

The estimation of stock biomass in the pre-assessment period

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The estimation of stock biomass in the pre-assessment period

1. The analytical stock assessments cover years for which catch-at-age data are available (exception may be assessments using stock-production models).
2. The goal is to extend existing stock assessments into pre-assessment time, when usually catch volume is the only available data.
3. Eero & MacKenzie ^{/*} (2011) presented a simple method for such extension

$$B_y = \frac{B_{y+1} + C_y}{1 + SPR}$$

where B=biomass, C=catch, **SPR=surplus production rate**, y=year.

4. Within the project another methods have been developed and used parallel with method of Eero & MacKenzie.

^{/*} Eero & MacKenzie (2011 Extending time series of fish biomasses using a simple surplus production-based approach. Mar Ecol Prog Ser, 440:191-202

Methods

1. New methods developed:

- the Eero & McKenzie method was extended for density dependent SPR,
- the stock-production models were used for backwards biomass extrapolation

2. Extension of Eero & McKenzie method (**constant SPR method**)

In that approach the SPR is density dependent and coupled with Eero & McKenzie approach

$$B_y = \frac{B_{y+1} + C_y}{1 + SPR_y}$$

It may be shown that:

$SPR_y = H(B_\infty - B_y)$ if stock dynamics is by Schaefer (1954) model, **SPR is linearly dependent on biomass**

$SPR_y = H(\ln B_\infty - \ln B_y)$ if stock dynamics is by Fox (1970) model, **SPR is logarithmically dependent on biomass**

Methods

The use of stock-production model for backwards biomass extrapolation

1. First, the Schaefer stock-production model was fitted to the stock dynamics from assessment period (F was taken for fishing effort)
2. Next, the model is somewhat modified and used to extrapolate backwards biomass (provides biomass estimates in pre-assessment era).

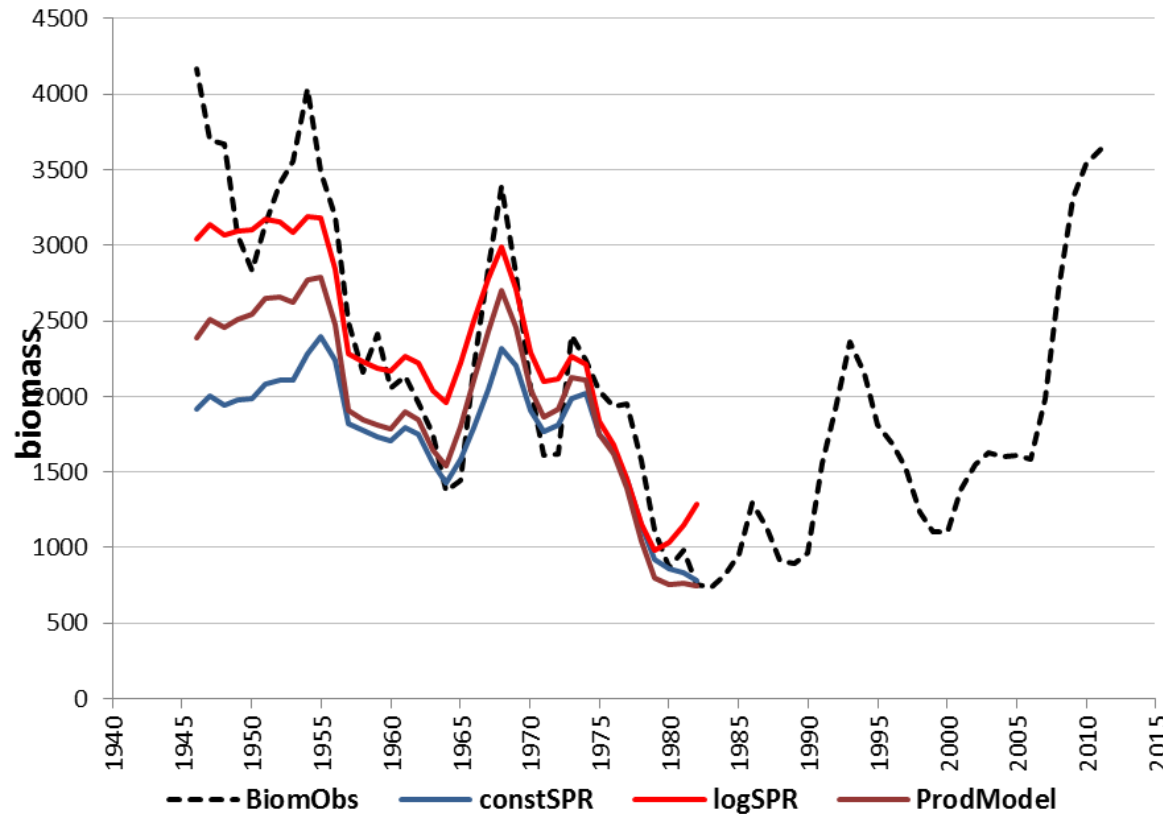
Modifications were similar to Pope (1972) approximation of VPA:

- biomass until middle of the year depends on the model parameters for unexploited stocks only,
- in middle of the year catches take place,
- for the next half of year biomass again depends on model parameters for unexploited stocks only

Testing the methods

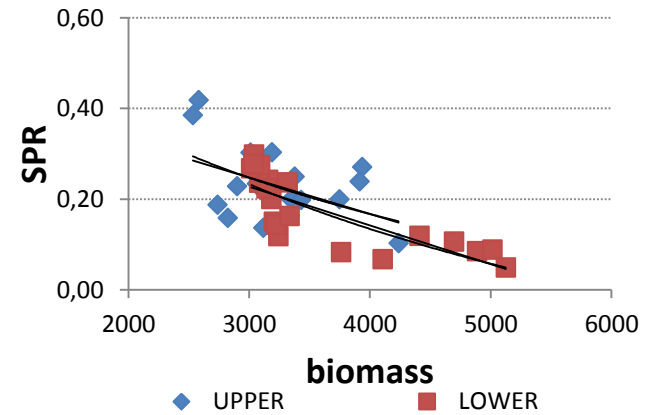
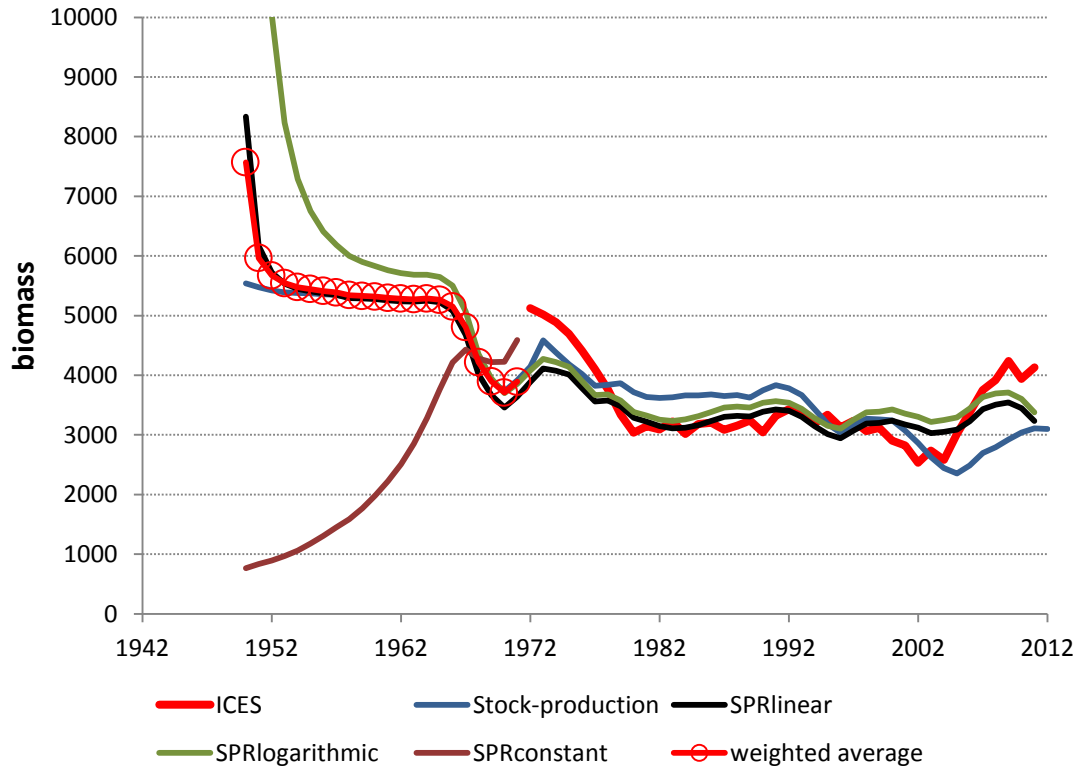
The methods may be tested on stock for which assessment results cover large number of years, e.g. 50 – 60. Such assessment may be separated into two parts and:

- first, the methods are calibrated using most recent part of assessment,
- next, the earlier part is reconstructed and the results are compared with original assessment results.



Arctic cod. Biomass estimated by ICES (BiomObs) and biomass reconstructed for 1945-82 using two methods. Reconstructed biomass is in many years similar to estimated by ICES.

Reconstruction of mackerel biomass



Thank you