Catch-Survey Analysis

Nesslage

2022-09-22

Load libraries and clear console

```
library(ggplot2)
library(reshape2)
graphics.off()
rm(list=ls(all=TRUE))
```

Background: assessment model for the North Carolina stock of blue crab (*Callinectes sapidus*)

In this exercise, you will explore the 2014 Catch-Survey Analysis (CSA) assessment of blue crab in North Carolina (NC) waters conducted by Amanda Colton for her 2011 thesis and published in Colton et al. (2014). The current assessment model used for management (Lee et al. 2018) will be presented to us by Yan Li of NCDEQ on October 6th. By exploring the older, simpler model, you will be able to better appreciate the innovations in her current model.

For the 2011 NC blue crab assessment, it was assumed that blue crabs caught in NCDEQ's estuarine trawl survey <70mm carapace length (CL) represented age-0 juveniles and blue crabs >=70mm CL represented age-1+ adults. Crabs in the age-0 category were termed "recruits" (i.e., "soon to be recruits to the fishery"), and those in the age-1+ category were termed "adults". In this survey, blue crabs are counted, sexed, and up to 60 individuals are measured at each station. Amanda used the measured percentage in each age class at that station to assign unmeasured crabs to categories. To account for recreational landings, the magnitude of which is unknown, landings data were inflated by 1%.

We'll review the ADMB code for the model in lecture first. Then, if you have ADMB loaded on your machine, try building the executable in the same directory as this code then run it from within R using the shell command. If you haven't been able to get ADMB working yet, skip this step.

```
shell("bcrab.exe")
```

Import ADMB results and catch time series into R

The following code is a quick work-around for importing ADMB results into R for this workshop exercise. If you are going to use ADMB for your research, I suggest exploring one of several good interface packages available such as ADMB2R. See this **guide for interfacing between ADMB and R**. We'll likely use this package in future sessions. For today, though, we'll just rename the report file (.rep), which contains model outputs, and then read our results into R as a text file. We'll also read in the catch time series for later plotting.

```
file.rename("bcrab.rep","bcrab.txt")

repfile=read.delim("bcrab.txt",header=FALSE,sep=" ")
popmod_ests=repfile[1:31,]
colnames(popmod_ests)=c("Year","Adult_N","Rec_N","u","log_R_devs")
obsmod_ests=repfile[32:62,]
colnames(obsmod_ests)=c("Year","Est_adult","Obs_adult","Est_juv","Obs_juv")

popmod_estsN=melt(popmod_ests[,1:3],id=c("Year"))
compad=melt(obsmod_ests[,1:3],id="Year")
colnames(compad)=c("Year","ObsPred","Est")
compad$ObsPred=factor(compad$ObsPred)
compjuv=melt(obsmod_ests[,c(1,4:5)],id="Year")
colnames(compjuv)=c("Year","ObsPred","Est")
compjuv$ObsPred=factor(compjuv$ObsPred)

catch=read.delim("bcrab_catch.txt",header=T)
```

Examine model estimates

Start by plotting the time series of population model estimates of adult abundance, recruit abundance, and
annual recruitment deviations (from mean recruitment).

What trends do you observe in abundance of adults vs recruits?

```
ggplot(data=popmod_ests, aes(x=Year, y=Adult_N)) +
  geom_line()+
  geom_point()+
  labs(x="Year", y = "Adult abundance")+
  theme_classic()
ggplot(data=popmod_ests, aes(x=Year, y=Rec_N)) +
  geom_line()+
  geom_point()+
  labs(x="Year", y = "Recruit abundance")+
  theme_classic()
ggplot(data=popmod_ests, aes(x=Year, y=log_R_devs)) +
  geom_line()+
  geom_point()+
  labs(x="Year", y = "Recruitment deviations",ylim=c(-0.6,0.6))+
  geom_hline(yintercept=0,col="red")+
  theme_classic()
```

Examine trends in catch and estimated exploitation rate

Compare the input time series of catch data with estimated fishery exploitation rate.

How does estimated fishery exploitation rate (U) change over time relative to catch? Do the trends make
sense? What appears to be going on with this stock? Hint: compare catch with recruit abundance.

```
ggplot(data=popmod_ests, aes(x=Year, y=u)) +
  geom_line()+
  geom_point()+
```

```
  labs(x="Year", y = "Exploitation Rate")+
  theme_classic()
ggplot(data=catch, aes(x=Year, y=Catch)) +
  geom_line()+
  geom_point()+
  labs(x="Year", y = "Catch")+
  theme_classic()
```

Examine model fits to the observed data

Compare model estimates of adult and recruit indices with observed indices by stage (recruits vs adults).

How would you describe model fits to the survey data? What might be causing poor fit to some data sources?

```
ggplot(data=compad, aes(x=Year, y=Est,group=ObsPred)) +
  geom_line(aes(col=ObsPred))+
  geom_point(aes(shape=ObsPred))+
  labs(x="Year", y = "Adult index")+
  theme_classic()
ggplot(data=compjuv, aes(x=Year, y=Est,group=ObsPred)) +
  geom_line(aes(col=ObsPred))+
  geom_point(aes(shape=ObsPred))+
  labs(x="Year", y = "Recruit index")+
  theme_classic()
```