# Stock Assessment notes

## General stuff…

**Euler-Lotka equation** describes how a population grows based on demography of females, and is age structured. This is the basis for a lot of population modelling.

Where:

a=age

ω=maximum age

r=discrete growth rate

ba= individuals born at time a

sa=survival to age a

* total instantaneous mortality rate is calculated by plotting ln(abundance) against age, then fitting a linear regression. Slope of the regression is the mortality rate (Z)

**von Bertalanffy growth equation** describes the relationship between age and length or weight, usually in this format:

Where:

t = age

t0 = theoretical age at which length=0

l = length

K = von Bertalanffy growth constant – describes rate of change of growth over time

*L¥=* maximum length, or length at which growth rate is 0

see FAO page <http://www.fao.org/3/x5685e/x5685e03.htm>

To find age at length, rearrange equation to this:

## Hilborn & Walters Quantitative Fisheries Stock Assessment Book

### Introduction

Stock assessment = the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices OR = a collection of analyses aimed at estimating the stock size and productivity from statistics gathered from the commercial fishing process

* Long-lived species typically have large yields at the beginning of the fishery, which then swiftly decline as older age classes are fished out
* Surplus production rates can differ drastically from stock to stock (within same species) even over narrow geographical range. ‘rough bounds on productivity can be established from general biological information about the species, but there are no precise quantitative laws that might be used as predictive substitutes for the role of a stock assessment’
* Traditionally, production and effort data for stock assessments is gathered from a commercial fishery and stock size is presumed to be proportional to catch per effort. However, fishing for economic gain usually results in unrandom and unrepresentative patterns over time and space
* The pitfalls of using only commercial data have led agencies to collect fishery-independent information. However, these usually are super expensive and they collect a tiny number of samples compared to the commercial fishing fleet
* Even when your sampling and stats provide a good picture of past stock status, it is not always possible to predict how stock will behave in future

### Behaviour of Fisheries

* Population fluctuation is the rule rather than the exception – we should expect fish populations to change in abundance with or without fishing
* Almost all fisheries theory is based on the idea that natural populations exist in equilibrium
* The relative importance of natural factors and fishing pressure in determining stock abundance is still debated. Effects of these two drivers are often statistically confounded
* There is a huge range of mathematical models to describe fish population dynamics, which have been developed independently in different labs around the world. There is no single ideal model.
* Estimation of optimum fishing effort is usually sensitive to parameters estimating rate of population growth when population size is small. This parameter is often poorly estimated