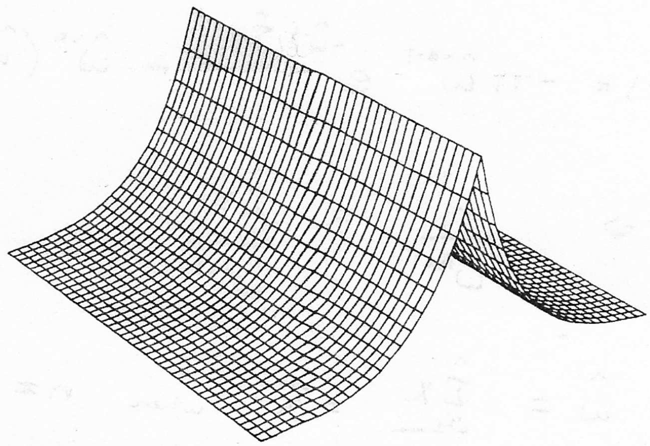

Figure 17.8. The detectability function of a line transect with exponential profile.

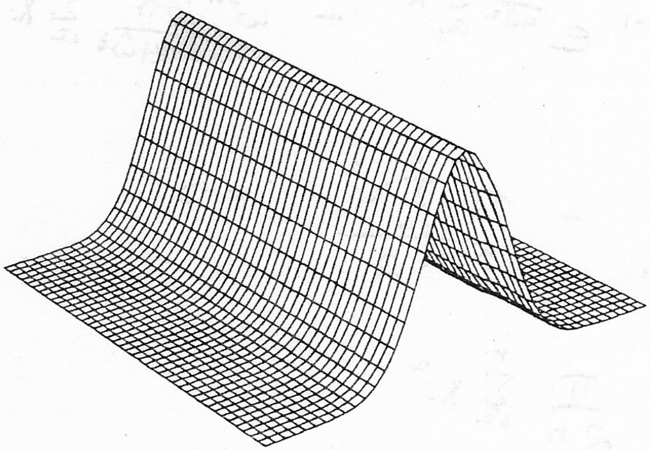

Figure 17.9. The detectability function of a line transect with half-normal profile.

Exponential:

$$\prod_{i=1}^{n} g(x_i) = \prod_{i=1}^{n} \frac{e^{-\frac{x_i}{\omega}}}{\omega} = \frac{1}{\omega^n} e^{-\frac{\sum_{i=1}^{n} x_i}{\omega}} = \omega^{-n} e^{-\omega^{-1}\sum_{i=1}^{n} x_i}$$

$$\frac{d}{d\omega} \prod_{i=1}^{n} g(x_i) = -n\hat{\omega}^{-n-1} e^{-\hat{\omega}^{-1}\sum_{i=1}^{n} x_i} + \hat{\omega}^{-n}\left(\hat{\omega}^{-2}\sum_{i=1}^{n} x_i\right) e^{-\hat{\omega}^{-1}\sum_{i=1}^{n} x_i} = 0$$

$$\Rightarrow \quad \frac{n}{\hat{\omega}^{n+1}} = \frac{\sum_{i=1}^{n} x_i}{\hat{\omega}^{n+2}}$$

so $$\hat{\omega} = \frac{\sum_{i=1}^{n} x_i}{n} = \bar{x},$$ where $n \equiv$ # of sitings along transect.

Half-normal:

$$\prod_{i=1}^{n} g(x_i) = \prod_{i=1}^{n} \frac{e^{-\frac{\pi x_i^2}{4\omega^2}}}{\omega} = \frac{1}{\omega^n} e^{-\frac{\pi}{4\omega^2}\sum_{i=1}^{n} x_i^2} = \omega^{-n} e^{-\frac{\pi}{4\omega^2}\sum_{i=1}^{n} x_i^2}$$

$$\frac{d}{d\omega} \prod_{i=1}^{n} g(x_i) = -n\hat{\omega}^{-n-1} e^{-\frac{\pi}{4\hat{\omega}^2}\sum_{i=1}^{n} x_i^2} + \hat{\omega}^{-n}\left(\frac{2\pi}{4\hat{\omega}^3}\sum_{i=1}^{n} x_i^2\right) e^{-\frac{\pi}{4\hat{\omega}^2}\sum_{i=1}^{n} x_i^2} = 0$$

$$\Rightarrow \quad \frac{n}{\hat{\omega}^{n+1}} + \frac{\pi \sum_{i=1}^{n} x_i^2}{\hat{\omega}^{n+3}\, 2} = 0$$

so $$\hat{\omega}^2 = \frac{\pi}{2n}\sum_{i=1}^{n} x_i^2$$

and $$\hat{\omega} = \sqrt{\frac{\pi}{2n}\sum_{i=1}^{n} x_i^2}$$, where $n \equiv$ # of sitings along transect.