**Description and layout of KPFM2 input files**.

**Initial model setup information:** Number of SSMUs

Number of “bathtubs” (sources for krill outside model arena)

Years in the initiating time series

Krill age at recruitment

Initial season (summer = 1)

Base fishing option

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SETUP |  |  |  |  | |  | |  |  | |  |  |
| N.SSMU | N.Bathtub | N.season | Timeseries.Yrs | Krill.Rage | | Init.Season | | Base.Fishing.Option | |  | | |
| 15 | 3 | 2 | 38 | 2 | | 1 | | 3 |  | |  |  |
|  |  |  |  |  | |  | |  |  | |  |  |
| SSMU.INFO | |  |  |  | |  | |  |  | |  |  |
| SSMU | SSMU | Area.(m2) | Historical.Catch(g) | | **Spatial data information**: Delineation of spatial areas (in this case, small-scale management units, SSMUs), with their size and historical catch. | |  | |  | |  |  |
| 1 | APPA | 4.22E+11 | 2.54E+10 |  | |  | |  |  | |  |  |
| 2 | APW | 3.51E+10 | 7.4E+09 |  | |  | |  |  | |  |  |
| 3 | APDPW | 1.51E+10 | 2.28E+11 |  | |  | |  |  | |  |  |
| 4 | APDPE | 1.56E+10 | 1.03E+11 |  | |  | |  |  | |  |  |
| 5 | APBSW | 2.1E+10 | 1.15E+10 |  | |  | |  |  | |  |  |
| 6 | APBSE | 2.74E+10 | 5.95E+09 |  | |  | |  |  | |  |  |
| 7 | APEI | 3.53E+10 | 9.49E+10 |  | |  | |  |  | |  |  |
| 8 | APE | 5.87E+10 | 25000000 |  | |  | |  |  | |  |  |
| 9 | SOPA | 8.09E+11 | 6.25E+09 |  | |  | |  |  | |  |  |
| 10 | SOW | 1.56E+10 | 2.17E+11 |  | |  | |  |  | |  |  |
| 11 | SONE | 1.03E+10 | 1.59E+10 |  | |  | |  |  | |  |  |
| 12 | SOSE | 1.5E+10 | 1.95E+10 |  | |  | |  |  | |  |  |
| 13 | SGPA | 9.20E+11 | 7.82E+09 |  | |  | |  |  | |  |  |
| 14 | SGW | 4.21E+10 | 3.14E+10 |  | |  | |  |  | |  |  |
| 15 | SGE | 5.37E+10 | 2.09E+11 |  | |  | |  |  | |  |  |
| 16 | BT1 | 1.88E+12 | NA |  | |  | |  |  | |  |  |
| 17 | BT2 | 7.80E+11 | NA |  | |  | |  |  | |  |  |
| 18 | BT3 | 5.24E+11 | NA |  | |  | |  |  | |  |  |
|  |  |  |  |  | |  | |  |  | |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| WHALES |  | |  |  |  |  |  |  |  |  |
|  |  | | Rage | init.type | init.value | Jphi | M | Mswitch | Mprop | Ralpha |
| SSMU | SSMU | | NA | NA | NA | NA | 1 | 1 | 1 | 1 |
| 1 | APPA | | 5 | N  **Input data for predators**:  Parameters for each predator, including initial conditions, recruitment, mortality, consumption etc. Predator groups are Whales, Seals, Penguins, and Fish (in that order). As this is for example purposes only, not all columns for predator parameters or all predator groups are shown. | 2680 | NA | 0.035 | 0 | 0 | 0.1077 |
| 2 | APW | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 3 | APDPW | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 4 | APDPE | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 5 | APBSW | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 6 | APBSE | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 7 | APEI | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 8 | APE | | 5 | N | 0 | NA | NA | NA | NA | NA |
| 9 | SOPA | | 6 | N | 2970 | NA | 0.0289 | 0 | 0 | 0.1032 |
| 10 | SOW | | 6 | N | 0 | NA | NA | NA | NA | NA |
| 11 | SONE | | 6 | N | 0 | NA | NA | NA | NA | NA |
| 12 | SOSE | | 6 | N | 0 | NA | NA | NA | NA | NA |
| 13 | SGPA | | 6 | N | 0 | NA | NA | NA | NA | NA |
| 14 | SGW | | 6 | N | 0 | NA | NA | NA | NA | NA |
| 15 | SGE | | 6 | N | 0 | NA | NA | NA | NA | NA |
|  |  | |  |  |  |  |  |  |  |  |
| SEALS |  | |  |  |  |  |  |  |  |  |
|  |  | | Rage | init.type | init.value | Jphi | M | Mswitch | Mprop | Ralpha |
| SSMU | SSMU | |  |  |  |  |  |  |  |  |
| 1 | APPA | |  |  |  |  |  |  |  |  |
| 2 | APW | |  |  |  |  |  |  |  |  |
| 3 | APDPW | |  |  |  |  |  |  |  |  |
| 4 | APDPE | |  |  |  |  |  |  |  |  |
| 5 | APBSW | |  |  |  |  |  |  |  |  |
| 6 | APBSE | |  |  |  |  |  |  |  |  |
| 7 | APEI | |  |  |  |  |  |  |  |  |
| 8 | APE | |  |  |  |  |  |  |  |  |
| KRILL |  | |  |  |  |  |  |  |  |  |
|  |  | | wbar | init.density | M0 | Ralpha | Rbeta | Rphi | M0 | Ralpha |
| Area | SSMU | | NA | NA | 1 | 1 | 1 | 1 | 2 | 2 |
| 1 | APPA | | 0.46 | 39.2 | 0 | 1.73E+12 | 1000 | 1 | 0 | 0 |
| 2 | APW | | 0.46 | 272 | 0 | 2.07E+13 | 1000 | 1 | 0 | 0 |
| 3 | APDPW | | 0.46 | 272 | 0 | 1.45E+13 | 1000 | 1 | 0 | 0 |
| 4 | APDPE | | 0.46 | 75.4 | 0  **Input data for krill**:  Parameters for krill on initial conditions, recruitment, mortality, etc. *As above, not all columns for krill parameters are shown.* | 2.82E+12 | 1000 | 1 | 0 | 0 |
| 5 | APBSW | | 0.46 | 271.92 | 0 | 1.86E+13 | 1000 | 1 | 0 | 0 |
| 6 | APBSE | | 0.46 | 271.92 | 0 | 1.37E+13 | 1000 | 1 | 0 | 0 |
| 7 | APEI | | 0.46 | 271.92 | 0 | 1.45E+13 | 1000 | 1 | 0 | 0 |
| 8 | APE | | 0.46 | 271.92 | 0 | 2.71E+13 | 1000 | 1 | 0 | 0 |
| 9 | SOPA | | 0.46 | 62.94 | 0 | 8.97E+08 | 1000 | 1 | 0 | 0 |
| 10 | SOW | | 0.46 | 638.84 | 0 | 3.51E+13 | 1000 | 1 | 0 | 0 |
| 11 | SONE | | 0.46 | 638.84 | 0 | 2.30E+13 | 1000 | 1 | 0 | 0 |
| 12 | SOSE | | 0.46 | 638.84 | 0 | 3.08E+13 | 1000 | 1 | 0 | 0 |
| 13 | SGPA | | 0.46 | 62.94 | 0 | 7.66E+09 | 1000 | 1 | 0 | 0 |
| 14 | SGW | | 0.46 | 67.68 | 0 | 4.5E+09 | 1000 | 1 | 0 | 0 |
| 15 | SGE | | 0.46 | 67.68 | 0 | 2.1E+09 | 1000 | 1 | 0 | 0 |
| 16 | BT1 | | 0.46 | NA | NA | NA | NA | NA | NA | NA |
| 17 | BT2 | | 0.46 | NA | NA | NA | NA | NA | NA | NA |
| 18 | BT2 | | 0.46 | NA | NA | NA | NA | NA | NA | NA |
|  |  | |  |  |  |  |  |  |  |  |
| CATCH.SETUP | | |  |  |  |  |  |  |  |  |
| Year | | Season | SSMU.1 | SSMU.2 | SSMU.3 | SSMU.4 | SSMU.5 | SSMU.6 | SSMU.7 | SSMU.8 |
| 1 | | 1 |  |  |  |  |  | **Catch setup**: Spatial and season distribution of catch by SSMU |  |  |
| 1 | | 2 |  |  |  |  |  |  |  |  |

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| FISHING.OPTION5.SETUP | | |  |  |  |  |  |  |
| Option5.Areas | Monitored.Spp. | Monitoring.Season | N.Points | Density.dist | Obs.Multiplier | Obs.SD |  |  |
| 1 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 2 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 3 | pengs | 1 | 10 | runif(n=100,min=5,max=45) | 1 | 0.01 |  |  |
| 4 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 5 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 6 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA  Information on fishing under options that require monitoring and observations (i.e. catch depends on changes in predators). *These have not been previously been employed in published research* |  |  |
| 7 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 8 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 9 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 10 | pengs | 1 | 10 | runif(n=100,min=5,max=45) | 1 | 0.01 |  |  |
| 11 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 12 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 13 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 14 | pengs | 1 | 10 | runif(n=100,min=5,max=45) | 1 | 0.01 |  |  |
| 15 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 16 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 17 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
| 18 | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
|  | NA | NA | NA | runif(n=100,min=5,max=45) | NA | NA |  |  |
|  |  |  |  |  |  |  |  |  |
| THESHOLD.DENSITY | |  |  | **Threshold density:** Level of krill below which the krill fishery suspends operations for the season in that area. *Not all rows shown.* |  |  |  |  |
| SSMU.1 | SSMU.2 | SSMU.3 | SSMU.4 | SSMU.5 | SSMU.6 | SSMU.7 | SSMU.8 | SSMU.9 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  |  |  |  |  |  |  |  |
| AVAILABLE.FRACTION | |  |  | **Available fraction:** Proportion of krill available to predators in each spatial area (SSMU). *Not all rows shown.* |  |  |  |  |
| SSMU.1 | SSMU.2 | SSMU.3 | SSMU.4 | SSMU.5 | SSMU.6 | SSMU.7 | SSMU.8 | SSMU.9 |
| 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
|  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| VMATRIX |  |  |  |  |  |  |  |  |  |  |
| Name | SSMU.1 | SSMU.2 | SSMU.3 | SSMU.4 | SSMU.5 | SSMU.6 | SSMU.7 | SSMU.8 | SSMU.9 | SSMU.10 |
| Season | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SSMU.1 | 0 | 0.0386 | 0.0091 | 0.0015 | 0.0091 | 0.0152 | 0.0137 | 0 | 0.3117 | 0.0061 |
| SSMU.2 | 0.077 | 0 | 0 | 0 | 0.0187 | 0 | 0 | 0 | 0.3254 | 0 |
| SSMU.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSMU.4 | 0 | 0 | 0 | 0 | 0 | 0  **Movement matrix**: Defines krill movement across spatial units (SSMUs) | 0.0445 | 0 | 0 | 0 |
| SSMU.5 | 0 | 0.0328 | 0.0328 | 0 | 0 | 0.0328 | 0 | 0 | 0.0328 | 0 |
| SSMU.6 | 0.0235 | 0 | 0 | 0 | 0.0235 | 0 | 0 | 0 | 0.0235 | 0 |
| SSMU.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2603 | 0 |
| SSMU.8 | 0.0861 | 0 | 0 | 0 | 0 | 0.0529 | 0.0421 | 0 | 0.1803 | 0.0314 |
| SSMU.9 | 0.0046 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0018 |
| SSMU.10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9957 | 0 |
| SSMU.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.7726 | 0 |
| SSMU.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6582 | 0 |
| SSMU.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSMU.14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSMU.15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BT.1 | 0.1287 | 0.005 | 0.0028 | 0.0032 | 0.0007 | 0.0025 | 0.0075 | 0 | 0.015 | 0 |
| BT.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0022 | 0 |
| BT.3 | 0.1363 | 0 | 0 | 0 | 0 | 0 | 0.0082 | 0.0555 | 0.3504 | 0.0113 |
|  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| COMPETITION.MATRIX | | |  |  |  |  |  |  |  |  |
|  | Seals | Pengs | Whales | Fish | Fishery |  |  |  |  |  |
| SSMU.1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.2 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.3 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.4 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.5 | 1 | 1 | 1 | 1 | 1 |  |  |  | **Competition matrix:** Denotes relative competition among predators and with fishery. Currently, all are equal competitors for krill (1). *This has not been altered in any published research thus far.* |  |
| SSMU.6 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.7 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.8 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.9 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.10 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.11 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.12 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.13 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.14 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| SSMU.15 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| BT1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| BT2 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| BT3 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| TIMESERIES | |  |  |  |  |  |  |  |  |  |
| Year | Season | Tub1 | Tub2 | Tub3 | Env.anomoly | Fill down as required | | |  |  |
| 1 | Time series to drive conditions based on environment and those in the bathtubs as needed. Also use to initiate model for calibration |  |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |