Schnute models

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Model aspects in more detail

In this vignette we will go into a little more detail into certain aspects of the Schnute models implemented within `sbar`. To demonstrate these aspects we'll run through an assessment with the more complex Schnute adapted observation error model of black-bellied anglerfish stock introduced in the **introsbar** vignette

##Load the data and get mean weights matrix

In this example we'll also try to fit to an additional survey which is the IE-IAMS monkfish and megrim survey. This survey runs from 2006 to 2020 but has quite a few missing years.

Remember in the **introsbar** vignette we use the IBTS survey for mean weights as this is the closest to unbias mean weights estimates we can get. Catch is likely to be too biased. Also a reminder that there's no survey data for IBTS in 2017, this isn't an issue for this assessment with the survey observations but we still need a fully populated mean weight matrix, so we fill 2017 column with `rowMeans`.

```
library(sbar)
library(FLCore)
library(TMBhelper)
data("ank78")
data("ank78.indices")
years<-as.character(2003:2020)
no.years<-length(years)
IBTS_PR_ages<-as.character(range(ank78.indices$FR_IE_IBTS)["min"]+1:range(ank78.indices$FR_IE_IBTS)["ma
IEmon_PR_ages<-ac(range(ank78.indices$IE_MONKSURVEY)["min"]+1:range(ank78.indices$IE_MONKSURVEY)["max"]
IEmon_yearrange<-ac(range(ank78.indices$IE_MONKSURVEY)["minyear"]:range(ank78.indices$IE_MONKSURVEY)["ma

Y <- c(quantSums(catch.wt(ank78)["0",years]*index(ank78.indices$FR_IE_IBTS)["0",years])/quantSums(index
Z <- c(quantSums(catch.wt(ank78)[IBTS_PR_ages,years]*index(ank78.indices$FR_IE_IBTS)[IBTS_PR_ages,years
X <- c(quantSums(catch.wt(ank78)[,years]*index(ank78.indices$FR_IE_IBTS)[,years])/quantSums(index(ank78

mwts <- matrix(NA,ncol=no.years,nrow=3)
mwts[1,] <- Y
mwts[2,] <- Z
mwts[3,] <- X
mwts[,15] <- rowSums(mwts,na.rm=T)/(no.years-1)
```

Growth and estimating growth parameters

If information on growth is available and weights-at-age are available these can be used (as is common for delay-difference models) to estimate growth parameters with a linear model,

$$\bar{w}_{a+1} = W + \rho \bar{w}_a$$

where $\bar{w}_a$ is the estimated weight-at-age and $\bar{w}_{a+1}$ is the weight-at-age a year older from sampling.

Another option, suggested as a check by Schnute (1987), can be used to estimate growth parameters through estimation of a linear model on overall mean weights and previously-exploited stage mean weights from sampling:

$$X_t^{'} = W + \rho \bar{X}_t = \bar{Z}_{t+1}$$

This equation states that the entire population sampled mean weight ($\bar{X}$) in time *t*, after a year of growth, will be equivalent to the sampled mean weight of the previously-exploited population ($\bar{Z}$) in time *t+1*. This relationship enables the estimation of the parameters W and ρ prior to assessment model by fitting a simple linear model where $\bar{X}_t$ and $\bar{Z}_{t+1}$ are generally calculated from the chosen weight intervals applied to the catch data. When fitting these linear models prior to running the assessments, residuals were assumed to be normally distributed.

Schnute, Jon. 1987. "A General Fishery Model for a Size-Structured Fish Population." *Canadian Journal of Fisheries and Aquatic Sciences* 44 (5): 924–40.