

# *The estimation of stock biomass in the pre-assessment period*

Jan Horbowy  
NMFRI, Gdynia, Poland  
[www.mir.gdynia.pl](http://www.mir.gdynia.pl)

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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 <sup>/\*</sup> (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.

<sup>/\*</sup> 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).

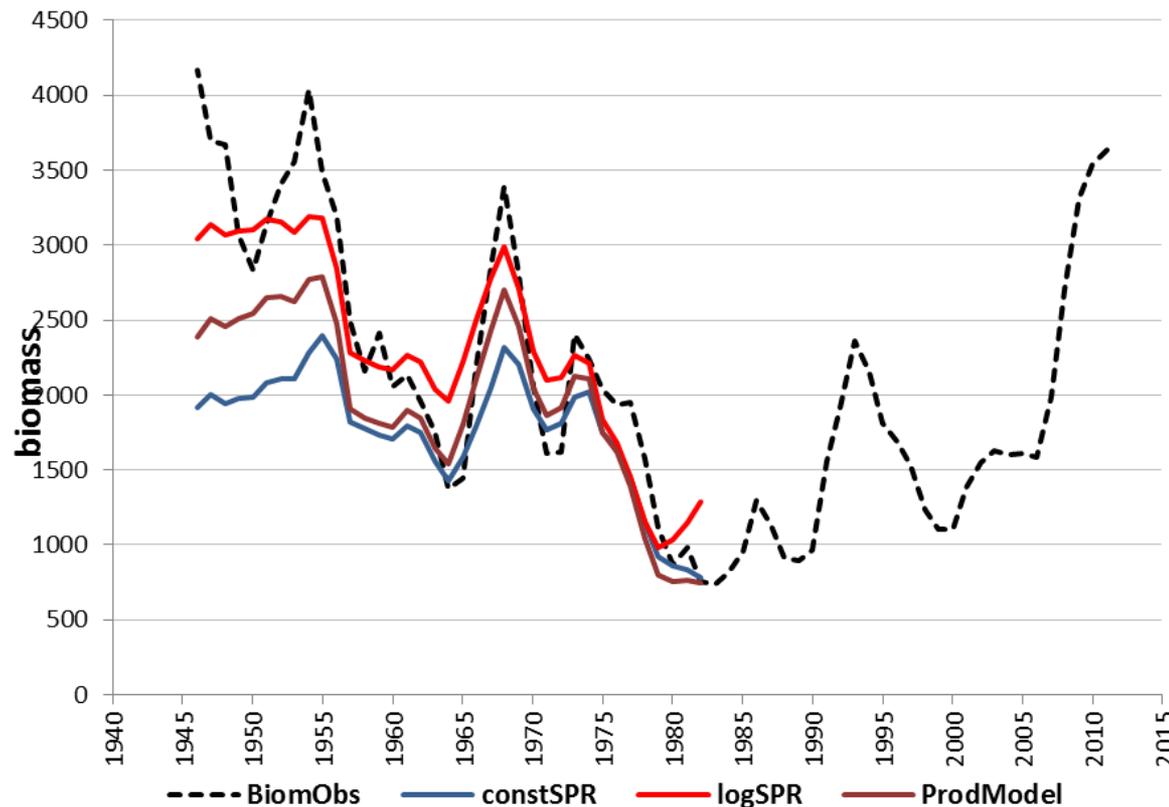
Modifications were similar to Pope (1972) approximation of VPA:

- 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

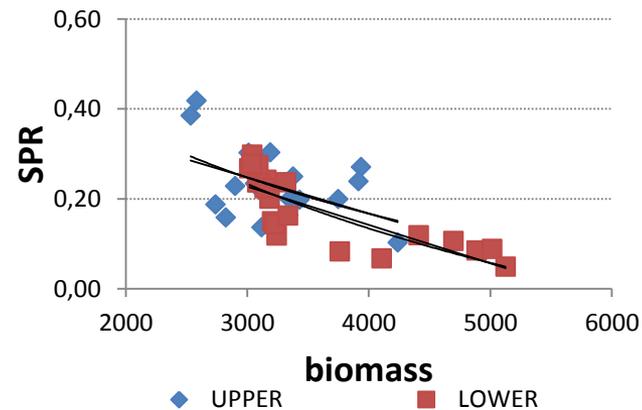
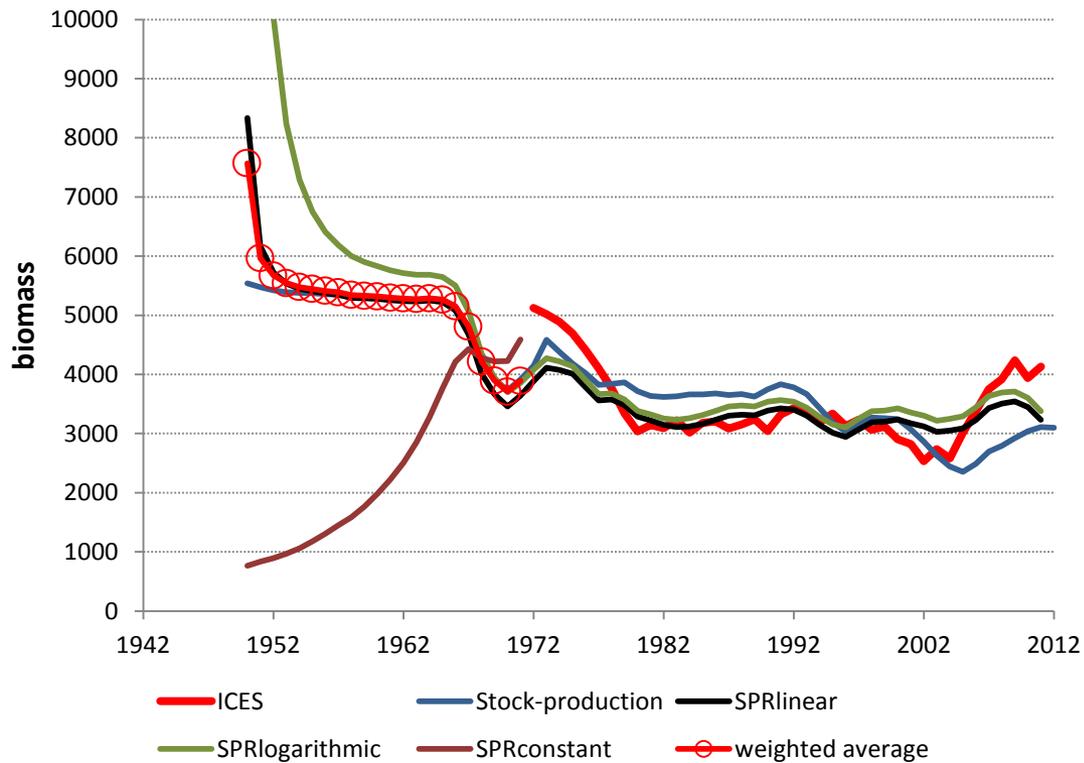
The methods may be tested on stock for which assessment results cover large number of years, e.g. 50 – 60. Such assessment may be separated into two parts and:

- 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***