DG-MARE course on assessment & advice in (tuna) RFMOs

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05 december, 2016

Stock Assessment

As in this yellowfin example the dyanamics can be described by a variety of models that depend on a variety of data types and assumptions

The Russell Equation

The provision of fisheries management advice requires the assessment of stock status relative to reference points, the prediction of the response of a stock to management, and checking that predictions are consistent with reality.

Russell (1931) summarised the key processes influencing the dynamics of exploited populations, i.e.

$$f(B_{t+1}) = B_t - (F + M) + (G + R) \tag{1}$$

where a biomass B_{t+1} is a function of the biomass in the previous year (B_t), losses due to fishing (F) and natural mortality (M), and gains due to growth (G) and recruitment (R). Two processes have been recognised since Russel originally formulated his equation, important for highly migratory populations, i.e. gains due to immigration (I) and losses due to emigration (E) i.e.

$$f(B_{t+1}) = B_t - (F + M + H) + (G + R + I) \tag{2}$$

Knowledge about all these processes affects our ability to provide robust scientific advice.

Fisheries management relies heavily on reference points, for limits and target, which can be estimated from complex statistical or simple models. An alternative approach is the use of management strategy evaluation (MSE) to tune HCRs to set management measures such as catch quotas, directly from the observed data. Most reference points, from both simple and complex models, are based on the idea of suplus production i.e.

$$f(B_{t+1}) = B_t - C_t + P(B_t) \tag{3}$$

where the biomass next year is the sum of current biomass less the removals due to fishing (C_t), losses due to natural mortality and gains due to reproduction and growth summarised as the production function $P(B_t)$.

Excercises

Based on shiny apps

Evaluate the impact of biology on reference points

Compare production functions from biomass and age based models

Perform a cross test using a biomass dynamic model with data generated by an Integrated model

Conduct a hindcast i.e.fit to data using a retrospective analysis then predict over years omitted and compare.

Run a projection

Russell, ES. 1931. "Some Theoretical Considerations on the ?Overfishing? Problem." *Journal Du Conseil* 6 (1): 3.