Supporting Information 3

Justification for post-hoc stratification of Distance estimates

The program Distance is capable of post-stratification of data according to a given criteria, e.g. species. However, stratification with low numbers of detections can return unrealistic estimates. We calculated density and abundance estimates by: i) counting each transect (i.e. each separate road) individually, post-stratifying by zone and species (Fig. S1c, Table S3); and ii) counting each transect (i.e. each separate road) individually, post-stratifying by zone (Table S4), and calculating species-specific densities post-hoc (Fig. S3d, Table S5).

Due to the paucity of native species sightings in the core range, post-stratification by zone and species returned wholly unrealistic density and abundance estimates (Fig. S3c, Table S3), for example, 19.7 European hares/km^2 (95%CI 8.96 - 43.46) and 3.4 (95% CI 0.0 - 204,620) Irish hares/km^2.

While post-stratifying by zone and calculating species-specific densities post-hoc returned more reasonable Irish hare estimates for the core range, the European hare density estimate and associated confidence interval for the core remained excessive (19.74 hares/km^2 (95% CI 8.73 - 44.6); Fig. S3d, Table S5). We therefore suggest that the methodology described in the manuscript is appropriate as it provides results that are approximate to those obtained in previous Northern Ireland Irish hare Surveys (Reid *et al*., 2010).

References

Reid N, Montgomery WI (2010) Retrospective analysis of the Northern Ireland Irish hare Survey data from 2002-2010. Report prepared by the Natural Heritage Research Partnership, Quercus, Queen's University Belfast for the Northern Ireland Environment Agency. Northern Ireland Environment Agency Research and Development Series No. 11/16.

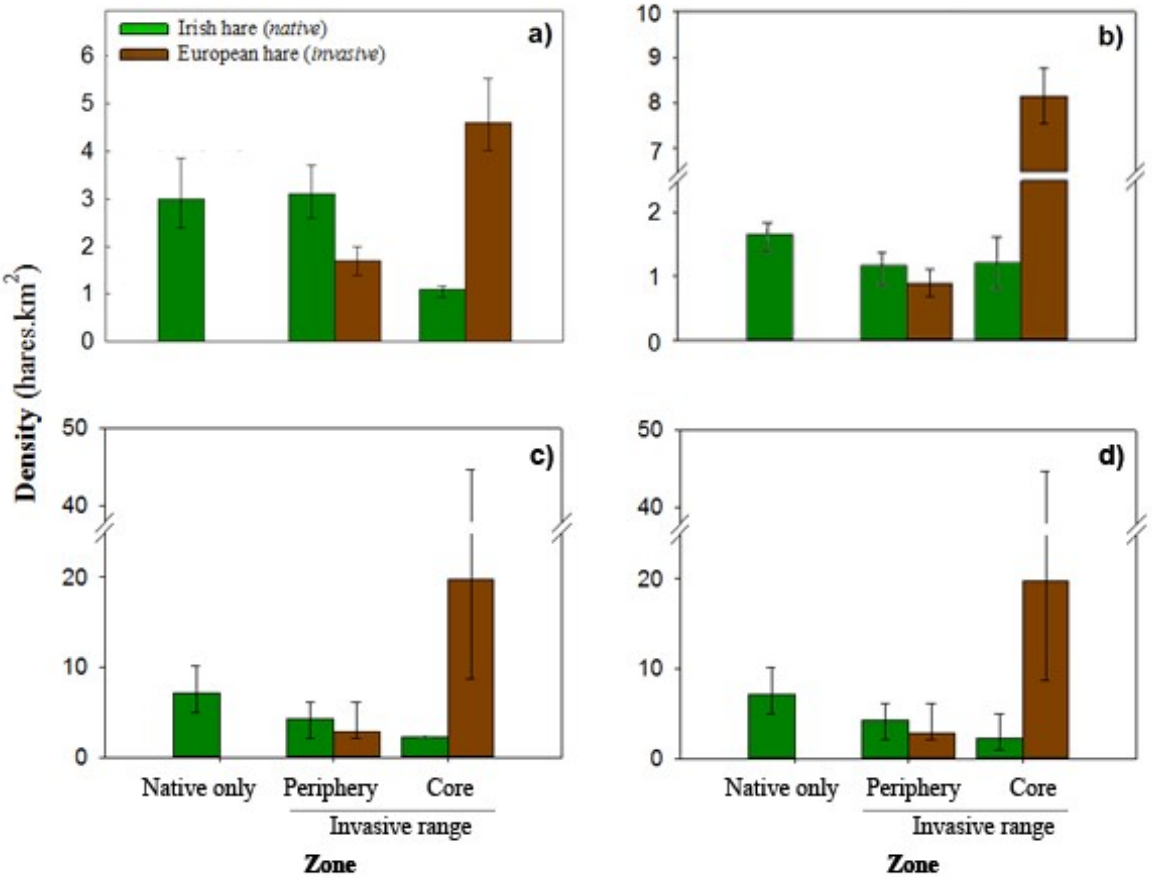

Fig. S3 Species replacement as demonstrated by native and invading hare densities (hares/km^2 ± 95% CIs) derived from **(a)** the Random Encounter Model (REM) using camera trapping data and **(b, c, d)** Distance sampling using nocturnal spotlight surveys in three zones: i) native species only, ii) invasive species peripheral range and iii) invasive species core range. Distance estimates and 95%CI were calculated: **(b)** according to the main Methods described in the primary manuscript; **(c)** post-stratifying by species and zone; **(d)** post-stratifying by zone, and calculating relative species densities *post-hoc*. Error bars are omitted from core Irish hare estimates in **(c)** due to their extreme nature (Table S3).

Table S3. Population density and abundance estimates of hares in Northern Ireland, calculated using the software Distance, stratified by zone and species.

Species	Range	Density (hares/km^2)		Abundance	
European hare	Invasive core	19.7	(9.0 - 43.4)	653	(297 - 1,438)
	Invasive periphery	3.8	(2.2 - 6.4)	2,022	(1,194 - 3,424)
	Native allopatry	0	(0.0 - 0.0)	0	(0 - 0)
Irish hare	Invasive core	3.4	(0.0 - 204,620.0)	113	(0 - 6,772,400)
	Invasive periphery	3.7	(2.2 - 6.1)	1,981	(1,194 - 3,2487)
	Native allopatry	7.2	(4.2 - 12.4)	7,667	(4,437 - 13,250)

Table S4. Population density and abundance estimates of hares in Northern Ireland, calculated using the software Distance, stratified by zone. Species-specific estimates **(Table S5)** were calculated post-hoc based on relative proportions observed during Distance Sampling.

Range	Density (hares/km^2)		Abundance	
Invasive core	22	(3.7 - 50.0)	726	(321 - 1,640)
Invasive periphery	7.1	(5.0 - 10.2)	3,816	(2,665 - 5,465)
Native allopatry	7.2	(4.2 - 12.4)	7,667	(4,437 - 13,250)

Table S5. Population density estimates of European and Irish hares in Northern Ireland, derived from data in **Table S4**, and based on relative proportions observed during Distance Sampling.

Range	European hare		Irish hare	
Invasive core	19.7	(8.7 - 44.6)	2.2	(1.0 - 5.0)
Invasive periphery	2.9	(2.1 - 6.2)	4.3	(2.1 - 6.2)
Native allopatry	0	(0.0 - 0.0)	7.2	(4.2 - 12.4)