

Line Transect

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Hayne's Estimator

The Hayne estimator was developed to estimate density of birds that flush as an observer comes within a certain radius. This method assumes that there is a fixed flushing distance r and all animals within r distance of the observer will flush.

Sample Area

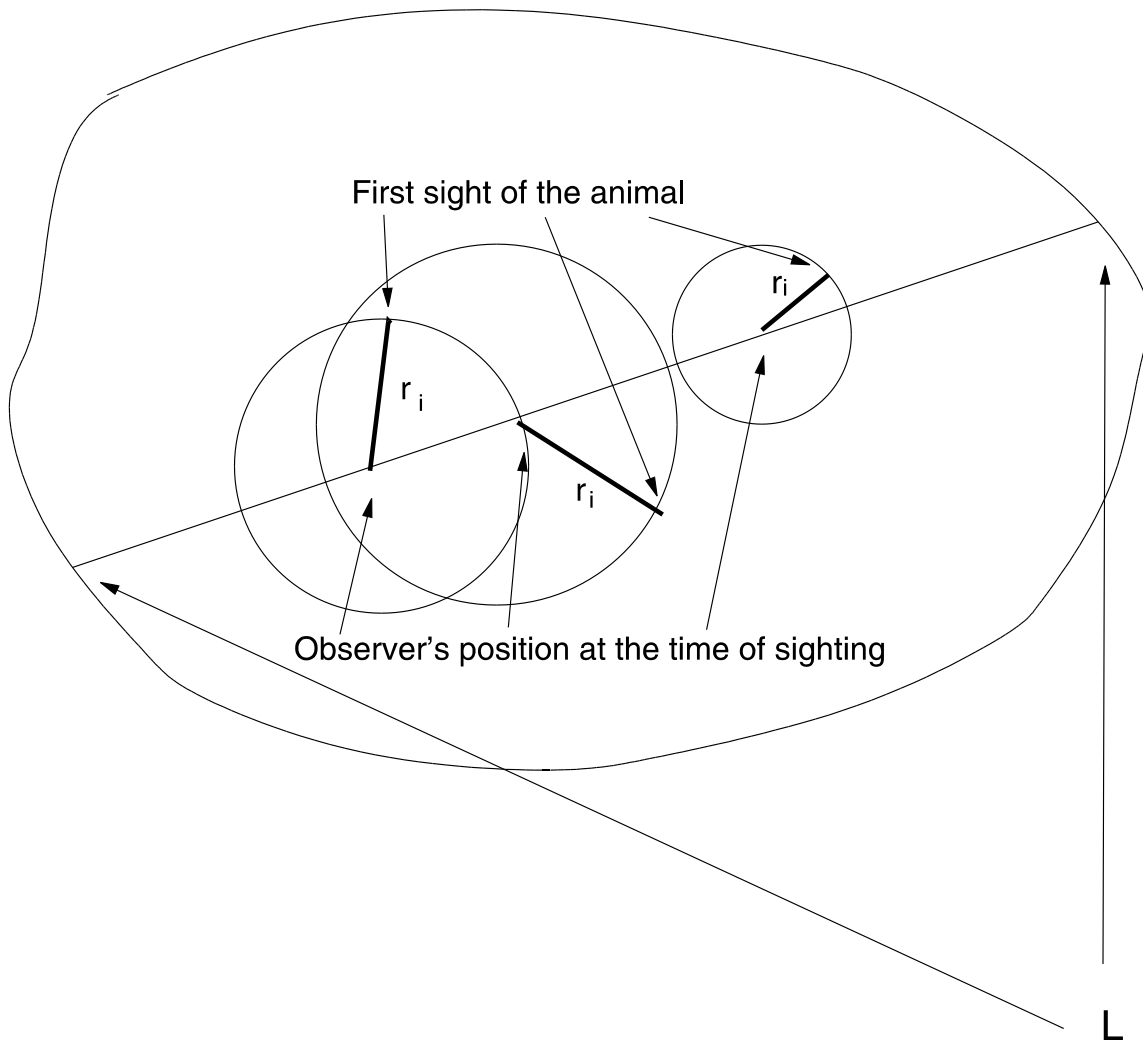


Figure 1: Illustrating the layout and important measures for the Hayne's line transect estimator

The density is estimated by :

$$\hat{D}_H = \frac{n}{2L} \left(\frac{1}{n} \sum_{i=1}^n \frac{1}{r_i} \right)$$

where:

DH is the Hayne density estimate
n is the number of animals
L is the length of the transect
r_i is the sighting distance to the *i*th animal.

R is the mean of the reciprocal of the sighting distances and is calculated as:

$$R = \frac{1}{n} \sum_{i=1}^n \frac{1}{r_i}$$

The variance of the density estimate is calculated as :

$$s_{\hat{D}_H}^2 \approx D_H^2 \left[\frac{s_n^2}{n^2} + \frac{\sum_{i=1}^n \left(\frac{1}{r_i} - R \right)^2}{R^2 n(n-1)} \right]$$

where:

D_H is the Hayne density estimate
n is the number of animals
s_n² is the variance of n approximately equal to n
r_i is the sighting distance to the *i*th animal.

The standard error of the mean density is estimated by the square root of the variance.

Hayne method assumed that the mean sighting angle is 32.7°. This can be tested by:

$$Z = \frac{\sqrt{n}(\bar{\theta} - 32.7)}{21.56}$$

where:

Z is the standard normal deviate test value
n is the number of animals sighted
z̄ is the mean observed sighting angle (Figure 1).

The test would be if the **Z** value is greater than 1.96 or less than -1.96 the sighting angle is statistically different than 32.7° at the $\alpha = 0.05$ level.

Also See:

Chapter 2 - Estimating Abundance: Line Transects pages 115-121 in:

Krebs, C. J. 1989. Ecological Methodology. Harper and Row, Publishers. New York. 654 pp.