

(8.2) From the histogram of observations, there does not appear to be an obvious choice of a post-hoc cut-off width w_0 . There is a slight drop from 21–25 metres to 26–30 metres, and there is also a slight drop from 31–35 metres to 36–40 metres. Hence, we will calculate three density estimators, one for each of the widths $w = 25$, $w = 35$, and $w = 40$. Note that the transect line has length $\ell = 400$ metres, and the wilderness reserve has area $A = 120\,000\text{ m}^2$.

If $w = 25$, then $n = 71$ so that

$$\tilde{\delta} = \frac{n}{2w\ell} = \frac{71}{2 \times 25 \times 400} = 0.00355$$

giving an approximate estimated population of

$$\tilde{T} = A\tilde{\delta} = 120\,000 \times 0.00355 = 426.$$

If $w = 35$, then $n = 79$ so that

$$\tilde{\delta} = \frac{n}{2w\ell} = \frac{79}{2 \times 35 \times 400} \approx 0.00282$$

giving an approximate estimated population of

$$\tilde{T} = A\tilde{\delta} = 120\,000 \times 0.00282 \approx 338.$$

If $w = 40$, then $n = 80$ so that

$$\tilde{\delta} = \frac{n}{2w\ell} = \frac{71}{2 \times 40 \times 400} = 0.00250$$

giving an approximate estimated population of

$$\tilde{T} = A\tilde{\delta} = 120\,000 \times 0.00250 = 300.$$

Since the observation of pheasants probably required an estimation of the sighting distance, it is unlikely that any of these three estimates is significantly better than any other. It seems reasonable to conclude that the true population of pheasants in this reserve lies between 300 and 400.