Introduction to Distance Sampling

Notes on point transect exercises

1. Results from selected model options; remember these are simulated data with a half normal detection function and true density 79.6:

Key	Adjustments	# terms	*w* (m)	$\hat{D}$	%cv	95% c.i. for *D*
Half-normal	None	0	34.2	79.6	12.6	(62.1,102.1)
Half-normal	None	0	20.0	70.8	15.7	(52.0, 96.5)
Uniform	Cosine	1	20.0	75.0	14.4	(56.5, 99.6)
Hazard-rate	None	0	20.0	62.4	18.7	(43.2, 90.0)
Neg. exp.	Simple poly	1	20.0	73.1	29.2	(41.5,128.6)

We see a fair degree of variability between analyses – reliable analysis of point transect data is more difficult than for line transect data. We see greater loss in precision from truncating data relative to line transect sampling, but if we don't truncate data, different models can give widely differing estimates. For these data, the hazard-rate model appears to have downward bias, and precision is very poor for the negative exponential model.

2. I got the following estimated densities (territories ha^{-1}). I have included estimates for the three other species surveyed (not provided in the projects for the workshop). Method 5 is territory mapping (which does not use distance sampling, and as you note has no measure of precision associated because it is akin to a census method).

Species	Common Chaffinch	Great Tit	European Robin	Winter Wren
Method				
1	1.03	0.58	0.52	1.29
	(0.74,1.43)	(0.36,0.94)	(0.26,1.06)	(0.80,2.11)
2	0.90	0.22	0.60	1.02
	(0.62,1.29)	(0.13,0.39)	(0.38,0.94)	(0.80,1.32)
3	0.71	0.26	0.82	1.21
	(0.45,1.23)	(0.09,0.76)	(0.52,1.31)	(0.82,1.79)
4	0.64	0.26	0.69	1.07
	(0.46,0.90)	(0.16,0.42)	(0.47,1.00)	(0.87,1.31)
5	0.75	0.21	0.84	1.30

To obtain the above estimates, I used a truncation distance of 110m for methods 1 and 2, 92.5m for method 3, and 95m for method 4. For the wren data, I used the uniform key with two cosine adjustments for method 1, the hazard-rate model for methods 2 and 3, and the half-normal key with two Hermite polynomial adjustments for method 4.

Points to note about the wren data: the wren more than any of the other species showed evidence of observer avoidance. This didn't cause too many difficulties, except that the model favoured by AIC for line transect sampling was the hazard-rate model, which had a very flat shoulder out to around 75m. It was implausible that detection was certain out to this distance, so that I selected a model with a slightly inferior AIC value, but with a more plausible fitted detection function. Analyses of the cue count data are necessarily rather subjective, as the data show substantial over-dispersion (a single bird may give many songbursts all from the same location during a five-minute count). In this circumstance, goodness-of-fit tests are very misleading, and care must be taken not to overfit the data.

3. I obtained good fits to the 1980 savannah sparrow data by truncating at 55m. The half-normal detection function without adjustments fitted well, as did the uniform with cosine adjustments. The hazard-rate model performed less well. There was a marginal preference for fitting the detection function separately in each stratum as judged by AIC, but pooling distance data across strata might offer rather more robust estimation. The estimates of density in the table correspond to a half-normal detection function, fitted separately in each stratum, with a truncation distance of 55m.

For 1981, w=55m was again satisfactory. There was now a clear preference for estimating the detection function separately by stratum, but little to choose between the half-normal model and the uniform model with cosine adjustments. For comparability with 1980, I chose the half-normal model, although AIC showed a very marginal preference for uniform + cosine. (Again, the hazard-rate model provided less good fits overall.)

Estimated densities $\hat{D}$ (birds/ha) of savannah sparrows

Year	Pasture	$\hat{D}$	95% c.i. for $\hat{D}$
1980	1	1.43	(0.94, 2.18)
	2	4.12	(3.15, 5.38)
	3	2.35	(1.72, 3.20)
	All	2.63	(2.19, 3.16)
1981	0	1.39	(0.82, 2.36)
	1	0.52	(0.27, 1.03)
	2	1.70	(1.07, 2.71)
	3	1.35	(0.81, 2.26)
	All	1.24	(0.95, 1.62)