Review of literature for state-space assessment project

**2014, Nielsen & Berg, “Estimation of time-varying selectivity in stock assessments using state-space models”, Fisheries Research.**

Explored time-varying selectivity.

Define selectivity at age a in year y as Sa,y = Fa,y / suma(Fa,y)

Explored four different structures on Fa,y:

(A) Equal and constant F’s

(B) Uncorrelated F’s (rho = 0)

(C) A single, identical correlation for all ages (rho = x, termed compound symmetry)

(D) Correlation between ages is an AR(1) function of difference between ages (rho = x|age diff|)

Process variance in F was held constant across ages and time. The correlation between F’s across ages was varied.

Simulation tested using north sea cod case (N = 100). And a north sea cod case study.

Simulation test suggests the model is able to capture the data-generating model (Fig 2).

Model D was best according to AIC (time-varying selectivity that is correlated according to an AR1 process over ages).

Large differences in terminal year SSB and F depending on correlation structure.

**2016, Berg & Nielsen, “Accounting for correlated observations in an age-based state-space stock assessment model”, ICES Journal of Marine Science.**

Explored correlated observations.

The general correlation structure to be considered is Rax,ay = 0.5|dax – day|  which means the correlation between any age-x and age-y is a function of the difference between the two ages. The distances between any two ages can be treated as a vector of parameters which allows for the correlation to vary depending on the age.

(1) Uncorrelated observations

(2) AR(1) correlation between ages

(3) Irregular AR(1) between ages (distance varies with age, termed IRAR(1))

(4) Unconstrained for commercial catches, irregular AR(1) for surveys

(5) Unconstrained for both

They performed a simulation study to verify that the model could recapture the correct parameter values and states (supplement). Their procedure seems to work well at differentiating between true model 1 and model 5.

In the case studies, model 4 always performed best, model 5 was sometimes close. Model 1 (independent observation error) was never close.

Large differences were found in Bmsy and Fmsy when comparing the model with independent error (model 1) to the model with correlated error (model 5).

**2016, Albertsen, Nielsen, Thygesen, “Choosing the observational likelihood in state-space stock assessment models”, CJFAS.**

They explored different observation likelihoods for (i) total & proportion-at-age, and (ii) numbers-at-age.

13 models total applied to four case studies.

In general, models that included correlated observations had better AIC than those with independent observations.

Catch advice varies quite a bit depending on whether the observations are assumed independent or correlated.

**2017, Thygesen et al., “Validation of ecological state space models using the Laplace approximation”, Environ. Eco. Stat.**

Use one-step-ahead residuals to validate that the correct model structure was chosen. If problems are evident one can sometimes use the patterns in the residuals to diagnose the problem.

**2018, Aeberhard et al., “Review of State-Space Models for Fisheries Science”, Annual Review of Statistics and Its Application.**