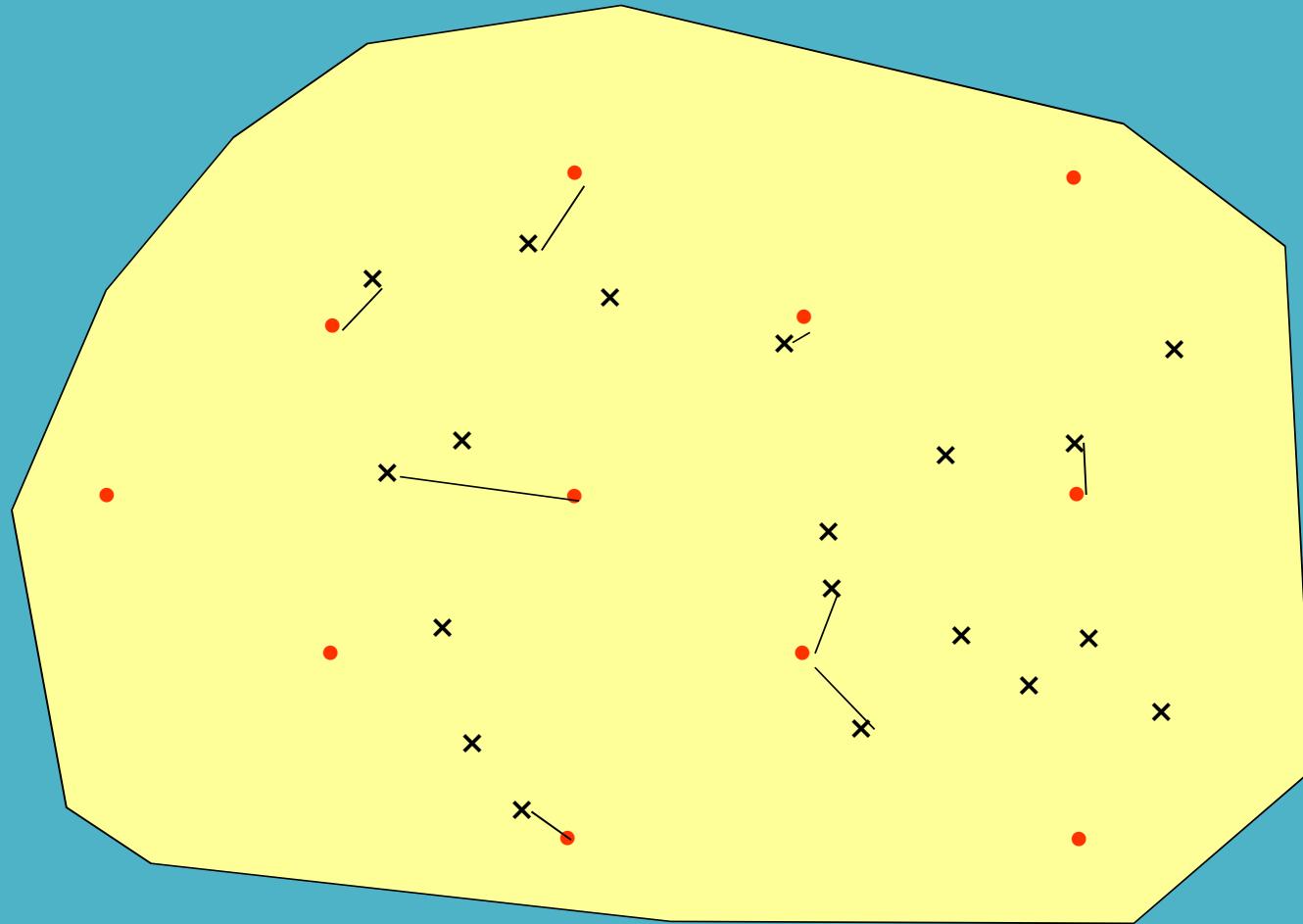


Point transect sampling



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

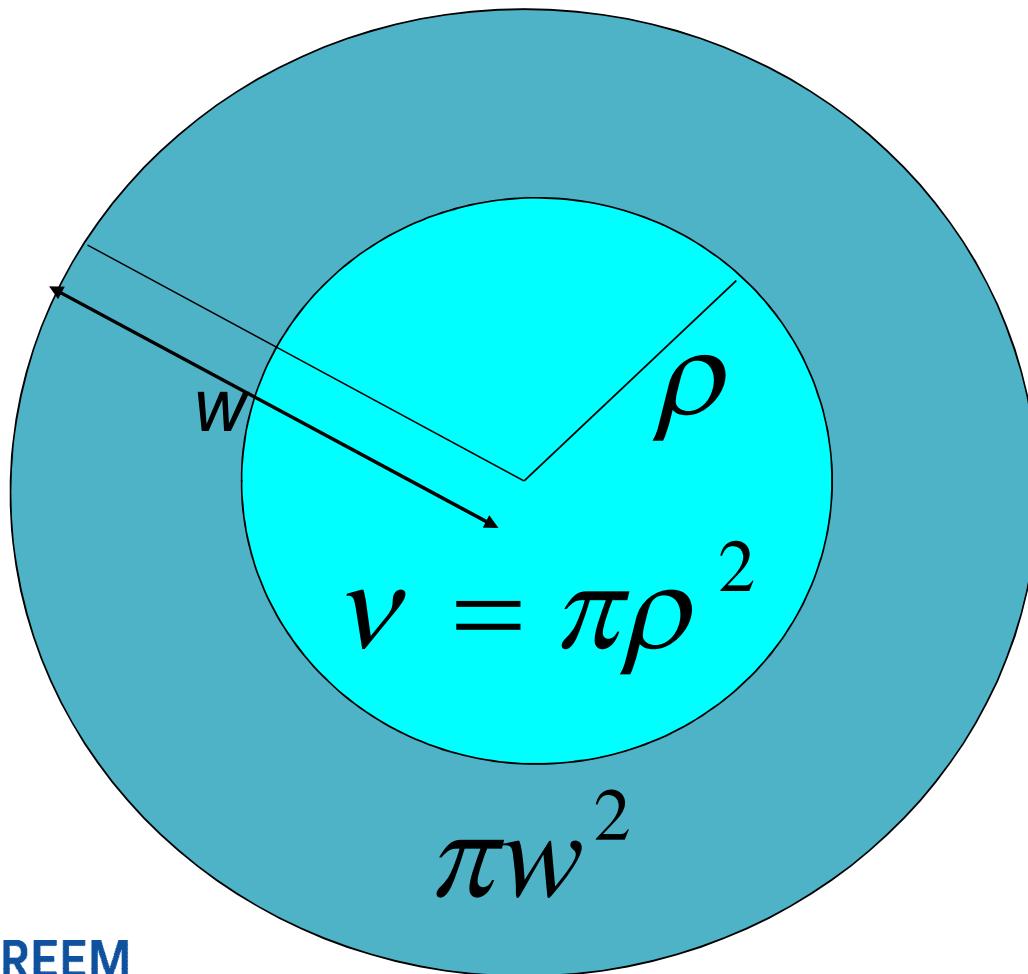
Point transect sampling

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

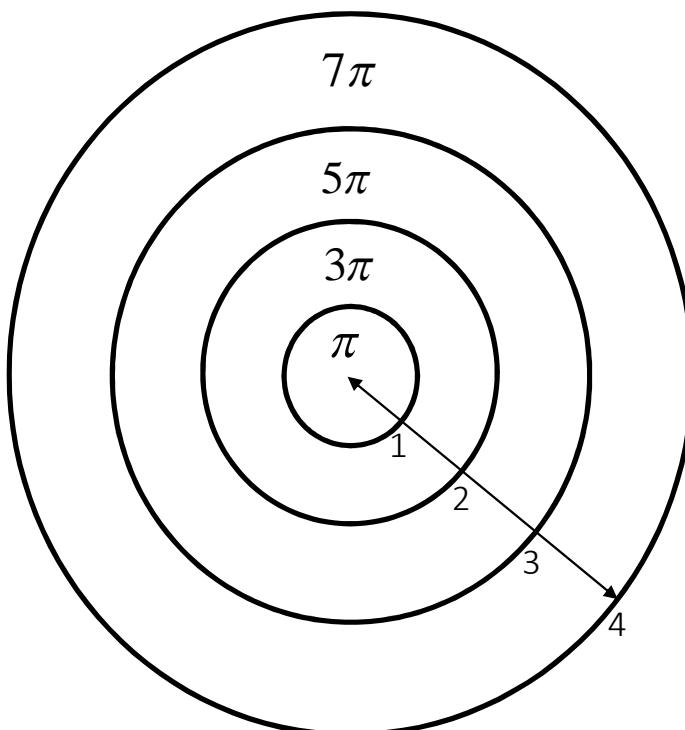
v = effective area

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

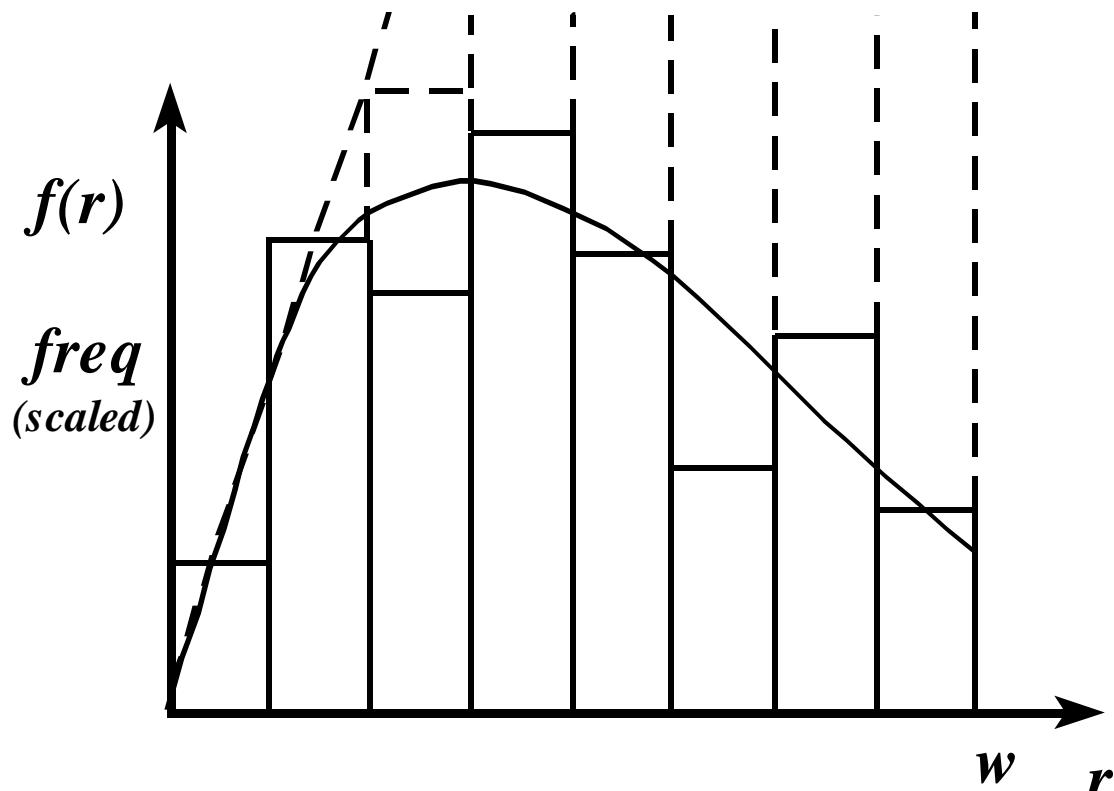
Proportion detected: $P_a = \frac{k\pi\rho^2}{k\pi w^2} = \frac{\rho^2}{w^2}$

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

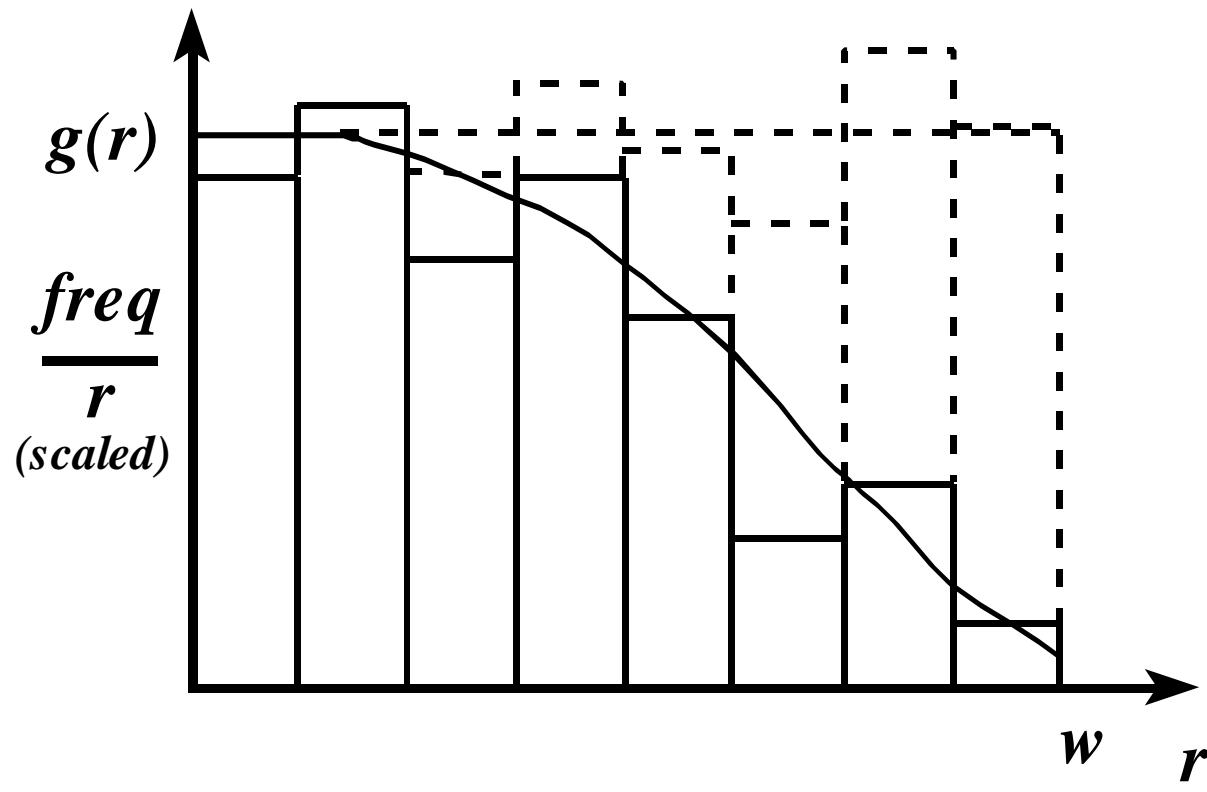
Area and hence number of birds increase linearly with distance:

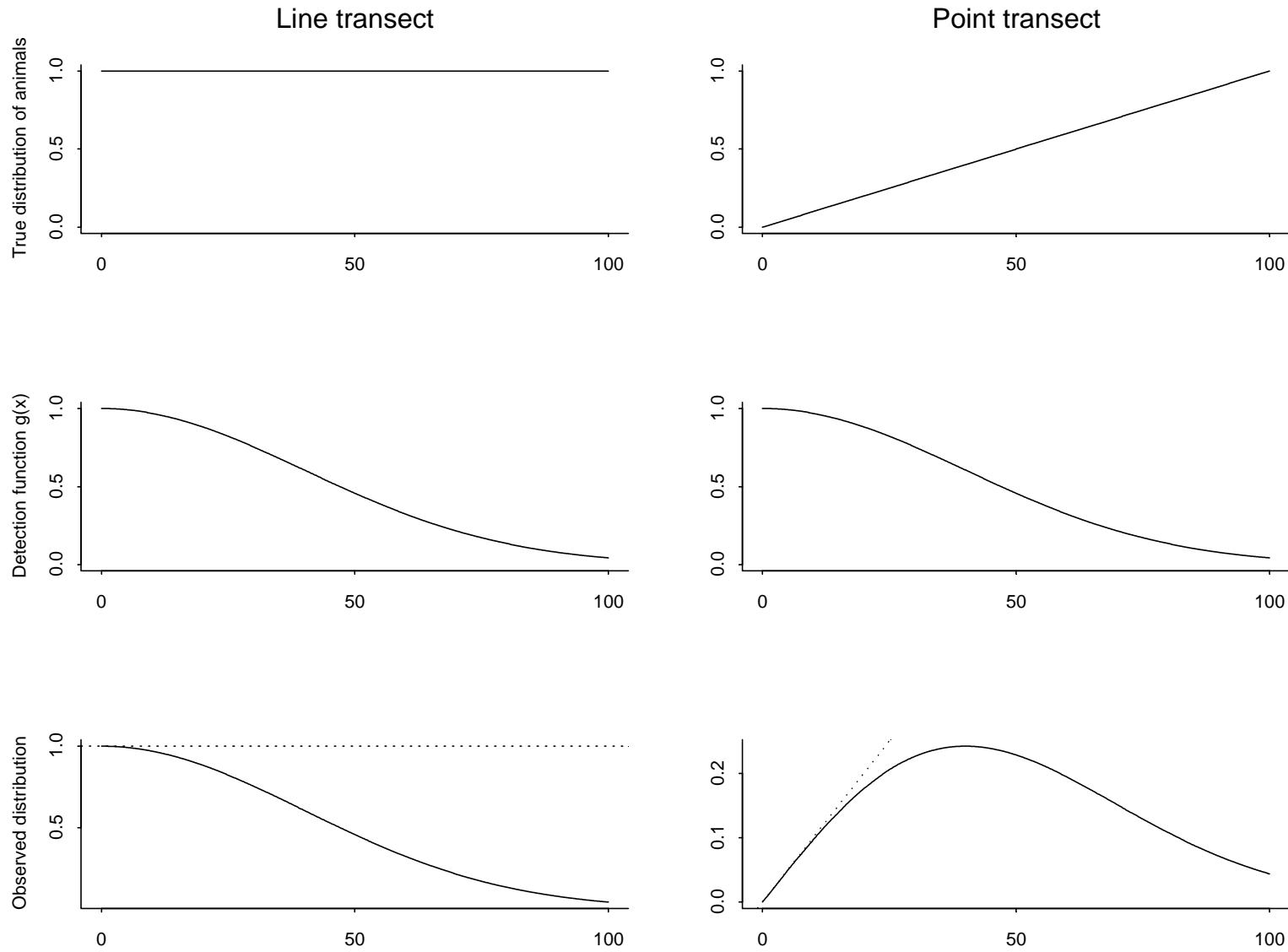


Probability density function

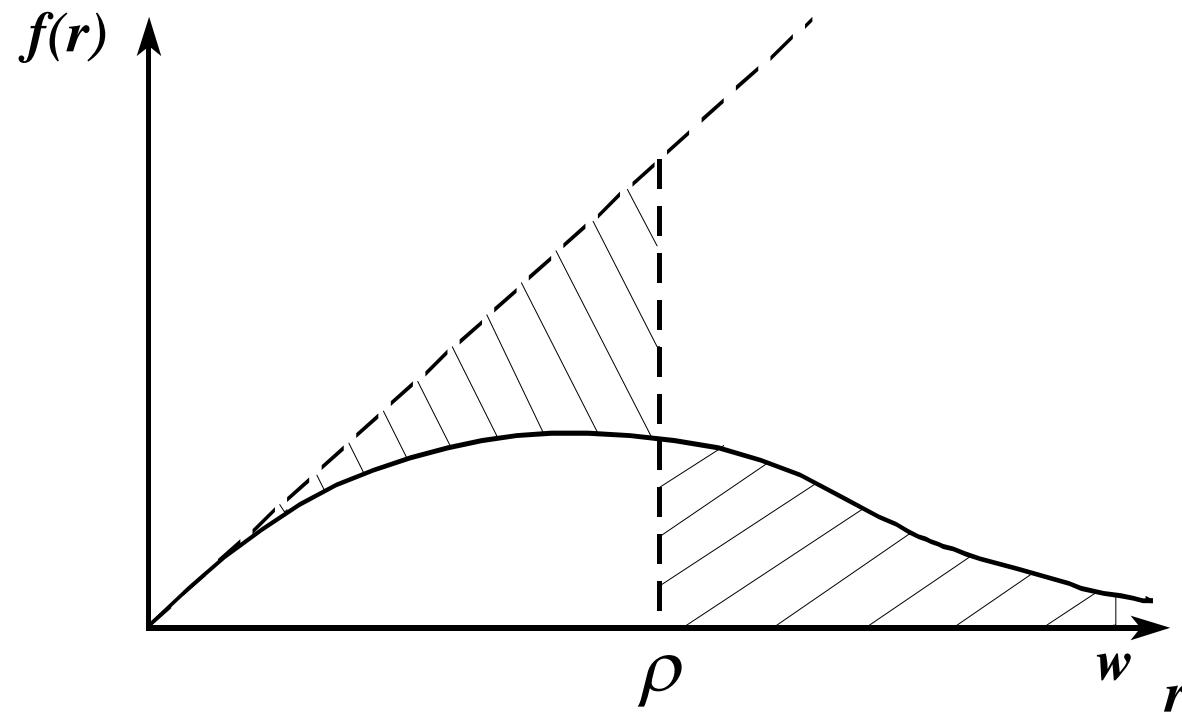


Detection function





The effective radius ρ ...



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

Area under curve:

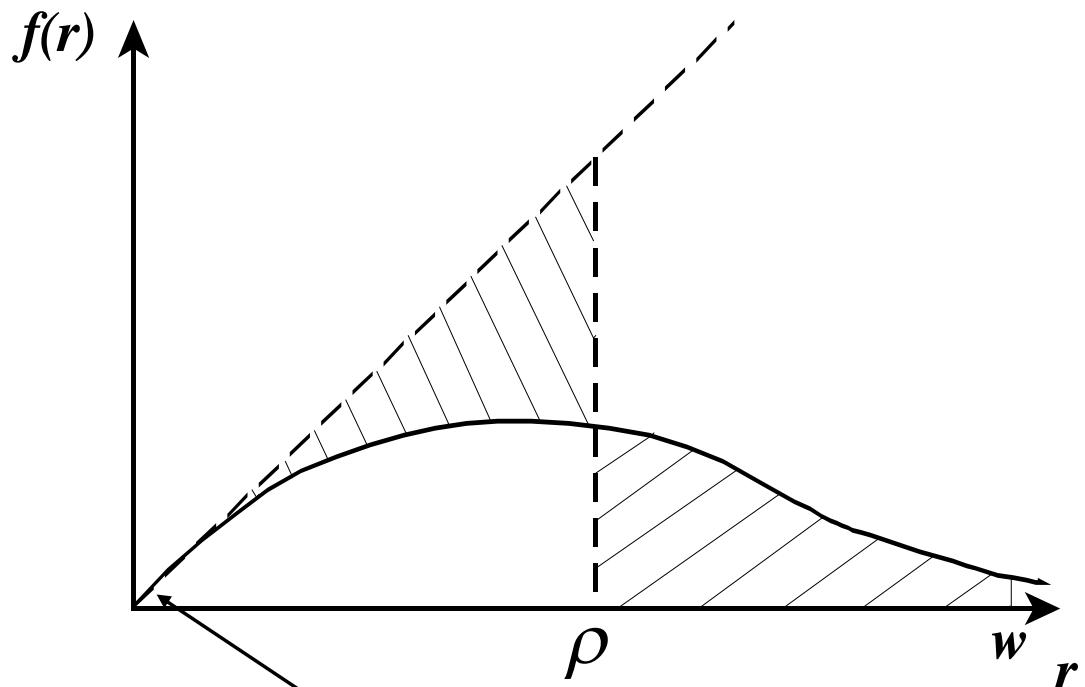
$$\int_0^w f(r)dr = 1$$

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, $i = 1, \dots, n$

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, $i = 1, \dots, n$

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

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

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

Comparative study^a

1. Point transect, 5-minute counts (9.8 hrs)
2. Point transect, snapshot method (8.4 hrs)
3. Cue counting, 5 mins per point (10.0 hrs)
4. Line transect sampling (7.9 hrs)
5. Territory mapping

^aBuckland, S.T. 2006. Point-transect surveys for songbirds: robust methodologies. *The Auk* 123:345-357.

Focal species in Montrave study

Chaffinch
Fringilla coelebs



Great tit
Parus major



Robin
Erythacus rubecula



Wren
Troglodytes troglodytes



Study area, Montrave Estate

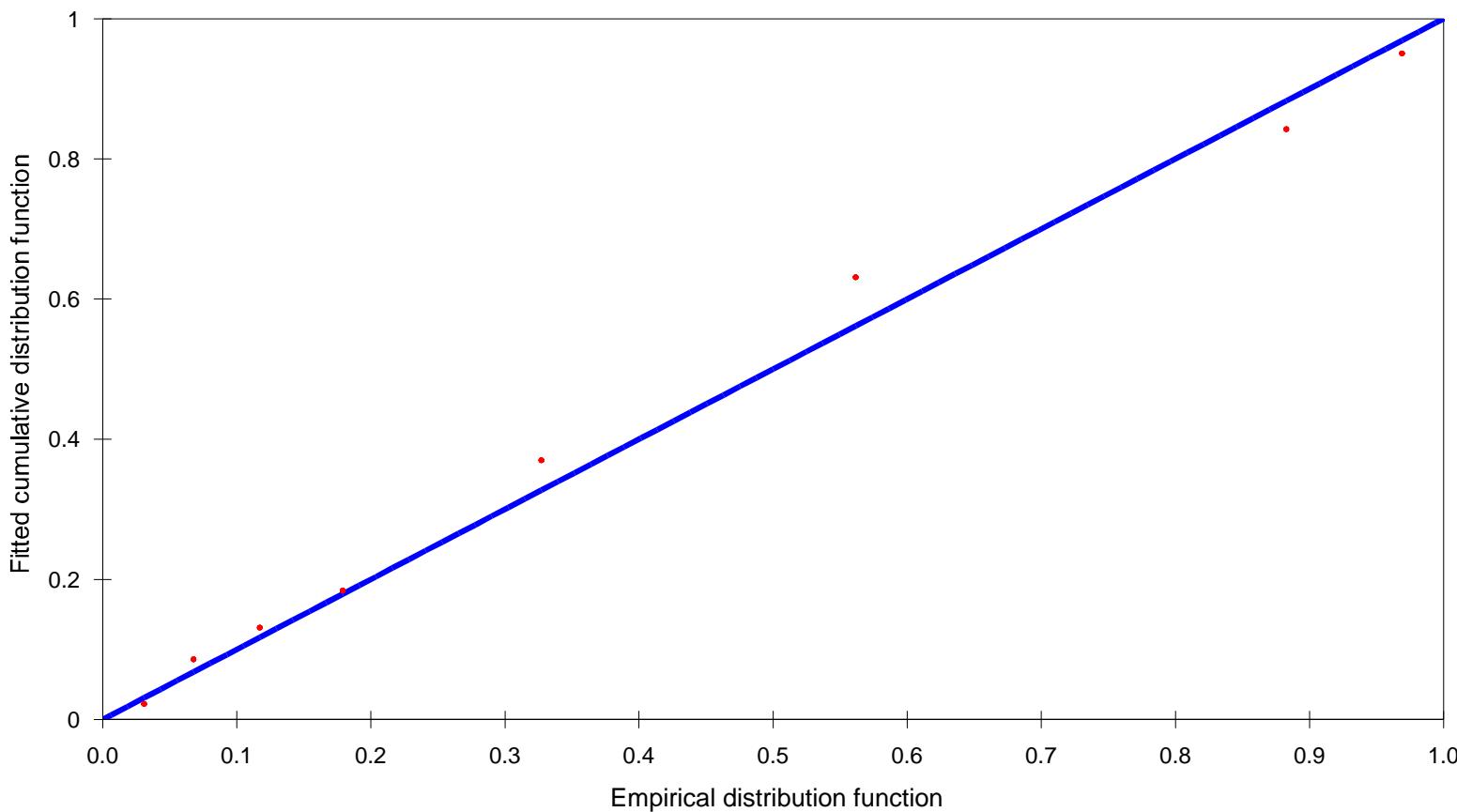


Parkland and
mixed woodland
33.2 ha
 $k = 32$ points

The data

	Chaffinch	Great tit	Robin	Wren
M1 ($w=110m$) n :	74	44	57	132
M2 ($w=110m$) n :	63	18	50	117
M3 ($w=92.5m$) n :	627	177	785	765
Cue rate:				
Sample size	33	12	26	43
Mean	7.9	8.2	17.9	7.3
M4 ($w=95m$) n :	73	32	80	155
M5 territories:	25	7	28	43

Example analyses: chaffinch



K-S and C-von M tests

Kolmogorov-Smirnov test

D_n = 0.0978

p = 0.4205

Cramer-von Mises family tests

W-sq (uniform weighting) = 0.1194

0.400 < p <= 0.500

Relevant critical values:

W-sq crit(alpha=0.500) = 0.1188

W-sq crit(alpha=0.400) = 0.1464

C-sq (cosine weighting) = 0.0705

0.500 < p <= 0.600

Relevant critical values:

C-sq crit(alpha=0.600) = 0.0623

C-sq crit(alpha=0.500) = 0.0770