**Outline for Chapter 5. Biomass and Production**

Test Edit by Kwak!

5.1 Introduction [jim]

5.1.1 Definitions

5.1.2 Ecological relevance of biomass and production

5.1.3 Optimal levels of population assessment  
 (objective based: qualitative to quantitative estimates and variance)

5.1.4 Topics covered

5.2 Sampling and data requirements [jim]

5.2.1 Field measurements

5.2.2 Sampling bias

5.2.3 Data stratification (by size, age, or sex, etc.)

5.2.4 Accuracy and precision

5.3 Biomass estimation and dynamics (8.5 A&IFFD P353) [Mike]

5.3.1 Direct methods (N x mean w) (8.5 A&IFFD P357)

5.3.2 Estimates from fishery catch (8.5 A&IFFD P353)

5.3.3 Modeling approaches-mass balance of Ecopath equations

5.3.4 Biomass dynamic models: surplus production models

5.3.4.1 Models (Graham-Schaefer, Gompertz, Pella-Tomlinson)

5.3.4.2. Reference points (e.g., FMSY, BMSY)

5.4 Production estimation (8.7 A&IFFD P360)[tom]

5.4.1 Concepts and terminology: a vital rate (8.7.1 A&IFFD P360)

5.4.2 Production estimation methods (8.7.2 A&IFFD P361)

5.4.2.1 Summation methods (A&IFFD P362)

5.4.2.2 Instantaneous Growth Rate and Allen Curve methods (A&IFFD P363)

5.4.2.3 Size-Frequency Method (A&IFFD p366)

5.4.3 Production to mean biomass (P/B) ratio (A&IFFD P367)

Direct estimates

Estimates based on life history and allometry

5.4.4 Production estimates in practice (A&IFFD P367)

5.5 Summary and practical considerations []

Assuming we just redo the boxes in R then these will come together quickly.

Box 1 Application of surplus production modeling (Box 8.7 A&IFFD P 358)[Code done; needs narrative]

Box 2. Production estimation based on the instantaneous growth rate method (Box 8.8 p364)[pending]

Box 3. Production estimation based on the Size-Frequency method (P368)[pending]

New boxes?

* Biomass estimates for SRS & stratified sample
* Mass balance estimates of biomass from P/B, Q/B, and EE (likely rare in practice and might not be worth doing but mec has some code to do this but needs to dig it out & clean up)