Construct Age-Length Keys

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Preliminaries

```
> library(FSA)                        # for headtail()
> library(dplyr)                      # for filter()
> library(nnet)                       # for multinom()
```

Loading and Preparing Data

```
> sp <- read.csv("SpotVA2.csv",header=TRUE)   # appropriately set the working directory before this
> headtail(sp)
      tl age
1   10.6   1
2    7.1   1
3   12.3   3
401  9.6  NA
402  7.5  NA
403  7.4  NA

> sp.len <- filter(sp,is.na(age))
> headtail(sp.len)
     tl age
1   9.6  NA
2   9.4  NA
3   9.1  NA
329 9.6  NA
330 7.5  NA
331 7.4  NA

> sp.age <- filter(sp,!is.na(age))
> headtail(sp.age)
     tl age
1  10.6   1
2   7.1   1
3  12.3   3
70 13.7   3
71 13.9   3
72  6.3   0

> Summarize(~tl,data=sp.age,digits=1)
       n     mean       sd      min       Q1   median       Q3      max percZero
    72.0     10.3      2.1      6.3      8.7     10.3     12.0     13.9      0.0

> sp.age.mod <- lencat(~tl,data=sp.age,startcat=6,w=1)
> headtail(sp.age.mod)
     tl age LCat
1  10.6   1   10
2   7.1   1    7
3  12.3   3   12
70 13.7   3   13
71 13.9   3   13
72  6.3   0    6
```

Observed Age-Length Key

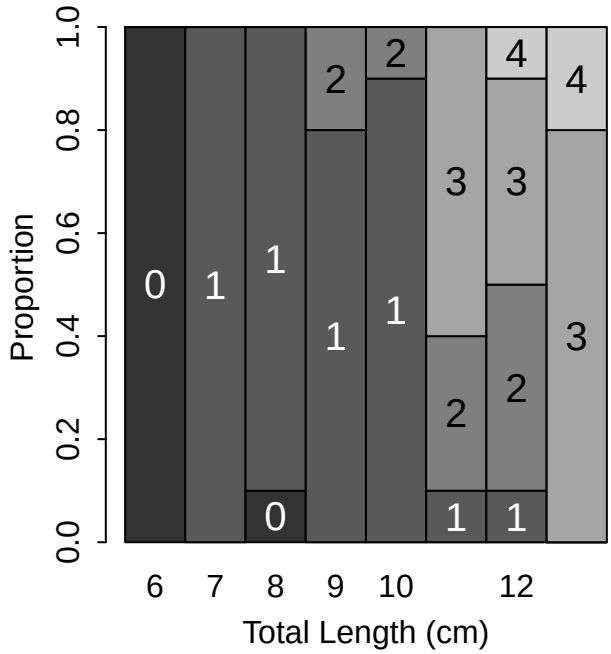
```
> ( raw <- xtabs(~LCat+age,data=sp.age.mod) )
    age
LCat  0  1  2  3  4
  6   2  0  0  0  0
  7   0 10  0  0  0
  8   1  9  0  0  0
  9   0  8  2  0  0
  10  0  9  1  0  0
  11  0  1  3  6  0
  12  0  1  4  4  1
  13  0  0  0  8  2

> ( ALK.obs <- prop.table(raw,margin=1) )
    age
LCat   0   1   2   3   4
  6  1.0 0.0 0.0 0.0 0.0
  7  0.0 1.0 0.0 0.0 0.0
  8  0.1 0.9 0.0 0.0 0.0
  9  0.0 0.8 0.2 0.0 0.0
  10 0.0 0.9 0.1 0.0 0.0
  11 0.0 0.1 0.3 0.6 0.0
  12 0.0 0.1 0.4 0.4 0.1
  13 0.0 0.0 0.0 0.8 0.2
```

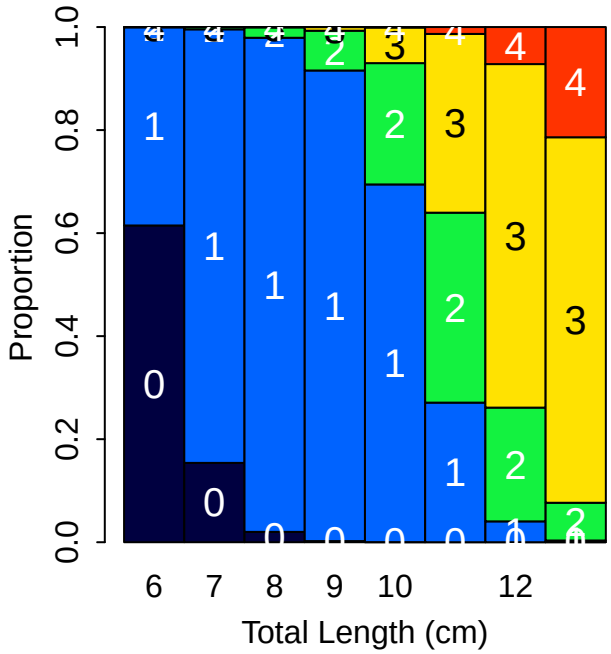
Smoothed Age-Length Key

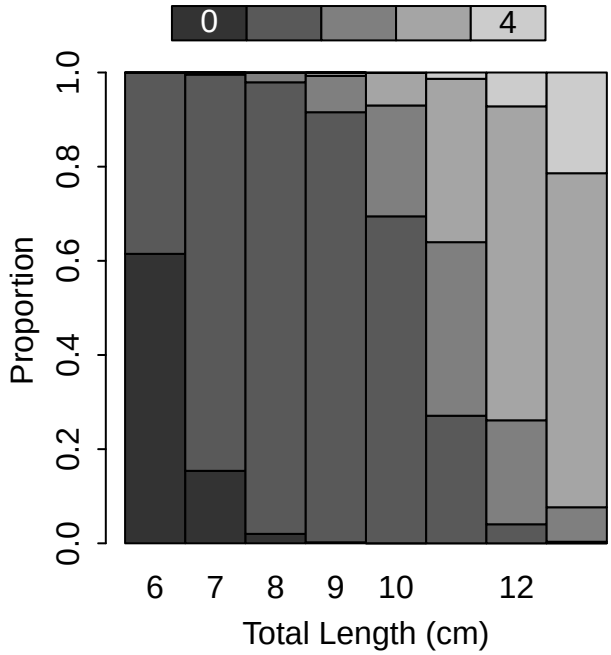
```
> mlr <- multinom(age~LCat,data=sp.age.mod,maxit=500)
# weights:  15 (8 variable)
initial  value 115.879530
iter  10 value 59.182854
iter  20 value 47.862700
iter  30 value 47.690923
iter  40 value 47.587817
iter  50 value 47.560383
iter  60 value 47.552660
iter  70 value 47.542159
iter  80 value 47.539583
iter  90 value 47.539245
iter  90 value 47.539245
final  value 47.539239
converged

> lens <- 6:13
> ALK.sm <- predict(mlr,data.frame(LCat=lens),type="probs")
> row.names(ALK.sm) <- lens
> round(ALK.sm,3)
       0     1     2     3     4
6  0.615 0.385 0.001 0.000 0.000
7  0.154 0.842 0.004 0.000 0.000
8  0.020 0.959 0.020 0.001 0.000
9  0.002 0.913 0.077 0.007 0.000
10 0.000 0.694 0.235 0.069 0.001
11 0.000 0.271 0.369 0.347 0.013
12 0.000 0.040 0.221 0.667 0.072
13 0.000 0.003 0.073 0.709 0.214
```

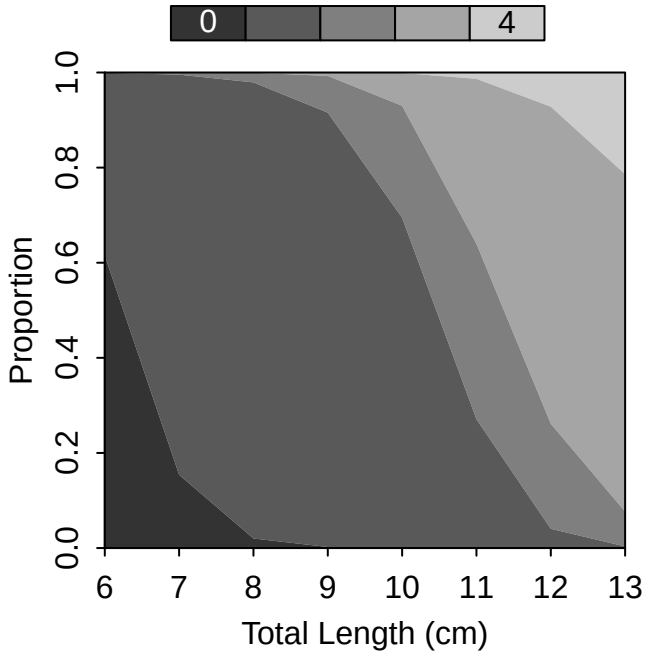
Visualizing an Age-Length Key

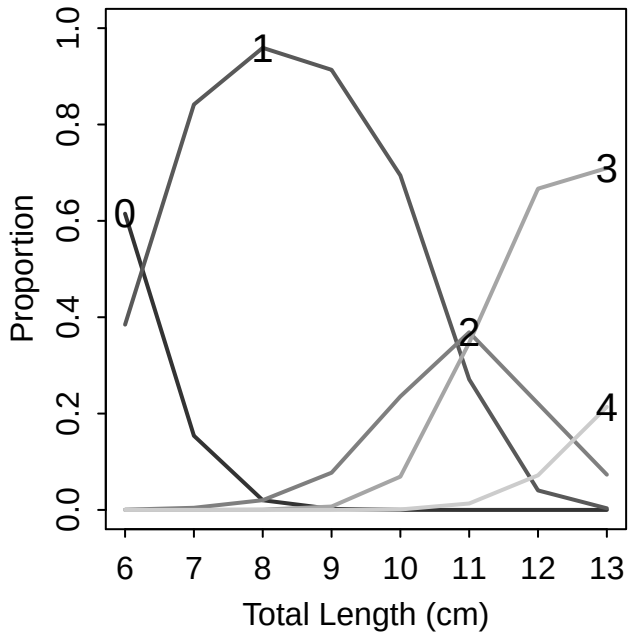
```
> alkPlot(ALK.obs,pal="gray",xlab="Total Length (cm)")
> alkPlot(ALK.sm,xlab="Total Length (cm)")
> alkPlot(ALK.sm,pal="gray",showLegend=TRUE,xlab="Total Length (cm)")
> alkPlot(ALK.sm,type="area",pal="gray",showLegend=TRUE,xlab="Total Length (cm)")
> alkPlot(ALK.sm,type="lines",pal="gray",xlab="Total Length (cm)")
> alkPlot(ALK.sm,type="bubble",xlab="Total Length (cm)")
```

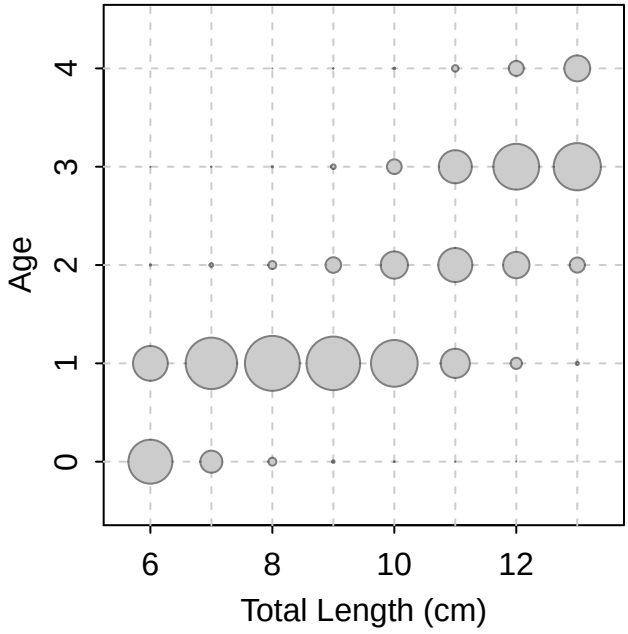












Application Assignment

Wolfert (1980) examined the population of Rock Bass (*Ambloplites rupestris*) from Eastern Lake Ontario in the late 1970s. In his studies, he measured the total length of 1288 Rock Bass. Scales were removed for age assignment from as many as 10 fish from each 10-mm length interval. The lengths and ages (if they existed) from all 1288 fish are recorded in `RockBassLO2.csv` [Note: the filename contains an "oh" not a "zero."].

Create a script that performs the following tasks:

1. Separate the observed data into age- and length-samples. How many fish are in the age-sample? How many fish are in the length-sample?

2. Add a variable that contains the 10-mm length categories to the age-sample (save as a new data frame). Then construct a table of the **number** (not proportions) of fish in each age and 10-mm TL category in the age sample. From these results, compute each of the following **BY HAND** (i.e., not using R).

- How many fish in the age-sample are in the 180-mm length category?
- How many age-7 fish are in the age-sample?
- What proportion of Rock Bass in the 140-mm length category are age-4?
- What proportion of Rock Bass in the 200-mm length category are age-8?

3. Construct an **observed** age-length key from the table above (using R). From these results answer the following questions.

- What proportion of Rock Bass in the 210-mm length category should be assigned an age of 5?
- How many of thirty Rock Bass in the 180-mm length category should be assigned an age of 5?

4. Construct a plot of the **observed** age-length key. Are there any potential anomalies in the plot that would suggest that a smoothed age-length key would be more appropriate.

5. Construct a **smoothed** age-length key from the aged sample (using R). From these results answer the same two questions as in Question 3.

Save your script!