

Production and replacement

fish5106stockrec Spawning stock, recruitment and production

Gunnar Stefansson

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Production

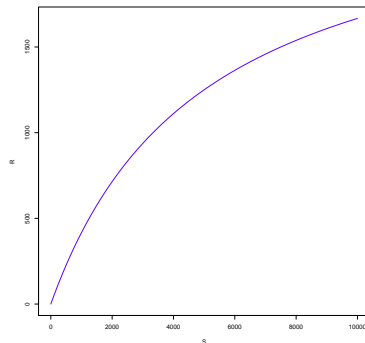


Figure : The stock-recruitment curve can be called a production curve.

S-R curve is a production curve

Replacement

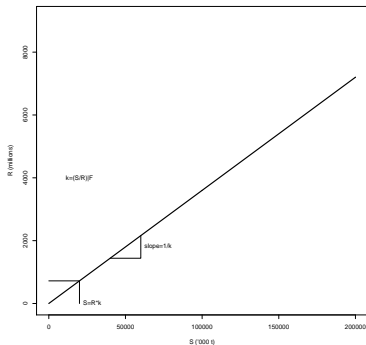


Figure : A line reflecting the replacement of the stock, i.e, how much a given yearclass size provides in terms of spawning stock biomass, is a replacement curve.

Data requirements

Need several data sets for production and replacement curves

Assessment gives the production (stock-recruit) curve

Mean weight at age, natural mortality at age, selection at age and proportion mature at age gives spawning stock biomass per recruit

Can simulate or use real data...

Example: To generate data for simulating the production and replacement curves, one can start with simple assumptions concerning growth etc.

```
Linf<-160
k<-0.1
beta<-3
cond<-0.02
```

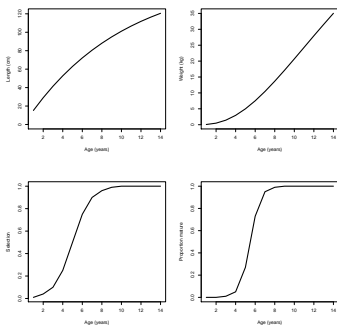
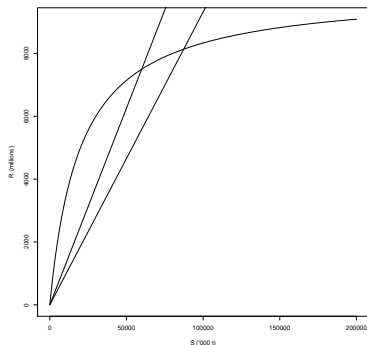


Figure : Assumptions are needed...

Production and replacement

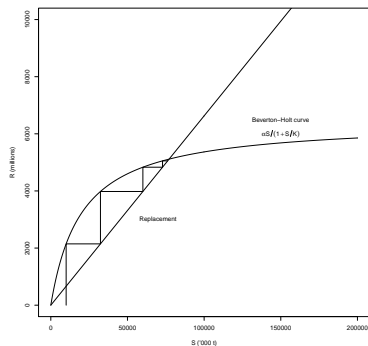


Example: Given appropriate definitions of parameters, the following commands can be used to plot some production and replacement curves.

```
Srange<-0:2000*100
Rhat<-alpha*Srange/(1+Srange/K)
plot(Srange,Rhat,type='l',xlab="S ('000 t)",ylab="R (millions)")
```

```
sr1<-srfun(selF1)
```

Production and replacement: Low effort



Production and replacement: Heavy effort

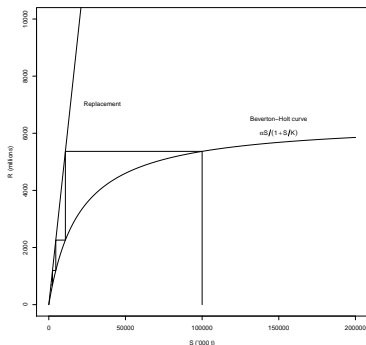


Figure : The figure shows the long-term effects of allowing recruitment to return only a spawning biomass which is lower than the spawning stock that produced these recruits.

Reference point: F_{crash}

F_{crash} = Fishing mortality corresponding to stock collapse.

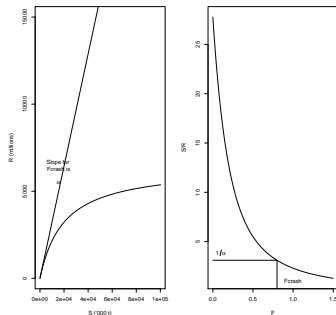


Figure : A simulated stock-recruitment curve along with the replacement line for F_{crash} .

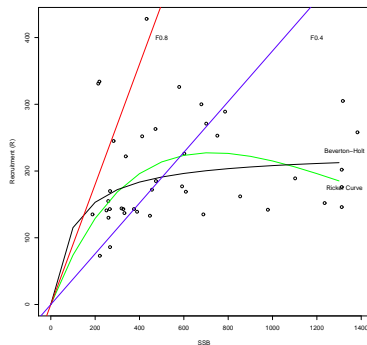
Reference points: F_{med}

F_{med} is the fishing mortality which corresponds to the median observed slopes from data in an S-R plot.

F_{med} is used to denote a specific mortality rate, computed based on S-R data and an S/R curve.

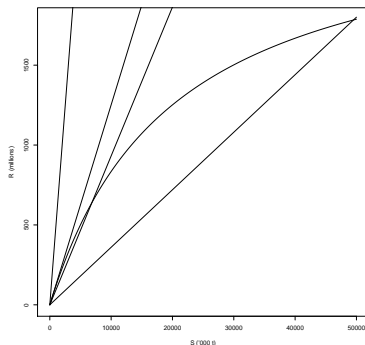
First take the median slope of the S-R data, i.e. compute $\text{median}(S/R)$ over all the years from an assessment. Now, check that the units of this quantity are the same as in the S/R function (e.g. '000 tonnes/million individuals=kg/recruit). Finally, find what F corresponds to this value of S/R. This is F_{med} .

Production and replacement presentation



Note varying interpretation!

Spawning Stock and Recruitment - Summary



A stock-recruit curve for a simulated stock, with some replacement lines including $F = 0$ and $F = F_{crash}$.

References See Shepherd and Nicholson for Fmed.