Herring Assessment Model (Input/Output for Sitka)

Sea State

The following output is based on the R-scripts in ham.R, and references therein.

Input Data

The following is an annotated description of the input data file. First, the R-script *ham.R* is sourced, and I use the results of the report file to read the input data into R. The input data file starts with first defining the model dimensions.

Model dimensions

The first six elements in the following code snippet shows the first and last years of data (**dat_syr, dat_nyr**), the first and last years of the population dynamics model (**mod_syr, mod_nyr**), and the youngest age-class (**sage**) and the oldest age class (**nage**). Note that the oldest age-class is modelled as a plus group.

```
source("ham.R")
t(D[1:6])
```

```
##      dat_syr dat_nyr mod_syr mod_nyr sage nage
## [1,] 1971    2015    1980    2015    3    8
```

Fecundity-at-age

The next section of the data file is the Fecundity and regression coefficients for computing the year- age-specific fecundity.

```
D[7:10]
```

```
## $nFecBlocks
## [1] 4
##
## $nFecBlockYears
## [1] 1984 1998 2002 2015
##
## $fec_slope
## [1] 195.3140 222.5500 226.1260 198.7829
##
## $fec_inter
## [1] 1840.107 2503.900 3383.016 3031.979
```

Total Annual Catch

The units of the catch can be specified in the control file, but see the section on Understanding Model Units.

```
colnames(D[['data_ct_raw']]) <- c("Year","Catch","log.se")
head(D$data_ct_raw)
```

```
##      Year Catch log.se
## [1,] 1971   686   0.07
## [2,] 1972   558   0.07
## [3,] 1973   597   0.07
## [4,] 1974   681   0.07
## [5,] 1975  1532   0.07
## [6,] 1976   800   0.07
```

The time series plot in Fig. 1 shows the catch before any scaling factors have been apllied. The model output, however, provides the scaled catch data (i.e., conversion from short tons to metric tons).
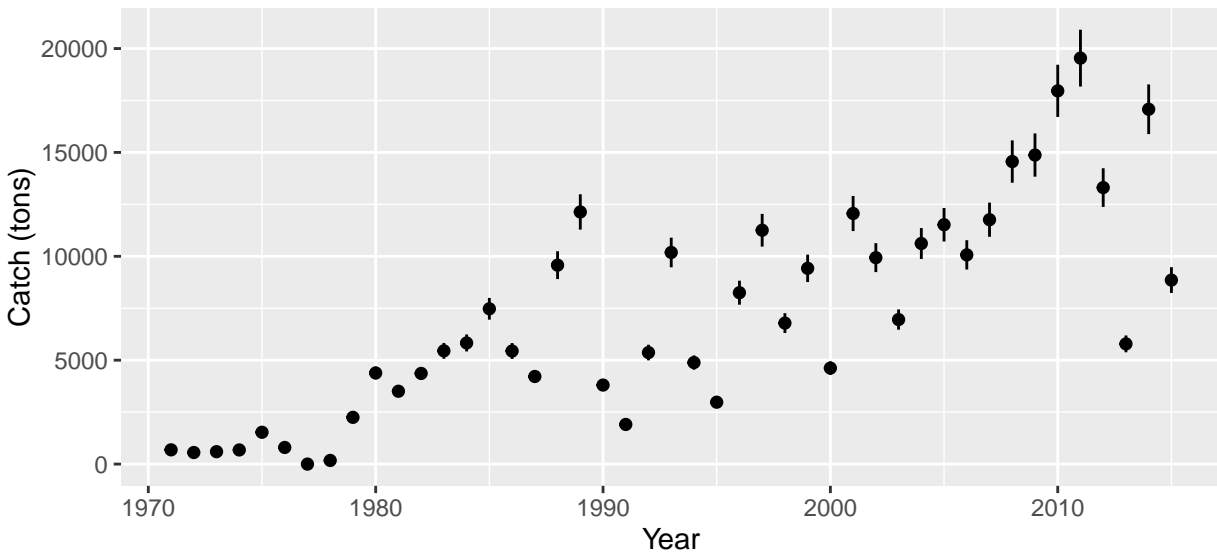
```
print(d1)
```


Figure 1: Catch time series and input standard deviation.

Empirical Weight-at-age

The weight-at-age data have the units of grams. There are two input weight-at-age matrixes, the first is for the observed spawning weight-at-age, and the second is the observed commercial catch weight-at-age. The row dimensions of each matrix are from dat_syr – dat_nyr.

```
colnames(D[['data_sp_waa']]) <- c("Year",paste(D$sage:D$nage))
head(D$data_sp_waa)
```

```
##      Year  3     4     5     6   7   8
## [1,] 1971 85 113.0 131.0 137.0 155 170
## [2,] 1972 85 110.0 128.0 153.0 154 177
## [3,] 1973 67  85.6 108.6 137.2 172 186
## [4,] 1974 67 102.0 119.0 153.0 166 190
## [5,] 1975 76  85.0 114.0 121.0 129 153
## [6,] 1976 73 100.0 116.0 129.0 137 160
```
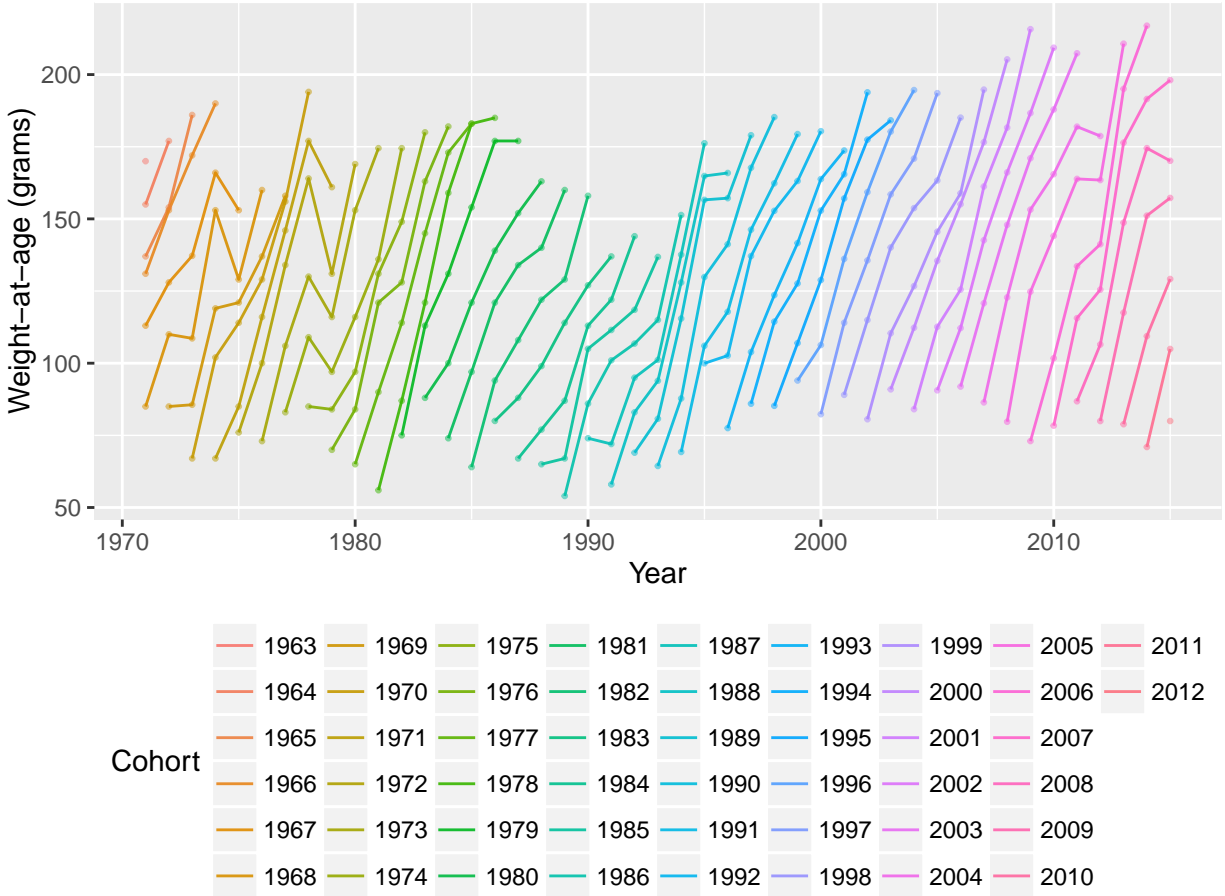
```
print(d2)
```


Figure 2: Empirical weight-at-age data versus year, where each line represents a specific cohort over time. Note that the terminal age is a plus group.

The commercial weight-at-age data entry has the same units and dimensions of the empirical spawning weight-at-age data. Note that weight-at-age data must be specfied for all – as in no missing – data years.

Catch Composition

The next two blocks of data input correspond to the Commercial age composition and spawn–sample age composition data, respectively. A row must be specified for each year, and if there are no data for a given year, the entry is simply -9. For example, see the missing data in 1977 in the example below.

```
colnames(D[['data_cm_comp']]) <- c("Year",paste(D$sage:D$nage))
head(D$data_cm_comp, 10)
```

```
##        Year      3      4      5      6      7      8
## [1,] 1971  0.0700  0.2100  0.3100  0.1000  0.1700  0.1400
## [2,] 1972  0.0620  0.3051  0.1835  0.2038  0.0721  0.1734
## [3,] 1973  0.8330  0.0648  0.0666  0.0164  0.0128  0.0064
## [4,] 1974  0.0303  0.7273  0.1010  0.0707  0.0303  0.0404
```

```
##  [5,] 1975  0.1100  0.0900  0.5400  0.1700  0.0700  0.0200
##  [6,] 1976  0.0202  0.1717  0.1616  0.5152  0.1111  0.0202
##  [7,] 1977 -9.0000 -9.0000 -9.0000 -9.0000 -9.0000 -9.0000
##  [8,] 1978  0.5900  0.2800  0.0700  0.0200  0.0100  0.0300
##  [9,] 1979  0.6245  0.3117  0.0401  0.0135  0.0034  0.0068
## [10,] 1980  0.1606  0.6970  0.1275  0.0125  0.0025  0.0000
```
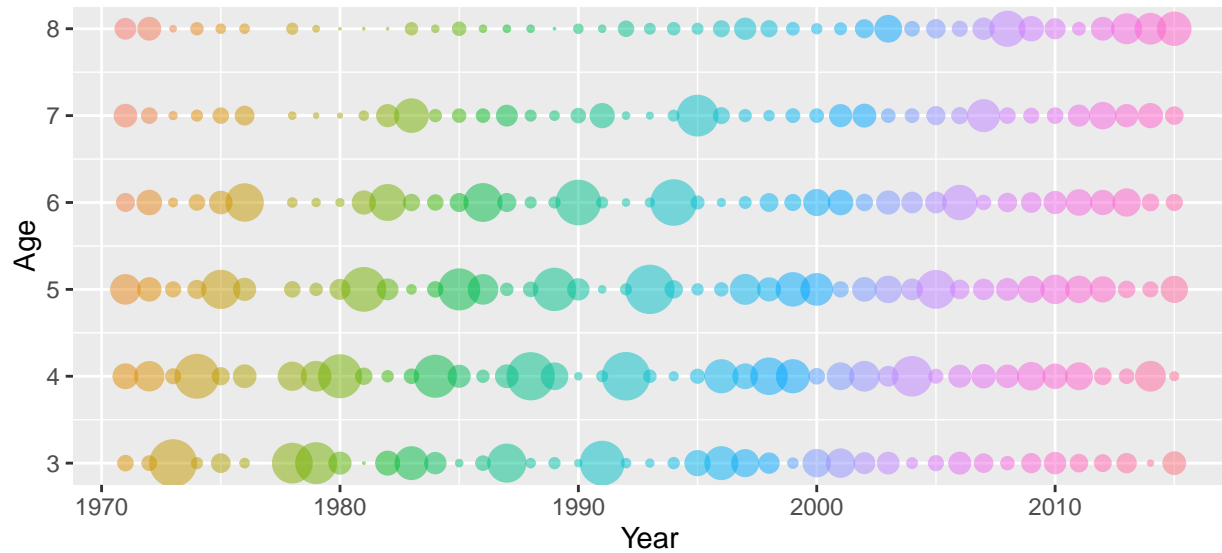
```
print(d4)
```


Figure 3: Commercial age-proportions where the area of each circle is proportional to the proportion-at-age in a given year and the colors are unique to each cohort.

Egg Deposition Data

The egg deposition data follows the spawn–sample age composition data. This is a 3 column matrix with row dimensions specified for each *data year*. The index value for years with no survey data are set equal to -9.

```
colnames(D[['data_egg_dep']]) <- c("Year","Index","log.se")
head(D$data_egg_dep, 10)
```

```
##        Year Index log.se
##  [1,] 1971 0.425    0.1
##  [2,] 1972 0.675    0.1
##  [3,] 1973 0.500    0.1
##  [4,] 1974 0.500    0.1
##  [5,] 1975 0.400    0.1
##  [6,] 1976 0.308    0.1
##  [7,] 1977 0.523    0.1
##  [8,] 1978 0.341    0.1
##  [9,] 1979 2.050    0.1
## [10,] 1980 3.150    0.1
```

4

Mile-Days of Milt

The last of the fisheries independent data is just before the *end of file marker* (#EOF 999). This data structure has the same dimensions as the previous table. There must be a row for each *data year*, and missing data is substituded with a -9 for the index value.

```
colnames(D[['data_mileday']]) <- c("Year","Index","log.se")
head(D$data_mileday, 10)
```

```
##       Year Index log.se
## [1,] 1971    -9      0
## [2,] 1972    -9      0
## [3,] 1973    -9      0
## [4,] 1974    -9      0
## [5,] 1975    -9      0
## [6,] 1976    -9      0
## [7,] 1977    -9      0
## [8,] 1978    -9      0
## [9,] 1979    -9      0
## [10,] 1980   -9      0
```

Model Output

All of the model output is contained in the *ham.rep* file. There is an R-script with a function called *read.admb(fileBaseName)* that will

Estimated parameters

```
parameters <- data.frame(Parameter=D$fit$names,MLE=D$fit$est,StDev=D$fit$std)
head(parameters,8)
```

```
##          Parameter        MLE   StDev
## 1         theta[1] -1.045600 0.23521
## 2         theta[2]  5.142400 0.58151
## 3         theta[3]  5.770400 0.25542
## 4         theta[4]  6.019000 0.47491
## 5         theta[5]  0.914180 0.47230
## 6 log_rinit_devs   0.400930 0.61973
## 7 log_rinit_devs  -0.074337 0.59512
## 8 log_rinit_devs  -0.092254 0.59716
```

Time series outputs include spawning stock biomass (Fig. 4) and fits to the egg deposition survey data (Fig. 5), and fits to the milt-mile data.
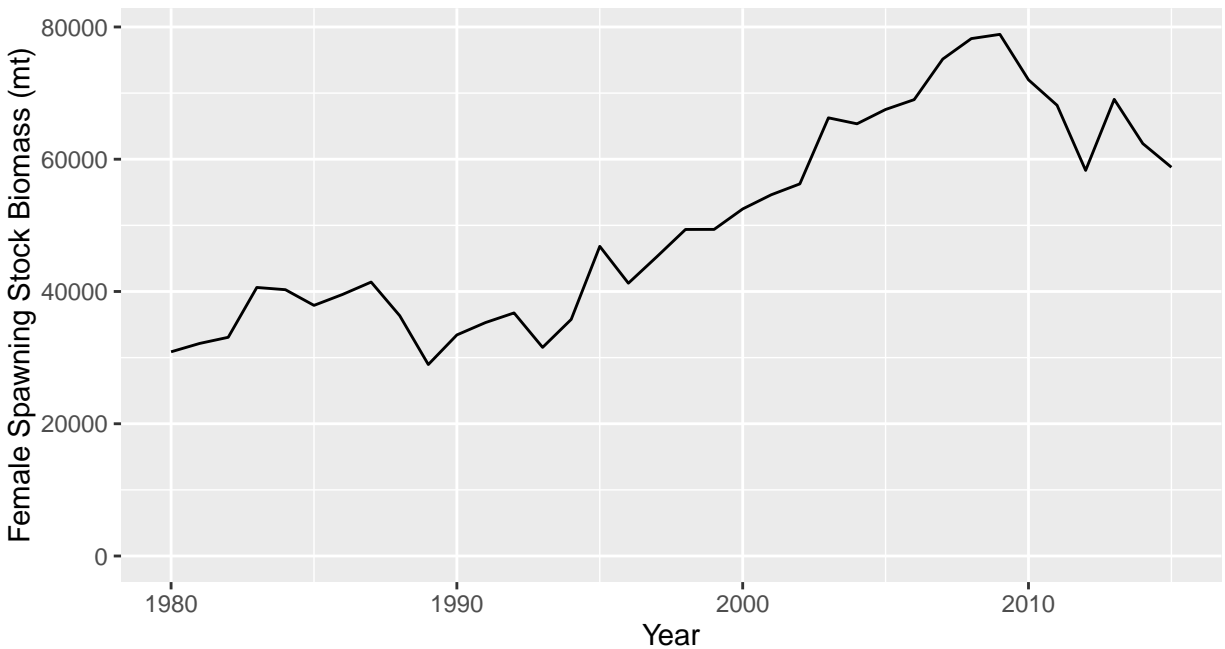
```
plot.ssb(D)
```

Figure 4: Spawning stock biomass.

```
plot.datafit(D,sfx="egg_dep")
```

Understanding Model Units

(1) The units for annual catch is specified in the model as metric tons. Therefore, if you input short tons in the data file, you must specify the conversion factor (e.g., 0.90718 # - Catch Scaler (convert from short tons to metric tons)) in the control file under Miscellaneous Controls.
(2) Numbers-at-age are in millions, assuming that weight-at-age is specified in grams.
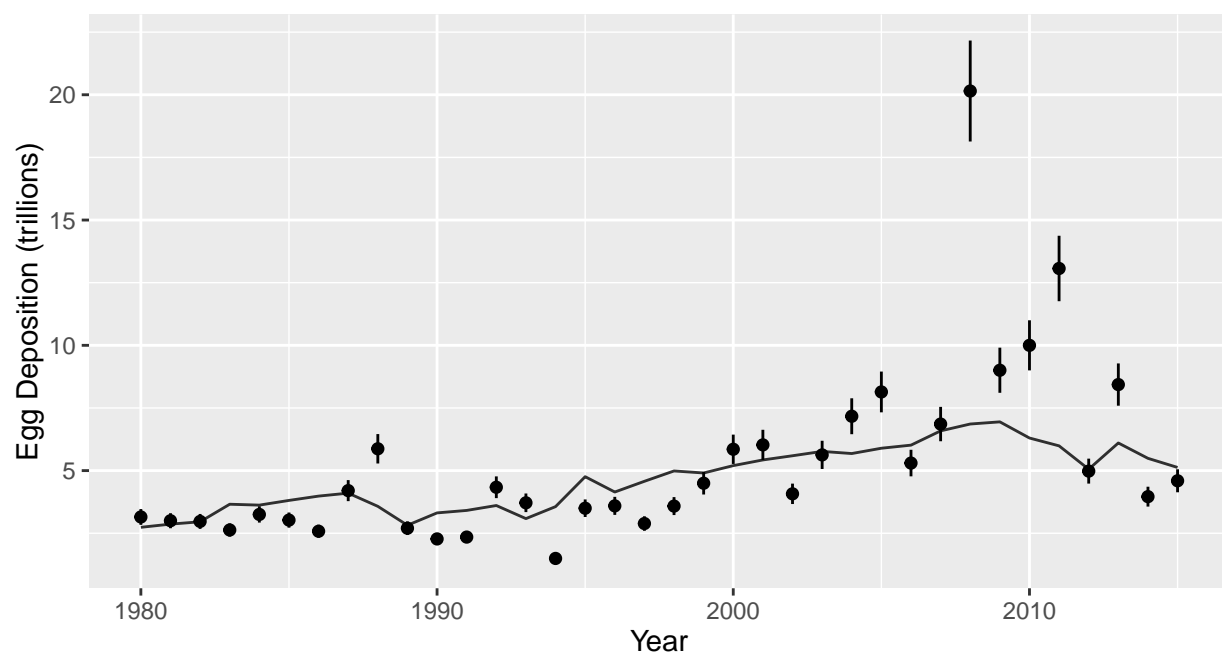(3) Egg survey numbers are scaled to trillions. For example, and entry of 1.0 corresponds to one trillion eggs.

Figure 5: Fit to the survey egg deposition data.