Estimation methods

fish5106stockrec Spawning stock, recruitment and production

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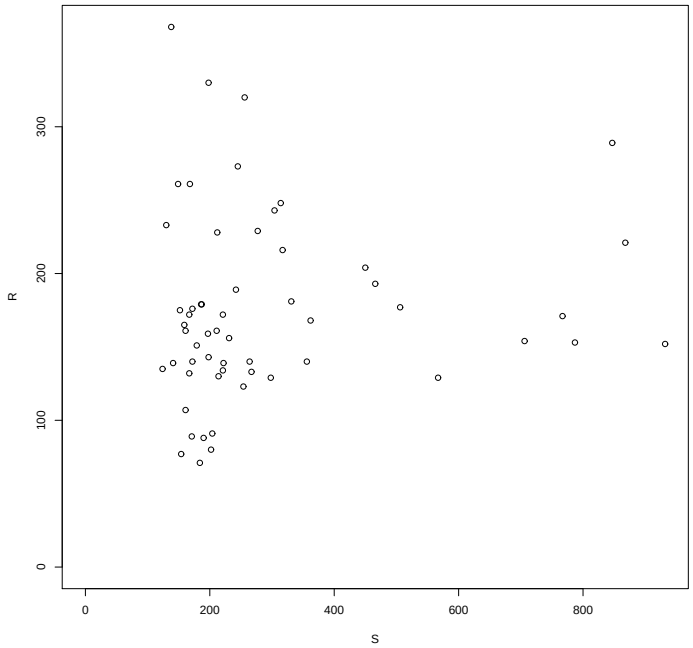
Estimation methods

Long-term dynamics:

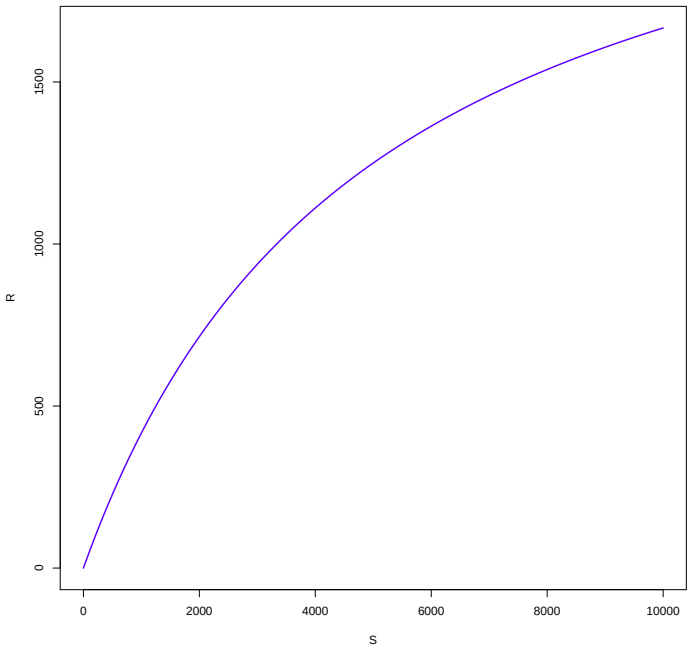
- Need stock-recruitment relationship
- Can be assumed or estimated from data
- Prefer using data
- Can draw "by hand"
- Prefer objective method of fitting



A predictive model

Given parameters one can "predict" recruitment

Equivalently: Given parameters one can draw an S-R curve



Initial values

Need to set initial values for α and K

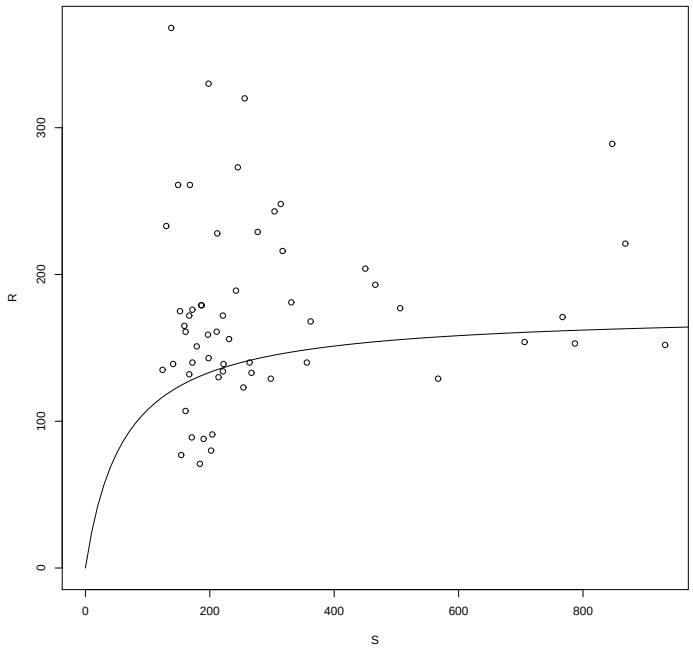


Figure : Stock and recruitment data with B-H curve based on initial parameter values.

Measuring the quality of the model

Can use sums of squared errors:

$$\sum_y \left[R_y - \hat{R}_y \right]^2$$

e.g.:

$$\sum_y \left[R_y - \alpha S_y e^{-S_y/K} \right]^2$$

$$\sum_y \left[\ln\left(R_y\right) - \ln\left(\hat{R}_y\right) \right]^2$$

Log-transformed data is often used.

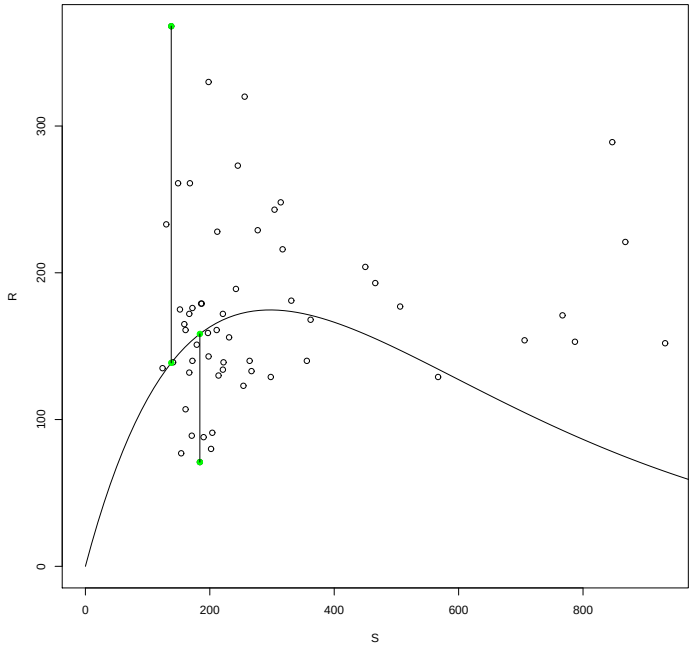


Figure : Stock-recruit data for I-Cod with a potential Ricker curve. Squared residuals between the curve and observations give a measure of how well the model fits the data.

Nonlinear estimation

Use nonlinear estimation

Get $\hat{\alpha}$ and $\hat{K}$

Obtain fitted curve

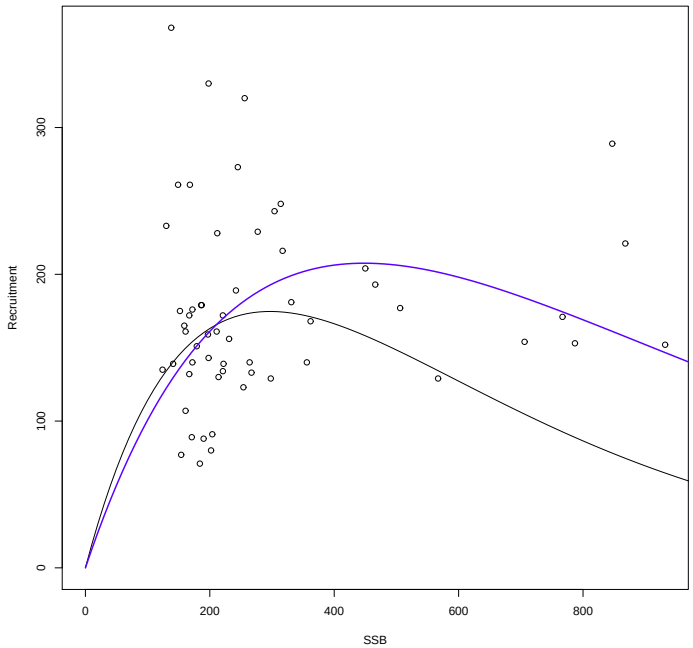


Figure : Stock and recruit data for I-cod (1955-2011) with fitted (blue) curve. Also shown is the curve corresponding to the initial values.

References Stefansson, G. 1992.

Ricker

Beverton and Holt