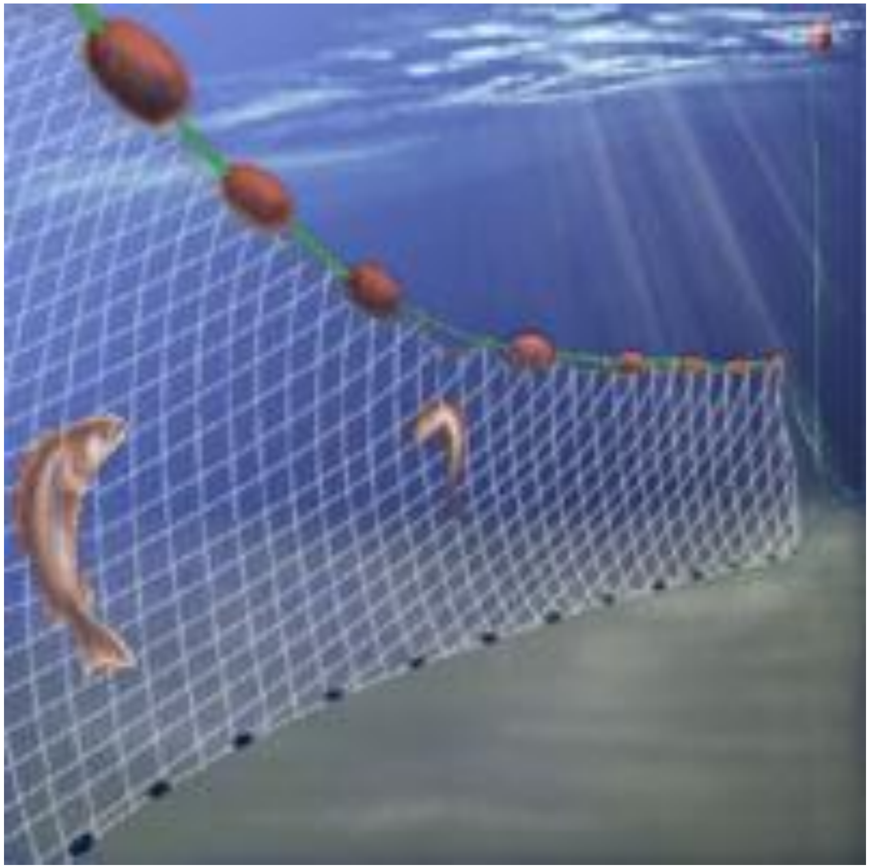
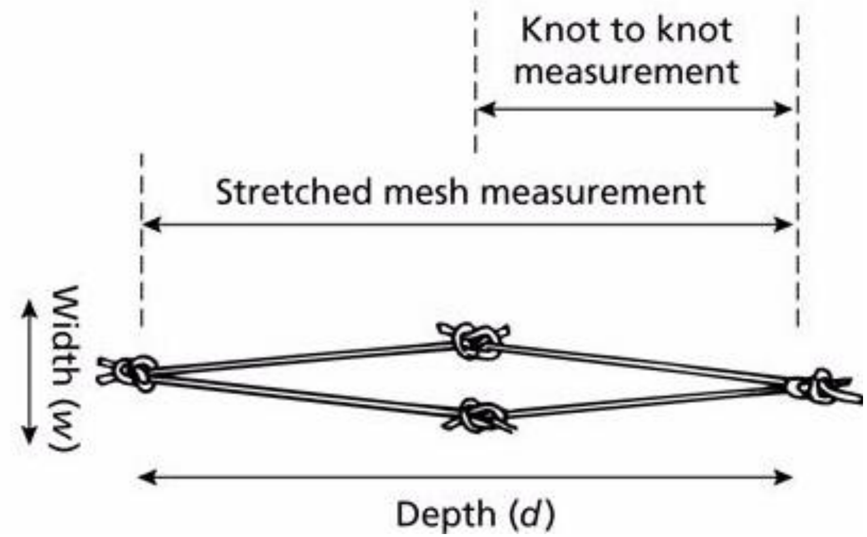
Gear Selectivity

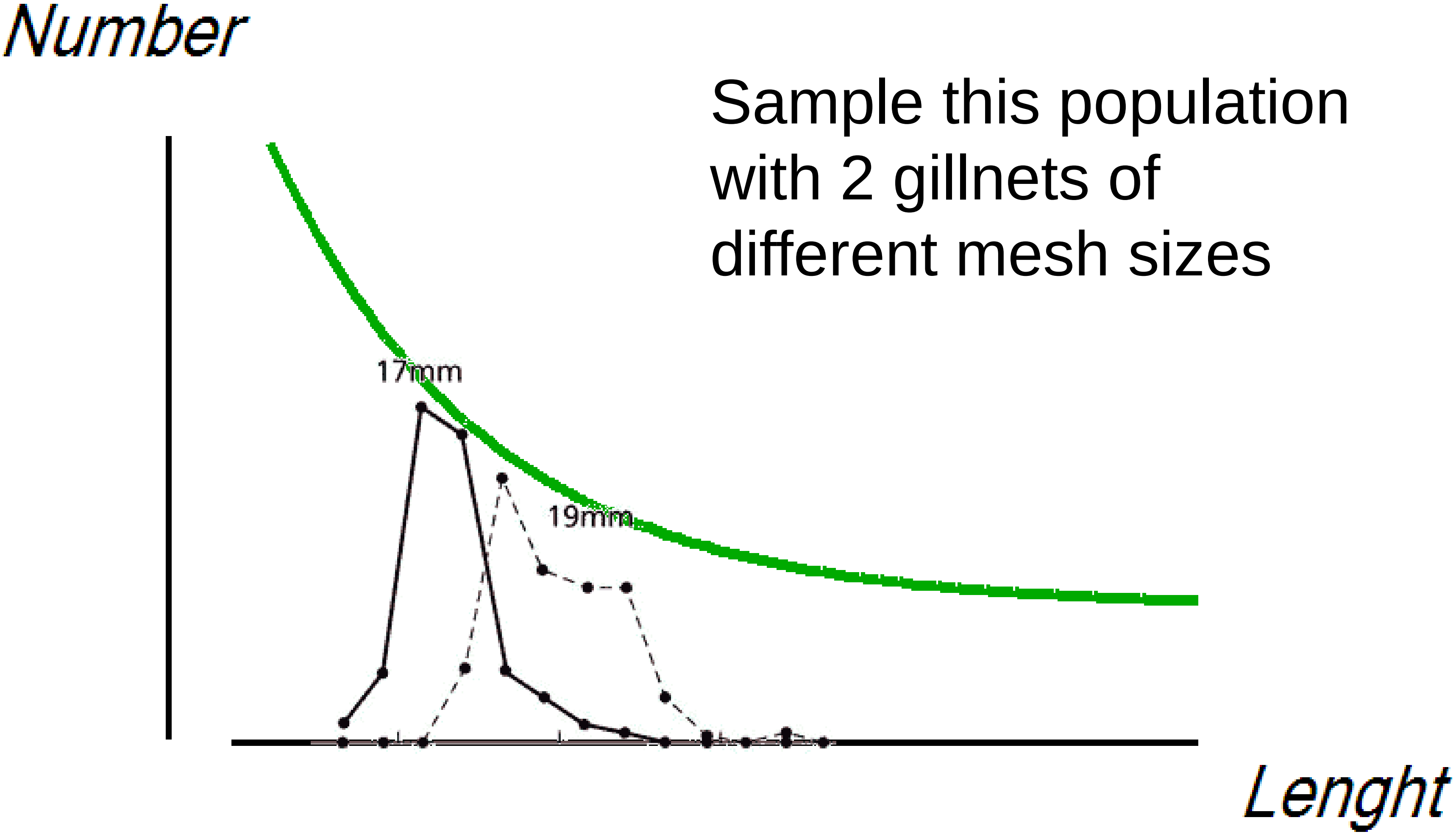




All fishing or sampling gears are more or less selective

What is selectivity?

Sample this population with 2 gillnets of different mesh sizes

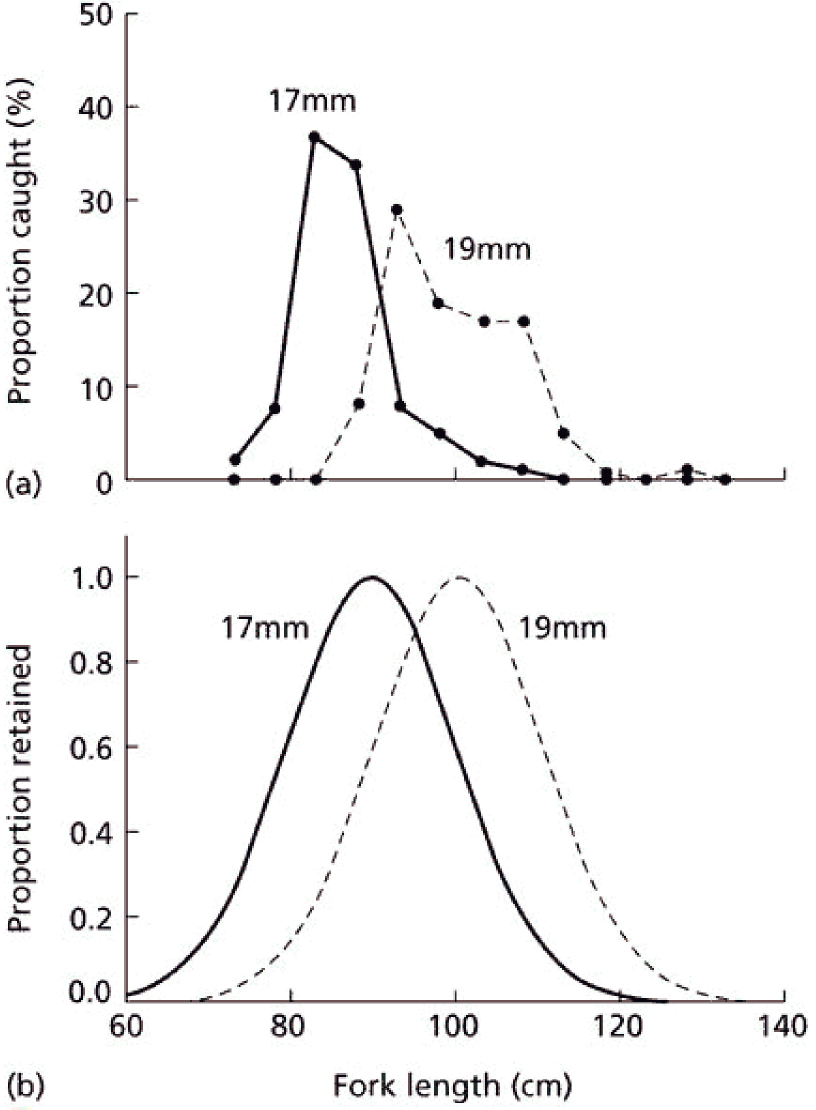


Gear Selectivity

- The fish retained in a gear is usually only an unknown proportion of the various size classes available in the fished population.

- Selectivity is a quantitative expression of this proportion and represented as a probability of capture of a certain size of fish in a certain size of mesh (or hook).

Gear Selectivity



- From observed catches one can calculate the selection curves, which are the probabilities that a certain length is caught in a certain mesh size

Gear Selectivity

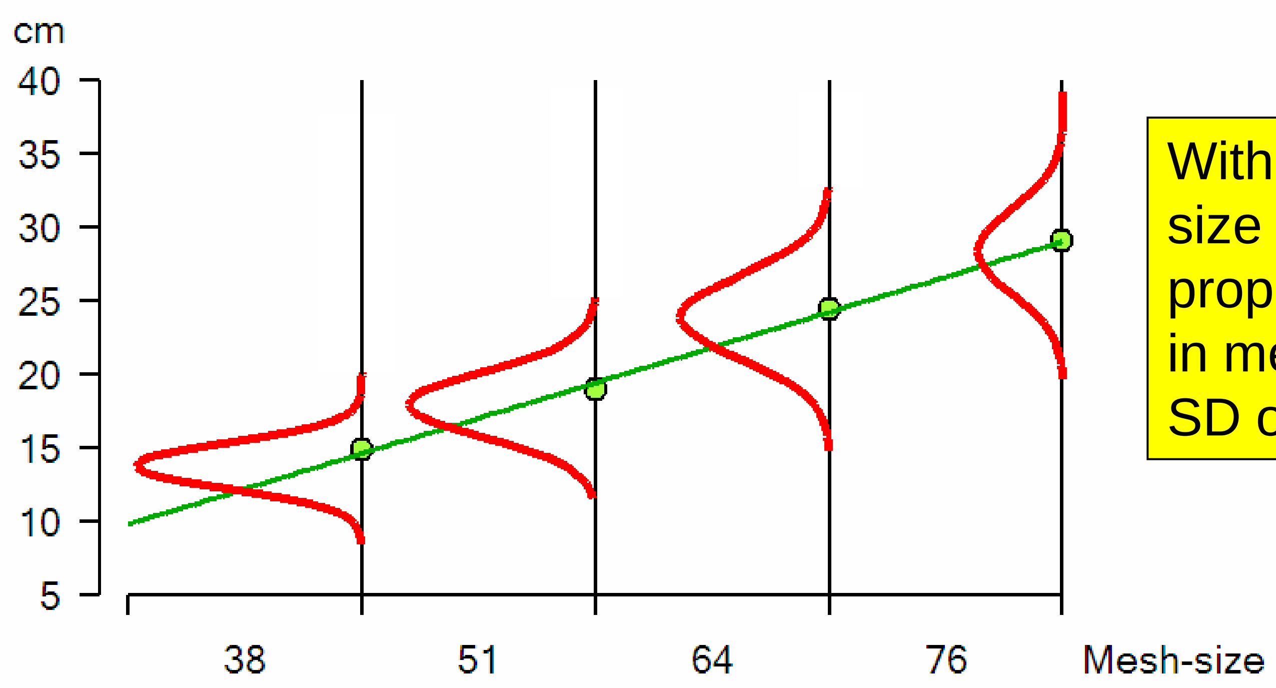
- Gillnet, hook, and trap selectivity can be indirectly estimated from comparative data of observed catch frequencies across a series of mesh or hook sizes.

- The general statistical model (SELECT) is described in Millar (1992), and the specific application on gillnets and hooks is described in Millar & Holst (1997) and Millar and Fryer (1999)

Gear Selectivity

- The principle of geometric similarity:

  Length of maximum retention (mean length) and spread of selection curve (SD) are both proportional to mesh size (Baranov 1948)



With increasing mesh size there is a proportional increase in mean length and SD of the fish caught

Gear Selectivity – 5 models

Model	Equation
Normal location shift	$\exp\left(-\frac{(L_j - k \cdot m_i)^2}{2\sigma^2}\right)$
Normal scale shift	$\exp\left(-\frac{(L_j - k_1 \cdot m_i)^2}{2(k_2 \cdot m_i)^2}\right)$
Lognormal	$\frac{1}{L_j}\exp\left[\mu_1 + \log\left(\frac{m_i}{m_1}\right) - \frac{\sigma^2}{2} - \frac{\left(\log(L_j) - \mu_1 - \log\left(\frac{m_i}{m_1}\right)\right)^2}{2\sigma^2}\right]$
Gamma	$\left(\frac{L_j}{(\alpha - 1)k \cdot m_i}\right)^{\alpha - 1} \cdot \exp\left(\alpha - 1 - \frac{L_j}{k \cdot m_i}\right)$
Bimodal normal scale shift	$\exp\left(-\frac{(L_j - k_1 \cdot m_i)^2}{2(k_2 \cdot m_i)^2}\right) + w \cdot \exp\left(-\frac{(L_j - k_3 \cdot m_i)^2}{2(k_4 \cdot m_i)^2}\right)$

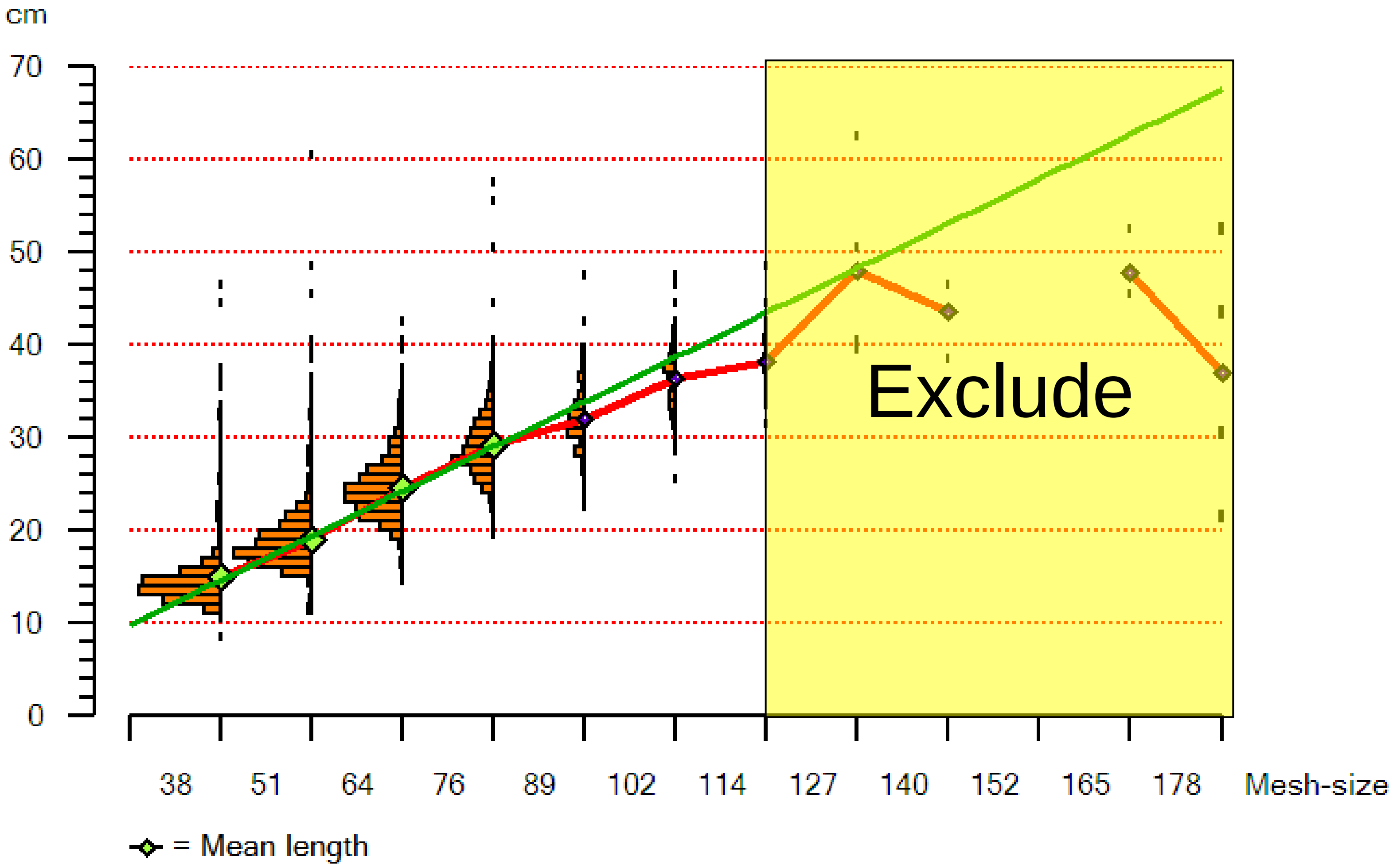
μ_i = mean size (length) of fish caught in mesh size *i* = $k_1 \cdot m_i$
σ_i = standard deviation of the size of fish in mesh *i* = $k_2 \cdot m_i$ or $\alpha \cdot m_i$
L_j = mean size of fish in size (length) class *j*

Gear Selectivity – 5 models

Normal location shift	Only means are proportional to mesh size, spread is constant.
Normal scale shift	Both means and spread are proportional to mesh size (principle of geometric similarity).
Lognormal	Both means and spread are proportional to mesh size but with asymmetrical retention modes (i.e. skewed distributions).
Gamma	Both means and spread are proportional to mesh size but with asymmetrical retention modes (i.e. skewed distributions).
Bimodal normal scale shift	Both means and spread are proportional to mesh size but different capture modes, i.e. fish wedged by the gills and entangled in the mesh sizes

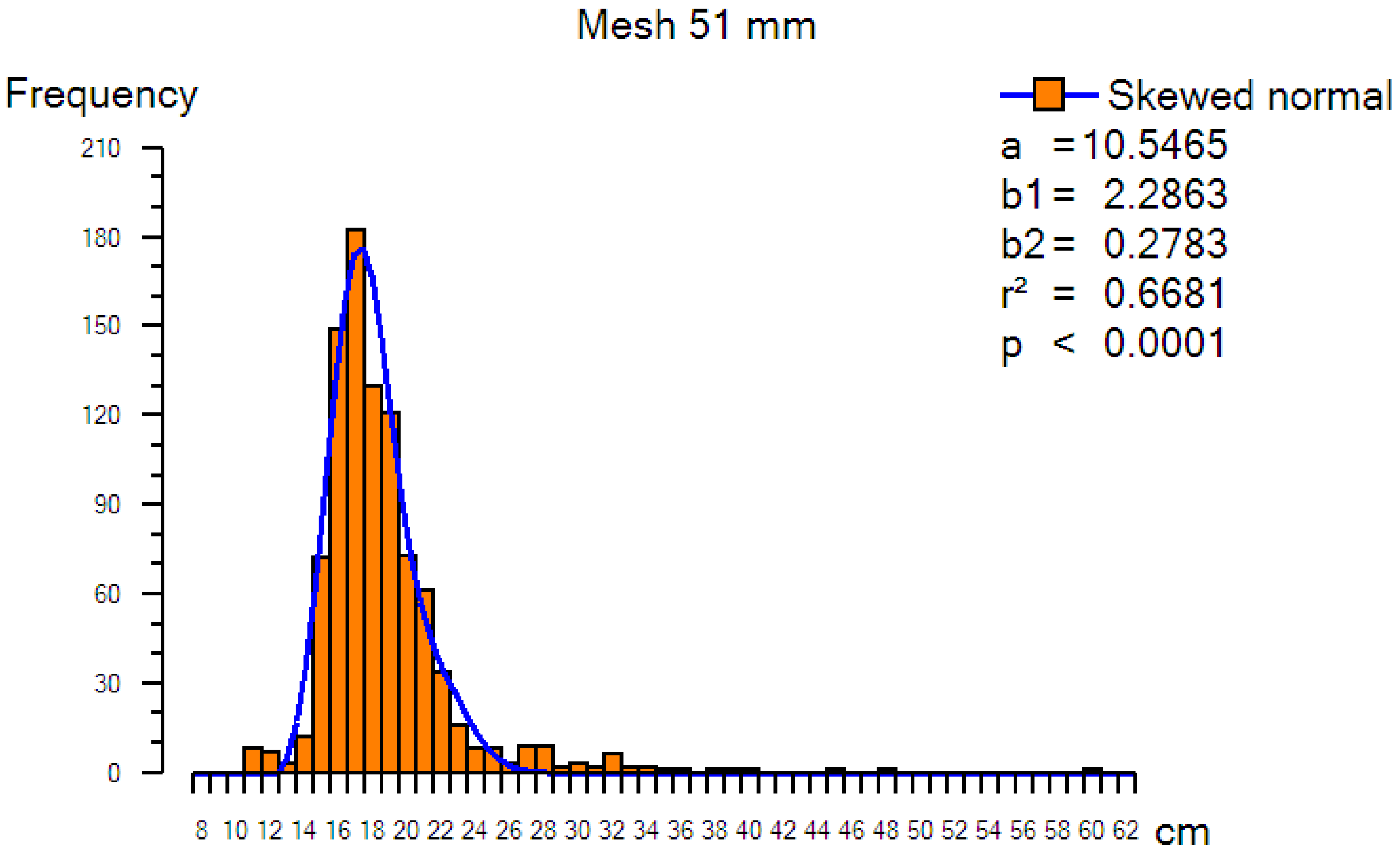
Gear Selectivity – Step 1

- Find the linear part of the mesh size range



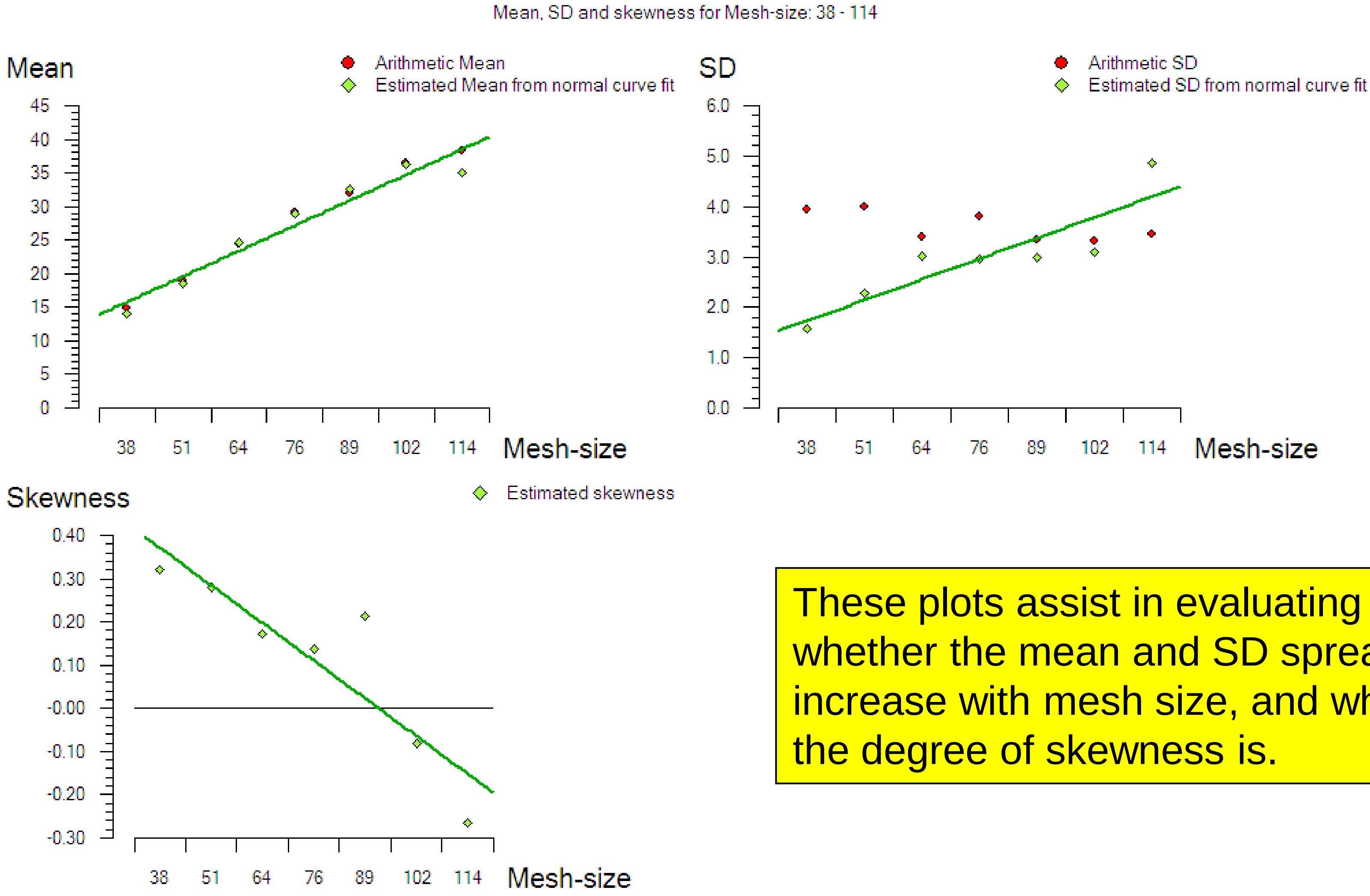
Gear Selectivity – Step 2

- Evaluate appropriate model



Gear Selectivity – Step 2

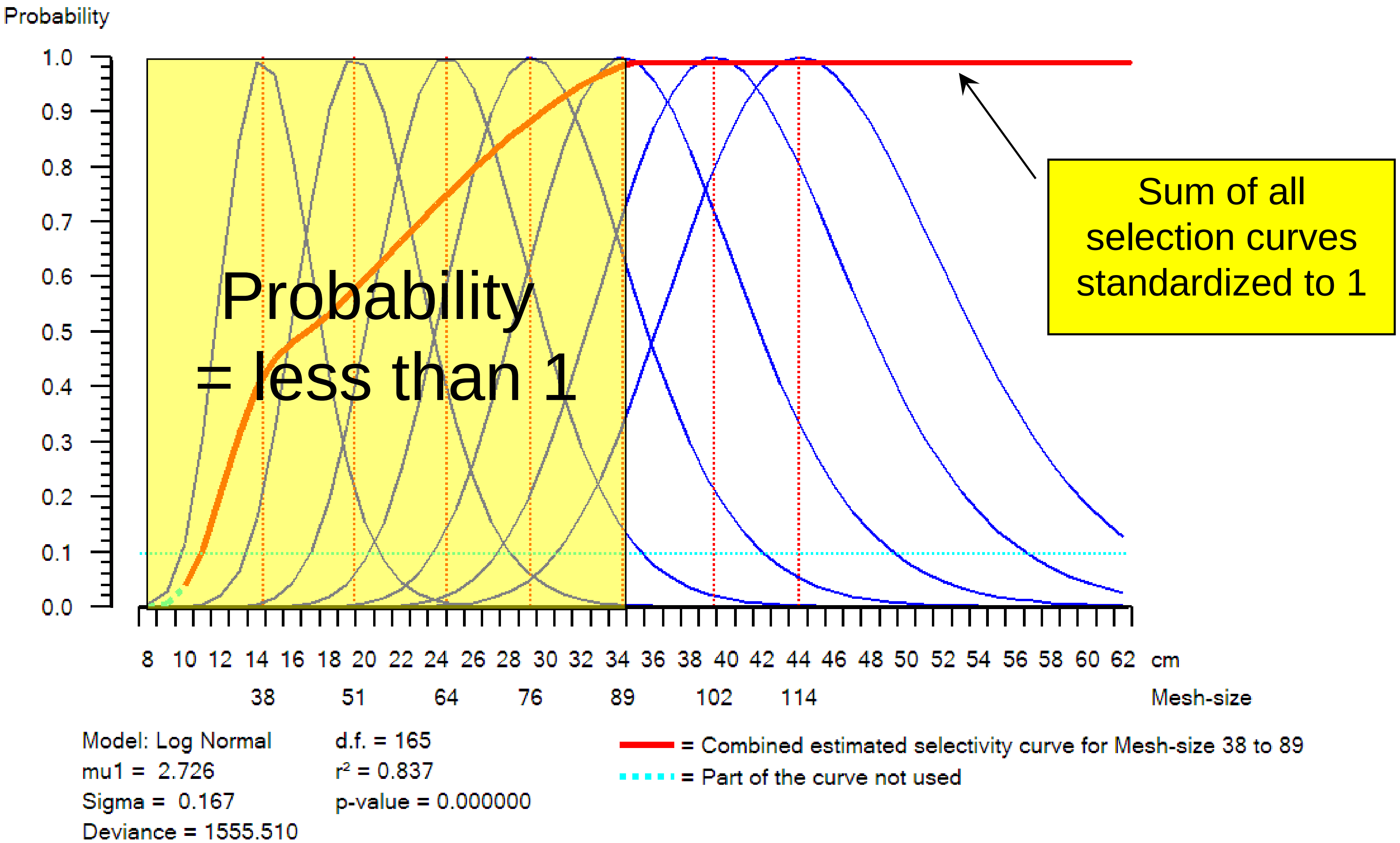
- Evaluate appropriate model



These plots assist in evaluating whether the mean and SD spread increase with mesh size, and what the degree of skewness is.

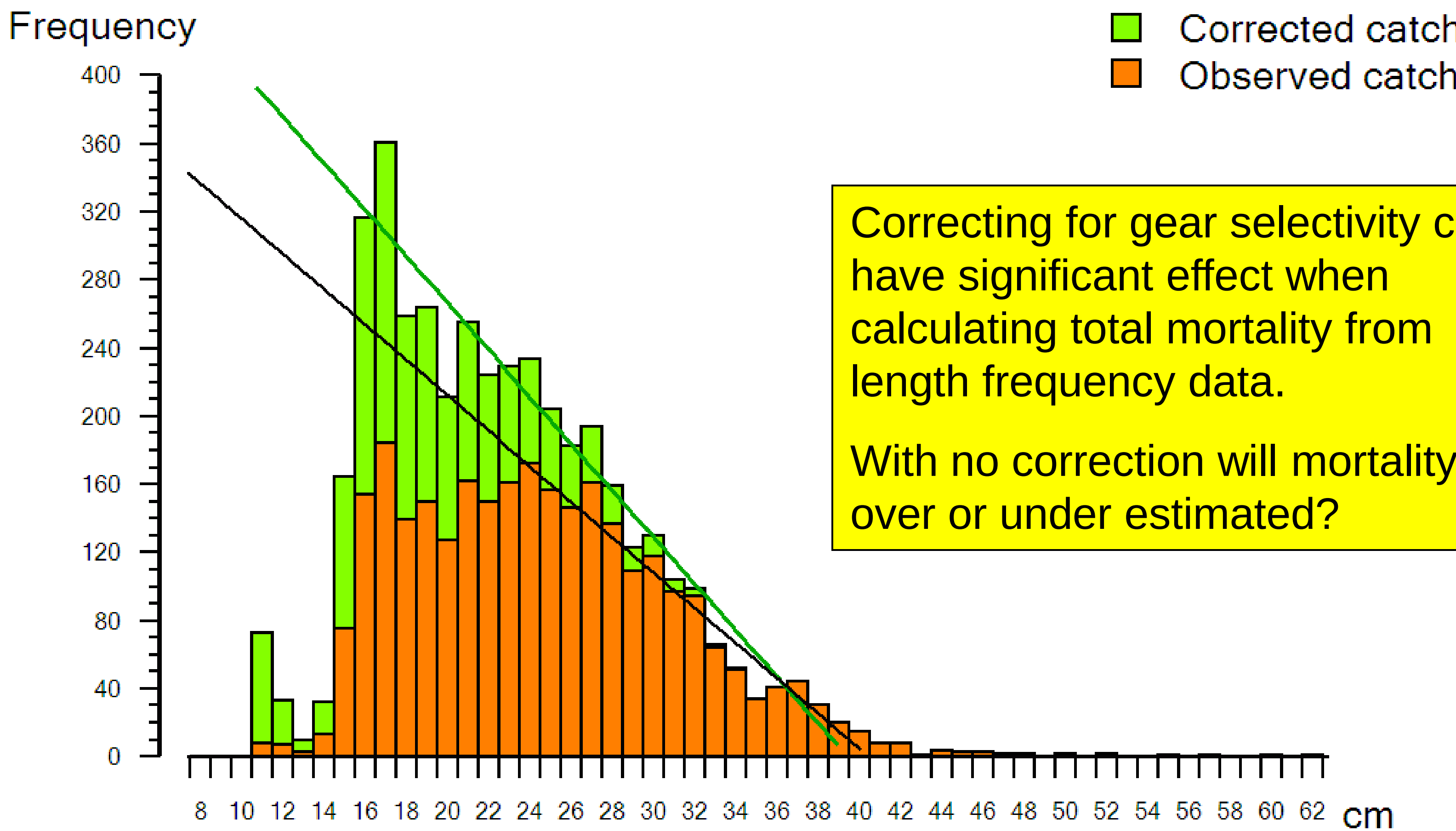
Gear Selectivity – Step 3

- Estimate selection curve



Gear Selectivity – Step 4

- Correct observed catches



Corrected catch = 1338 (= 31.9 %)
Observed catch = 2862 (= 68.1 %)
Cut level = 0.10

Correcting for gear selectivity can have significant effect when calculating total mortality from length frequency data.

With no correction will mortality be over or under estimated?