

Construct Age-Length Keys

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Preliminaries

```
> library(FSA)                # for headtail(), alkPlot()
> library(dplyr)              # for filter(), mutate()
> library(multinom)           # for multinom()
```

Loading and Preparing Data

```
> sp <- read.csv("data/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

```
> sp.age.mod <- mutate(sp.age,lcat=lencat(tl,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  100 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)")
```



