Yield per Recruit Model

File: d:\B173-2010\yield_per_recruit.wpd
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1. Given the following age/weight structure for a fish population, and assuming that M=0.2,

Age	Weight (kg)
1	0.6
2	0.9
3	2.1
4	4.1
5	6.3
6	8.4
7	10.0
8	11.2
9	12.6
10	13.5

construct a spreadsheet that will allow you to explore the effects of different values of F (in 0.1 increments) on Population Biomass per recruit and Yield per recruit. You do this using the catch equation and the survivorship equation. Recall:

$$C_t = F/Z * N_t * (1-e^{-Z}) \text{ where } Z = F + M$$

and $N_t = N_o * e^{-Zt}$ (Note: you need to use t from the age before because this is the number at the START of the time period)

or $N_{t+1} = N_t * e^{-Z}$

So, add columns to the data table labeled Number Alive, Catch, Population Biomass and Catch Weight. At the bottom of the last two columns, sum up the values and below that calculate a sum per recruit.

Then, once you are sure your spreadsheet is working correctly (e.g., with an F of 0.6, the Population Biomass per Recruit should be 2.37), you can construct a second table listing F, B/R and Y/R for a wide range of values of F (i.e., from 0.1 to 1.0 in increments of 0.1).

Finally, produce a graph of Biomass per Recruit and Catch (or Yield) per recruit versus F (both lines on one graph, each with its own vertical axis – I kid you not!). Here is how you do that. Construct the graph as a Standard Scatter Plot, then when you have all the data on it, do the following. On the graph, click on one point in the second series. The points in the series should temporarily change to a different marker indicating that they are "selected". Now, click on the Layout tab of Chart Tools|. At the far left of the ribbon bar you should see "Format Selection". Click on that and up pops the Format Data Series panel. You should now see an option pane which includes Series Options. Choose "Secondary Axis". Continue on with your cool new graph. For instance, you will notice that other menus have changed, such as the Layout | Axis titles menu which now allows you to enter and edit a "Secondary Vertical Axis Title".

This graph will show the F that will maximize the catch weight per recruit. [Hint: it should be roughly 0.23]

2. Does it matter what value you use for the initial number alive in terms of the statistics per recruit that you generate?
3. How would you incorporate different values of F for different ages?