# FISH 559: Example Application I (Fitting growth curves)

Two commonly applied curves relating length to age are the logistic function (Eqn 1a) and the von Bertalanffy curve (Eqn 1b)[1]:

$$L_a = L_\infty \left(1 + \exp\left[-\ell n 19 \frac{(a - a_{50})}{\Delta}\right]\right)^{-1} \tag{1a}$$

$$L_a = L_\infty (1 - \exp(-\kappa (a - a_0))) \tag{1b}$$

where $L_\infty$ is the asymptotic size, $a_{50}$ is the age at which length is half of $L_\infty$, $\Delta$ is the difference between age at which length is 95% of $L_\infty$ and $a_{50}$, $\kappa$ is the growth rate parameter, and $a_0$ is the age corresponding to zero length. You can assume that the errors measuring length-at-age are normally distributed with mean 0 and standard deviation $\sigma$.

Given the data file EX1.DAT:

- fit models 1a and 1b using TMB;
- print out the model predictions for ages 0-20 ;
- write an R function to plot the data and the two sets of model predictions;
- use AIC to (a) select a best model and (b) compute AIC-weights; and
- find a model-averaged estimate for $L_\infty$.

Hints:

- Write down the negative log-likelihood function first
- To keep parameters positive, estimate them in log-space
- You should have one CPP file and use the map option to ensure that you only estimate the correct number of parameters.

[1] Both of these curves are special cases of Schnute's (1981) generalize growth model.