Spawning stock and recruitment

fish5106stockrec Spawning stock, recruitment and production

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December 19, 2016

Background

Need to find limiting factors for recruitment...

- Birds: Number of sills in cliffs
- Marine mammals: Number of mature females
- etc

Figure : The recruitment process depends on many factors.

Importance of relationships

Eventually we want to describe production

- Production = Yield per recruit * Recruitment
- Can use average R to start: $\bar{Y} = Y/R \cdot \bar{R}$
- But recruitment may be related to the stock size which depends on recruitment which ...

Checking relationships

- Now check if SSB and R are related
- Need to decide what sort of relationship should be considered
- It may not make much sense to do linear regression
- Should incorporate biological knowledge

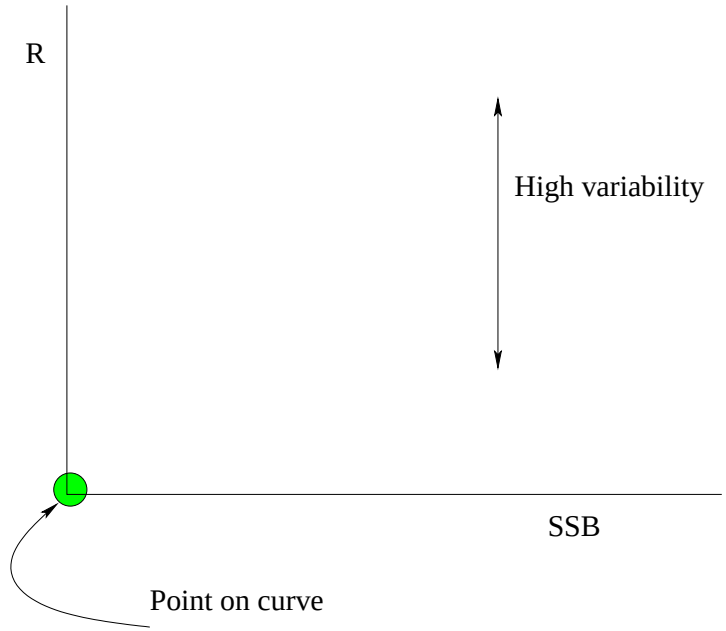
The recruitment process

The recruitment process

- spawning, fertilized eggs
- larval stage, first feeding
- drift, predation
- settlement
- overwintering
- competition

Spawning stock and recruitment

- Spawning stock and environment have an effect
- No SSB $\Rightarrow$ no recruitment
- But is there any further relationship ?



Types of trajectories

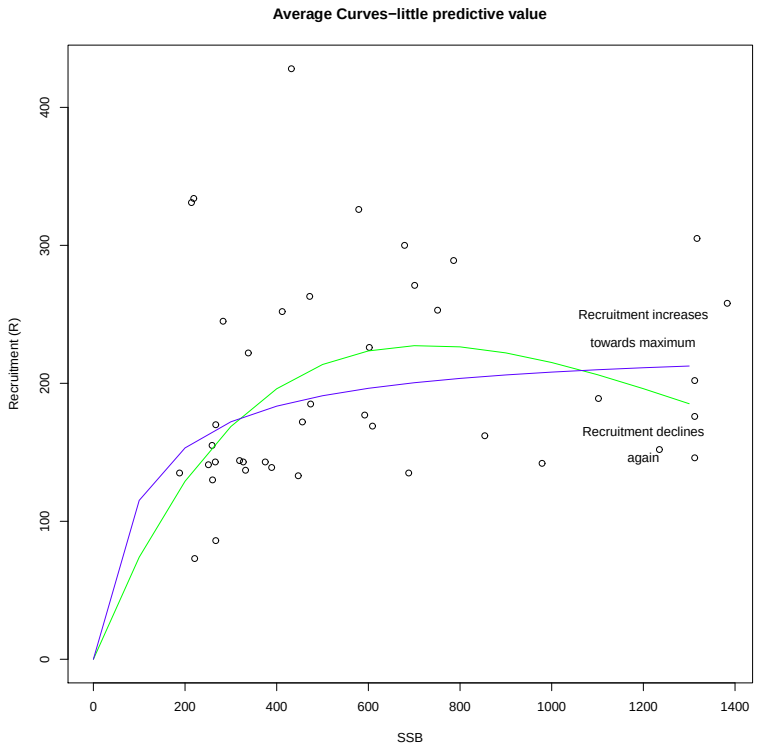


Figure : The blue line is a Beverton-Holt curve and the green line is a Ricker curve.

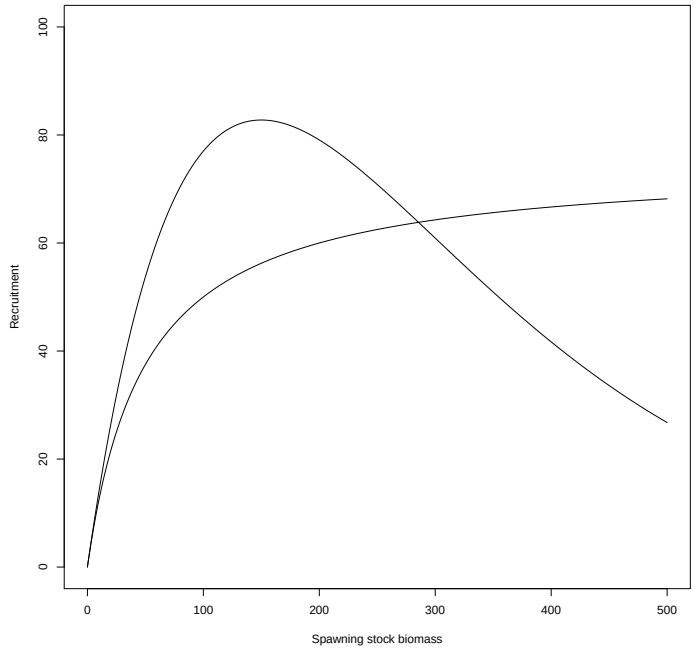
Two possible trajectories

Beverton-Holt

$$R = \frac{\alpha S}{1 + S/K}$$

Ricker

$$R = \alpha S e^{-S/K}$$



Recruitment and spawning stock biomass definitions

Need to define quantities

- SSB or egg production or...
- At time of spawning or ...
- Recruitment at age 0 or 1 or ...

In principle one can get SSB and R from assessment

Beverton-Holt curve

$$R = \frac{\alpha S}{1 + S/K}$$

$\alpha K = R_\infty$

K=location on SSB-axis for $R_\infty/2$

Ricker curve

Ricker Curve:

$$R = \alpha S e^{-S/K}$$

Think of this as:

- Egg production proportional to SSB
- Density dependent mortality: $-S/K$ appears as M, e.g. due to cannibalism
- K is the location of the maximum

Need for S-R curves

Need to generate recruitment when predicting medium-term effects of strategies, for example. Also to compare with Y/R to get equilibrium Y.

When to investigate S-R relationships

- What if there is no "significant relationship"?
- What does significance mean?
- Does significance=importance???
- Can a model be used if it is not "Significant"?

Common problem: No obvious relationship???

1. Is that true?
2. So what?