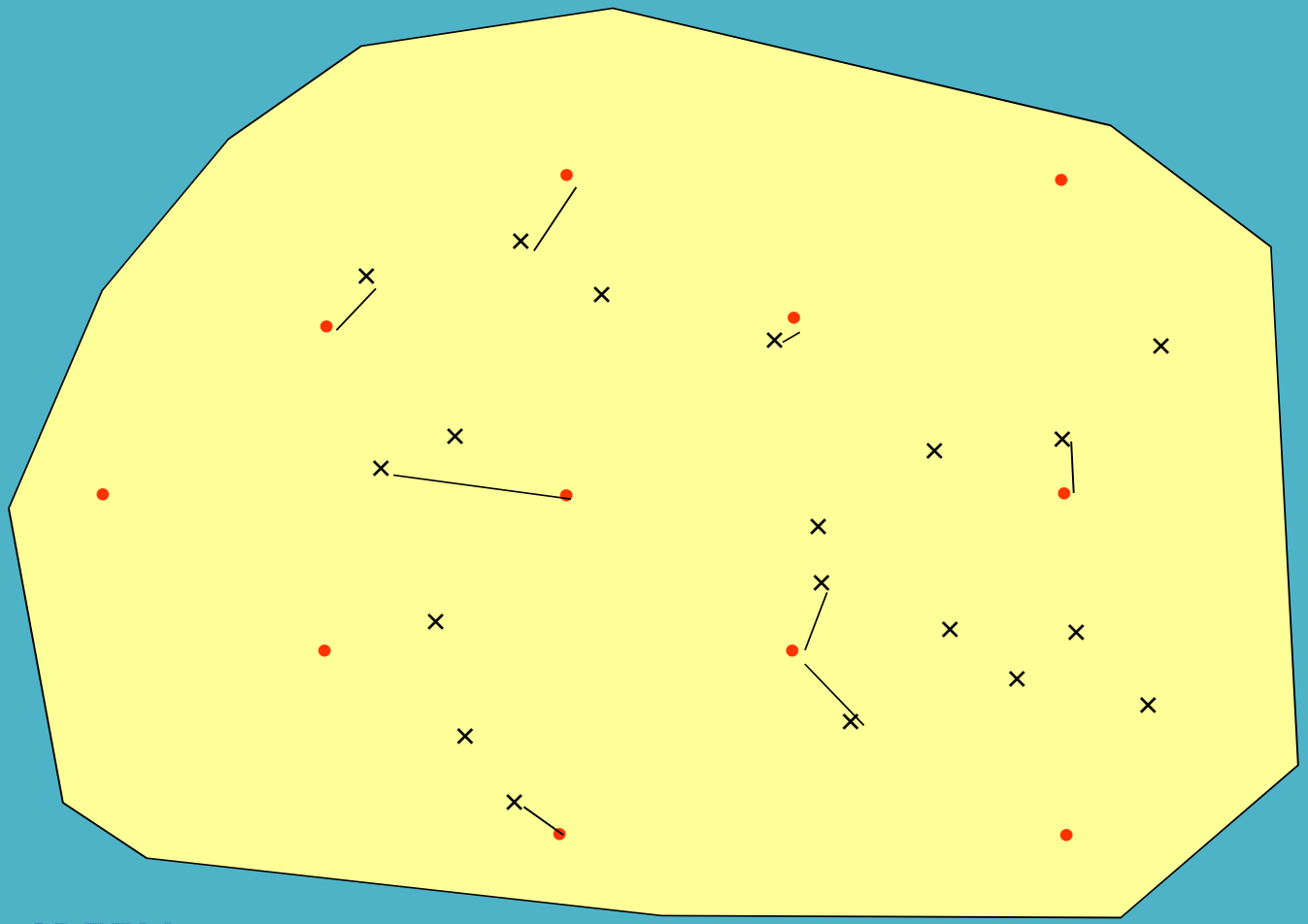
Point transect sampling



Random points or systematic grid of points randomly placed; observer records distance to any detected animals

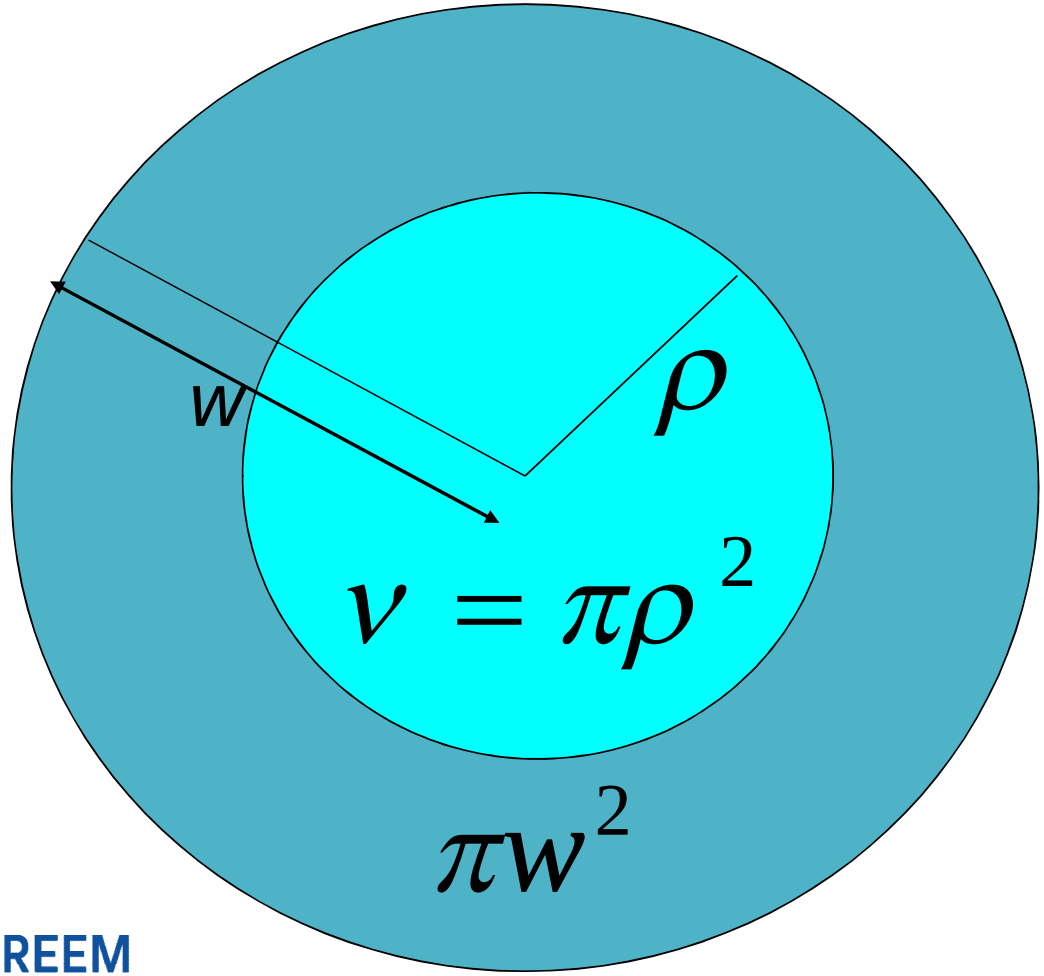
Point transect sampling

For *k* point counts with certain detection to distance *w*:

$$\hat{D} = \frac{n}{k\pi w^2}$$

How does this change if detection is uncertain?

Effective radius and effective area



ρ = effective radius

ν = effective area

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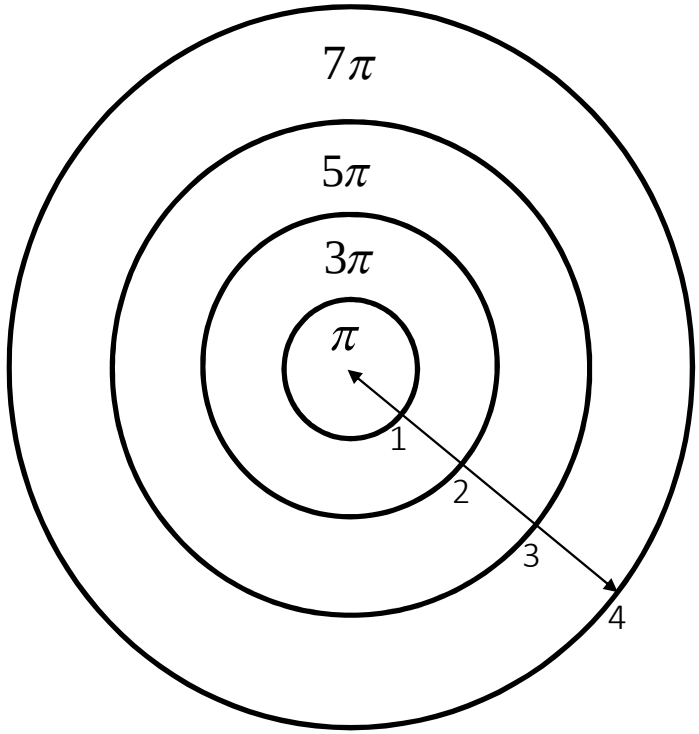
Covered area: $a = k\pi w^2$

Proportion detected: $P_a = \frac{k\pi\rho^2}{k\pi w^2} = \frac{\rho^2}{w^2}$

Estimated density: $\hat{D} = \frac{n}{a\hat{P}_a} = \frac{n}{k\pi w^2 \times \hat{\rho}^2 / w^2} = \frac{n}{k\pi\hat{\rho}^2}$

Area and hence number of birds increase linearly with distance:



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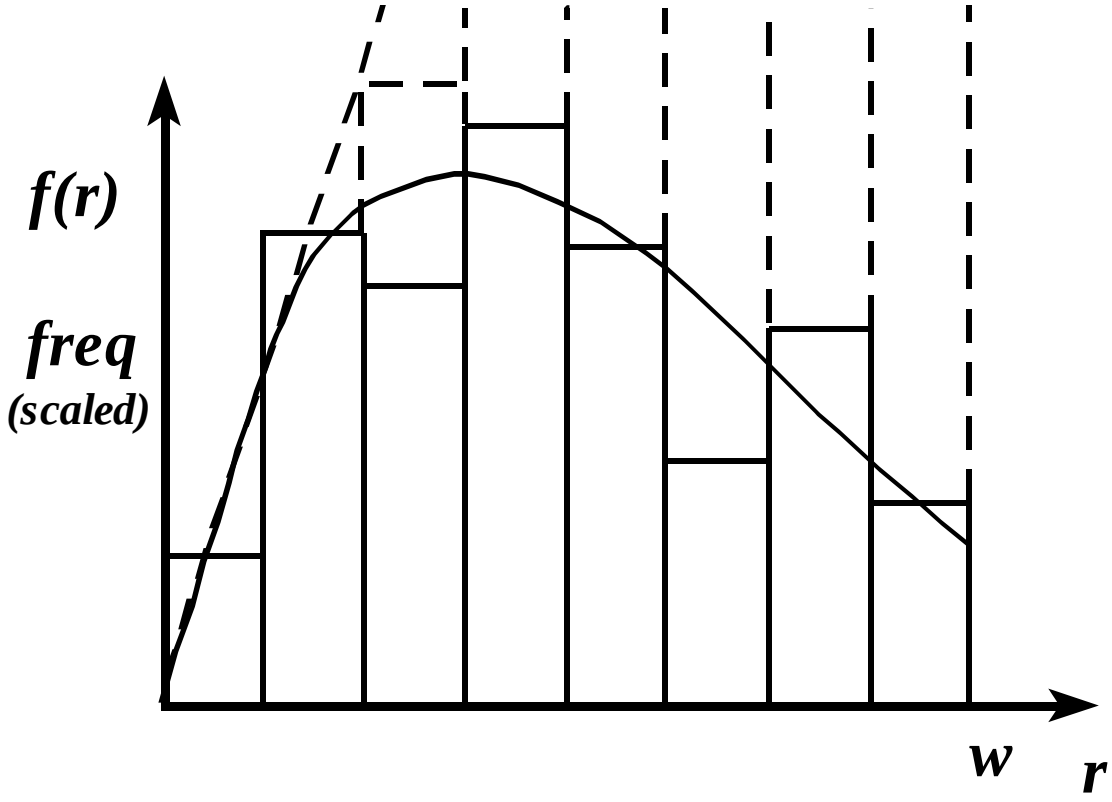
Probability density function



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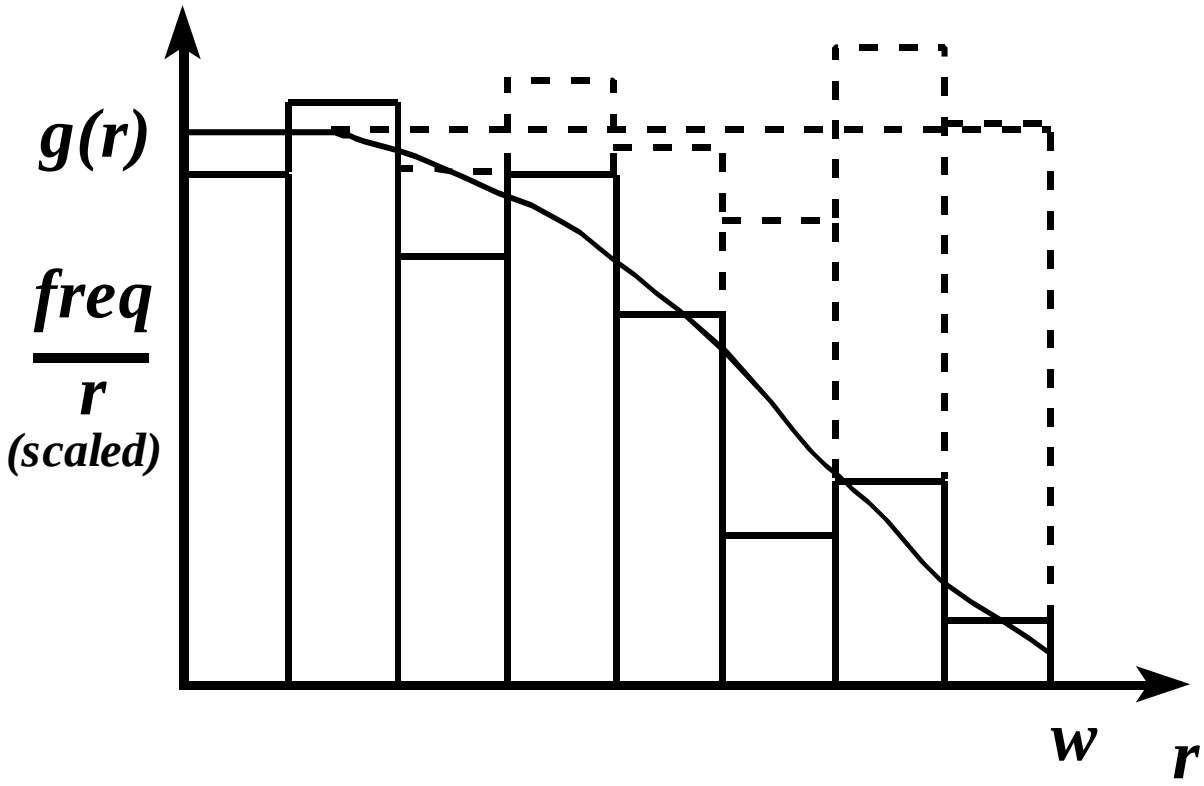
Detection function



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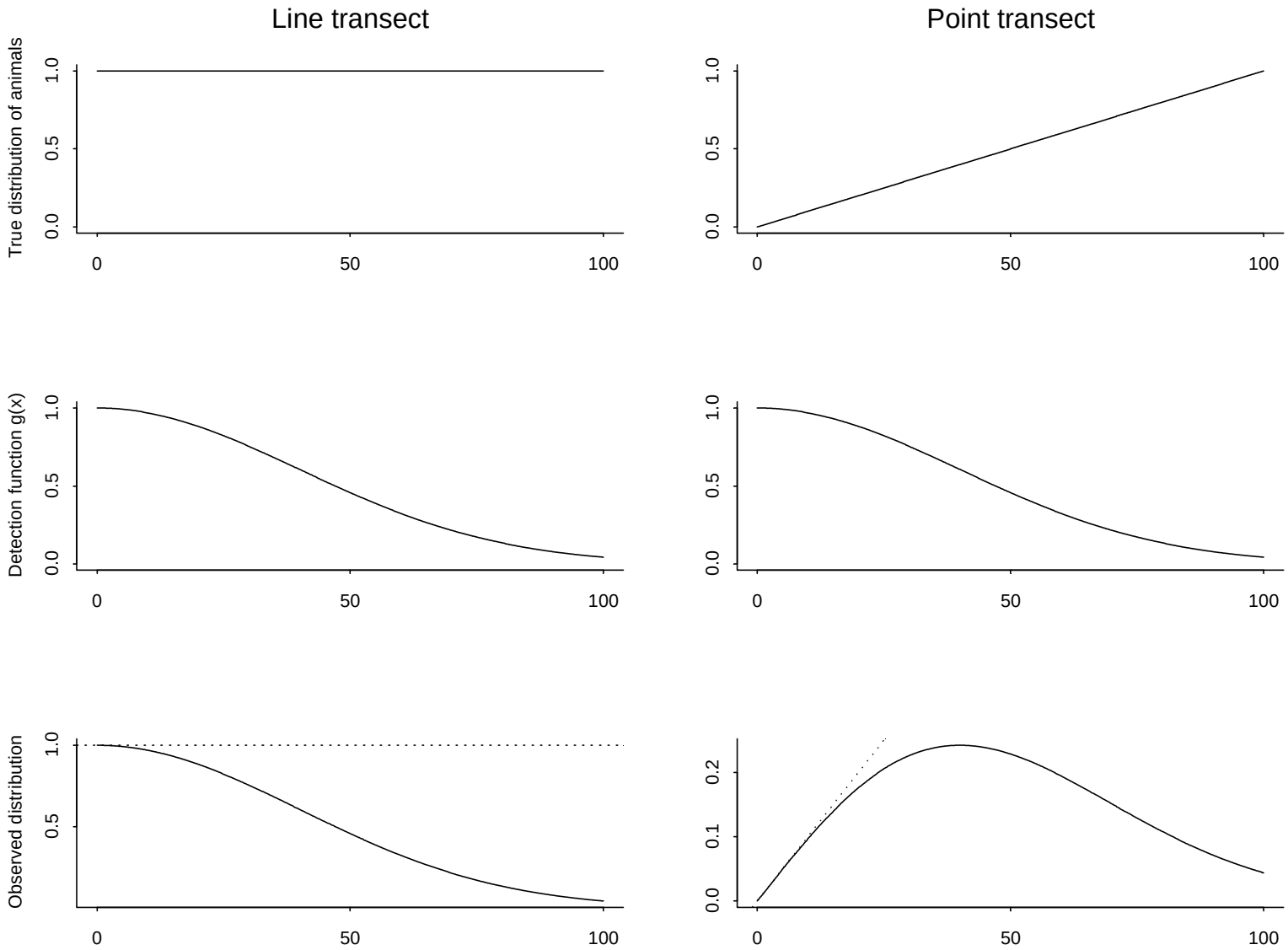

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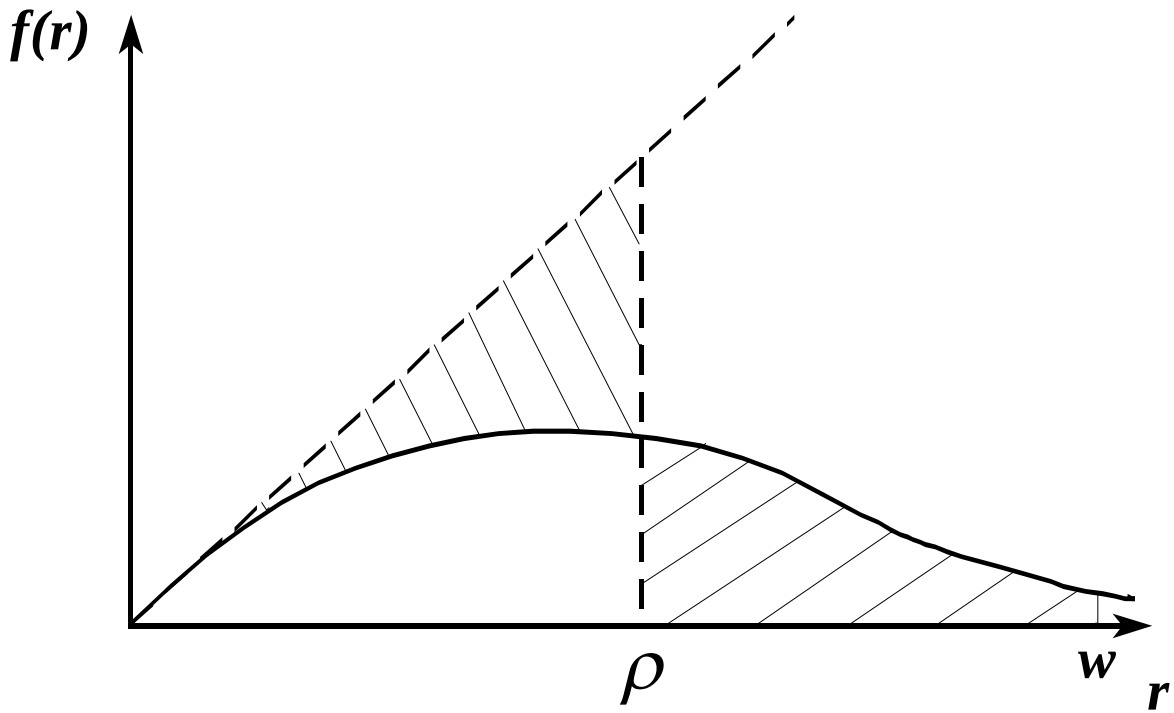
The effective radius ρ …



… is the distance such that as many birds beyond ρ are detected as are missed within ρ of the point.

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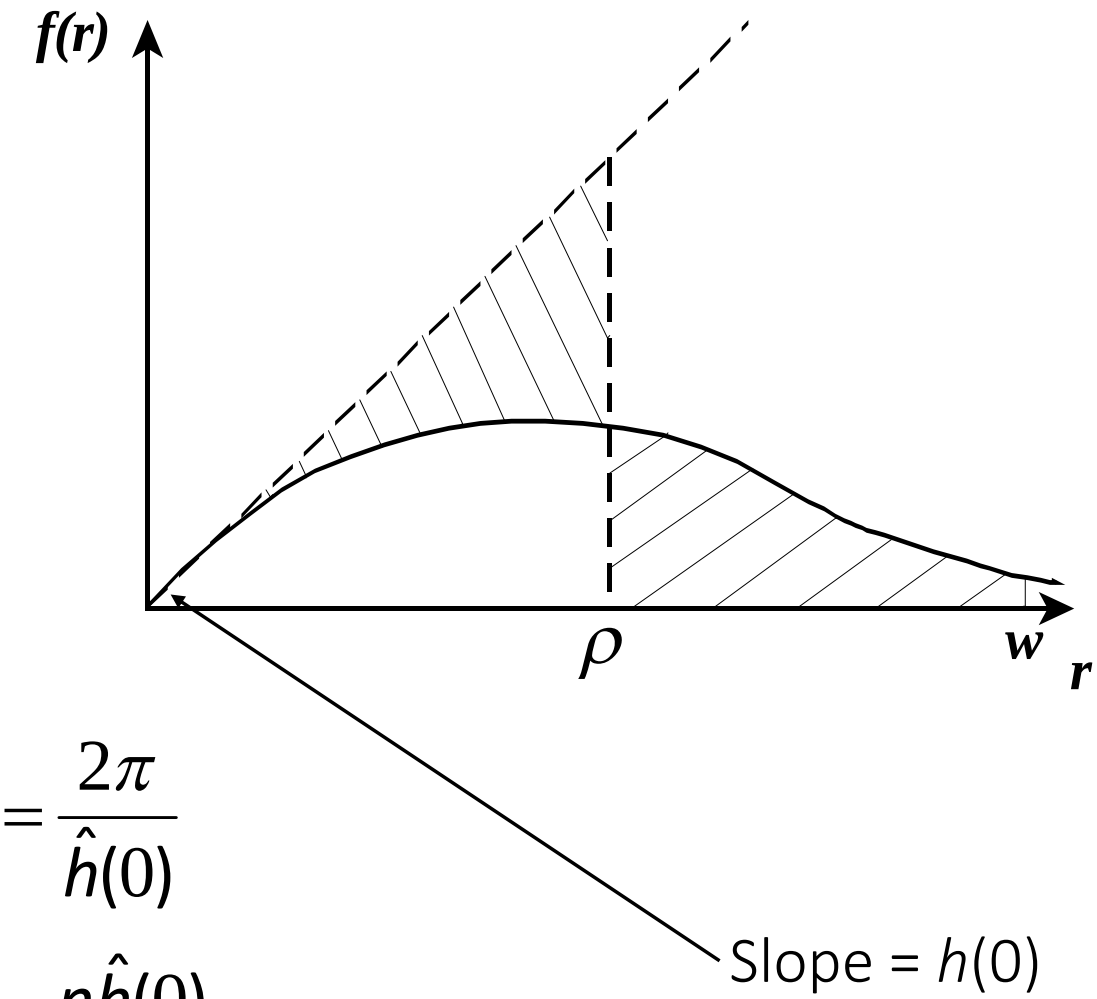
Area under curve:

$$\int_0^w f(r)dr = 1$$

Area of triangle:

$$\frac{\rho \times \rho f'(0)}{2} = \frac{\rho^2 h(0)}{2}$$



Hence $\hat{\rho}^2 = \frac{2}{\hat{h}(0)}$ and $\hat{v} = \frac{2\pi}{\hat{h}(0)}$

so that $\hat{D} = \frac{n\hat{h}(0)}{2\pi k}$

Notation: point transects

Known constants and data:

k = number of points

n = no. of animals or clusters detected

r_i = distance of i^{th} detected animal or cluster from the point, i = 1, ..., n

w = truncation distance for r

A= size of region of interest

a = size of covered region = $k\pi w^2$

s_i = size of i^{th} detected cluster, i = 1, ..., n

Point transect notation (cont)

Functions:

$g(r)$ = detection function

$f(r)$ = probability density function (pdf) of detection distances

$h(r) = f'(r)$ = slope of pdf $f(r)$

$h(0)$ = slope of pdf evaluated at $r=0$

Point transect notation (cont)

Parameters:

D = density = animals per unit area

D_s = density of clusters

N = population size = $D \cdot A$

ρ = effective radius = $\sqrt{2/h(0)}$

ν = effective area (per point) = $2\pi/h(0)$

P_a = prob. of detection of animal or cluster in the covered area a