0.98 | 1.54 |
| RBC2018 | 0.092 | 1.66 | 1.09 | 1.09 | 1.00 | 1.16 | 1.02 | 2.36 | 1.35 | 1.35 | 0.90 | 1.82 |
| CV = 0.1; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.086 | 1.18 | 1.15 | 1.15 | 1.01 | 1.01 | 1.00 | 1.27 | 1.22 | 1.22 | 1.07 | 1.07 |
| SSB2018 | 0.058 | 1.37 | 1.26 | 1.26 | 1.03 | 1.07 | 0.99 | 1.65 | 1.36 | 1.36 | 1.00 | 1.10 |
| Depl2018 | 0.066 | 1.01 | 1.13 | 1.13 | 0.99 | 0.99 | 1.07 | 1.12 | 1.14 | 1.14 | 1.06 | 1.02 |
| RBC2018 | 0.055 | 1.25 | 1.20 | 1.20 | 1.01 | 1.05 | 1.04 | 1.70 | 1.46 | 1.46 | 1.05 | 1.10 |
| CV = 0.1; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.109 | 1.09 | 1.12 | 1.12 | 1.04 | 1.06 | 0.95 | 1.06 | 1.10 | 1.10 | 0.97 | 0.97 |
| SSB2018 | 0.123 | 1.02 | 1.06 | 1.06 | 1.06 | 1.04 | 1.04 | 1.18 | 1.10 | 1.11 | 1.07 | 1.08 |
| Depl2018 | 0.081 | 1.04 | 1.09 | 1.09 | 1.05 | 1.03 | 1.13 | 1.18 | 1.28 | 1.29 | 1.10 | 1.11 |
| RBC2018 | 0.117 | 0.99 | 0.94 | 0.94 | 1.02 | 1.02 | 1.08 | 1.17 | 1.04 | 1.06 | 1.01 | 1.00 |
| CV = 0.1; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.083 | 1.24 | 1.18 | 1.18 | 1.08 | 1.12 | 1.01 | 1.25 | 1.23 | 1.23 | 1.07 | 1.22 |
| SSB2018 | 0.051 | 1.51 | 1.42 | 1.39 | 0.97 | 1.13 | 1.03 | 1.85 | 1.54 | 1.54 | 0.98 | 1.30 |
| Depl2018 | 0.067 | 1.02 | 0.99 | 0.99 | 0.97 | 1.07 | 1.09 | 1.20 | 1.16 | 1.16 | 1.04 | 1.15 |
| RBC2018 | 0.047 | 1.41 | 1.47 | 1.44 | 1.00 | 1.11 | 1.12 | 1.86 | 1.65 | 1.67 | 1.04 | 1.31 |
| CV = 0.5; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.101 | 1.13 | 1.08 | 1.08 | 1.02 | 1.01 | 0.97 | 1.30 | 1.13 | 1.13 | 0.99 | 1.04 |
| SSB2018 | 0.136 | 1.53 | 1.28 | 1.28 | 0.96 | 1.06 | 0.99 | 2.39 | 1.49 | 1.49 | 1.00 | 1.49 |
| Depl2018 | 0.105 | 1.29 | 1.24 | 1.24 | 1.00 | 1.16 | 1.19 | 2.23 | 1.43 | 1.43 | 1.05 | 1.56 |
| RBC2018 | 0.129 | 1.48 | 1.26 | 1.26 | 0.92 | 1.04 | 1.01 | 2.40 | 1.48 | 1.48 | 0.97 | 1.57 |
| CV = 0.5; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.123 | 1.04 | 1.12 | 1.12 | 1.04 | 1.04 | 0.88 | 1.06 | 1.09 | 1.09 | 1.01 | 0.99 |
| SSB2018 | 0.186 | 1.04 | 1.05 | 1.05 | 0.98 | 1.04 | 1.18 | 1.24 | 1.11 | 1.11 | 1.15 | 1.10 |
| Depl2018 | 0.132 | 0.98 | 1.01 | 1.01 | 1.02 | 1.03 | 1.08 | 1.06 | 1.11 | 1.11 | 1.11 | 1.11 |
| RBC2018 | 0.163 | 1.06 | 1.04 | 1.04 | 1.03 | 1.06 | 1.19 | 1.35 | 1.20 | 1.20 | 1.12 | 1.12 |
| CV = 0.5; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.100 | 1.17 | 1.23 | 1.23 | 1.01 | 1.06 | 0.83 | 1.29 | 1.24 | 1.24 | 0.89 | 1.13 |
| SSB2018 | 0.131 | 1.73 | 1.16 | 1.16 | 1.00 | 1.14 | 0.99 | 2.54 | 1.44 | 1.44 | 0.94 | 2.19 |
| Depl2018 | 0.108 | 1.50 | 1.10 | 1.10 | 0.93 | 1.21 | 1.13 | 2.41 | 1.38 | 1.38 | 1.04 | 1.99 |
| RBC2018 | 0.125 | 1.67 | 1.16 | 1.16 | 1.00 | 1.14 | 0.96 | 2.52 | 1.38 | 1.38 | 0.92 | 2.16 |

1. Time-varying selectivity in the operating model

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimation method (time-invariant selectivity) | | | | | | Estimation method (time-varying selectivity) | | | | | |
|  | Base | Logistic | Spline | Spline-D | Double | AIC | Base | Logistic | Spline | Spline-D | Double | AIC |
| CV = 0.3; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.103 | 1.05 | 0.99 | 0.99 | 1.07 | 1.05 | 0.88 | 1.06 | 0.95 | 0.95 | 0.91 | 1.04 |
| SSB2018 | 0.120 | 1.24 | 1.04 | 1.04 | 0.99 | 1.05 | 0.99 | 1.92 | 1.10 | 1.10 | 0.96 | 1.32 |
| Depl2018 | 0.092 | 1.14 | 1.04 | 1.04 | 0.97 | 1.02 | 1.06 | 1.65 | 1.21 | 1.21 | 1.07 | 1.29 |
| RBC2018 | 0.110 | 1.28 | 1.11 | 1.11 | 1.08 | 1.12 | 1.01 | 1.94 | 1.18 | 1.18 | 1.01 | 1.36 |
| CV = 0.3; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.113 | 1.11 | 1.22 | 1.22 | 0.98 | 0.99 | 1.03 | 1.14 | 1.25 | 1.25 | 1.03 | 1.05 |
| SSB2018 | 0.152 | 0.98 | 1.04 | 1.01 | 0.97 | 0.99 | 1.09 | 1.24 | 1.06 | 1.06 | 1.08 | 1.06 |
| Depl2018 | 0.108 | 0.99 | 1.16 | 1.15 | 1.03 | 1.03 | 1.18 | 1.17 | 1.27 | 1.27 | 1.16 | 1.16 |
| RBC2018 | 0.143 | 1.04 | 1.03 | 1.02 | 0.98 | 1.00 | 1.06 | 1.26 | 1.10 | 1.10 | 0.98 | 0.98 |
| CV = 0.3; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.098 | 1.13 | 1.24 | 1.28 | 1.01 | 1.01 | 0.88 | 1.16 | 1.17 | 1.17 | 0.93 | 1.04 |
| SSB2018 | 0.121 | 1.38 | 1.07 | 1.08 | 1.06 | 1.13 | 1.00 | 2.18 | 1.09 | 1.09 | 0.98 | 1.66 |
| Depl2018 | 0.089 | 1.30 | 1.05 | 1.07 | 0.95 | 1.18 | 1.11 | 2.17 | 1.38 | 1.38 | 1.01 | 1.63 |
| RBC2018 | 0.115 | 1.38 | 1.05 | 1.06 | 1.06 | 1.18 | 0.99 | 2.21 | 1.13 | 1.13 | 0.98 | 1.62 |
| CV = 0.1; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.104 | 0.98 | 1.01 | 1.01 | 1.05 | 1.07 | 0.94 | 0.99 | 1.02 | 1.02 | 0.95 | 0.95 |
| SSB2018 | 0.091 | 1.04 | 1.09 | 1.09 | 0.98 | 1.05 | 0.96 | 1.19 | 1.09 | 1.09 | 0.92 | 0.96 |
| Depl2018 | 0.087 | 0.94 | 0.99 | 0.99 | 1.01 | 1.00 | 0.98 | 1.05 | 1.06 | 1.05 | 0.96 | 0.99 |
| RBC2018 | 0.098 | 1.04 | 1.07 | 1.07 | 1.01 | 1.11 | 0.92 | 1.13 | 1.06 | 1.06 | 0.92 | 0.96 |
| CV = 0.1; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.102 | 1.11 | 1.13 | 1.13 | 0.99 | 0.98 | 0.97 | 1.17 | 1.21 | 1.20 | 1.01 | 1.02 |
| SSB2018 | 0.136 | 1.02 | 0.92 | 0.92 | 1.01 | 1.00 | 0.98 | 1.06 | 1.03 | 1.01 | 0.97 | 0.96 |
| Depl2018 | 0.095 | 1.14 | 1.02 | 1.02 | 0.89 | 0.94 | 1.00 | 1.05 | 1.12 | 1.12 | 1.08 | 1.05 |
| RBC2018 | 0.123 | 1.09 | 1.00 | 1.00 | 1.04 | 1.03 | 0.99 | 1.11 | 0.95 | 0.92 | 0.93 | 0.94 |
| CV = 0.1; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.110 | 0.92 | 1.06 | 1.06 | 0.95 | 0.92 | 0.87 | 0.91 | 1.04 | 1.04 | 0.90 | 0.92 |
| SSB2018 | 0.093 | 1.15 | 0.99 | 0.99 | 1.01 | 1.03 | 0.90 | 1.24 | 1.08 | 1.08 | 0.89 | 0.94 |
| Depl2018 | 0.085 | 1.06 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 1.09 | 1.06 | 1.06 | 0.93 | 1.00 |
| RBC2018 | 0.094 | 1.11 | 1.08 | 1.08 | 1.01 | 1.04 | 0.91 | 1.17 | 1.12 | 1.12 | 0.90 | 0.97 |
| CV = 0.5; Effective sample size = 100 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.096 | 1.17 | 1.17 | 1.17 | 1.03 | 1.03 | 0.93 | 1.31 | 1.12 | 1.12 | 1.02 | 1.11 |
| SSB2018 | 0.154 | 1.39 | 1.08 | 1.09 | 1.00 | 1.09 | 1.04 | 2.17 | 1.22 | 1.22 | 1.03 | 1.33 |
| Depl2018 | 0.109 | 1.34 | 1.12 | 1.12 | 1.08 | 1.15 | 1.19 | 2.24 | 1.30 | 1.30 | 1.13 | 1.51 |
| RBC2018 | 0.142 | 1.35 | 1.02 | 1.03 | 1.00 | 1.12 | 1.06 | 2.21 | 1.20 | 1.20 | 1.06 | 1.40 |
| CV = 0.5; Effective sample size = 10 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.126 | 1.09 | 1.07 | 1.08 | 0.98 | 0.99 | 0.99 | 1.07 | 1.16 | 1.16 | 1.03 | 1.03 |
| SSB2018 | 0.181 | 1.01 | 1.02 | 1.02 | 1.03 | 1.03 | 1.17 | 1.27 | 1.18 | 1.18 | 1.13 | 1.15 |
| Depl2018 | 0.123 | 1.02 | 1.11 | 1.12 | 1.04 | 1.03 | 1.18 | 1.20 | 1.20 | 1.20 | 1.26 | 1.27 |
| RBC2018 | 0.168 | 1.00 | 1.04 | 1.04 | 1.02 | 1.03 | 1.14 | 1.31 | 1.21 | 1.21 | 1.07 | 1.07 |
| CV = 0.5; Effective sample size = 200 | | | | | | |  |  |  |  |  |  |
| SSB0 | 0.095 | 1.28 | 1.32 | 1.32 | 1.11 | 1.11 | 0.86 | 1.34 | 1.32 | 1.32 | 0.91 | 1.05 |
| SSB2018 | 0.149 | 1.41 | 1.08 | 1.09 | 1.01 | 1.17 | 0.97 | 2.44 | 1.20 | 1.20 | 0.94 | 2.12 |
| Depl2018 | 0.116 | 1.40 | 0.98 | 0.99 | 1.00 | 1.28 | 1.17 | 2.41 | 1.25 | 1.25 | 1.03 | 2.04 |
| RBC2018 | 0.135 | 1.41 | 1.03 | 1.03 | 1.12 | 1.20 | 1.06 | 2.60 | 1.27 | 1.27 | 0.96 | 2.13 |

 Supplementary Fig. S1. The 20-35-48 harvest control rule. F48 is the fully-selected fishing mortality that is estimated to leave the spawning biomass at 48% of its unfished level.



Supplementary Fig. S2a. Relative errors distributions (boxes 50% of distributions; bars extend to 90% intervals) for the model outputs and the coverage probability of 90% confidence intervals for these outputs (the gray bars indicate the proportion of simulations for which the true value is in the estimated 90% confidence intervals) (1st column), relative error distributions for spawning biomass, the deviations in recruitment about the stock-recruitment relationship, and depletion (columns 2-4; dashed red line median, light shading 50% intervals, dark shading 90% intervals), the distributions for the estimates of selectivity, with the operating model selectivity indicated by the black lines, and final column indicates the proportion of replicates that led to a positive definite Hessian matrix. The results in this figure pertain to tiger flathead and the case when the operating model assumes time-invariant selectivity and the estimation method assumes time-varying selectivity.



Supplementary Fig. S2b. As for Supplementary Fig. 2a, except that the results pertain to experiment 1 when the operating model assumes time-varying selectivity and estimation method assume time-invariant selectivity.



Supplementary Fig. S2c. As for Supplementary Fig. 2a, except that the results pertain to experiment 1 when the operating model and estimation method assume time-varying selectivity.



Supplementary Fig. S3. Frequency that a selectivity form was selected by AIC and that led to the lowest absolute relative errors by model output (colors), and the relative error distributions for the estimates of selectivity for the oldest age in 2017 by fleet when there is time-invariant selectivity in the operating model. Results when the operating model assumes time-varying selectivity are shown in the upper panels for tiger flathead, in the center panels for blue grenadier, and in the lower panels for school whiting. The results in the first two columns for each species pertain to when selectivity is time-invariant in the estimation method while those in the right two columns pertain to when selectivity is time-varying in the estimation method.



Supplementary Fig. S4a. As for Fig. 2, but for blue grenadier.



Supplementary Fig. S4b. As for Fig. S2a, but for blue grenadier.



Supplementary Fig. S4c. As for Fig. S2b, but for blue grenadier.



Supplementary Fig. S4d. As for Fig. S2c, but for blue grenadier.



Supplementary Fig. S5a. As for Fig. 2, but for school whiting.



Supplementary Fig. S5b. As for Fig. S2a, but for school whiting.



Supplementary Fig. S5c. As for Fig. S2b, but for school whiting.



Supplementary Fig. S5d. As for Fig. S2c, but for school whiting.



Supplementary Fig. S6. The results for tiger flathead when the operating model and estimation method assume time-invariant selectivity with 100, 500, and 1000 simulations (rows 1-3). The columns show the relative error distributions for spawning biomass, the deviations in recruitment about the stock-recruitment relationship, and depletion (black line median, dashed red line no error from the operating model, light shading 50% intervals, dark shading 90% intervals).