MULTIFAN Southern Bluefin Tuna Example

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Load libraries and clear console

```
library(dplyr)
library(ggplot2)
graphics.off()
rm(list=ls(all=TRUE))
```

Southern Bluefin Tuna Exercise

In this exercise you will explore application of MULTIFAN to one of the southern bluefin tuna datasets presented in Fournier et al. 1990 (CJFAS 47: 301-317). Note this implementation of MULTIFAN does not employ exactly the same form of the multinomial likelihood described in the paper and the bounding of parameters is implemented a bit differently.

Explore Dataset 1 (1963-1966)

Start by running the model with the data file (SBFT.dat) and control file (SBFT.ctl) provided. The control file configures the model in a similar fashion to Fournier's Model 2 (Table 1) without selectivity and by estimating proportions at age, mean length of the first age class, mean length of the last age class, lambda 1 (magnitude of sds for mean length-at-age), and lambda 2 (length-dependent trend in sd for mean length-at-age).

```
shell("SBFT.exe")
```

Inspect results

Inspect model fits to the length frequency data and the number of modes detected by the model. Compare model estimates of growth to those obtained by Fournier et al. in Table 6 (note your log-likelihood and estimated number of parameters will differ because you are not estimating all the same components in the likelihood. *How similar are your results to Fournier's? Do these results seem reasonable? IOW, if you didn't have another set of estimates to compare to, would you think these were reasonable? Consult Table 7 for previously published values of K and Lin for this species.*

```
#Visualize results
MFLFs=read.delim("sbft.rep",sep="",header=FALSE)
otherres=read.delim("other.rep",sep="",header=FALSE)
obsLF=otherres[1:10,]
```

```
obsNAL=otherres[11:20,]

#Prep for visualation
midbins=seq(30.5,208.5,2)
ts=10 #number of datasets
obsLFplot=t(rbind(obsLF,midbins,rep(2,length(midbins))))
colnames(obsLFplot)=c(seq(1,ts),"Midbin","Model")
MFLFsplot=t(rbind(MFLFs,midbins,rep(3,length(midbins))))
colnames(MFLFsplot)=c(seq(1,ts),"Midbin","Model")
resLF=data.frame(rbind(MFLFsplot,obsLFplot))
resLF$Model=as.factor(resLF$Model);levels(resLF$Model)= c("Obs","Est")

#Plot observed vs estimated LFs
graphics.off()
for(t in 1:ts){
  resLFsub=resLF[,t]
  resLFsub=data.frame(cbind(resLFsub,resLF[,ts+1],resLF[,ts+2]))
  colnames(resLFsub)=c("Proportion","Midbin","Model")
  resLFsub$Model=as.factor(resLFsub$Model)
  levels(resLFsub$Model) = c("Obs","Est")
  g=ggplot(resLFsub,aes(x=Midbin,y=Proportion,color=Model))+
  geom_line()+
  geom_point(size=4,aes(shape=Model))+
  scale_shape_manual(values=c(16,15))+
  scale_color_manual(values=c("#FF33B5","#660882"))+
  theme_bw(base_size = 20)+
  xlab("Length(midbin)")+
  theme(
    legend.position = c(.95, .95),
    legend.justification = c("right", "top"),
    legend.box.just = "right",
    legend.margin = margin(6, 6, 6, 6)
  )
  print(g)
}

#Grab vonB parameter estimates
vbkest=otherres[21,1]
linf=otherres[22,1]
mLfirst=otherres[23,1]
mLlast=otherres[24,1]

vbkest
linf
mLfirst
mLlast
```

Explore assumptions and alternative starting values

Try modifying your control file to explore the assumption of number of ages present in your samples. Use the R code above to visualize/examine your results.

Next, explore alternative starting values for your estimated parameters, especially K, lambdas 1 and 2, and

mean length of the first and last age classes (consult Figure 2 for reasonable values for these).

How sensitive is the model to the assumption of number of ages? How sensitive is the model to starting values?