Notes from hilborn Ann Walters quantitative fish stock assessment

* Chapter 8 bio mass dynamics model
* Bio mass dynamics models are commonly called production models or Sir plus production models hilborn and Walters prefer to use the term bio mass dynamic models because one can consider surplus production or net production in any sort of age structured or bio mass model
* Ludwig Ann Walters 1985 and 1989 showed bio mass dynamics models may provide better estimates of management parameters and age structured approaches even when important parameters such as growth and vulnerability are known
* Bio mass dynamics models combine recruitment and growth into a single term called production
* The term surplus production is generally used to represent the difference between the production and natural mortality. Sir plus production represents the amount of the population bio mass will increase in absence of fishing or the amount of catch that can be taken while maintaining the bio mass at a constant size
* Fisheries management plans depend greatly on the nature of the available data when fish bio mass can be directly estimated the graphical relationship between bio mass and surplus production can be directly fit although when bio mass cannot be directly measured and only an index of abundance is available the estimation processes become more complex and highly model dependent
* Almost all applications of bio mass dynamics models have used an index
* Since it’s rare to have direct estimates of Overtime people tend to estimate some index of abundance overtime and then in provide an independent estimate of the relationship between true abundance and the index I catchability
* The approach is used to reconstruct bio mass time series from the index data
* An estimated catchability is obtained from tagging studies
* Then biomasses reconstructed as bio mass equals catch per unit effort divided by catchability this was the approach used by Schaefer 1954 original paper
* There are three basic approaches that have been used to index abundance to model bio mass 1st is the equilibrium approach the second is a linearized model of bio mass dynamics and the third is a bio mass dynamics models fit as a time series
* Hilborn Walters include the Schaefer and appellate tomilson model as bio mass dynamics models that they present
* By mass dynamics models are fit as difference models or differential equations difference models are just discrete versions of differential equations
* Hilborn and Walters say never use equilibrium approaches to fit bio mass dynamics models
* must there has been a very informative perturbation history estimates from linearized versions of bio mass dynamics models are unlikely to provide reliable parameter estimates they can also be badly biased the bias may be reduced by using U T + 1 as a regression dependent variable with UT&UT squared and the ETUT as independent variables I know intercept term for the linear model page 308
* The best method for estimating production is fitting time series of bio mass data incorporating observation error and was first proposed and used by Pella tomilson in 1969
* in the formulation by Pella tomilson catch and capital U our observed data an B0 is a parameter to the estimated along with R&K
* Alternatively one can predict catches as B times catchability times effort and one can minimize the difference between observed catches and the predicted catches using sums of squares error
* In practice we do not new normally Attempt to estimate B0 as a separate parameter but we assume that B1 is equal to catch divided by effort times catchability which says in effect that for a given estimate of catchability we have an estimate of the starting population size
* In the context of parameter estimation for bio mass dynamics models this means that you have to have historical very Asian and stock size an fishing pressure to estimate parameters in the model with any reliability
* One way trip is essentially bio mass being reduced overtime due to fishing
* Continuous increasing fishing effort and declining catch per unit effort this type of time series is called a one way trip and it Most difficult to interpret page 312
* The one way trip provides such biases that estimates shown in table 8 two are totally unreliable the most useful information is that the standard deviation for each parameter is roughly as large as the parameter estimate and this tells us not to take any of the values seriously
* Other ways to fit bio mass dynamics models to time series include the addition of auxiliary information page 324
* The equation 8.4 point 16 on page 325 combines sums of squares for you and X and weights them to make use of auxiliary information in model fitting if the weight is very high greater than one it assumes that the bio mass dynamics models are going to be most accurately captured by the auxiliary information the weights can be viewed as ratios of the variance of the time series observations to the variance of the auxiliary observation and assigning low weights is assuming that the auxiliary information is measured with low accuracy and high variance
* Persistent problem in the use of bio mass dynamics models is the widespread belief that they are methods for analyzing catch and effort data
* It is accepted that CPU E catch per unit effort may not be proportional to abundant and this pros poses no major problem for bio mass dynamics models they work on any measure of abundance including absolute abundance surveys from fishing gear or hydroacoustics
* By mouse dynamics models require a measure of abundance and catch data but they do not need any effort data