Appendix 2   Supplemental Information from Section 3.7.

Cumulative Distribution Plots

More subtle changes in the depth distribution might be ascertained by considering the cumulative distribution of catch at depth by year and survey type. The general idea here is that the historical pattern of catches at depth constitute an "envelope" of historical variation. Under the hypothesis that the efficiency of capture decreases with increasing depth, the expected pattern during the post treatment period should be a CDF lying to the left of the envelope. The basic intuitive properties of this approach are summarized in Fig. H.23 using a hypothetical example. Suppose that the indices of abundance for species X in the 2000-2002 surveys were low and should actually have been 25%, 100%, or even 1000% higher.   Equation 6 can be substituted into Eq.4 and value of theta can be solved using nonlinear optimization of the equation:

$$\sum_j C_{j\,rev} = (1+\delta)\sum_j C_{j,obs} = \sum_j \left(\frac{C_{j,obs}}{1-\left(\dfrac{0.0134D_j}{W_{max}}\right)^{\theta}} \right) \quad (13)$$

Fig. H23 illustrates the expected behavior of the CDF for values of delta =0.1, 1.0, and 10.0.   The respective values of theta were 1.725, 0.721, and 0.109

Examination of these plots was conducted for the two stocks of cod (Fig. H.24-25), two haddock stocks (Fig. H.26-27), three yellowtail flounder stocks (Fig. H.28-30), witch flounder (Fig. H.31), spiny dogfish (Fig. H.32), and longhorn sculpin (Fig. H.33). There was some suggestion that one of the spring surveys for spiny dogfish and longhorn scalping "fit" this expected pattern. For all other species, stock, and surveys, the 2000-2002 Cuffs lay within the historical range. (Fig. H24-H33).
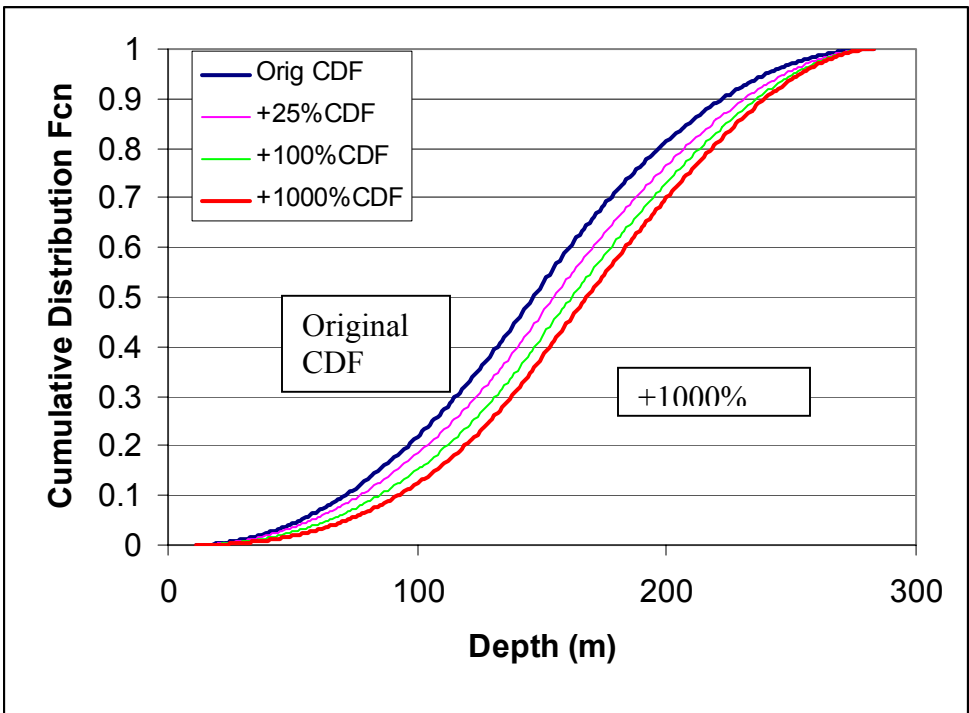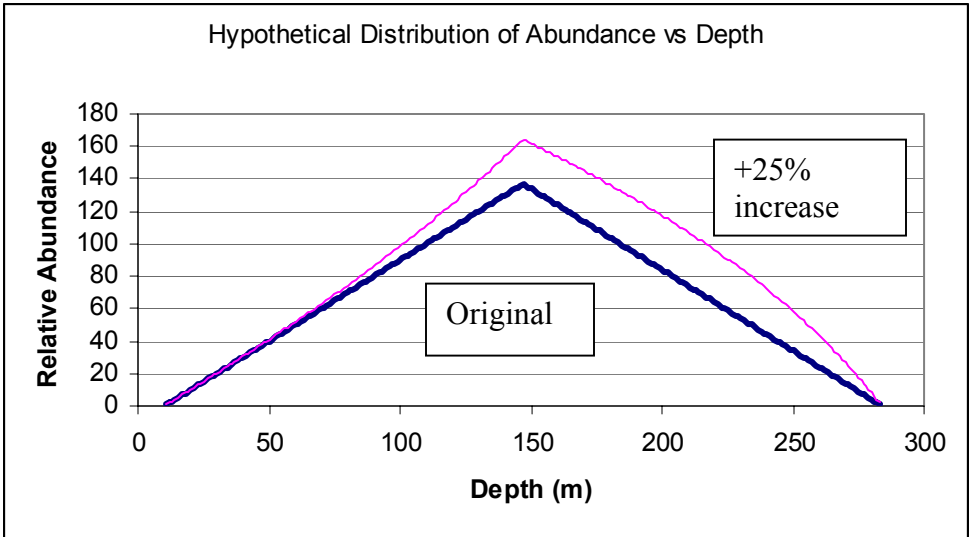
Hypothetical Distribution of Abundance vs Depth

+25% increase

Original

- Orig CDF
- +25%CDF
- +100%CDF
- +1000%CDF

Original CDF

+1000%

Fig. H23. Predicted shift in shift in average depth distribution for population distribution at depth for varying levels of underestimation of abundance. In the above example the theta parameter of the depth dependent relative efficiency function is modified to attain the target increase in biomass.