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Northern Ireland Irish Hare Survey 2005

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Northern Ireland Irish Hare Survey 2005

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by

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Executive Summary

1. A survey of Irish hares in Northern Ireland was undertaken in spring 2005 and compared to a similar survey undertaken in spring 2004. The survey was based on observations of hares made at night using a spotlight while driving 8 transects along roads. Data from the 2004 and 2005 surveys were analysed using improved methods of Distance Sampling, leading to improved estimates of hare densities and revisions to the 2004 survey findings.
2. The density of Irish hares was estimated to be 3.10 hares per km^2 in spring 2005 (and with 95% confidence was between the limits 2.49–3.87). The estimated density in 2004 was revised to 5.11 hares per km^2 (95% CL 4.23–6.16). Using these density estimates multiplied by land area, the Irish hare population in Northern Ireland was estimated to be 43,700 in 2005 (95% CL 35,000–54,400) and was revised to 72,000 in 2004 (95% CL 59,700-86,900).
3. The confidence intervals of these estimates do not overlap and we conclude that the hare population decreased between 2004 and 2005, but remains higher than the 2002 population.
4. We make the same four recommendations for action made in our 2004 report:
    a. Continue with regular surveys of Irish hare numbers. Until the extent and pattern of fluctuations is well established, these should be conducted annually.
    b. Improvement of the application of Distance Sampling techniques to Irish hare surveys forms part of this report but is ongoing. Future refinement of survey and analytical methodology will result in more reliable determination of population change and improved accuracy and precision of population estimates, possibly leading to further revisions of earlier estimates.
    c. Conduct research on the population biology of Irish hares. There is insufficient information on the most basic aspects of demography, such as survival and productivity, their relationship with intrinsic and extrinsic factors and the spatial scale at which these factors effect population change.
    d. Investigate the impact of agricultural practices on hare survival and recruitment.

Contents

Introduction

The Irish hare *Lepus timidus hibernicus* is the only lagomorph that is native to Ireland and is commonly recognized as an endemic sub-species of the mountain hare *Lepus timidus* (Fairley 2001; Hamill 2001). It is a priority species for conservation action in Northern Ireland.

During the 1990s, research undertaken by Queen's University Belfast (QUB) indicated that the Irish hare population in Northern Ireland was between 8250–21,000 hares and that there was evidence of a decline from historical levels (Dingerkus 1997; Dingerkus & Montgomery 2002). These findings prompted the Environment and Heritage Service (EHS) to create a Species Action Plan for the Irish hare that contained a series of measures and targets aimed at maintaining and enhancing the status of the Irish hare in Northern Ireland (EHS 2000). A series of hare surveys have since been commissioned by EHS with the aim of evaluating the Plan's success.

In 2002, QUB undertook a survey using line transect spotlight surveys conducted while driving along roads at night. Distance Sampling techniques were applied to determine hare densities. The population was estimated to have been 7,000–25,200 hares, indicating that hare numbers had not changed significantly since the previous estimate during the 1990s (Preston et al 2002).

Quercus was commissioned by EHS to conduct a further survey in spring 2004. A modified field protocol was adopted for health and safety reasons. Observations were made with a spotlight at a series of point transects distributed along the previously adopted line transects. Estimates of hare densities increased markedly between surveys, suggesting that the population had undergone a marked increase between 2002 and 2004 (Tosh et al 2004). In the report of this survey, it was recommended that hare surveys be continued until the extent of annual fluctuations is well known and that survey methodologies should be improved to enhance the ability of surveys to detect population trends (Tosh et al 2004).
In response to these recommendations, EHS commissioned a further survey from Quercus in 2005. In order to develop the application of Distance Sampling to Irish hare surveys, this survey was conducted in conjunction with the developers of the technique at the Research Unit for Wildlife Population Assessment (RUWPA), part of the Centre for Research into Ecological and Environmental Modelling (CREEM) at the University of St. Andrews.

The objectives of the 2005 survey were to:

- Establish the abundance and distribution of Irish hares in Northern Ireland in 2005
- Ascertain change in distribution and abundance since 2004
- Make recommendations for future work on Irish hares

Methods

Fieldwork was conducted from January to May 2005 and was undertaken along the eight transects used in the 2002 and 2004 surveys. These routes were approximately 100 km in length and were located such that they encompassed a typical sample of landscape types as characterized by the land classification system (Murray, McCann & Cooper 1992). The transects were located in all six counties of Northern Ireland (Figure 1).

A Nissan pick-up truck was driven along a transect, stopping at approximately 200 m intervals. Hares were searched for by a single observer standing on a platform mounted on the rear of the truck using a 2 million candlepower handheld spotlight. The same single observer (Tosh) conducted all counts during both the 2004 and 2005 surveys. The observer systematically swept the spotlight 180 degrees on one side working from the area closest to the vehicle towards the horizon. Two sweeps were carried out on each side of the vehicle. The sector of view over which the view was not obscured, e.g. by tall hedges, was noted in degrees and used as a measure of survey effort at each point. In common with the 2004 survey, if spotlighting was not effective at points because the view was largely obscured, the nearest gap in the roadside vegetation was sought. This was repeated along the length of a transect until it was completed.

The presence or absence of hares was noted at each point. Where hares were detected, the number of animals seen, the distance from the observer in metres measured using a laser range finder (Leica LRF 900 scan), bearing and position in the field were noted. At each point, the distance travelled (kilometres) and position to the nearest 10m were recorded using a Global Positioning System (GPS). Transects were surveyed from sunset for 5–7 hours a night. Between 20–25 km of a transect was surveyed each night and each transect required 4–5 nights survey effort.

Hare densities were estimated using DISTANCE 5 version Beta 4 (Thomas et al 2005) and customized scripts in R (R Development Core Team 2004). Sightings of more than one hare were entered as clusters. Model selection procedures based on Akaike's Information Criterion (AIC) value were the same throughout.

The analytical approach differed from that applied in 2004 in several respects:

- No left truncation of the data was made but right truncation of 10% of the largest distances was applied. This is not likely to have greatly affected density estimates, since few hares were seen within this left-truncated zone.
- The distances to hares were not rounded or grouped into bins as they had been in the 2004 analysis, rather the exact distance derived from the laser rangefinder was used. Using more precise distances reduces the risk of overestimation of density by underestimating distances, and *vice versa*.
- Variation in visibility at survey points, which equated to sampling effort for point transects, was accounted for in the 2005 survey but not in the 2004 survey. Accounting for obscured or reduced arcs of visibility reduces the risk of underestimating density.
- The whole sample of both surveys was stratified by county by fitting separate models to each. An overall estimate of density was therefore a composite of the county strata weighted by county area. Although sample sizes are small in some counties, and this leads to reduced goodness of model fit in some cases, this

will account in part for differences in the sampling intensity among counties and reduces the risk of bias due to inappropriate pooling of data, potentially resulting from variation in the distribution of hares among landscape types that are unevenly represented among counties. Data from Antrim and Down, where two transects were surveyed, remain pooled.

Further details of the analytical procedures are available upon request to Quercus in the first instance.

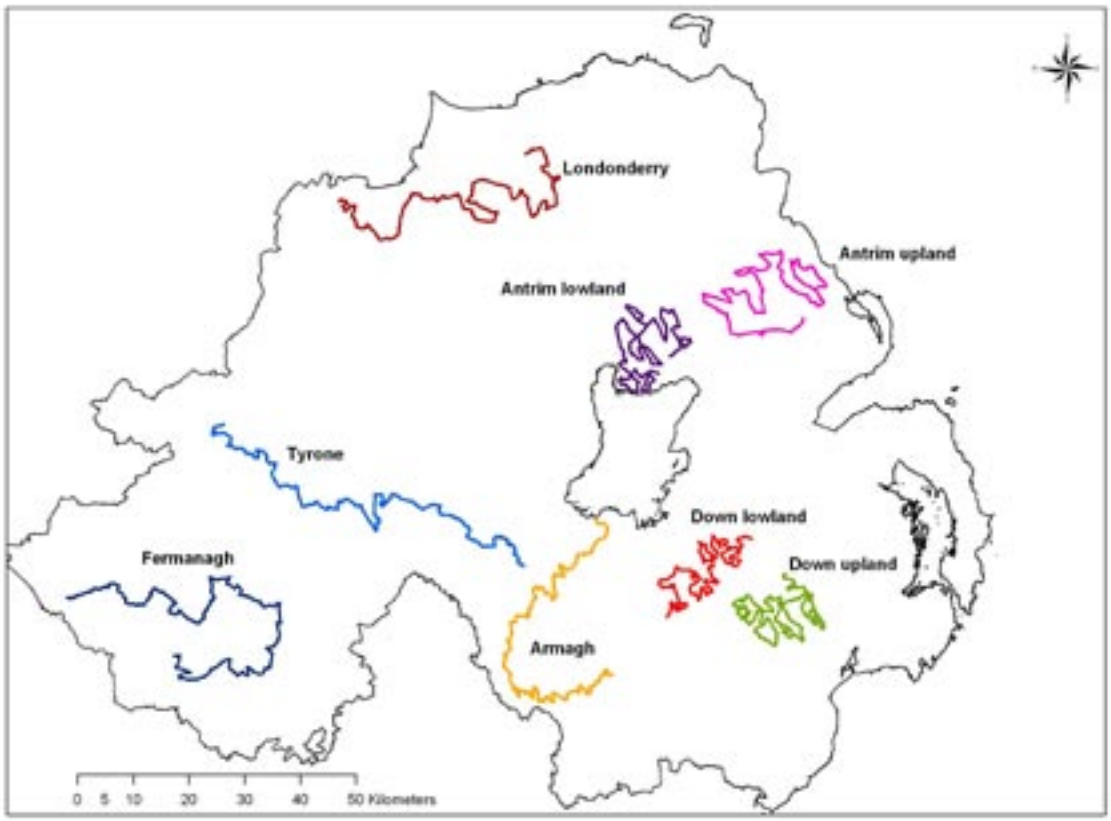

Figure 1. Location of hare survey transects

Results

A total of 314 Irish hares were detected on the 8 transects surveyed in 2005 (Table 1). In 2004, 373 Irish hares were seen. No brown hares were seen in either survey. In 2005, notwithstanding remaining sources of potential bias, the overall density of Irish hares in Northern Ireland was estimated to be 3.10 hares per km^2 (95% confidence interval 2.49–3.87). The population of Irish hares in Northern Ireland in spring 2005 was estimated to be 43,700 (95% CI 35,000–54,400). By applying improved analytical methods to the 2004 data, the previous density estimate of 5.87 hares per km^2 (95 % CI 4.94–6.99) was revised to 5.11 hares per km^2 (95% CI 4.23–6.16). The population of Irish hares in Northern Ireland in spring 2004 was revised from 82,200 (95% CI 69,200–97,900) to 72,000 (95% CI 59,700–86,900).

Table 1. Numbers of hares seen on each transect.

Transect	Number of hares seen		
	2002	2004	2005
Antrim	134	*120	126
Armagh	17	59	41
Down	63	67	29
Fermanagh	14	*60	80
Londonderry	7	34	9
Tyrone	4	*33	29
Total	**239**	**373**	**314**

*Minor change from figures reported in previous report (Antrim 119, Fermanagh 63, Tyrone 34) following further GPS data checks.

Table 2. Estimates of Irish hare density for each county

County	Year	Density (95% CI)		Abundance (95% CI)	
Antrim	2005	3.44	(2.49–4.76)	10500	(7600–14500)
	2004	5.42	(3.77–7.81)	16600	(11600–24000)
Armagh	2005	2.62	(1.26–5.47)	3500	(1700–7300)
	2004	8.41	(5.74–12.33)	11200	(7600–16400)
Down	2005	1.50	(0.67–3.34)	3700	(1700–8300)
	2004	3.77	(2.67–5.32)	9300	(6600–13200)
Fermanagh	2005	5.88	(4.20–8.21)	10900	(7800–15200)
	2004	8.43	(5.83–12.19)	15600	(10800–22600)
Londonderry	2005	1.05	(0.24–4.52)	2200	(500–9600)
	2004	3.28	(1.32–8.12)	6900	(2800–17200)
Tyrone	2005	3.94	(2.42–6.42)	12900	(7900–21000)
	2004	3.78	(2.25–6.33)	12300	(7300–20700)
Global	2005	3.10	(2.49–3.87)	43700	(35000–54400)
	2004	5.11	(4.23–6.16)	72000	(59700–86900)

Discussion

Spotlight surveys along road transects have been favoured as the best means of rapidly and economically surveying hare populations in Northern Ireland and it was a stipulation of this contract that the survey protocol should be similar to that adopted previously. This was the case, even to the extent that the same observer undertook the survey.

Nonetheless, a number of improvements have been made to data recording and analysis. It should be recognized that the inference of animal density from sightings data is a developing field and that means of dealing with the various sources of bias resulting from measurement error, uneven sampling and non-random animal distributions are being continually developed. The main software package used for these analyses Distance is also being continually developed and future surveys are likely to use further updated versions. This survey presents one of the few cases where survey methodology has been adapted and improved from one year to the next and the value of this can not be overstated, but there remains considerable potential further to improve the accuracy and precision of hare population estimates.

The greatest improvements to accuracy and precision are likely to stem from:

- Improving and maintaining accuracy in estimating detection distances and using exact distances for estimating densities rather than grouping data. This has been accounted for in this analysis.
- Accounting for uneven coverage among counties and landscapes. This has been partly accounted for in this analysis, although better resolution of landscape coverage is required by greater replication of independent samples, especially with respect to hare distribution among landscape types.
- Accounting for uneven visibility (survey effort) among points. This has been accounted for in this analysis, but could be more formalised.
- Accounting for non-random placement of transects along roads. This has not been accounted for at this stage, and is the least predictable in terms of its likely effect on density estimates. We are presently investigating novel means of accounting for this probable source of bias.

Notwithstanding the limitations of the current approach, it is apparent that there has been a decline in hare numbers in Northern Ireland between 2004 and 2005. Furthermore, taking into account the improvements made to the analysis of the 2004 survey, it remains clear that there had been a substantial increase in hare numbers between 2002 and 2004 and that the 2005 estimate remains clearly above that derived in 2002. In none of these three surveys, do the 95% confidence intervals of the density estimates overlap. This increases confidence in determining that these estimates reflect genuine change in hare populations.

In common with the previous survey (Tosh et al. 2004) we have detected marked change in hare populations. This is further evidence of the potential for hares rapidly to increase and decrease in short spaces of time. Given that rapid, marked changes in abundance appear to characterise Irish hare numbers, and that scant knowledge of hare ecology means that responses to management are hard to predict, it remains important to improve understanding of several aspects of hare population dynamics. Most significantly, little is known of the factors affecting hare population growth, particularly fertility and productivity, including intrinsic and extrinsic factors.

Equally, variation in hare demography and the spatial scale at which this is affected, as a means of understanding how local population change and management contributes to overall populations, requires further investigation. It remains important to improve understanding of these most basic aspects of hare ecology in order to make any substantial assessment of the reasons for population change, or to evaluate management actions or proposals.

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