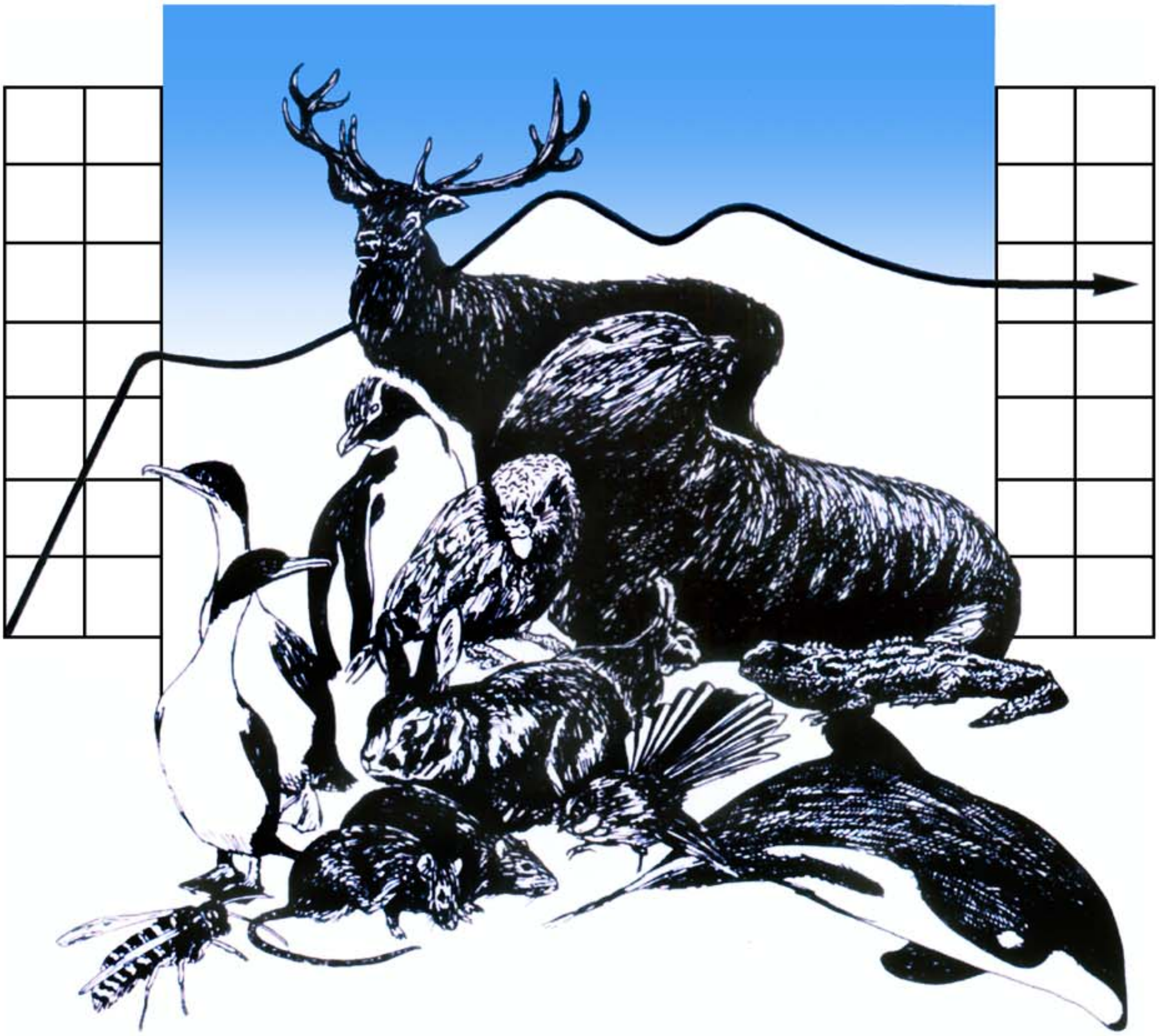
UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

DEPARTMENT OF ZOOLOGY



WILDLIFE MANAGEMENT

Interspecific interaction and habitat use by Australian magpies (*Gymnorhina tibicen*) on sheep and beef farms, South Island, New Zealand.

MARCIA GREEN[1]

A report submitted in partial fulfilment of the
Post-graduate Diploma in Wildlife Management

University of Otago

2006

University of Otago
Department of Zoology
P.O. Box 56, Dunedin
New Zealand

WLM Report Number: 194

The Magpies, by Denis Glover

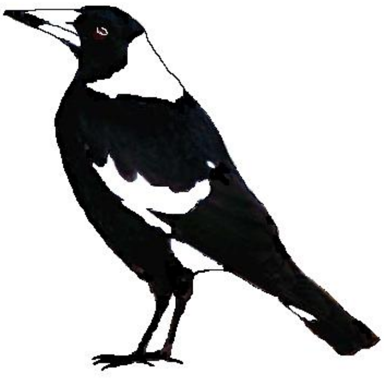
When Tom and Elizabeth took the farm
The bracken made their bed.
And quardle oodle ardle wardle doodle
The magpies said.

Tom's hand was strong to the plough
Elizabeth's lips were red.
And quardle oodle ardle wardle doodle
The magpies said.

Year in year out they worked
While the pines grew overhead.
And quardle oodle ardle wardle doodle
The magpies said.

Elizabeth is dead now (it's years ago)
Old Tom went light in the head;
And quardle oodle ardle wardle doodle
The magpies said.

The farm's still there. Mortgage corporations
Couldn't give it away.
And quardle oodle ardle wardle doodle
The magpies say.



1. EXECUTIVE SUMMARY

INVESTIGATION TITLE: Interspecific interaction and habitat use by Australian magpies (*Gymnorhina tibicen*) on sheep and beef farms, South Island, New Zealand.

STUDY VENUE: East coast sheep and beef farms, South Island, New Zealand.

INVESTIGATOR: Marcia Green

OBJECTIVES:

1. To determine whether magpie abundance is correlated with the abundance of other bird species.
2. To determine whether magpie abundance is related to farm management type.
3. To determine whether the habitat use of magpies differs from the habitat use of other bird species.

BACKGROUND:

Australian magpies (*Gymnorhina tibicen*) were introduced in the 1860's from their native Australia in an attempt to control agricultural invertebrate pests. They are regarded as a threat to native biodiversity due to their conspicuous attacks on native birds and some sheep/beef farmers actively control them by trapping, poisoning or shooting. However, there is little evidence that magpies are seriously affecting other birds on New Zealand sheep and beef farms.

METHODS AND RESULTS:

This study took place on twelve clusters of sheep and beef farms on the east coast of the South Island, New Zealand. Each cluster consisted of three farms, each under a different management regime (Conventional, Organic, Integrated Management).

Line transects surveys were conducted on all farms, with all birds seen or heard recorded. Surveying began on November 17th 2004 and was completed on January 31st 2005. The total length of transect sampled was 157.426km. 49 bird species were recorded by five observers over all 37 farms. Of these species 27 had sufficient observations required for analysis. Data was analysed with the software *Distance*, which calculates detection functions to provide an estimate of density.

Pearsons correlations determined that there was no effect of magpie abundance on other species abundance. A nested analysis of variance determined that there was no effect of management type on magpie abundance, nor was there any effect of cluster on magpie abundance, once any farm management effects were accounted for. The habitat that each individual bird was observed in was recorded and was coded into one of twelve categories. These values were summed for all farms and clusters to give overall habitat use on the study farms. Chi-squared contingency table analysis determined that there were significant differences in the observed habitat use for magpies, blackbirds, starlings, song thrushes, and skylarks.

Magpies were most commonly found in open paddock habitats, followed by shelterbelts. Blackbirds were also most common in this habitat, but differed from magpies in the use of other habitats, starlings and skylarks occurred most often in open paddocks, while song thrushes were most often found in shelterbelts. For tui and kereru, native vegetation was the only category with sufficient sightings for analysis, and the proportional use of this habitat type was significantly different from that of magpies.

CONCLUSIONS AND RECOMMENDATIONS:

It is likely that magpies do not have an effect on the abundance of other birds on the farms in this study, although displacement of other birds by magpies at a local scale may occur.

Farm management type appears to have no impact on the abundance of magpies, due to the integrated nature of the agricultural landscape and the spatial range of magpie non-breeding groups.

It is possible that magpies may be displacing blackbirds, starlings, song thrushes, and skylarks from their preferred habitat, but further inquiry including experimental removal of magpies from replicated sites will need to be undertaken to establish this.

It is recommended that with the limited resources available for the protection of the natural environment in New Zealand, priority needs to be given to more serious predators such as rodents and mustelids, which have proven negative impacts on native birds.

TABLE OF CONTENTS

10. APPENDICES

2. ABSTRACT: Australian magpies (*Gymnorhina tibicen*) were introduced to New Zealand in the 1860's from their native Australia. They are regarded as a threat to native biodiversity due to their conspicuous attacks on native birds. Distance sampling surveys were conducted across 12 clusters of sheep and beef farms, each consisting of three farms managed under a different regime (Conventional, Organic, Integrated Management), on the east coast of the South Island, New Zealand. The study aimed to determine whether (1) magpie abundance was correlated with the abundance of other bird species; (2) magpie abundance was related to farm management type; and (3) whether habitat use of magpies differed from the habitat use of other bird species. Data were analysed with the analysis software *Distance* to estimate farm by farm density for the most common species (>20 records). Results showed there was no effect of magpie abundance on other species abundance, nor was there any effect of cluster or management type on magpie abundance. There were significant differences in the observed habitat use for magpies, blackbirds, starlings, song thrushes, skylarks, tui and kereru. It can be concluded that magpies may displace other birds locally, but do not affect the abundance of birds found at the whole-farm scale. Farm management type appears to have no bearing on the abundance of magpies, due to the integrated nature of the agricultural landscape and the spatial range of magpie non-breeding groups. It is possible that magpies may be displacing blackbirds, starlings, song thrushes, and skylarks from their preferred habitat, as a result of magpie avoidance, but further inquiry will need to be undertaken to establish this. It is recommended that with the limited resources available for the protection of the natural environment in New Zealand, priority needs to be given to more serious predators such as introduced rodents and mustelids, which have proven negative impacts on native birds.

Keywords: Magpie, *Gymnorhina tibicen,* distance sampling, line transect sampling, interference competition, habitat use, control.

3. INTRODUCTION

Australian magpies (*Gymnorhina tibicen*) were introduced to New Zealand in the 1860's from Victoria and Tasmania (Thomson, 1922) to control agricultural invertebrate pests (Heather & Robertson, 2000). Over 546 were released in Canterbury between 1864 and 1870 (Bull, 1985). Since this time they have expanded their range considerably (Figure 1) and are now classified as 'Abundant Australian Introduction' (Heather & Robertson, 2000).

Magpies are highly social birds (Veltman, 1982; 1989) and can be extremely territorial (Reader's Digest, 1976) and highly aggressive, especially in their breeding season from July to December (Chambers, 1989; Jones & Nealson, 2003; Stevenson, 2005; Morgan, *in review*). The clearing of land for agriculture has benefited magpies in terms of food, as they feed mainly on pasture invertebrates. They will also feed on seeds, carrion, mice, lizards and other birds (Moeed, 1976; Reader's Digest, 1976; Veltman & Hickson, 1989; Whiting, 1996; Heather & Robertson, 2000).

Magpies have acquired a bad reputation both in Australia and New Zealand. Extravagant claims have been made regarding their impact on other bird species. For example:

> "It was like a scene out of Hitchcock's *The Birds* … They took over the skies and the land. Overnight the dawn chorus, apart from their own, dried up" (Barrington, 1996).

They have been blamed for a wide range of problems, from attacking birds, dogs, sheep, horses and humans to stealing food and shiny objects, short-circuiting power lines and even starting forest fires (McCaskill, 1945; Moon, 1956; Reader's Digest, 1985; Porter, 1993; Barrington, 1995; Barrington 1996; Cilento & Jones, 1999; Sanders & Maloney, 2002; Warne & Jones, 2003). In their native Australia magpies are responsible for more attacks on humans than any other species of wildlife (Stevenson, 2005). In New Zealand, they are regarded as a threat to native biodiversity due to their conspicuous attacks on native birds, with at least 45 bird species known to be attacked by magpies in New Zealand (Morgan *et al.*, 2005). Legal protection was removed from magpies in 1951 after complaints that they were driving away native birds and attacking small children (Reader's Digest, 1985). Various control options are used, such as trapping with the aid of 'call birds', poisoning and shooting (Barrington, 1995; Banks Peninsula Conservation Trust, 2003; Environment Bay of Plenty, 2005), all of which can become costly as ongoing control is likely to be needed to keep magpies from reestablishing (Innes *et al.*, 2004). However, it is unclear exactly what impacts magpies have on other species in agricultural landscapes in New Zealand.

A recent study by Innes *et al.* (2004) examined the effect of magpies control on other birds in rural areas. They found that in areas where magpie control was applied, counts of song thrush, myna (*Acridotheres tristis*), starling, blackbird, skylark, and to a lesser extent tui and kereru increased. However, the authors concluded that increased conspicuousness rather than abundance was the most likely explanation of count increases, as magpies may displace other species from certain areas but seldom do they
kill them (Innes *et al.*, 2004).

At a broader scale, it is not clear how other factors may affect magpie populations and their potential impacts in agricultural landscapes. There are three primary farm management strategies used on sheep/beef farms in New Zealand; organic, integrated management (minimal farm inputs at optimum places and times) and conventional farms. Organic management strategies claim significant potential to increase broad biodiversity values, including increases in native vegetation and avifauna (Hole *et al.*, 2005). Integrated management farms are rapidly becoming more common and offer an intermediate strategy between organic and conventional farming (Wharfe & Manhire 2004). It is unclear whether these different farm management strategies have any consistent impacts on magpies or wider avifauna on farms in New Zealand. Similarly, farms can vary greatly in their habitat composition, heterogeneity and complexity, and the influence of these factors and magpie presence and interactions with other species is not known.

Although the sampling techniques used by Innes *et al.* (2004) minimized potential biases arising from observer, weather and seasonal effects, the relative abundance index used (5-minute counts) may be ineffectual for detecting changes in population abundance (Rexstad, 1994). Five-minute bird counts are hugely affected by conspicuousness, so we chose to use distance sampling techniques to obtain density estimates of magpies and other bird species. Distance sampling is a more robust estimator of abundance than relative abundance indices as density estimates are not confounded by detectability (when critical assumptions are met) (Rosenstock, *et al.*, 2002; Thompson, 2002). This study examines the density and habitat use of magpies to determine whether (1) magpie abundance was correlated with the abundance of other bird species; (2) magpie abundance was related to farm management type; and (3) whether habitat use of magpies differed from the habitat use of other bird species.

This study was conducted as part of an ongoing investigation into the sustainability of production landscapes by the Agricultural Research Group on Sustainability (ARGOS).

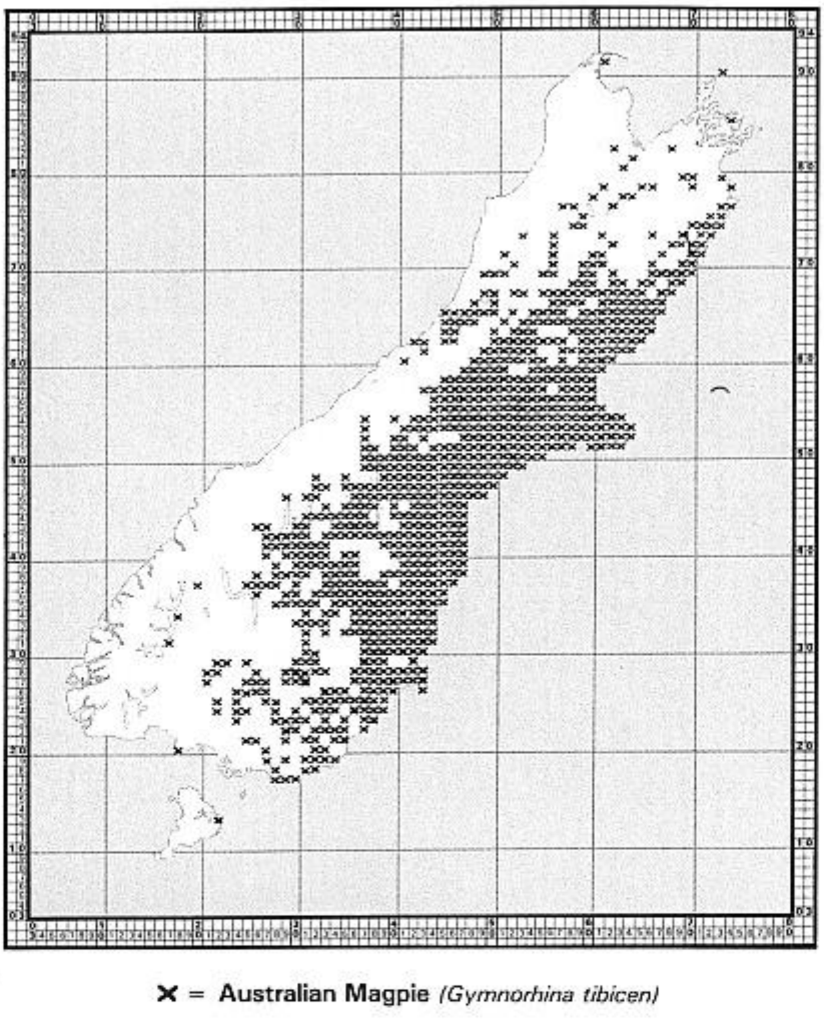


Figure 1. Australian magpie distribution in the South Island, New Zealand (Bull, 1985).

4. STUDY AREAS AND METHODS

4.1 *Study areas*

Twelve clusters of sheep and beef farms were selected from along the east coast of the South Island (Figure 2). Each cluster consisted of three farms within 25km of one another to approximately match them for altitude, rainfall and soil type. Each cluster had a 'Conventional' farm (no accreditation scheme) a certified Organic farm, and an 'Integrated Management' farm. The one exception was the Waimate cluster, which had a fourth farm which was in the process of converting to organic production. Habitat composition varied widely across all 37 farms, ranging from largely open farms with little woody vegetation (Waimate and Gore), to farms with large extents of exotic vegetation in shelterbelts (Canterbury), and farms with large tracts of native vegetation and high habitat complexity (Banks Peninsula and the Catlins).

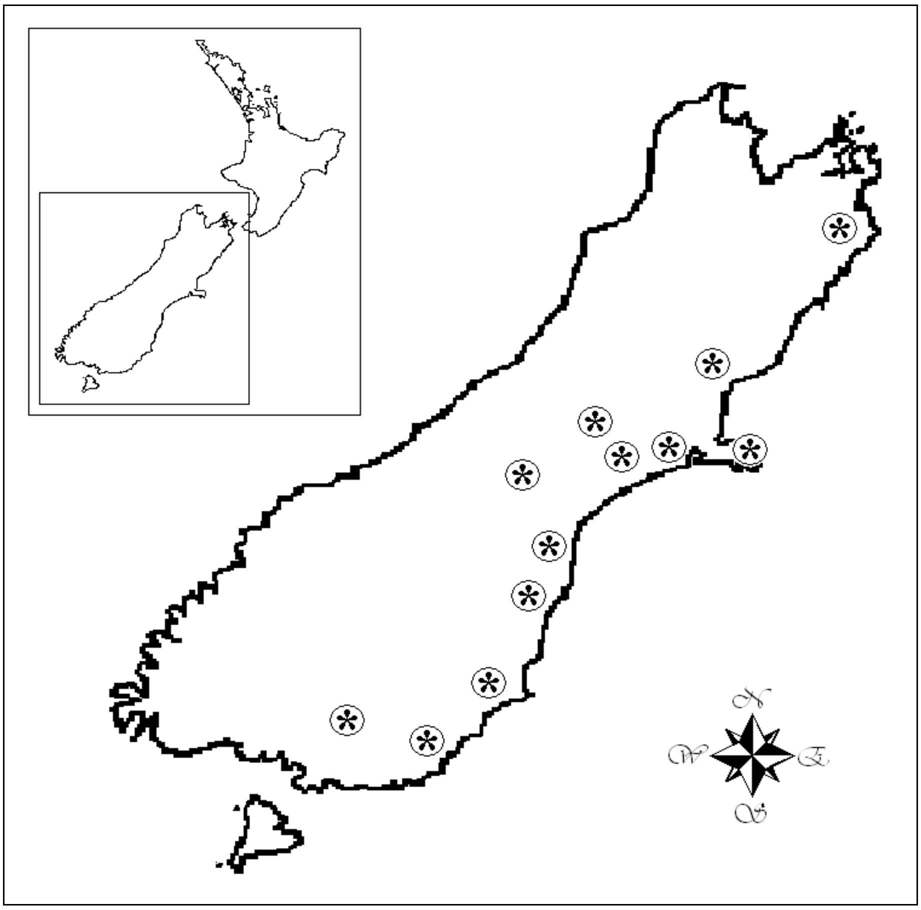


Figure 2. Approximate locations of study sites, South Island, New Zealand.

4.2 *Sampling methods*

Five observers undertook training prior to the beginning of the surveys. The training consisted of listening to bird call CDs, and practicing identification of birds amongst urban parks and gardens. One morning was spent on a farm becoming familiarized with the equipment (range finder, binoculars, compass and GPS).

Starting points of line transects were placed randomly on farm maps, with a minimum of five transects per farm (range 5-11). The starting points were located by observers using a handheld Garmin eTrex Global Positioning System (GPS; Garmin International Inc). Transects ran due south for 500m. Transects were stopped short of the farm boundaries by 100m to avoid edge effects, and the shortened distance was recorded using GPS. Altogether there were 333 transects, 67 (20.1%) of which were less than 500m long. The average length (± standard deviation) of the transects <500m long was 362.7 ± 88.6m. Observers moved slowly along the transect, noting down every bird seen or heard. Also noted was distance to individual bird or centre of flock, the incident angle from the transect line to the bird, along with the habitat the bird was observed in and its behaviour, sex (if possible) and group size. As accuracy in distance measurement is the foundation of line transect sampling and the key factor in producing reliable density estimates, all distances were measured using range finders (Scott *et al.*, 1981; Bibby *et al.*, 2000). Surveying began on November 17th 2004 and was completed on January 31st 2005, which is the summer season in New Zealand. The total length of transect sampled was 157.4km.

4.3 *Exclusion of weather effects*

As rain is likely to have a greater effect on bird counts than any other weather condition (Robbins, 1981), no counts were conducted during rain. The accepted upper limit of wind speed for satisfactory bird count results is 20kph, so no counts were conducted if wind reached this limit (Robbins, 1981). Counts were undertaken between the hours of 8.00am and 2.00pm to avoid rapid changes in conspicuousness and detectability that can occur around dawn and dusk (Dawson and Bull, 1975). Temperature and humidity was recorded on each farm on the day of sampling.

4.4 *Data Entry and Analysis*

Observers entered their own data into excel spreadsheets, which were then checked for accuracy and combined into one spreadsheet. Observations lacking species, distance or angle information were discarded. Species with less than 20 observations for all farms combined were also discarded, as smaller samples become more vulnerable to stochastic factors (Barraclough, 2000; Buckland *et al.*, 2001). For each species, perpendicular distances and flock size for each farm were imported into the analysis software *Distance* (Distance, 2005). The three critical assumptions of the distance sampling design were that (1) all birds on the line are detected; (2) birds are detected prior to evasive movement triggered by the observer; and (3) distances are measured accurately (Rosenstock *et al.*, 2002). Density estimates were calculated by pooling all records for each species to generate a global detection function (which assumes habitat preferences within a species are fairly conservative across farms) (Seddon, *et al.*, 2003). Detection functions were estimated using the uniform, half normal, hazard rate and negative exponential key functions with cosine and simple polynomial adjustment factors. The half normal key function with simple polynomial adjustment factor was recommended by Rosenstock *et al.* (2002) as a good starting model for landbirds, but this study found that other combinations generally resulted in a better fit. Exploratory truncation (to remove outliers) and grouping was carried out on the data in an attempt to improve fit. This worked well for most species but was abandoned for five of the species (duck (assorted spp), harrier hawk, mallard duck, paradise shelduck, and southern black backed gull) as the fit of the model worsened. The optimum model was selected by comparing the Akaike Information Criteria (AIC) values and Chi-squared statistics. The global detection function from the most parsimonious model was then applied to the individual farm counts to calculate density estimates for each farm (Appendix 2). Farm area was not included in the *Distance* analysis, so the density estimates are expressed as individuals per hectare.

Pearsons correlations were performed using Minitab version 14.1 (Minitab Inc, 2003) to determine if magpie abundance was related to the abundance of other bird species. Dunn-Sidak corrected significance levels were used in all tests to control for family-wise Type 1 errors (Quinn & Keough, 2002).

A nested analysis of variance was performed using Genstat (VSN International Ltd) to investigate any differences in magpie abundance between clusters and management type. Management type was selected as the fixed main factor, with the organic, integrated management and conventional farm management systems as the three factor levels, and cluster was entered as a random factor, nested within management type (Quinn & Keough, 2002).

4.5 *Habitat use and interactions*

The inclusion of habitat information is recommended when censusing biological populations, to gain a deeper understanding of the adaptations and behaviour of a species (Rotenberry, 1981; Wiens & Rotenberry, 1981).

The habitat that each individual bird was observed in was recorded and was coded into one of twelve categories (Table 1).

Table 1. Habitat categories.

Code	Habitat type
C	Crop
CF	Cliff
DG	Dense grass
EV	Exotic vegetation (forest block, scrub, orchard)
IT	Individual tree
MS	Man-made structure (house, farm building, yards, irrigator, powerline)
NV	Native vegetation (bush gully, forest, scrub, tussock)
OP	Open paddock
PP	Ploughed paddock
R	Road (includes farm tracks)
SB	Shelterbelt
WF	Water feature (pond, wetland, stream, riparian vegetation)

The average habitat use in the twelve categories across all farms was calculated for each species for which we had abundance estimates. Chi-squared contingency table analysis was then used to compare habitat use between magpies and species they are known or suspected to interact with (song thrush, starling, blackbird, skylark, tui and kereru) (Innes *et al.,* 2004).

5. RESULTS

Objective 1. Is magpie abundance correlated to the abundance of other bird species?

Forty-nine bird species were recorded by observers over all 37 farms (Appendix 1). Of these, 22 species were unsuitable for analysis due to low numbers (<20 observations). These species were as follows: little owl, morepork, pheasant, pipit, shining cuckoo, banded dotterel, black shag, falcon, robin, red billed gull, turkey, cirl bunting, grey duck, kingfisher, pukeko, black billed gull, rifleman, kereru, california quail, tui, poultry and tomtit. Densities per farm were estimated for the remaining 27 species (Appendix 2), using the optimum model for each species (Table 2).

Table 2. Optimal model parameters and chi-p values for species density estimates.

Species	Key function	Adjustment factor	Truncation	Interval Number	Chi-p
bellbird	negative exponential	simple polynomial	141	7	0.67172
blackbird	negative exponential	simple polynomial	125	6	0.50074
chaffinch	hazard rate	simple polynomial	150	14	0.77028
duck (assorted spp)	negative exponential	simple polynomial	none	none	0.78593
dunnock	negative exponential	simple polynomial	68	7	0.96133
fantail	hazard rate	cosine	none	10	0.88063
feral pigeon	negative exponential	simple polynomial	190	none	0.0869
goldfinch	half normal	cosine	190	11	0.39847
greenfinch	negative exponential	simple polynomial	200	none	0.35689
grey warbler	hazard rate	cosine	250	10	0.85925
harrier hawk	hazard rate	simple polynomial	none	none	0.47684
house sparrow	negative exponential	simple polynomial	175	8	0.31574
magpie	half normal	cosine	none	17	0.84057
mallard duck	negative exponential	simple polynomial	none	none	0.20609
paradise shelduck	negative exponential	simple polynomial	none	none	0.95968
pied oystercatcher	negative exponential	simple polynomial	200	10	0.97104
pied stilt	half normal	cosine	180	19	0.77858
redpoll	hazard rate	simple polynomial	100	10	0.94019
silvereye	hazard rate	cosine	80	8	0.70489
skylark	half normal	cosine	270	11	0.53474
song thrush	hazard rate	cosine	200	8	0.75492
southern black backed gull	negative exponential	simple polynomial	none	none	0.84564
spur winged plover	half normal	cosine	none	22	0.93915
starling	uniform	cosine	160	8	0.88391
welcome swallow	half normal	cosine	none	7	0.96076

white faced heron	hazard rate	cosine	101	10	0.65902
yellowhammer	hazard rate	simple polynomial	160	none	0.47661

Precision of the abundance estimates, as measured by the coefficient of variation (CV), varied between 4% and 228%. Precision was highest for species such as skylark, which occurred in relatively high numbers and for the most part as single individuals (CV of farm-by-farm estimates = 4.1% to 33.01%). Precision was lower for species with fewer observations, such as white faced heron (CV = 159.95% to 185.7%) and species which occurred in large flocks, such as starling (CV = 10.6% to 200.6%).

The overall average abundance (± standard deviation) of magpies across all farms was 0.19 ± 0.07 birds/ha (CV 38.41%) and the median was 0.17 birds/ha. The average abundance (± standard error) of magpies on Conventional, Organic and Integrated Management farms was 0.19 ± 0.02 birds/ha, 0.17 ± 0.02 birds/ha, and 0.19 ± 0.02 birds/ha respectively. These differences are not statistically significant (F2,23 = 0.28, P > 0. 5 for farming systems; F11,23 = 0.89, P > 0. 5 between clusters). However, it should be noted that the precision of the estimates was low (as indicated by the large 95% confidence limits) and thus the analysis had low power to detect any significant differences. There was no evidence of an effect of magpie abundance on other species abundance (P > 0.05).

Objective 2. Is magpie abundance correlated to farm management type?

There was no evidence of an effect of management type on magpie abundance ($F_{2,22}$ = 0.773, P > 0.05), nor was there any effect of cluster on magpie abundance, once management type was controlled for ($F_{11,22}$ = 0.93, P > 0.05).

Objective 3. Does the habitat use of magpies differ from the habitat use of other bird species?

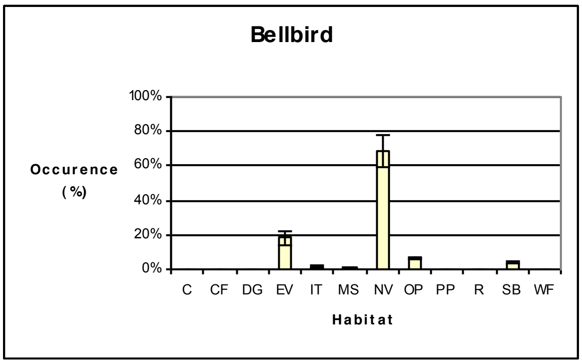
The average habitat use across the 12 habitat categories for each species are shown in Figure 3. There were significant differences in the observed habitat use for magpies, blackbirds, starlings, song thrushes, and skylarks (χ^2 = 2427.40, d.f. = 36, P < 0.001).

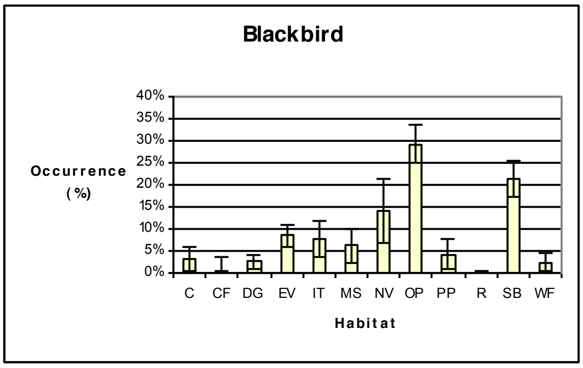
Magpies were found predominantly in open paddock habitat, followed by shelterbelts (Table 3). Blackbirds also followed this pattern of primary habitat use, but differed from magpies in the use of other habitats. Starlings and skylarks occurred most often in open paddocks, while song thrushes were most often found in shelterbelts (Table 3). Generally, observations of native birds on the farms were too rare to allow a comparison of habitat use with magpies. For tui and kereru, native vegetation was the only category with sufficient sightings for analysis, and the proportional use of this habitat type was significantly different from that of magpies ($\chi^2 = 243.49$, d.f. = 2, $P < 0.001$).

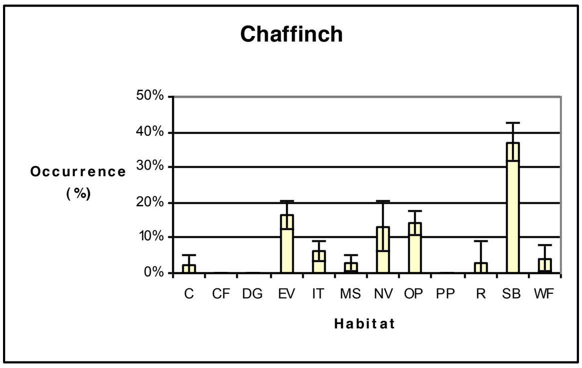
Table 3. (C = crop, CF = cliff, DG = dense grass, EV = exotic vegetation, IT = individual tree, MS = man-made structure, NV = native vegetation, OP = open paddock, PP = ploughed paddock, R = road, SB = shelterbelt, WF = water feature)

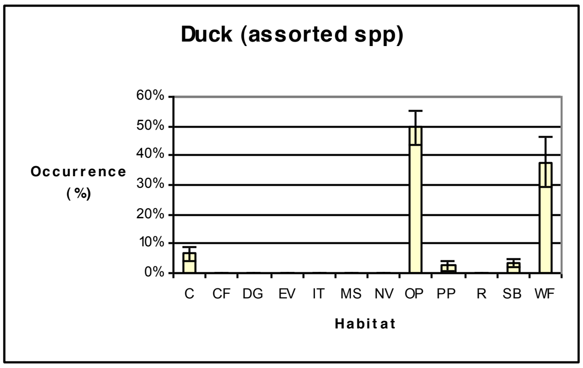
Species	Habitat											
	C	CF	DG	EV	IT	MS	NV	OP	PP	R	SB	WF
Magpie	5%	0%	4%	7%	4%	2%	5%	46%	2%	0%	23%	1%
Blackbird	3%	0%	3%	8%	8%	6%	14%	29%	4%	0%	21%	2%
Starling	6%	1%	3%	1%	1%	3%	9%	67%	5%	0%	6%	0%
Song thrush	2%	0%	1%	11%	6%	2%	11%	20%	6%	3%	34%	5%
Skylark	13%	0%	8%	1%	0%	0%	3%	71%	2%	0%	1%	0%

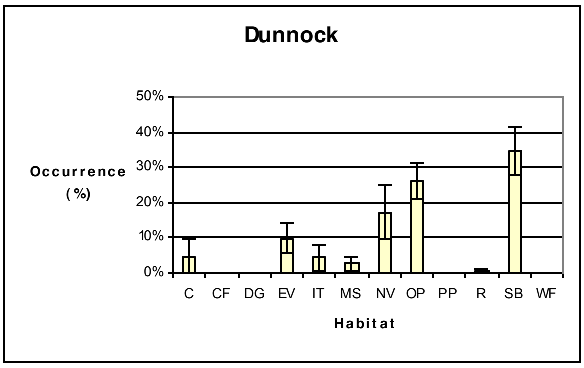
Figure 3. Percent use of different habitats for the twelve habitat categories for all species with Distance abundance estimates. Bars are the average proportional use for each category from all farms where each species was found. Habitat codes are as follows: C = Crop, CF = Cliff, DG = Dense grass, EV = Exotic vegetation, IT = individual tree, MS = Man-made structure, NV = Native vegetation, OP = Open paddock, PP = Ploughed paddock, R = Road, SB = Shelterbelt and WF = Water feature.

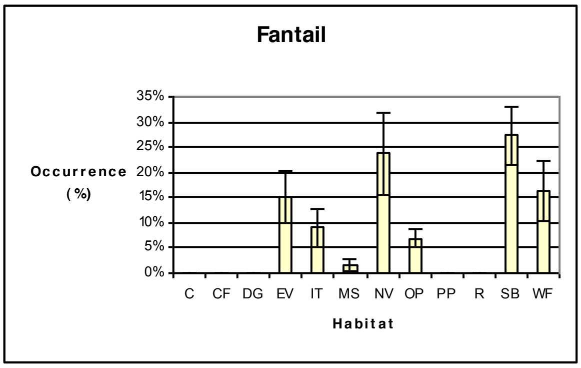


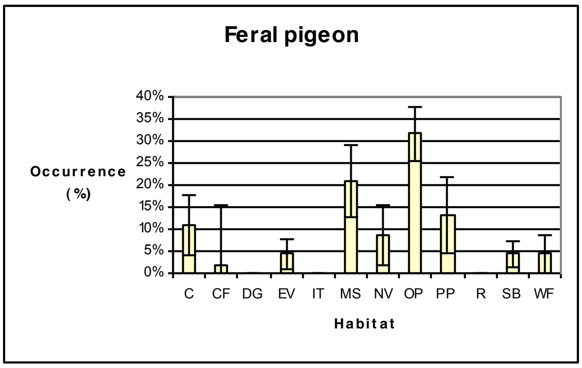


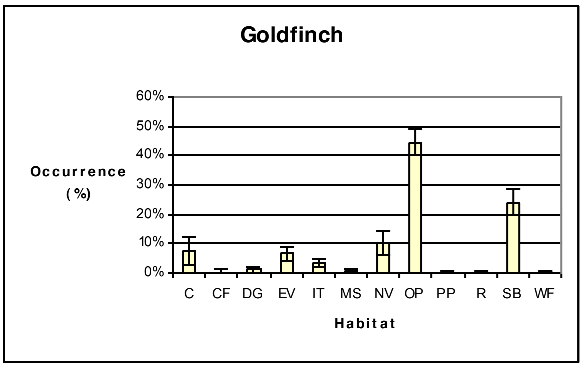

Chaffinch
Occurrence (%)
50%
40%
30%
20%
10%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

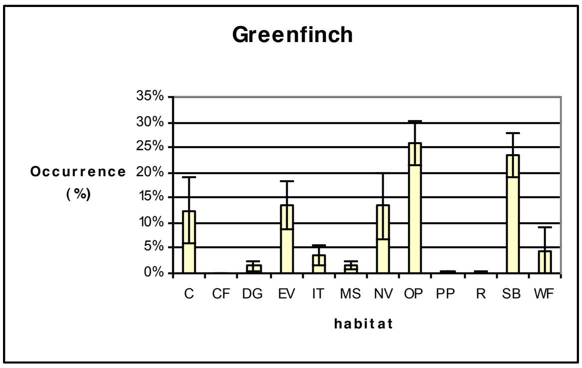

Duck (assorted spp)
Occurrence (%)
60%
50%
40%
30%
20%
10%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

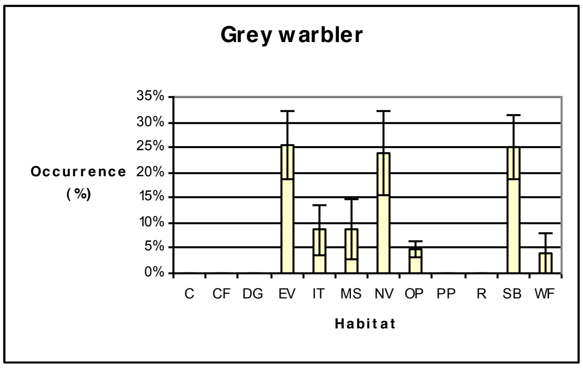

Dunnock
Occurrence (%)
50%
40%
30%
20%
10%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

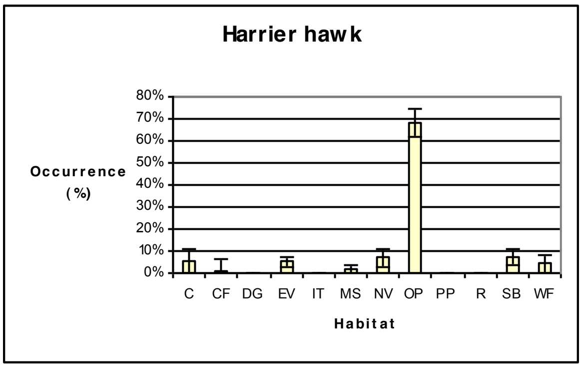

Fantail
Occurrence (%)
35%
30%
25%
20%
15%
10%
5%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

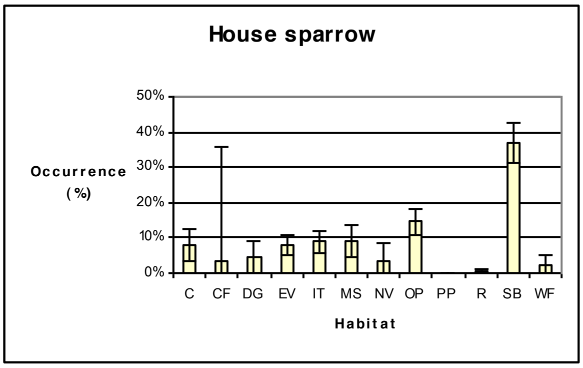

Feral pigeon
Occurrence (%)
40%
35%
30%
25%
20%
15%
10%
5%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

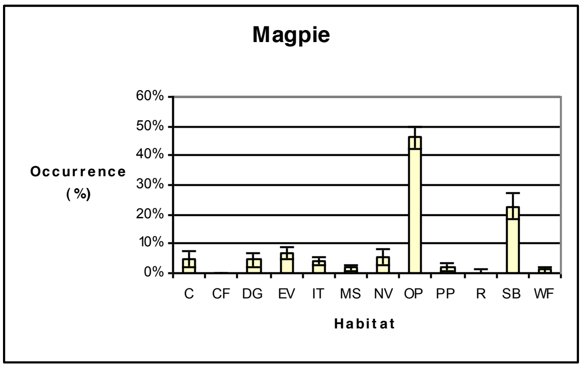

Goldfinch
Occurrence (%)
60%
50%
40%
30%
20%
10%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

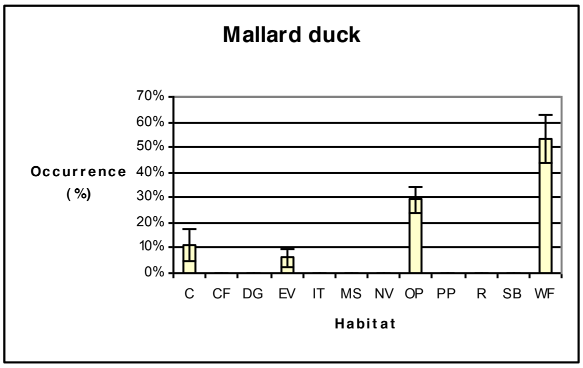

Greenfinch
Occurrence (%)
35%
30%
25%
20%
15%
10%
5%
0%
C CF DG EV IT MS NV OP PP R SB WF
habitat

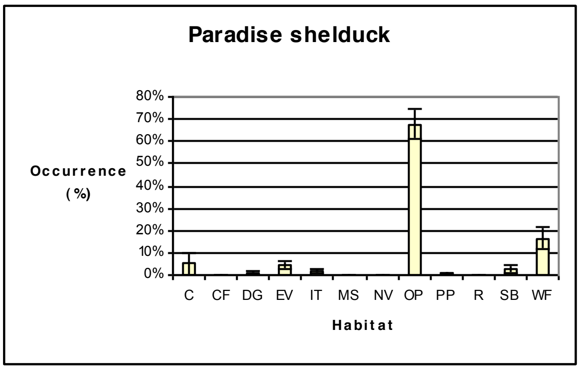

Grey warbler
Occurrence (%)
35%
30%
25%
20%
15%
10%
5%
0%
C CF DG EV IT MS NV OP PP R SB WF
Habitat

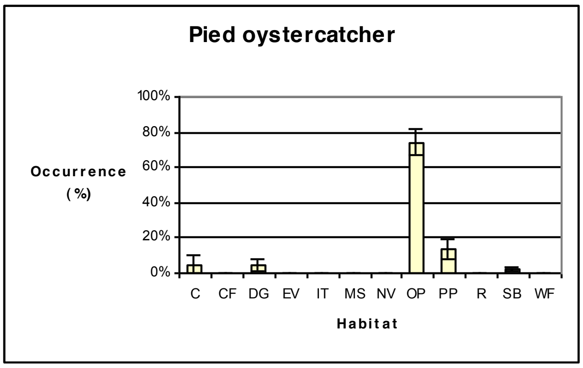

Harrier hawk

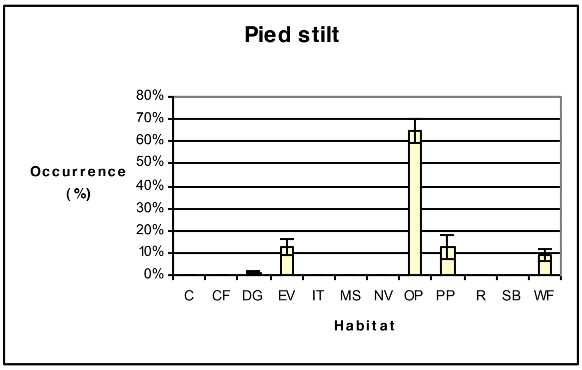

House sparrow

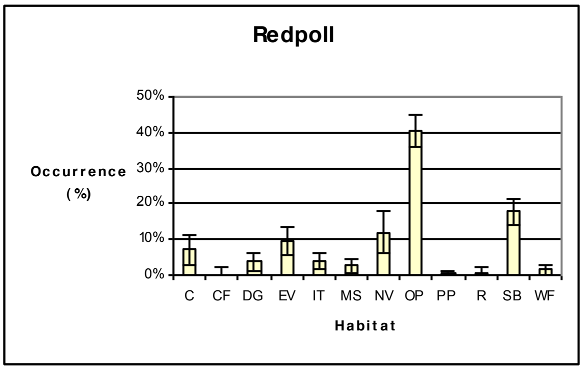

Magpie

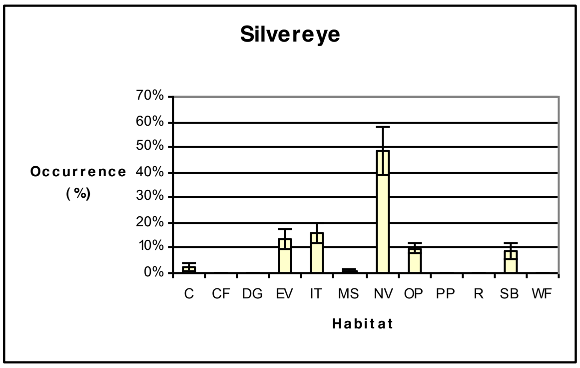

Mallard duck

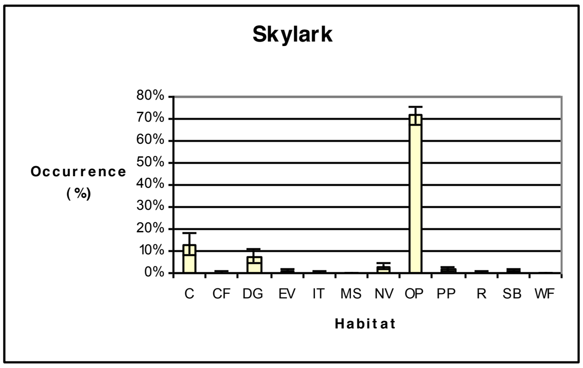

Paradise shelduck

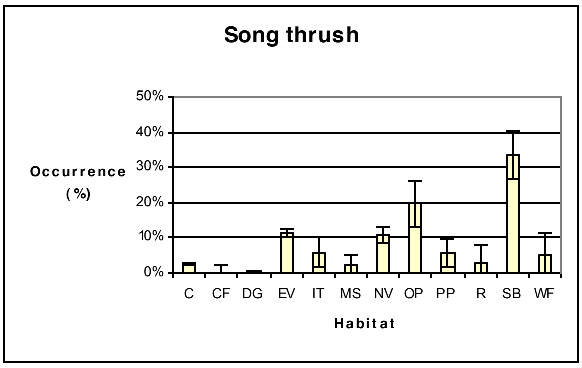

Pied oystercatcher

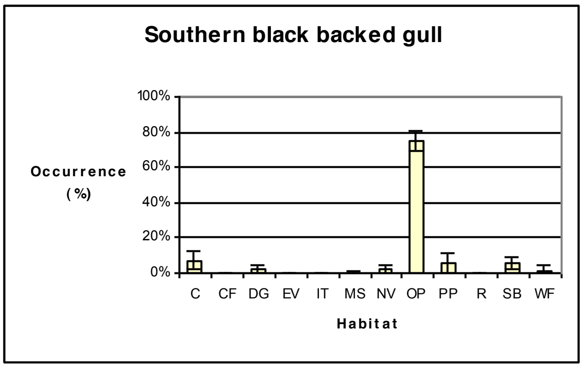

Pied stilt

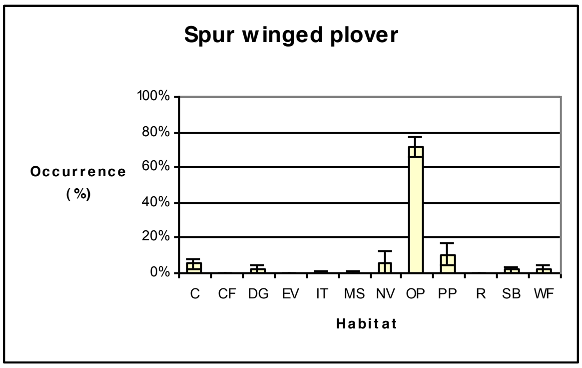

Redpoll

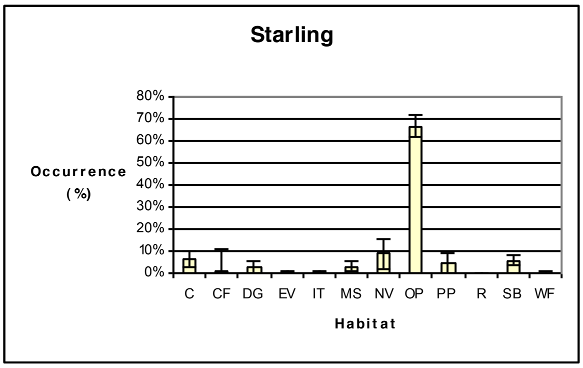

Silvereye

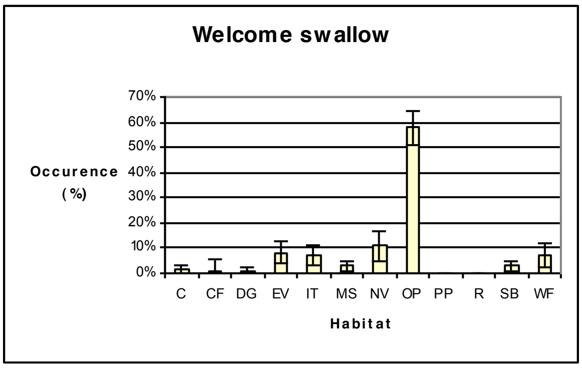

Skylark

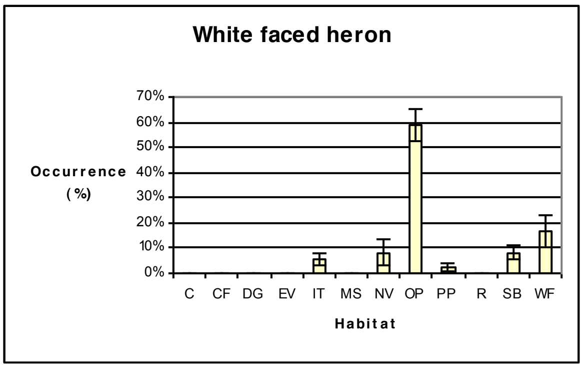

Song thrush

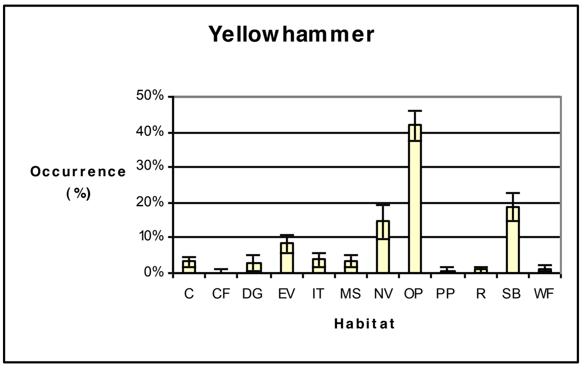

Southern black backed gull


Spur winged plover


Starling


Welcome swallow


White faced heron



DISCUSSION

6.1 *Precision and accuracy of density estimates*

The estimates of density calculated by *Distance* for each species were of varying precision. Precision, as measured by the coefficient of variation *(CV),* was between 4% and 228% for distance sampling estimates. Only 24% of density estimates were below the *CV* <20% recommended for estimates of density (White *et al.*, 1982 *in* Corn & Conroy, 1998). Of the 706 density estimates, half had a precision above 37%. Precision was most accurate for species such as skylarks, which occurred in relatively high numbers and for the most part as single individuals (*CV* = 4.1% to 33.01%). Precision was less accurate for species with fewer observations, such as white faced heron (*CV* = 159.95% to 185.7%) and species which occurred in large flocks, such as starlings (*CV* = 10.6% to 200.6%).

These measures of precision could be improved by taking repeated surveys of the sampling sites to build up sample sizes to >60 observations, as recommended by Buckland *et al.* (2001). Increasing the numbers of observations would also diminish other problems, such as data loss resulting from truncation. For example, the optimal model for white faced heron involved truncation at 101m. As a result of this, the density of farm 7A became 0, as the only white faced heron recorded on that farm had a perpendicular distance of 196m. However, the species of primary interest in this study (Blackbirds, skylarks, song thrushes and starlings) generally had CVs below the recommended level of 20%.

6.2 *Is magpie abundance correlated to the abundance of other bird species?*

Results from this study showed that magpie density did not correlate with the density of other bird species. This means that there is no evidence from this study that magpies are affecting the overall abundance of other bird species. However, it is possible that magpies may be having an effect on the distribution of other birds, as outlined in a study by Morgan *et al.* (*in review*), which showed that birds are wary of magpies and will actively avoid them. These effects occur on a small scale and could not be detected by the current study, which investigated effects on a whole-farm scale. The findings of these two studies suggest that magpies may displace other birds locally, but do not affect the abundance of birds found at the whole-farm scale.

6.3 *Is magpie abundance correlated to farm management type?*

This study found no evidence that farm management type affected magpie abundance. This may be attributed to the scale and heterogeneity of the agricultural landscape in which they are found. Magpies occupy a spatially complex and dynamic ecosystem, in which farm boundaries are not ecological boundaries. The effects of farm management may not be contained within the boundary of that farm if birds are affected by management practices but range across the wider landscape. Conversely, while breeding groups of magpies are strongly territorial, non breeding groups are known to be semi-nomadic (Carrick, 1972 *in* Morgan *et al.*, *in review*), thus their range could encompass a number of management regimes, with only a small proportion of time spent on any one farm, thus minimizing the impact of specific management actions.

6.4 *Does the habitat use of magpies differ from the habitat use of other bird species?*

The significant differences noted in the observed habitat use for magpies compared with blackbirds, starlings, song thrushes, and skylarks could simply mean that different species prefer different habitats. These differences could be the result of current magpie avoidance, or could indicate niche separation resulting from past competition. Evidence for the former is provided by Innes *et al.* (2004), who found significant increases in counts of these four species in areas where magpies were controlled. It is possible that magpies are displacing other birds from their preferred habitat, but experimental manipulation of magpie numbers is needed to establish the underlying mechanisms.

For tui and kereru, the only category with sufficient sightings for analysis was native vegetation, and the proportional use of this habitat type was significantly different from that of magpies. This is to be expected, as magpies are known to seldom frequent native bush (Chambers, 1989), and tui and kereru are most often found in this habitat type (Heather and Robertson, 2000). Nevertheless, potential negative impacts on tui and kereru could occur if they were displaced by magpies as they crossed open paddocks to reach different bush fragments (Innes *et al.*, 2004).

7. CONCLUSIONS AND RECOMMENDATIONS

It is likely that magpies do not have an affect on the abundance of other birds, although displacement of other birds by magpies at a local scale may occur.

Farm management type appears to have no bearing on the abundance of magpies, due to the integrated nature of the agricultural landscape and the spatial range of magpie non-breeding groups.

It is possible that magpies may be displacing blackbirds, starlings, song thrushes, and skylarks from their preferred habitat, as a result of magpie avoidance, but further inquiry will need to be undertaken to establish this.

It is recommended that with the limited resources available for the protection of the natural environment in New Zealand, priority needs to be given to more serious predators such as rodents and mustelids, which have proven negative impacts on native birds.

8. ACKNOWLEDGEMENTS

I would firstly like to thank John Innes, Dai Morgan, Annelies Pekelharing, and Frances Schmechel for their generosity in sharing their knowledge and information on magpies. Thanks go to the all the people who spent their summer gathering data, Dean Clarke, Tracey Dearlove, Francesca Buzzi, Steve Rate, Grant Blackwell, and especially my fellow bat box believers Erin O'Neill and Joanna Wright. The Titi Team and CSAFE gave me the use of their computers during my lengthy data analysis and write up. Thank you to Sarah Spalding for organising my data to be sent to Roger Littlejohn, who performed the nested ANOVA on Genstat. Thank you to Phil Seddon, who taught me (once again) how to use DISTANCE. Thank you to Henrik Moller, who got me involved with ARGOS and made comments on the manuscript. Thanks also go to Margaret and Sam for opening up their home to me and not kicking me out when this report ran overtime.

But most of all I am eternally grateful to Grant Blackwell for his wonderful patience in explaining everything to me from nested ANOVAs to turbo engines in subarus. I also thank him for not breaking anything associated with my report.

This work was funded mainly by the Foundation for Research, Science and Technology (Contract Number AGRB0301) with additional assistance from a meat packing company, Merino New Zealand Inc. and Te Rūnanga O Ngāi Tahu.

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10. APPENDICES

10.1 Species List

Common name(s)	Scientific name	Number of observations
banded dotteral (tuturiwhatu)	*Charadrius binictus*	2
bellbird (korimako)	*Anthornis melanura*	106
black billed gull	*Larus bulleri*	7
black shag (kawau)	*Phalacrocorax carbo*	3
blackbird	*Turdus merula*	456
california quail	*Callipepla californica*	10
chaffinch	*Fringilla coelebs*	364
cirl bunting	*Emberiza cirlus*	5
duck (assorted spp)		32
dunnock	*Prunella modularis*	86
falcon (karearea)	*Falco novaeseelandiae*	3
fantail (piwakawaka)	*Rhipidura fuliginosa*	49
feral pigeon	*Columba livia*	79
goldfinch	*Carduelis carduelis*	598
greenfinch	*Carduelis chloris*	544
grey duck (parera)	*Anas superciliosa*	6
grey warbler (riroriro)	*Greygone igata*	98
harrier hawk (kahu)	*Circus approximans*	84
house sparrow	*Passer domesticus*	448
kereru	*Hemiphaga novaeseelandiae*	8
kingfisher (kotare)	*Halcyon sancta*	6
little owl	*Athene noctua*	1
magpie	*Gymnorhina tibicen*	580
mallard duck	*Anas platyrhynchos*	38
morepork (ruru)	*Ninox novaeseelandiae*	1
paradise shelduck (putangitangi)	*Tadorna variegata*	71
pheasant	*Phasianus colchicus*	1
pied oystercatcher (torea)	*Haematopus ostralegus*	108
pied stilt (poaka)	*Himantopus himantopus*	20
pipit (pihoihoi)	*Anthus novaeseelandiae*	1
poultry	*Gallus gallus domesticus*	15
pukeko	*Porphyrio porphyrio*	6
red billed gull (tarapunga)	*Larus novaeseelandiae*	4
redpoll	*Carduelis flammea*	773
rifleman (titipounamu)	*Acanthisitta chloris*	7
robin (toutouwai)	*Petroica australis*	3
shining cuckoo (pipiwharauroa)	*Chrysococcyx lucidus*	1
silvereye (tauhou)	*Zosteropus lateralis*	81
skylark	*Alanda arvensis*	1640
song thrush	*Turdus philomelos*	395
southern black backed gull (karoro)	*Larus dominicanus*	173
spur winged plover	*Vanellus miles*	249
starling	*Sturnus vulgaris*	504
tomtit (ngiru-ngiru)	*Petroica macrocephala*	15

tui	*Prosthemadera novaseelandiae*	11
turkey	*Meleagris gallopavo*	4
welcome swallow	*Hirundo tahitica*	132
white faced heron (matuka-moana)	*Ardea novaehollandiae*	20
yellowhammer	*Emberiza citrinella*	728

10.2 Avian density estimates for each farm

BELLBIRD

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 3A	1.0036	26.44	11.47	0.56795	1.7735
Farm 3B	0.86173	39.87	8.57	0.35902	2.0683
Farm 3C	0.79663	27.83	12.51	0.44052	1.4406
Farm 8C	0.31442	11.29	96.00	0.25147	0.39313
Farm 9A	1.0061	31.36	8.35	0.49905	2.0284
Farm 9B	1.9250	21.85	1.86	0.70768	5.2364
Farm 9C	0.73064	30.98	8.77	0.36739	1.4530
Farm 11A	3.2818	109.91	2.27	0.10657	101.06
Farm 11B	0.35811	100.64	96.00	0.068079	1.8837

BLACKBIRD

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.94395	78.37	1.06	0.00040242	2214.2
Farm 1B	0.41953	50.31	2.05	0.056914	3.0925
Farm 1C	0.20977	50.31	2.05	0.028457	1.5463
Farm 2A	0.48707	13.66	1.43	0.20357	1.1654
Farm 2B	0.57920	38.33	4.10	0.20921	1.6035
Farm 2C	0.44004	18.99	25.75	0.29882	0.64799
Farm 3A	0.31465	5.55	427.00	0.28216	0.35088
Farm 3B	0.47774	14.04	35.29	0.35976	0.63440
Farm 3C	0.33121	8.01	14.69	0.27922	0.39287
Farm 4A	0.37030	15.14	6.67	0.25849	0.53048
Farm 4B	0.43604	19.37	3.56	0.24913	0.76318
Farm 4C	0.60517	39.93	8.55	0.25176	1.4547
Farm 5A	0.42917	26.46	10.00	0.24038	0.76622
Farm 5B	0.36136	13.05	34.52	0.27753	0.47052
Farm 5C	0.14010	28.98	3.32	0.059519	0.32977
Farm 6A	0.31465	5.55	427.00	0.28216	0.35088
Farm 6B	0.67276	22.62	22.46	0.42354	1.0686
Farm 6C	1.0634	38.49	6.69	0.43783	2.5828
Farm 7A	0.15732	100.15	1.01	0.0000046086	5370.6
Farm 7B	0.40707	27.00	4.36	0.19954	0.83046
Farm 7C	0.66570	20.65	47.03	0.44131	1.0042
Farm 8A	0.42437	14.33	32.88	0.31753	0.56717
Farm 8B	0.31465	5.55	427.00	0.28216	0.35088
Farm 8C	0.49214	13.69	30.00	0.37259	0.65004
Farm 9A	0.59692	22.69	18.24	0.37300	0.95526
Farm 9B	0.44773	26.91	26.87	0.26022	0.77034
Farm 9C	0.41953	18.53	9.65	0.27804	0.63302
Farm 10A	0.65751	16.27	53.37	0.47544	0.90931
Farm 10B	0.31465	55.05	4.08	0.076267	1.2981
Farm 10C	0.46575	12.70	78.33	0.36209	0.59908
Farm 11A	0.54645	25.56	23.03	0.32474	0.91954
Farm 11B	0.63031	20.67	12.02	0.40366	0.98421
Farm 11C	1.1002	19.47	29.59	0.74172	1.6318
Farm 12A	1.0369	30.17	6.26	0.50724	2.1196
Farm 12B	1.0937	20.39	14.23	0.70984	1.6852
Farm 12C	0.35314	15.54	3.94	0.22940	0.54364
Farm 12D	0.58091	42.22	6.18	0.21713	1.5542

CHAFFINCH

MODEL = Hazard Rate / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	1.3303	53.43	345.00	0.49645	3.5649
Farm 1B	0.49888	38.29	1.74	0.079111	3.1460
Farm 1C	0.33259	101.76	345.00	0.063353	1.7460
Farm 2A	0.94314	41.72	13.85	0.39907	2.2290
Farm 2B	0.40658	23.38	38.78	0.25494	0.64844
Farm 2C	0.29318	28.35	15.91	0.16256	0.52875
Farm 3A	0.87544	31.51	20.23	0.46103	1.6624
Farm 3B	0.39974	21.45	121.23	0.26266	0.60838
Farm 3C	0.42011	24.58	23.02	0.25457	0.69329
Farm 4A	0.63797	46.38	2.72	0.14354	2.8354
Farm 4B	0.62050	30.98	7.54	0.30643	1.2564
Farm 4C	0.90711	29.53	73.17	0.50979	1.6141
Farm 5A	0.63289	30.81	16.40	0.33467	1.1969
Farm 5B	0.95540	41.52	9.44	0.39005	2.3402
Farm 5C	0.34430	29.93	10.93	0.18061	0.65635
Farm 6A	1.2563	52.29	5.91	0.37559	4.2024
Farm 6B	0.34519	48.87	4.14	0.097120	1.2269
Farm 6C	0.30013	24.86	80.68	0.18437	0.48857
Farm 7A	0.42738	22.11	283.40	0.27801	0.65702
Farm 7B	0.33259	101.76	1.07	0.000035412	3123.6
Farm 7C	0.46575	20.59	409.23	0.31199	0.69526
Farm 8A	0.47357	23.41	92.72	0.29935	0.74917
Farm 8B	0.22172	53.43	2.61	0.038942	1.2624
Farm 8C	0.69738	29.49	40.80	0.38918	1.2497
Farm 9A	1.0862	47.11	13.49	0.41440	2.8469
Farm 9B	0.38802	23.65	35.97	0.24176	0.62276
Farm 9C	0.35306	19.18	322.74	0.24292	0.51315
Farm 10A	0.38270	21.69	257.42	0.25090	0.58371
Farm 10B	0.66517	53.43	2.61	0.11683	3.7873
Farm 10C	0.79514	27.00	97.70	0.46968	1.3461
Farm 11A	0.41573	27.48	10.62	0.22897	0.75484
Farm 11B	0.48062	27.79	6.83	0.25134	0.91904
Farm 11C	0.60483	28.53	34.22	0.34263	1.0677
Farm 12A	1.5985	52.36	10.21	0.53541	4.7725
Farm 12B	0.51455	23.31	177.92	0.32683	0.81008
Farm 12C	1.0410	47.10	5.90	0.34663	3.1262
Farm 12D	2.3281	42.23	345.00	1.0494	5.1650

DUCK (ASSORTED SPP)

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 2A	2.9323	102.69	24.00	0.50888	16.896
Farm 2C	0.55663	62.83	2.67	0.077521	3.9967
Farm 3A	0.75295	50.45	24.00	0.28180	2.0118
Farm 4A	0.40128	42.23	2.07	0.074064	2.1742
Farm 4C	0.58128	102.69	24.00	0.10088	3.3494
Farm 6C	36.988	170.12	1.25	0.0031448	435040
Farm 7B	2.7126	102.69	24.00	0.47076	15.631
Farm 9B	52.694	208.94	4.15	1.5190	1827.9
Farm 9C	0.11626	102.69	24.00	0.020175	0.66989
Farm 10A	0.23251	102.69	24.00	0.040351	1.3398
Farm 12B	0.23251	102.69	24.00	0.040351	1.3398

DUNNOCK

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	4.7852	68.26	3.38	0.75370	30.381
Farm 3A	0.58811	100.77	82.00	0.11122	3.1098
Farm 3B	0.81681	26.03	3.35	0.37877	1.7615
Farm 4B	0.44404	19.97	9.59	0.28508	0.69162
Farm 4C	0.88216	35.58	1.30	0.065653	11.853
Farm 5A	0.78414	71.80	2.83	0.093972	6.5432
Farm 5B	0.96565	64.31	3.85	0.18370	5.0760
Farm 5C	1.4426	32.92	2.72	0.48839	4.2612
Farm 6A	23.836	43.75	8.28	9.1315	62.218
Farm 6B	1.1762	71.80	82.00	0.32617	4.2416
Farm 6C	7.2050	68.56	3.30	1.1024	47.089
Farm 7A	0.58811	100.77	82.00	0.11122	3.1098
Farm 7B	0.88216	35.58	1.30	0.065653	11.853
Farm 7C	2.5256	73.89	1.14	0.0047890	1332.0
Farm 8A	5.9494	41.76	4.80	2.0958	16.889
Farm 8B	1.1762	100.77	82.00	0.22244	6.2195
Farm 8C	4.3704	70.42	2.75	0.52178	36.606
Farm 9A	0.63994	15.26	8.45	0.45244	0.90514
Farm 9B	3.6170	89.64	2.35	0.20482	63.874
Farm 10A	0.58811	12.44	82.00	0.45965	0.75247
Farm 10C	3.0845	83.06	2.52	0.23430	40.606
Farm 11B	0.58811	100.77	82.00	0.11122	3.1098
Farm 11C	13.188	72.18	2.50	1.3049	133.30
Farm 12B	0.95329	56.49	3.31	0.19465	4.6688
Farm 12C	0.60505	100.77	82.00	0.11442	3.1993
Farm 12D	0.58811	100.77	82.00	0.11122	3.1098

FANTAIL

MODEL = Hazard Rate / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	1.0457	122.82	47.00	0.15189	7.1994
Farm 1B	1.0457	122.82	47.00	0.15189	7.1994
Farm 1C	1.0457	122.82	47.00	0.15189	7.1994
Farm 2A	1.4404	122.82	47.00	0.20922	9.9165
Farm 2C	1.4404	74.79	49.17	0.37741	5.4973
Farm 3A	1.0457	122.82	47.00	0.15189	7.1994
Farm 3B	1.2857	73.09	50.36	0.34556	4.7837
Farm 3C	1.7477	74.38	54.21	0.46208	6.6104
Farm 4A	1.0457	122.82	47.00	0.15189	7.1994
Farm 7B	1.0457	122.82	47.00	0.15189	7.1994
Farm 8C	1.0457	122.82	47.00	0.15189	7.1994
Farm 9A	1.7526	82.65	29.80	0.40134	7.6535
Farm 9B	5.4465	84.18	47.00	1.2493	23.744
Farm 9C	5.0879	78.94	52.56	1.2594	20.556
Farm 11A	2.0914	122.82	47.00	0.30379	14.399
Farm 12B	1.0814	71.39	47.20	0.29738	3.9325

FERAL PIGEON

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 2A	21.041	130.58	1.03	0.00016601	2666800
Farm 2C	0.35329	101.11	56.00	0.065774	1.8977
Farm 3B	0.35329	101.11	56.00	0.065774	1.8977
Farm 3C	0.35329	101.11	56.00	0.065774	1.8977
Farm 4A	0.52994	101.11	56.00	0.098661	2.8465
Farm 4B	0.52994	101.11	56.00	0.098661	2.8465
Farm 4C	2.2964	101.11	56.00	0.42753	12.335
Farm 5A	0.41218	59.06	2.28	0.050676	3.3524
Farm 5C	0.35329	72.27	56.00	0.096422	1.2945
Farm 6A	0.23807	101.11	56.00	0.044322	1.2788
Farm 6B	1.5979	44.32	14.02	0.64438	3.9624
Farm 6C	8.5942	95.58	1.13	0.0031858	23184.
Farm 7A	0.35329	101.11	56.00	0.065774	1.8977
Farm 7B	0.35329	101.11	56.00	0.065774	1.8977
Farm 7C	329.57	99.12	1.09	0.059523	1824800
Farm 8B	0.52994	101.11	56.00	0.098661	2.8465
Farm 10A	0.35329	101.11	56.00	0.065774	1.8977
Farm 10B	0.52994	101.11	56.00	0.098661	2.8465
Farm 11A	0.97156	65.36	1.11	0.0024522	384.94
Farm 11B	1.4641	60.98	2.05	0.13781	15.555
Farm 11C	0.35329	101.11	56.00	0.065774	1.8977
Farm 12A	0.52994	101.11	56.00	0.098661	2.8465
Farm 12B	12.608	36.61	1.45	1.3552	117.29

GOLDFINCH

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.65381	17.21	34.89	0.46217	0.92491
Farm 1B	0.80970	25.57	18.98	0.47816	1.3711
Farm 1C	0.69575	17.03	69.37	0.49652	0.97493
Farm 2A	1.0759	17.95	47.84	0.75199	1.5392
Farm 2B	0.75139	15.06	84.53	0.55786	1.0121
Farm 2C	0.70921	12.24	106.03	0.55694	0.90312
Farm 3A	0.49638	22.55	22.64	0.31303	0.78713
Farm 3B	0.47442	12.12	90.88	0.37322	0.60307
Farm 3C	0.59341	20.45	25.54	0.39127	0.89999
Farm 4A	0.54054	18.14	23.64	0.37273	0.78392
Farm 4B	0.45284	41.95	1.90	0.072843	2.8151
Farm 4C	0.52565	22.84	16.78	0.32646	0.84637
Farm 5A	0.82257	42.35	8.63	0.32623	2.0740
Farm 5C	0.24272	4.10	570.00	0.22396	0.26305
Farm 6A	0.71619	21.02	16.55	0.46141	1.1117
Farm 6B	0.42137	19.19	3.29	0.23694	0.74938
Farm 6C	1.2110	70.57	1.83	0.060315	24.313
Farm 7A	0.50081	16.14	39.48	0.36216	0.69254
Farm 7B	0.36408	33.58	1.03	0.0075585	17.537
Farm 7C	0.41696	24.09	2.15	0.15993	1.0871
Farm 8A	0.94808	49.09	3.30	0.23261	3.8642
Farm 8B	1.9418	100.08	570.00	0.37808	9.9725
Farm 8C	0.88742	62.36	1.71	0.047903	16.440
Farm 9A	0.71222	31.39	14.08	0.36919	1.3740
Farm 9B	0.49173	17.19	19.87	0.34442	0.70206
Farm 9C	0.38898	16.21	7.08	0.26602	0.56878
Farm 10A	0.79278	41.26	3.06	0.22761	2.7613
Farm 10B	0.48544	100.08	570.00	0.094521	2.4931
Farm 10C	0.30776	25.04	4.22	0.15739	0.60180
Farm 11A	0.53501	15.18	33.11	0.39355	0.72730
Farm 11B	0.65645	13.71	83.55	0.50042	0.86114
Farm 11C	0.40169	14.00	33.10	0.30253	0.53336
Farm 12A	0.79946	40.83	3.39	0.24757	2.5816
Farm 12B	0.35991	13.49	13.35	0.26946	0.48073
Farm 12C	0.32725	25.53	6.49	0.17894	0.59847

GREENFINCH

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.31084	44.48	12.60	0.12377	0.78065
Farm 1B	0.59729	35.76	7.02	0.26315	1.3557
Farm 1C	2.0435	66.02	5.31	0.44734	9.3347
Farm 2A	10.782	74.73	16.47	2.6357	44.107
Farm 2B	0.39948	16.91	46.96	0.28497	0.56000
Farm 2C	0.34075	10.39	171.23	0.27772	0.41810
Farm 3A	0.54567	13.23	75.29	0.41975	0.70937
Farm 3B	0.44773	18.20	38.60	0.31071	0.64518
Farm 3C	0.39522	14.44	45.73	0.29599	0.52773
Farm 4A	2.9116	167.73	5.02	0.14926	56.795
Farm 4B	1.1139	51.54	26.48	0.41106	3.0183
Farm 4C	1.4143	36.55	29.01	0.68548	2.9179
Farm 5A	0.49770	14.86	77.19	0.37082	0.66799
Farm 5B	0.49915	14.14	90.37	0.37745	0.66009
Farm 5C	0.41930	11.61	111.97	0.33339	0.52736
Farm 6A	0.71972	23.71	20.85	0.44242	1.1708
Farm 6B	1.4058	32.95	25.62	0.72623	2.7212
Farm 6C	0.62410	12.89	99.54	0.48375	0.80517
Farm 7A	0.39799	55.23	2.92	0.075065	2.1101
Farm 7B	0.84100	100.25	531.00	0.16339	4.3288
Farm 7C	0.63865	36.16	8.32	0.28611	1.4256
Farm 8A	0.28033	100.25	531.00	0.054463	1.4429
Farm 8B	0.28033	7.09	531.00	0.24394	0.32216
Farm 9A	0.76314	33.16	6.08	0.34715	1.6776
Farm 9B	0.49374	21.72	27.35	0.31789	0.76685
Farm 9C	0.59652	27.13	14.85	0.33784	1.0533
Farm 10A	0.39247	29.44	4.51	0.18243	0.84432
Farm 10B	0.28033	100.25	531.00	0.054463	1.4429
Farm 10C	0.48977	21.51	20.93	0.31466	0.76232
Farm 11A	0.65789	18.43	28.69	0.45262	0.95625
Farm 11B	0.53948	21.71	23.03	0.34609	0.84092
Farm 11C	0.68986	48.50	10.79	0.25023	1.9018
Farm 12B	0.43544	31.83	6.64	0.20719	0.91517
Farm 12C	1.0915	55.92	1.52	0.050667	23.512
Farm 12D	0.56067	100.25	531.00	0.10893	2.8859

GREY WARBLER

MODEL = Hazard Rate / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 2A	0.20704	31.13	9.55	0.10467	0.40953
Farm 2B	0.20117	22.19	93.00	0.13016	0.31090
Farm 2C	1.5769	64.39	2.48	0.19028	13.067
Farm 3A	0.43667	30.61	61.59	0.24006	0.79431
Farm 3B	0.23807	25.18	67.51	0.14514	0.39049
Farm 3C	0.28399	29.55	47.07	0.15867	0.50826
Farm 4A	0.20117	102.43	93.00	0.037416	1.0816
Farm 4C	0.20117	102.43	93.00	0.037416	1.0816
Farm 7A	0.20117	102.43	93.00	0.037416	1.0816
Farm 7B	0.20117	102.43	93.00	0.037416	1.0816
Farm 7C	0.37024	52.81	1.47	0.017377	7.8886
Farm 8A	0.20117	22.19	93.00	0.13016	0.31090
Farm 8C	0.40233	54.70	1.43	0.014967	10.815
Farm 9A	0.78934	47.28	8.98	0.28565	2.1812
Farm 9B	0.23786	26.78	40.41	0.13975	0.40485
Farm 9C	0.29145	24.13	89.73	0.18168	0.46752
Farm 10A	0.20117	22.19	93.00	0.13016	0.31090
Farm 10C	0.38065	30.46	17.20	0.20315	0.71325
Farm 11A	0.60350	81.26	2.08	0.031381	11.606
Farm 11B	0.45824	102.43	93.00	0.085229	2.4637
Farm 12A	0.40233	74.11	93.00	0.10814	1.4969
Farm 12B	0.56095	26.19	22.61	0.32905	0.95626
Farm 12C	0.20117	102.43	93.00	0.037416	1.0816

HARRIER HAWK

MODEL = Hazard Rate / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.044961	100.37	78.00	0.0085326	0.23691
Farm 1B	0.089922	71.23	78.00	0.025118	0.32192
Farm 1C	0.070472	100.37	78.00	0.013374	0.37133
Farm 2A	0.064972	22.71	2.72	0.030497	0.13842
Farm 2B	0.067610	22.13	2.77	0.032605	0.14020
Farm 2C	0.077341	19.94	3.01	0.041320	0.14476
Farm 3A	0.048197	10.58	40.34	0.038945	0.059647
Farm 3B	0.046351	9.17	67.49	0.038612	0.055643
Farm 3C	0.089922	71.23	78.00	0.025118	0.32192
Farm 4A	0.044961	8.60	78.00	0.037899	0.053338
Farm 4B	0.12541	57.88	3.03	0.022847	0.68834
Farm 4C	0.086258	41.28	1.43	0.0066647	1.1164
Farm 7A	0.044961	8.60	78.00	0.037899	0.053338
Farm 7B	0.044961	8.60	78.00	0.037899	0.053338
Farm 7C	0.064230	100.37	78.00	0.012189	0.33845
Farm 8B	0.089922	100.37	78.00	0.017065	0.47382
Farm 8C	0.049862	14.63	16.48	0.036650	0.067837
Farm 9A	0.044961	8.60	78.00	0.037899	0.053338
Farm 9B	0.049994	14.80	4.53	0.033825	0.073892
Farm 9C	0.089922	71.23	78.00	0.025118	0.32192
Farm 10A	0.044961	8.60	78.00	0.037899	0.053338
Farm 10B	0.044961	100.37	78.00	0.0085326	0.23691
Farm 10C	0.061422	100.37	78.00	0.011657	0.32365
Farm 11A	0.053034	14.69	11.38	0.038501	0.073052
Farm 11B	0.046686	10.76	16.23	0.037202	0.058589
Farm 11C	0.044961	8.60	78.00	0.037899	0.053338
Farm 12A	0.089922	71.23	78.00	0.025118	0.32192
Farm 12B	0.044961	100.37	78.00	0.0085326	0.23691
Farm 12C	0.079718	100.37	78.00	0.015129	0.42006
Farm 12D	0.089922	100.37	78.00	0.017065	0.47382

HOUSE SPARROW

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.62309	31.70	30.90	0.33147	1.1713
Farm 1B	1.8919	36.72	9.61	0.85284	4.1969
Farm 1C	0.37039	20.93	37.03	0.24347	0.56346
Farm 2A	0.96244	16.58	84.64	0.69364	1.3354
Farm 2B	0.39315	17.11	49.36	0.27945	0.55311
Farm 2C	0.46194	15.54	81.97	0.33973	0.62813
Farm 3A	1.4311	41.25	410.00	0.65654	3.1194
Farm 4A	1.4286	63.30	12.32	0.40480	5.0419
Farm 4B	0.28920	70.35	1.20	0.0011900	70.280
Farm 4C	0.20861	15.72	2.71	0.12289	0.35413
Farm 5A	0.40653	30.00	15.29	0.21766	0.75929
Farm 5B	0.84932	59.13	2.04	0.084092	8.5780
Farm 5C	0.54260	28.85	15.46	0.29742	0.98988
Farm 6A	0.73991	52.24	3.08	0.15844	3.4555
Farm 6B	0.80932	40.65	11.50	0.34383	1.9050
Farm 6C	0.68471	50.17	8.37	0.23153	2.0249
Farm 7A	0.85063	45.79	1.30	0.032096	22.544
Farm 7B	1307.2	202.04	10.72	78.286	21827
Farm 7C	1.3538	158.92	2.26	0.017734	103.34
Farm 8A	0.36827	70.96	410.00	0.10495	1.2922
Farm 8B	0.36827	100.17	410.00	0.071532	1.8959
Farm 9B	0.30689	40.43	2.09	0.061410	1.5336
Farm 9C	0.32042	33.95	1.08	0.0091145	11.264
Farm 10C	0.36827	100.17	410.00	0.071532	1.8959
Farm 11A	0.32630	31.67	13.33	0.16761	0.63524
Farm 11B	0.53073	63.33	5.23	0.12160	2.3164
Farm 11C	0.69101	44.82	21.18	0.28395	1.6816
Farm 12A	1.3873	107.57	1.01	0.000023537	81774.
Farm 12B	3.7609	180.60	1.07	0.0000080847	1749500
Farm 12C	0.50212	40.83	4.90	0.18183	1.3866

MAGPIE

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.15512	18.91	6.65	0.099106	0.24278
Farm 1B	0.26410	32.66	8.37	0.12745	0.54727
Farm 1C	0.12012	24.07	23.10	0.073524	0.19624
Farm 2A	0.30228	32.73	9.20	0.14724	0.62057
Farm 2B	0.18116	12.10	17.95	0.14061	0.23340
Farm 2C	0.15442	12.52	58.19	0.12030	0.19821
Farm 3A	0.08066	5.19	531.00	0.072847	0.089312
Farm 3B	0.21908	16.56	40.54	0.15714	0.30543
Farm 3C	0.23356	55.88	4.81	0.060198	0.90614
Farm 4A	0.25608	31.00	15.72	0.13461	0.48714
Farm 4B	0.16451	23.22	15.27	0.10103	0.26790
Farm 4C	0.30330	26.92	32.35	0.17700	0.51973
Farm 5A	0.13542	21.95	26.45	0.086738	0.21144
Farm 5B	0.11840	19.58	25.17	0.079413	0.17652
Farm 5C	0.22935	30.60	22.18	0.12334	0.42645
Farm 6A	0.18706	23.29	10.71	0.11260	0.31076
Farm 6B	0.17239	33.28	16.26	0.086802	0.34235
Farm 6C	0.12980	27.01	8.14	0.070530	0.23888
Farm 7A	0.15742	20.74	36.03	0.10383	0.23866
Farm 7B	0.30469	21.86	40.03	0.19688	0.47154
Farm 7C	0.24592	26.10	35.02	0.14604	0.41414
Farm 8A	0.19064	51.55	2.04	0.024558	1.4799
Farm 8B	0.12099	33.73	1.05	0.028813	5.0805
Farm 8C	0.11557	16.35	10.32	0.080598	0.16573
Farm 9A	0.26932	30.68	16.67	0.14289	0.50759
Farm 9B	0.13606	28.50	6.42	0.069411	0.26672
Farm 9C	0.18275	26.31	11.40	0.10367	0.32215
Farm 10A	0.10888	36.47	6.27	0.046277	0.25619
Farm 10B	0.080660	100.13	531.00	0.015692	0.41461
Farm 10C	0.18238	23.05	8.84	0.10885	0.30556
Farm 11A	0.15109	18.59	27.98	0.10357	0.22042
Farm 11B	0.16282	12.94	88.03	0.12603	0.21033
Farm 11C	0.13866	18.59	17.25	0.094027	0.20449
Farm 12A	0.15460	19.20	18.14	0.10369	0.23051
Farm 12B	0.14038	14.51	40.72	0.10488	0.18789
Farm 12C	0.25560	29.56	18.89	0.13944	0.46852
Farm 12D	0.40323	22.80	10.56	0.24504	0.66354

MALLARD DUCK

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 2A	34.462	91.83	1.24	0.056953	20853.
Farm 5A	0.29101	101.71	35.00	0.052585	1.6105
Farm 5C	0.29101	18.59	35.00	0.20017	0.42307
Farm 7A	0.58202	18.59	35.00	0.40034	0.84615
Farm 7B	2.4442	74.13	1.16	0.0054242	1101.4
Farm 7C	0.58202	101.71	35.00	0.10517	3.2210
Farm 8C	0.58202	101.71	35.00	0.10517	3.2210
Farm 9B	32.593	94.30	2.27	1.5198	699.00
Farm 10A	2.3281	101.71	35.00	0.42068	12.884
Farm 10B	9.3123	71.22	1.15	0.023119	3751.1
Farm 11C	1.1640	53.34	35.00	0.42147	3.2149
Farm 12B	0.000039721	38.17	1.71	0.061254	0.00025757
Farm 12C	0.51598	101.71	35.00	0.093235	2.8555
Farm 12D	1.1640	101.71	35.00	0.21034	6.4420

PARADISE SHELDUCK

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1C	0.61827	60.22	1.37	0.013160	29.047
Farm 2A	3.2041	116.25	5.42	0.31392	32.703
Farm 2B	0.46714	101.09	69.00	0.087599	2.4911
Farm 2C	0.23673	14.90	69.97	0.17614	0.31815
Farm 3A	0.075557	81.59	1.07	0.000031894	179.00
Farm 3B	0.68332	77.98	3.51	0.090208	5.1761
Farm 7A	0.15662	55.34	1.52	0.0073474	3.3385
Farm 7B	0.053005	29.59	3.90	0.023520	0.11945
Farm 7C	0.23357	14.78	69.00	0.17420	0.31317
Farm 8A	0.11679	101.09	69.00	0.021900	0.62278
Farm 8C	0.34862	74.08	3.33	0.047533	2.5569
Farm 10C	0.23357	101.09	69.00	0.043799	1.2456
Farm 11A	0.23357	101.09	69.00	0.043799	1.2456
Farm 11C	4.0875	101.09	69.00	0.76649	21.797
Farm 12B	0.37371	29.04	7.23	0.19152	0.72923
Farm 12C	1.4496	157.65	3.44	0.052756	39.833
Farm 12D	0.59994	34.78	12.20	0.28771	1.2510

PIED OYSTERCATCHER

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.75770	100.79	102.00	0.14396	3.9880
Farm 4B	0.19747	24.26	3.74	0.099828	0.39062
Farm 4C	0.56822	43.33	19.41	0.23878	1.3521
Farm 5A	0.34805	33.83	1.38	0.036996	3.2744
Farm 5C	0.00011468	42.84	2.17	0.022197	0.00059245
Farm 6A	0.37885	100.79	102.00	0.071978	1.9940
Farm 6B	0.068114	108.94	1.03	0.017716	2618.8
Farm 6C	3.3760	84.91	7.01	0.59164	19.263
Farm 7A	0.19552	36.10	8.46	0.087882	0.43500
Farm 7B	0.38855	70.76	7.47	0.087762	1.7202
Farm 7C	0.31869	40.55	3.67	0.10375	0.97888
Farm 8A	0.25257	12.61	102.00	0.19688	0.32400
Farm 8B	0.25257	100.79	102.00	0.047986	1.3293
Farm 8C	0.12628	100.79	102.00	0.023993	0.66467
Farm 9B	0.25257	100.79	102.00	0.047986	1.3293
Farm 10A	0.36429	54.60	3.41	0.079576	1.6677
Farm 10B	0.25049	42.22	12.81	0.10429	0.60167
Farm 10C	0.24970	23.09	42.95	0.15768	0.39541
Farm 12A	0.24924	48.76	2.30	0.042856	1.4495
Farm 12B	0.45157	49.18	3.38	0.11223	1.8170
Farm 12C	0.24665	45.05	2.27	0.047283	1.2866
Farm 12D	0.17307	24.24	29.36	0.10619	0.28208

PIED STILT

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.18271	106.00	16.00	0.029027	1.1501
Farm 4C	0.18271	106.00	16.00	0.029027	1.1501
Farm 7B	0.091357	69.62	5.27	0.018609	0.44850
Farm 10A	0.36543	61.12	16.00	0.11068	1.2065
Farm 10B	0.45068	180.05	1.16	0.0000070569	28783.
Farm 10C	0.30365	66.35	8.84	0.077142	1.1953
Farm 11C	0.30452	106.00	16.00	0.048378	1.9169
Farm 12C	0.16198	106.00	16.00	0.025733	1.0196

REDPOLL

MODEL = Hazard Rate / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.38321	100.35	750.00	0.074444	1.9726
Farm 1C	0.76642	100.35	750.00	0.14889	3.9453
Farm 2A	0.66607	50.54	1.06	0.0032048	138.43
Farm 2B	1.8397	53.95	1.34	0.050635	66.839
Farm 2C	0.21266	111.98	1.01	0.0000030366	14893.
Farm 3A	0.78613	18.19	92.11	0.54944	1.1248
Farm 3B	0.89837	19.11	40.76	0.61280	1.3170
Farm 3C	0.87838	17.69	107.77	0.62031	1.2438
Farm 4A	8.9163	56.25	5.94	2.4644	32.259
Farm 4B	4.0514	104.32	1.01	0.00010321	159030
Farm 4C	2.8116	61.58	5.50	0.68046	11.617
Farm 5A	1.4040	28.39	13.66	0.77167	2.5544
Farm 5B	0.76276	62.10	2.07	0.070957	8.1995
Farm 5C	1.1496	67.19	1.03	0.00084744	1559.6
Farm 6A	1.2580	23.55	33.08	0.78424	2.0180
Farm 6B	0.42292	23.07	15.02	0.26030	0.68714
Farm 6C	1.5715	24.46	12.76	0.93272	2.6477
Farm 7A	0.88848	23.59	69.20	0.55851	1.4134
Farm 7B	0.57482	34.37	1.13	0.022346	14.786
Farm 7C	0.78267	44.79	9.60	0.30026	2.0401
Farm 8A	1.2538	26.49	25.24	0.73355	2.1430
Farm 8B	17.480	102.57	9.78	2.6277	116.28
Farm 8C	0.86194	29.63	28.38	0.47600	1.5608
Farm 9A	1.1175	14.62	193.40	0.83881	1.4888
Farm 9B	0.75170	14.15	148.68	0.56910	0.99289
Farm 9C	0.95801	13.84	187.92	0.73014	1.2570
Farm 10A	0.67161	11.59	426.08	0.53522	0.84276
Farm 10B	0.95803	48.34	3.19	0.23371	3.9272
Farm 10C	0.66096	13.10	180.33	0.51101	0.85492
Farm 11A	0.62489	15.76	96.87	0.45797	0.85267
Farm 11B	0.81436	20.64	32.18	0.53728	1.2343
Farm 11C	0.38321	8.38	750.00	0.32520	0.45157
Farm 12A	5.3536	37.50	15.84	2.4799	11.557
Farm 12B	0.87039	14.48	118.24	0.65437	1.1577
Farm 12C	1.3737	32.69	33.79	0.71876	2.6255
Farm 12D	0.76642	50.70	1.06	0.0036183	162.34

SILVEREYE

MODEL = Hazard Rate / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	5.4266	65.18	58.67	1.6496	17.852
Farm 1C	3.1170	115.09	76.00	0.50038	19.417
Farm 2B	3.9420	197.58	1.27	0.00019713	78827.
Farm 2C	113.89	227.56	1.57	0.055854	232220
Farm 3A	6.2682	73.43	23.04	1.6115	24.382
Farm 3B	3.4439	59.63	88.72	1.1510	10.305
Farm 3C	2.6955	62.86	78.88	0.85472	8.5010
Farm 9A	2.4998	64.02	79.66	0.77864	8.0256
Farm 9B	4.5848	61.21	85.01	1.4936	14.073
Farm 9C	86.910	93.16	25.85	17.109	441.49
Farm 11A	1.6364	66.01	13.83	0.44984	5.9532
Farm 11B	4.3639	115.09	76.00	0.70054	27.184
Farm 12B	16.728	108.96	4.65	1.6325	171.40

SKYLARK

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.26253	9.92	116.45	0.21581	0.31937
Farm 1B	0.28277	14.47	58.01	0.21199	0.37717
Farm 1C	0.34767	12.13	127.10	0.27374	0.44157
Farm 2A	0.44106	24.55	23.85	0.26769	0.72673
Farm 2B	0.23455	11.50	43.89	0.18616	0.29551
Farm 2C	0.32538	13.85	55.35	0.24684	0.42892
Farm 3A	0.27787	18.76	14.69	0.18680	0.41334
Farm 3B	0.13260	20.93	5.20	0.078342	0.22443
Farm 3C	0.22219	11.21	11.49	0.17397	0.28377
Farm 4A	0.29045	10.61	106.97	0.23548	0.35824
Farm 4B	0.29656	6.91	353.72	0.25892	0.33967
Farm 4C	0.25027	8.79	131.13	0.21041	0.29768
Farm 5A	0.29155	15.74	32.27	0.21201	0.40091
Farm 5B	0.25615	15.47	35.41	0.18748	0.34998
Farm 5C	0.34735	9.57	121.74	0.28750	0.41966
Farm 6A	0.36954	9.63	155.81	0.30566	0.44676
Farm 6B	0.27845	6.63	337.49	0.24445	0.31718
Farm 6C	0.27245	8.34	124.50	0.23106	0.32126
Farm 7A	0.21239	7.90	93.93	0.18160	0.24842
Farm 7B	0.22646	6.71	152.91	0.19837	0.25854
Farm 7C	0.34304	22.75	16.67	0.21340	0.55143
Farm 8A	0.27395	11.59	55.76	0.21735	0.34529
Farm 8B	0.24728	8.44	102.61	0.20923	0.29225
Farm 8C	0.32594	19.41	35.12	0.22058	0.48162
Farm 9A	0.15920	4.10	27.97	0.14638	0.17314
Farm 9B	0.29342	18.38	15.38	0.19912	0.43237
Farm 9C	0.31716	14.90	9.59	0.22753	0.44209
Farm 10A	0.19110	10.09	48.40	0.15611	0.23394
Farm 10B	0.22368	10.61	57.48	0.18097	0.27647
Farm 10C	0.18347	7.83	73.89	0.15701	0.21439
Farm 11A	0.34237	20.31	21.95	0.22561	0.51955
Farm 11B	0.30511	13.87	63.60	0.23158	0.40198
Farm 11C	0.34277	18.53	66.72	0.23753	0.49463
Farm 12A	0.38038	33.01	15.48	0.19200	0.75359
Farm 12B	0.21350	7.66	85.14	0.18339	0.24856
Farm 12C	0.25153	13.46	31.27	0.19138	0.33057
Farm 12D	0.33599	21.19	13.09	0.21374	0.52816

SONG THRUSH

MODEL = Hazard Rate / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.44133	71.43	261.00	0.12465	1.5625
Farm 2A	0.65479	71.43	261.00	0.18495	2.3182
Farm 2B	0.22066	100.51	261.00	0.042575	1.1437
Farm 2C	0.45342	25.57	4.20	0.22846	0.89990
Farm 3A	0.22066	100.51	261.00	0.042575	1.1437
Farm 3B	0.29422	26.96	2.70	0.11988	0.72207
Farm 3C	0.66199	58.61	261.00	0.22707	1.9299
Farm 4A	0.22357	10.17	263.19	0.18309	0.27299
Farm 4B	0.22066	100.51	261.00	0.042575	1.1437
Farm 4C	1.0216	58.61	261.00	0.35042	2.9783
Farm 5A	0.22066	100.51	261.00	0.042575	1.1437
Farm 5B	0.40154	28.94	4.14	0.18464	0.87325
Farm 5C	0.22066	10.08	261.00	0.18102	0.26898
Farm 6A	0.80475	84.86	2.06	0.036763	17.616
Farm 6B	0.27433	15.52	19.51	0.19874	0.37868
Farm 6C	0.30710	19.57	14.77	0.20304	0.46448
Farm 7A	0.34507	25.01	13.58	0.20316	0.58610
Farm 7B	0.39206	43.11	7.81	0.15070	1.0199
Farm 7C	0.33253	16.15	59.25	0.24120	0.45844
Farm 8A	0.32271	22.26	23.27	0.20480	0.50851
Farm 8B	0.66199	58.61	261.00	0.22707	1.9299
Farm 8C	0.26805	15.52	48.67	0.19660	0.36547
Farm 9A	0.53564	37.43	12.96	0.24494	1.1713
Farm 9B	0.44455	18.18	130.89	0.31119	0.63506
Farm 9C	0.33681	18.13	83.05	0.23553	0.48163
Farm 10A	0.45738	31.64	10.55	0.23095	0.90580
Farm 10B	0.22066	10.08	261.00	0.18102	0.26898
Farm 10C	0.29491	28.03	11.34	0.16133	0.53910
Farm 11A	0.46855	36.05	7.31	0.20647	1.0633
Farm 11B	0.55166	22.40	1.57	0.15827	1.9228
Farm 11C	0.42901	27.47	25.33	0.24623	0.74745
Farm 12A	0.25048	28.78	9.84	0.13343	0.47022
Farm 12B	0.33099	21.73	4.87	0.18972	0.57748
Farm 12C	0.25819	21.82	3.23	0.13352	0.49925
Farm 12D	0.44133	100.51	261.00	0.085151	2.2873

SOUTHERN BLACK BACKED GULL

MODEL = Negative Exponential / Simple Polynomial

Farm	Density Estimate	%CV	df	95% Confidence Interval	95% Confidence Interval
Farm 1A	0.15809	100.92	165.00	0.030217	0.82709
Farm 1B	2.3255	132.74	1.03	0.000013560	398810
Farm 1C	0.19761	100.92	165.00	0.037772	1.0339
Farm 2A	0.52580	100.92	165.00	0.10050	2.7508
Farm 3A	0.21007	20.49	15.76	0.13659	0.32307
Farm 3B	0.15809	100.92	165.00	0.030217	0.82709
Farm 3C	0.23713	36.01	1.36	0.020929	2.6868
Farm 4A	8.6394	167.49	3.04	0.22417	332.96
Farm 4B	0.15809	13.62	165.00	0.12096	0.20662
Farm 4C	0.35831	22.90	31.86	0.22605	0.56796
Farm 5A	0.15123	20.25	53.54	0.10118	0.22604
Farm 5B	0.23463	21.38	8.57	0.14489	0.37993
Farm 5C	0.16332	13.80	170.51	0.12454	0.21417
Farm 6A	0.72709	94.52	2.40	0.038492	13.734
Farm 6B	0.15809	13.62	165.00	0.12096	0.20662
Farm 6C	0.27528	43.93	6.40	0.10002	0.75764
Farm 7A	0.21079	28.47	3.36	0.091278	0.48676
Farm 7B	2.2303	226.21	1.01	0.00000011168	44541000
Farm 7C	0.23184	46.39	13.99	0.089941	0.59760
Farm 8A	0.15470	27.53	8.74	0.083697	0.28593
Farm 8B	0.44885	26.93	14.35	0.25478	0.79075
Farm 8C	0.56317	60.56	2.84	0.089696	3.5360
Farm 9A	0.17202	16.24	10.98	0.12059	0.24540
Farm 9B	0.15809	13.62	165.00	0.12096	0.20662
Farm 9C	0.15809	100.92	165.00	0.030217	0.82709
Farm 10A	0.49869	25.08	20.88	0.29829	0.83372
Farm 10B	0.30422	29.52	12.42	0.16246	0.56968
Farm 10C	0.54765	53.58	1.14	0.0046268	64.824
Farm 11A	0.39086	19.93	47.49	0.26279	0.58135
Farm 11B	0.19538	24.79	20.07	0.11740	0.32516
Farm 11C	2.1240	78.19	8.96	0.44476	10.143
Farm 12A	0.15809	13.62	165.00	0.12096	0.20662
Farm 12B	0.15809	100.92	165.00	0.030217	0.82709
Farm 12C	0.15809	100.92	165.00	0.030217	0.82709

SPUR WINGED PLOVER

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.88127	139.63	3.53	0.04186	18.552
Farm 1C	0.49810	32.90	2.28	0.14554	1.7047
Farm 2A	0.39715	69.59	4.29	0.072572	2.1734
Farm 2B	0.15863	100.11	231.00	0.030720	0.81918
Farm 2C	0.22301	20.73	2.23	0.10003	0.49717
Farm 3A	0.079317	100.11	231.00	0.015360	0.40959
Farm 3B	0.18027	70.87	231.00	0.051291	0.63356
Farm 4A	0.19366	13.20	2.64	0.12310	0.30466
Farm 4B	0.37240	44.51	17.99	0.15243	0.90984
Farm 4C	0.45076	40.64	4.67	0.16150	1.2581
Farm 5A	0.13919	18.72	22.34	0.094749	0.20448
Farm 5B	0.20758	52.61	7.38	0.065290	0.65998
Farm 5C	0.38058	42.04	8.00	0.15013	0.96481
Farm 6A	0.39119	23.10	4.96	0.21740	0.70390
Farm 6B	0.23581	42.66	12.05	0.096794	0.57447
Farm 6C	1.2013	49.12	15.08	0.44618	3.2345
Farm 7A	0.079317	100.11	231.00	0.015360	0.40959
Farm 7B	0.33496	23.82	25.48	0.20658	0.54312
Farm 7C	0.14480	35.66	4.15	0.056135	0.37351
Farm 8A	0.47590	78.32	1.04	0.00015754	1437.6
Farm 9A	0.81032	46.16	4.37	0.24895	2.6376
Farm 9B	0.44100	35.84	8.81	0.20034	0.97079
Farm 9C	0.15863	100.11	231.00	0.030720	0.81918
Farm 10A	0.079317	4.74	231.00	0.072249	0.087077
Farm 10B	0.13620	23.00	16.30	0.084240	0.22022
Farm 10C	0.18932	30.54	13.26	0.099442	0.36044
Farm 11A	0.23795	66.83	1.01	0.00012636	448.09
Farm 11B	0.14672	35.96	8.40	0.066086	0.32572
Farm 11C	0.14633	34.88	10.44	0.069074	0.31001
Farm 12A	0.050824	35.80	1.31	0.0038535	0.67032
Farm 12B	0.23164	21.06	3.33	0.12370	0.43378
Farm 12C	0.19359	40.65	4.27	0.067139	0.55822
Farm 12D	0.33051	29.11	11.38	0.17688	0.61758

STARLING

MODEL = Uniform / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1C	0.15442	54.61	1.22	0.0021431	11.126
Farm 2A	31.516	161.85	1.36	0.011229	88455.
Farm 2B	3.3327	114.16	1.79	0.040430	274.73
Farm 2C	3.1760	45.52	13.75	1.2503	8.0674
Farm 3A	0.12325	10.57	3.16	0.088968	0.17074
Farm 3B	0.54006	41.62	20.94	0.23517	1.2402
Farm 3C	0.35266	37.04	8.07	0.15447	0.80516
Farm 4A	1.2514	65.64	8.39	0.31817	4.9216
Farm 4B	3.5754	81.90	18.33	0.79520	16.075
Farm 4C	0.13728	29.31	7.27	0.069977	0.26931
Farm 5A	0.88397	45.62	28.18	0.36282	2.1537
Farm 5B	1.6717	50.57	21.65	0.62079	4.5014
Farm 5C	2.4343	46.19	37.36	0.99893	5.9321
Farm 6A	1.0641	63.21	2.01	0.089156	12.700
Farm 6B	0.41042	17.32	78.19	0.29144	0.57798
Farm 6C	110.18	200.62	4.06	3.2989	3679.6
Farm 7A	0.32196	30.97	24.40	0.17250	0.60092
Farm 7B	0.66575	45.33	17.74	0.26820	1.6526
Farm 7C	0.46434	39.65	33.23	0.21345	1.0101
Farm 8A	0.36756	35.65	7.75	0.16481	0.81974
Farm 8B	2.0483	95.85	1.27	0.0037871	1107.9
Farm 8C	1.9417	74.51	2.05	0.11832	31.863
Farm 9A	1.4378	100.02	482.00	0.27999	7.3827
Farm 9B	0.10525	63.63	3.66	0.019602	0.56518
Farm 9C	0.30121	100.02	1.00	0.0000077758	11668
Farm 10A	0.25718	39.18	11.26	0.11221	0.58942
Farm 10B	0.17732	42.41	9.75	0.071425	0.44020
Farm 10C	0.66179	38.27	25.20	0.30916	1.4166
Farm 11A	3.7029	98.03	9.65	0.58945	23.262
Farm 11B	0.77317	38.40	17.03	0.35362	1.6905
Farm 11C	0.91601	55.69	13.56	0.29943	2.8022
Farm 12A	0.14597	42.48	1.00	0.00086009	24.772
Farm 12B	0.69869	64.34	10.78	0.19068	2.5602
Farm 12C	5.5472	125.05	7.07	0.56188	54.765
Farm 12D	0.43908	48.13	11.83	0.16216	1.1888

WELCOME SWALLOW

MODEL = Half-normal / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.45728	100.15	130.00	0.087922	2.3783
Farm 1B	0.58531	100.15	130.00	0.11254	3.0442
Farm 1C	0.58531	100.15	130.00	0.11254	3.0442
Farm 2A	0.45117	29.42	2.14	0.14083	1.4454
Farm 2B	0.29266	100.15	130.00	0.056270	1.5221
Farm 3A	0.93043	49.75	17.65	0.34592	2.5026
Farm 3B	0.60614	40.87	4.08	0.20534	1.7892
Farm 3C	1.1664	30.09	10.70	0.60879	2.2346
Farm 4A	0.67219	40.64	6.40	0.26197	1.7247
Farm 5C	1.1706	100.15	130.00	0.22508	6.0884
Farm 6A	0.39442	100.15	130.00	0.075836	2.0513
Farm 7A	0.29266	5.40	130.00	0.26303	0.32562
Farm 7B	0.83715	36.13	13.57	0.39403	1.7786
Farm 8A	0.77448	40.22	4.85	0.28351	2.1157
Farm 8B	0.80207	50.42	5.31	0.24111	2.6682
Farm 8C	0.55343	24.16	9.97	0.32545	0.94111
Farm 9B	0.51027	22.44	9.01	0.30907	0.84243
Farm 9C	0.33106	100.15	130.00	0.063654	1.7218
Farm 10B	0.87797	100.15	130.00	0.16881	4.5663
Farm 11A	0.53903	30.49	9.52	0.27614	1.0522
Farm 11B	0.48794	27.34	12.87	0.27302	0.87205
Farm 11C	0.75325	31.98	15.12	0.38750	1.4642
Farm 12B	0.29266	100.15	130.00	0.056270	1.5221
Farm 12C	1.9521	73.70	2.19	0.14290	26.667
Farm 12D	0.29266	100.15	130.00	0.056270	1.5221

WHITE FACED HERON

MODEL = Hazard Rate / Cosine

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1B	0.78479	185.67	8.65	0.048652	12.659
Farm 1C	1.1772	159.95	16.93	0.10919	12.691
Farm 2A	1.1644	185.67	16.00	0.087382	15.516
Farm 4B	3.8723	166.75	16.00	0.33594	44.636
Farm 5C	0.78479	185.67	16.00	0.058896	10.457
Farm 6C	1.5696	185.67	16.00	0.11779	20.915
Farm 7A	0.00000				
Farm 7B	6.3670	185.34	13.69	0.46200	87.744
Farm 9A	1.0577	185.67	16.00	0.079374	14.094
Farm 10B	0.78479	185.67	16.00	0.058896	10.457
Farm 10C	0.78479	185.67	16.00	0.058896	10.457
Farm 11A	2.3544	174.88	16.93	0.19367	28.621

YELLOWHAMMER

MODEL = Hazard Rate / Simple Polynomial

Farm	Density Estimate	%CV	df	L95% Confidence Interval	U95% Confidence Interval
Farm 1A	0.42260	13.12	138.64	0.32638	0.54720
Farm 1B	0.67622	30.14	23.34	0.36758	1.2440
Farm 1C	0.31238	16.81	55.02	0.22356	0.43649
Farm 2A	0.37925	16.96	30.34	0.26892	0.53484
Farm 2B	0.48290	19.77	45.95	0.32559	0.71622
Farm 2C	0.35724	16.82	97.17	0.25645	0.49766
Farm 3A	0.28333	13.11	316.39	0.21916	0.36628
Farm 3B	0.38470	18.58	46.22	0.26551	0.55738
Farm 3C	0.35362	14.06	208.56	0.26837	0.46594
Farm 4A	0.35409	26.40	25.68	0.20761	0.60391
Farm 4B	0.36766	34.14	8.86	0.17316	0.78063
Farm 4C	0.68905	58.59	646.00	0.23711	2.0024
Farm 5A	0.86134	31.85	10.33	0.43225	1.7164
Farm 5B	0.43290	19.56	22.95	0.28994	0.64636
Farm 5C	0.38086	21.91	26.96	0.24424	0.59391
Farm 6A	0.86167	21.95	26.54	0.55193	1.3452
Farm 6B	0.33123	19.14	7.55	0.21290	0.51532
Farm 6C	0.41649	28.13	7.50	0.21877	0.79288
Farm 7A	0.33714	14.97	156.00	0.25126	0.45238
Farm 7B	0.41770	16.83	67.77	0.29925	0.58304
Farm 7C	0.36258	15.55	84.37	0.26664	0.49303
Farm 8A	0.32156	20.15	7.03	0.20071	0.51516
Farm 8B	0.27573	16.56	48.84	0.19811	0.38375
Farm 8C	0.33168	25.72	11.09	0.19012	0.57863
Farm 9A	0.33559	16.87	53.62	0.23985	0.46956
Farm 9B	0.26467	18.24	34.56	0.18330	0.38217
Farm 9C	0.36453	17.80	29.74	0.25412	0.52289
Farm 10A	0.25460	16.27	87.72	0.18463	0.35107
Farm 10B	1.1907	84.87	3.30	0.12846	11.037
Farm 10C	0.37645	16.97	53.36	0.26853	0.52775
Farm 11A	0.24791	14.44	90.95	0.18636	0.32981
Farm 11B	0.23856	21.56	19.44	0.15282	0.37243
Farm 11C	0.33492	20.64	28.08	0.22041	0.50893
Farm 12A	0.22968	100.50	646.00	0.044522	1.1849
Farm 12B	0.37339	16.36	97.49	0.27043	0.51555
Farm 12C	0.40760	31.82	4.92	0.18276	0.90906
Farm 12D	0.45937	71.41	646.00	0.13023	1.6204