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Factors associated with hare mortality during coursing

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Abstract

*Hare coursing is a widespread but controversial activity. In an attempt to reduce hare mortality and mitigate the activity's impact on hare welfare, the Irish Coursing Club introduced measures including the compulsory muzzling of dogs in 1993. However, the efficacy of these measures remained the subject of heated debate. Official records, corroborated by independent video evidence, were used to assess the fate of individual Irish hares (*Lepus timidus hibernicus*) during coursing events from 1988–2004. Muzzling dogs significantly reduced levels of hare mortality. In courses using unmuzzled dogs from 1988/89–1992/93 mean hare mortality was 15.8%, compared to 4.1% in courses using muzzled dogs from 1993/94–2003/04. Further reductions in mortality could not be accounted for by muzzling dogs, supporting the efficacy of other factors such as improved hare husbandry. The duration of the head start given to the hare prior to the release of the dogs significantly affected the outcome of the course. Hares that were killed had head starts of greater duration than those that were chased but survived, suggesting the former may have been slower. The selection of hares by assessment of their running ability may provide means to reduce hare mortality during courses further. Our findings support the efficacy of measures taken to mitigate the impact of coursing on individual hares. However, it is necessary to evaluate the impact of removing hares from the source population and of returning coursed hares to the wild before the wider impact of coursing on wild hare populations can be determined.*

Keywords: *animal welfare, field sports, hunting with dogs,* Lepus timidus*, mountain hare, welfare*

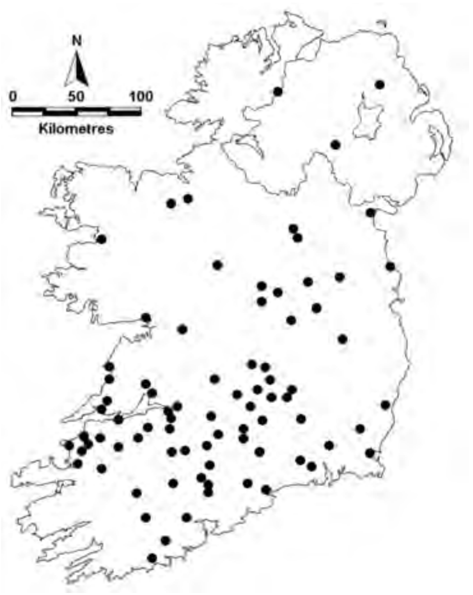
Introduction

The pursuit of game and pest animals with dogs is a common practice worldwide but is frequently contentious, particularly in terms of welfare and ethics. Much of the high profile and controversial debate about hunting with dogs in Great Britain has focused on fox and deer hunting (Bateson & Bradshaw 1997; Burns *et al* 2000; Macdonald *et al* 2000; Baker *et al* 2002). These hunts involve prolonged pursuit in the wild by a pack of hounds. Hunted deer are usually killed after the pursuit by a shot to the head but their welfare, as assessed by physiological indicators, is compromised by the pursuit (Bateson & Bradshaw 1997). Hunted foxes are usually killed either directly by the hounds or are shot after being dug out of a refuge (Burns *et al* 2000). Pursuit by dogs increases physiological indicators of stress such as heart rate and body temperature in foxes (Kreeger *et al* 1989). In most cases, however, hunted animals usually escape capture (Burns *et al* 2000).

As with fox and deer hunting, hare coursing is effectively banned throughout the UK (Protection of Wild Mammals Act Scotland [2002]; Hunting Act [2004] England and Wales; Game Preservation [Special Protection for Irish Hares] Order NI [2003]) but remains legal and widespread across the Republic of Ireland (Figure 1). While the purpose of both fox and deer hunting is to kill the animal for population control and/or sport, the intention of hare coursing is not to kill the hare. Instead, it is a contest of speed and agility between two dogs, where each is awarded points depending on its ability to divert or 'turn' the hare from a direct escape route along the coursing field. In Ireland, Irish hares (*Lepus timidus hibernicus* Bell 1837) are captured from the wild and held in captivity for up to 8 weeks prior to an event during which the hare is coursed within an enclosed park. A running hare is given a head start prior to the release of two dogs, which in Ireland are always greyhounds. The magnitude of the head start is measured by distance, rather than time. When the hare reaches a distance of approximately 75 m, an official releases or 'slips' the dogs. A judge assesses the performance of the dogs and surviving hares escape into a holding area from which the dogs are excluded. The duration of the pursuit is relatively brief, and usually lasts 35–40 seconds (Burns *et al* 2000). After the event, surviving hares are returned to the wild but not necessarily at the site of capture.

Prior to the ban in England and Wales (Hunting Act 2004) approximately 13% of all hares coursed died in the process (Burns *et al* 2000). The Universities Federation for Animal

Figure 1



Distribution of active coursing clubs in Ireland for which records were available between 1988/89 and 2003/04.

Welfare (1977/79) suggested that 77% of hares that were killed during courses using unmuzzled dogs experienced rapidly fatal chest injuries and that 34% had their neck broken by a steward; 15% of which had sustained abdominal injuries and/or broken spines and legs prior to euthanasia. Anti-hunting organisations cite both welfare and high mortality as their main objections to hare coursing (ICABS 2005; LACS 2005). In an attempt to reduce hare mortality, the Irish Coursing Club (the governing body of coursing in Ireland) implemented compulsory dog muzzling in 1993. However, the welfare implications of coursing and the efficacy of this step remained the focus of heated debate (ICABS 2005; LACS 2005). Using official records and video recordings spanning 20 years, we evaluated efforts to improve animal welfare and decrease hare mortality by comparing the outcomes of courses using unmuzzled and muzzled dogs.

Materials and methods

Irish Coursing Club records

The official records of the Irish Coursing Club (ICC) are reported annually to the Department of the Environment, Heritage and Local Government in the Republic of Ireland. Records were examined for all coursing club meetings in Ireland between the coursing seasons 1988/89 and 2003/04. The numbers of active clubs per season and the number of hares taken from and released back into the wild were collated. Mortality was taken as the difference between the number captured and the number released. Approximately 13% of records were missing data on the numbers of captures but data on the numbers of releases were always present. Capture data were missing entirely for 1995/96 and 1997/98. The reasons for missing data are not known. For descriptive purposes only, missing capture data were interpolated using the number of hares released and mean mortality for the specific season. For 1995/96 and 1997/98 data were interpolated using mean hare mortality after 1993, ie after the implementation of muzzling.

Video recordings

Video footage of completed courses during the annual 3-day National Coursing Meeting held at Clonmel, Co Tipperary (52°19'25" N, 07°38'08" W) during late February each year were obtained from Bart J Arnold Sound & Communications Systems, Fermoy, Co Cork. Recordings of meetings were examined at three year intervals between 1984-2002, whilst data were directly collected by one of the authors (NR) during the 2005 event. The outcome of all courses completed during these years, were categorised on an ordinal scale of their impact on the hare: 1) 'Straight run': the hare escaped by a straight run without interaction with the dogs; 2) 'Minor chase': the hare evaded capture by making relatively small deviations from a straight run; 3) 'Major chase': the hare escaped after an extended pursuit involving one or more evasive 360° turns; 4) 'Physical contact': the hare escaped but stumbled and/or fell as a result of direct contact with the dogs or their muzzles, and 5) 'Death': the hare did not escape and was either killed by the dogs or severely mauled and retrieved by a steward and euthanased. These outcomes were further categorised according to their sporting value. Minor chases, Major chases and Physical contacts provided the best means to judge the dogs' performance and were categorised as 'desired' sporting outcomes. Straight runs make it more difficult to judge the dogs' performance and were categorised with Deaths as 'undesired' sporting outcomes.

A random sample of 100 courses with unmuzzled dogs and 200 courses with muzzled dogs were examined in greater detail. The duration of the head start (the time between the release of the hare and the release of the dogs) and the total duration of each course were recorded to the nearest 0.1 s using a stopwatch. The total duration of courses categorised as Straight runs, where the hare neither deviated off line nor was interfered with by the dogs, was used to calculate hare running speeds over a course distance of 366 m.

Statistical analyses

Descriptive statistics were used to clarify trends in the official records between 1988/89 and 2003/04. Standard deviations, denoted hereafter by the symbol ±, are presented with mean values. Factors affecting the number of hares released per club were analysed by fitting a linear mixed model using the REML procedure (Patterson & Thompson 1971). Yearly data were treated as repeated measures, the use of muzzled or unmuzzled dogs was a fixed factor, the number of captures per club per year was treated as a covariate, and coursing club was treated as a random factor. Prior to analysis all variables were tested for colinearity

Table 1 Summary of Irish Coursing Club records between 1988/89–2003/04.

Status of dogs	Year	Number of hares captured	Number of hares released	Number of hares not released	Number of active clubs	Mean (± SD) hares captured per club	Mean (± SD) percentage mortality of hares per club
Unmuzzled	1988/89	6,644*	5,590	1,054*	79	84.1 (± 17.2)	16.0 (± 8.8)
	1989/90	6,709*	5,636	1,073*	79	84.9 (± 16.0)	16.0 (± 9.7)
	1990/91	6,373	5,315	1,058	77	82.8 (± 17.6)	17.3 (± 1.8)
	1991/92	6,569	5,617	952	77	85.3 (± 15.9)	14.5 (± 7.4)
	1992/93	6,756	5,722	1,034	78	86.6 (± 15.6)	15.2 (± 6.7)
Sub-total	–	33,051	27,880	5,171	390	84.7 (± 16.5)	15.8 (± 9.1)
Muzzled	1993/94	5,866*	5,427	439*	73	80.4 (± 14.9)	7.6 (± 4.9)
	1994/95	5,921	5,650	271	76	77.9 (± 14.6)	4.7 (± 5.9)
	1995/96	6,265*	6,006	259*	77	81.4 (± 16.7)	4.2 (± 0.7)
	1996/97	6,224	6,024	200	74	84.1 (± 13.7)	3.4 (± 0.5)
	1997/98	6,133*	5,882	251*	78	78.6 (± 14.4)	4.1 (± 0.1)
	1998/99	6,050	5,804	246	76	79.6 (± 17.8)	4.4 (± 0.9)
	1999/00	6,507	6,294	213	78	83.4 (± 18.2)	3.4 (± 0.5)
	2000/01	5,877	5,570	307	76	77.3 (± 13.9)	5.5 (± 1.4)
	2001/02	6,005	5,823	182	76	79.0 (± 15.6)	3.3 (± 0.5)
	2002/03	5,877	5,720	157	75	78.5 (± 15.9)	2.7 (± 0.4)
	2003/04	5,751	5,608	143	71	81.0 (± 17.4)	2.3 (± 0.6)
Sub-total	–	66,476	63,808	2,668	830	80.1 (± 15.9)	4.1 (± 5.9)
Total	–	99,527	91,688	7,839	1,220	81.6 (± 16.2)	7.9 (± 8.9)

* Partially complete records were interpolated.

Table 2 Factors affecting the number of hares released by coursing clubs from a REML linear mixed model.

Explanatory variables	F_{df}	*P*-value
Captures	$139.45_{1,902}$	< 0.001
Muzzling	$72.29_{1,902}$	< 0.001
Club*muzzling	$2.78_{76,902}$	< 0.001
Captures*muzzling	$228.07_{1,902}$	< 0.001
Year	$10.61_{1,902}$	0.001
Club*year	$3.28_{79,902}$	< 0.001
Captures*year	$88.03_{1,902}$	< 0.001
Club	$4.65_{80,902}$	< 0.001
Captures*club	$1.73_{79,902}$	< 0.001

using correlation, ensuring that none of the variables were significant bivariates ie $r > 0.7$ (Fielding and Haworth 1995). Model parsimony for each possible permutation of variables was evaluated using Akaike's Information Criterion (AIC; Akaike 1983) with the most parsimonious model selected on the basis of the lowest AIC value. The influence of each term in the final model was described by the *F* statistic taken as the Wald statistic (which corresponds to a χ^2 distribution), generated when the term of interest was fitted last (Kruuk *et al* 1999), divided by the degrees of freedom (Quinn & Keough 2002). To assess the change in strength of the relationship between the number of hares caught on hare survival over the study period, within-year linear regression coefficients were plotted against time.

For video data, the influences of muzzling (treated as a factor) and year (treated as a covariate) on the outcome of coursing events were examined using an ordinal regression model. A general linear model was also fitted to assess the effect of variation in the duration of the hare's head start on the likelihood of different outcomes (treated as an ordinal response) during courses with unmuzzled and muzzled dogs.

GenStat© (v6) was used for linear mixed model analysis, while all other statistical tests were performed using SPSS© (v12).

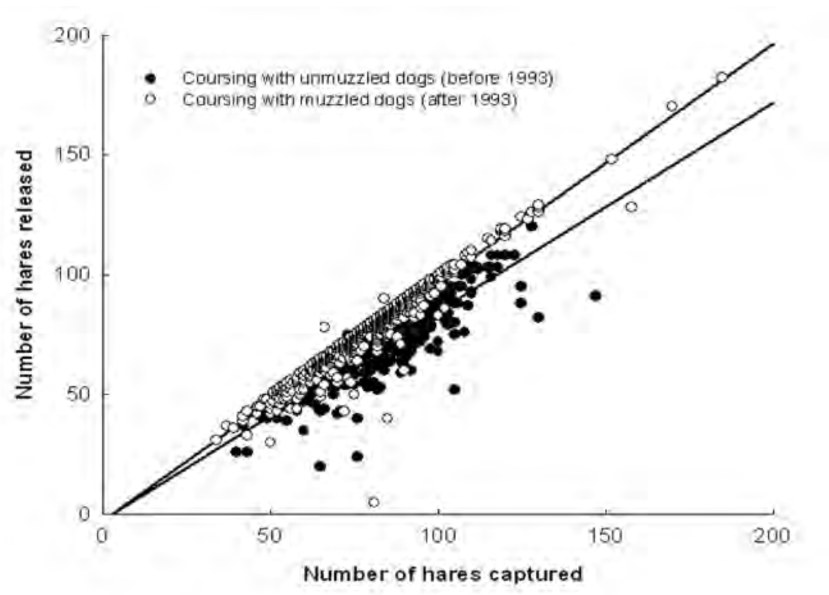
Results

Irish Coursing Club records

The records of 81 clubs conducting 1,220 coursing meetings (390 with unmuzzled dogs and 830 with muzzled dogs) over 16 seasons were analysed. The number of hares caught per club and the number of active clubs decreased over the period of study (Table 1). The mean mortality of hares decreased from 15.8 ± 9.1%, n = 390 (club-years) to 4.1 ± 5.9%, n = 830 (club-years) after the introduction of dog muzzling. The total mean number of hares killed during coursing when dogs were unmuzzled decreased from 1,034 ± 48.0 to 243 ± 82.2 hares per year when dogs were muzzled.

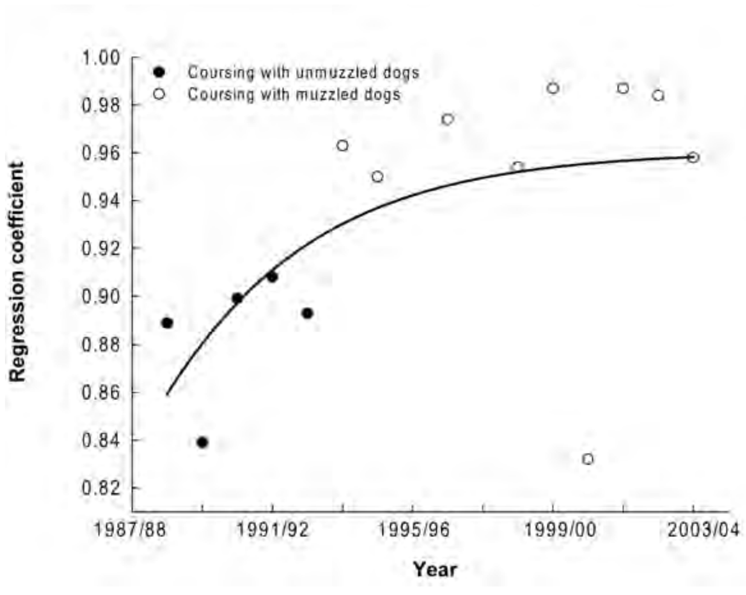
Clearly, the number of hares released back into the wild is related to the number of hares caught. Factors affecting variation in hare survival therefore, were identified by significant interactions with this variable (Table 2). The number of hares released significantly increased when dogs were muzzled and the scale of this effect varied among

Figure 2



Relationship between the number of hares captured and the number of hares released during coursing using unmuzzled (n = 386 club-years) and unmuzzled dogs (n = 675 club-years).

Figure 3



Regression coefficients of the relationship between the numbers of hares released and captured between 1988/89 and 2003/04. * During 2000/01, two out of 76 clubs experienced unusual rates of hare mortality.

clubs. Muzzling dogs affected the relationship between the number of hares released and the number captured. More hares were released relative to the number caught when dogs were muzzled than when dogs were unmuzzled (Figure 2). This indicates that muzzling dogs increased hare survival.

The number of hares released varied among years, and these trends varied among clubs. The relationship between the number of hares released and those captured also varied among years (Figure 3), indicating that hare survival increased over the period studied for reasons that could not be accounted for by the effect of muzzling dogs alone. The number of hares that were released back into the wild varied among clubs and the relationship between the number of hares released and the number of hares captured varied among clubs, indicating that hare survival also varied among clubs. During 2000/01 the strength of relationship between the number of hares captured and released was atypical of the overall trend exhibited from 1988–2004 (Figure 3). Two of the 76 clubs of that year experienced highly unusual rates of mortality. One club released 18.2% more hares than were caught, whilst another had an exceptionally high rate of mortality at 94%.

Figure 4

Outcomes of filmed courses with unmuzzled and muzzled dogs at the Irish national meeting at Clonmel, Co Tipperary between 1984 and 2005. Sample size (n) is provided above each column.

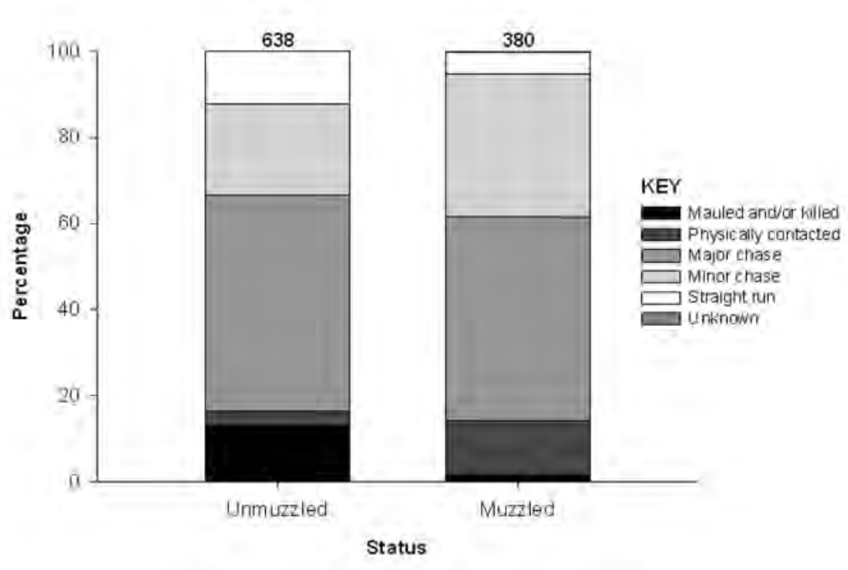
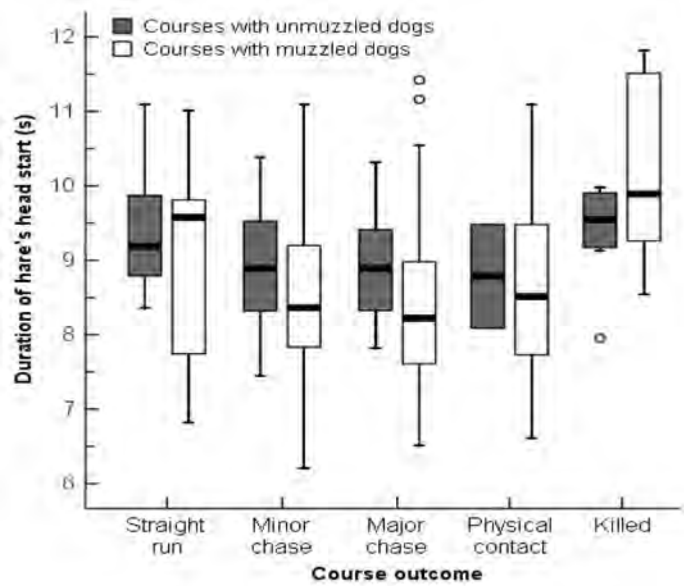


Figure 5

The effect of duration of the hare's head start on the outcome of courses with unmuzzled (grey boxes) and muzzled (white boxes) dogs (n = 300). Black lines denote medians, bars represent the upper and lower quartiles, whiskers denote the extremes of the ranges and open circles denote outliers.



Video recordings

A total of 1018 courses were examined. The outcome of filmed courses differed according to whether dogs were unmuzzled or muzzled (Figure 4). Annual hare mortality in filmed courses was 13.2 ± 2.8% with unmuzzled dogs (n = 4 years including 638 courses) compared to 1.8 ± 0.9% with muzzled dogs (n = 4 years including 380 courses). The percentage of courses where the outcome was Physical contact between the hare and the dogs increased from 3.4 ± 2.3% using unmuzzled dogs to 12.8 ± 3.0% using muzzled dogs. The outcome of courses did not vary across years ($F_{1,1007}$ = 0.026, ns), but was affected by the muzzling of dogs ($F_{1,1007}$ = 7.176, $P < 0.01$). The muzzling of dogs had a significant effect on course outcomes within years ($F_{1,1007}$ = 7.200, $P < 0.01$).

The mean duration of each course was 37.3 ± 6.3 s (n = 300 courses). During Straight runs, the mean running speed of hares was 43.3 ± 1.8 km h^{-1} (n = 20 courses). In courses with unmuzzled dogs, hares were given head starts of significantly greater duration (mean = 9.0 ± 0.8 s, n = 100 courses) than in courses with muzzled dogs (mean = 8.6 ± 1.1 s, n = 197 courses, $F_{1,294}$ = 9.49, $P < 0.01$). The duration of the head start significantly affected the outcome of the course ($F_{1,291}$ = 4.43, $P < 0.01$, Figure 5). In courses that had 'undesired' sporting outcomes hares had been given head starts of greater duration (mean = 9.4 ± 1.1 s, n = 33 courses) than in those that had 'desired' sporting outcomes (mean = 8.6 ± 1.0 s, n = 264 courses, $F_{1,294}$ = 14.51, $P < 0.001$).

Discussion

Hare mortality during coursing

This is the first study that examines the factors associated with hare mortality during coursing and evaluates attempts made to improve animal welfare. Rates of hare mortality reported by the ICC when using unmuzzled dogs (15.8%) and those observed in video footage (13.2%) are comparable to those reported by the National Coursing Club in Great Britain (13.0%) prior to the ban in England and Wales (Burns *et al* 2000). After the implementation of compulsory dog muzzling in Ireland, hare mortality during courses decreased to 4.1% in ICC records and 1.8% in video records. The percentage of hares experiencing direct physical contact by dogs was greater in courses using muzzled dogs than courses using unmuzzled dogs. Obviously, muzzled dogs are incapable of biting hares that they intercept as had previously been possible during events with unmuzzled dogs. However, hares may be buffeted and pawed by muzzled dogs resulting in stumbling, falling or mauling. It is possible, therefore, that some hares may receive injuries that cause pain and suffering that may compromise their subsequent survival. Furthermore, mortality resulting from mauling by muzzled dogs may not follow as swiftly as mortality resulting from being bitten and mauled by unmuzzled dogs. Irish Coursing Club directives (Anon 2002) require the presence of 'dispatchers' to intervene should a hare have difficulty and a veterinary surgeon should always be present to examine hares that have been hit by the dogs. If necessary hares are euthanased by concussion or dislocation of the neck.

Video records, therefore, underestimate overall hare mortality by excluding deaths that occur in captivity before or after the filmed event. Other causes of mortality apart from the actual course that may account for discrepancies between the number of hares released and those caught may include natural causes and injury, stress or disease resulting from capture or confinement. The level and causes of mortality specifically associated with capture are unknown. The increase in hare survival over the period studied was not explained by the muzzling of dogs alone. ICC directives advocate holding captive hares in naturalised paddocks, artificial feeding, the treatment of hares for parasitic infections, veterinary assistance when required, the use of hares for coursing only once in every 24 hour period and their prompt return to the wild (Anon 2002). Such efforts to improve the husbandry of captive hares may have contributed to increases in hare survival in addition to that achieved by muzzling dogs. Variation among clubs in rates of hare survival suggests that some may implement hare husbandry procedures to greater effect than others.

Implications for animal welfare

Hares, like deer, are evolutionarily adapted for short sprints at high speed to evade capture by terrestrial predators. Bateson and Bradshaw (1997) demonstrated that prolonged pursuits during deer hunting lead to physiological stress such that major tissue breakdown had begun by the time the hunted animals were shot. Unlike the protracted pursuit of deer during hunting, the short pursuit of hares during coursing may emulate more closely the evasive behaviour exhibited by hares in the wild. Physiological studies comparable to those of Bateson and Bradshaw (1997) would make a valuable contribution to assessing the levels and effects of stress in coursed hares.

Since the object of coursing is to judge the ability of the dogs, courses that end with the hare escaping by a Straight run or the hare being killed are both undesired outcomes from the sporting point of view. The duration of the head start given to the hare in both cases is similar but greater than those given to hares in courses with desired outcomes (ie the hare was turned and chased but survived). This suggests that hares that accelerate slowly at the beginning of the course either provide a burst of speed after the release of the dogs enabling them to escape with a straight run, or are incapable of the necessary speed required to escape and are killed. Our data suggest that hares that cover the initial head start distance (≥ 75 m) sufficiently quickly exhibit an appropriate level of acceleration and running ability to enable them to escape whilst providing a 'sporting' chase. Hares that do not reach this distance within a specific time (our data suggest a figure of 8.6 seconds) should not be coursed as it is increasingly likely that the course will have an undesired outcome. Better selection of hares by assessment of their running ability prior to and during a course may provide means to reduce hare mortality further whilst minimising the number of courses that are difficult to judge. Running speed within mammal species has been correlated with body condition and morphology (Trombulak 1989; Galisteo *et al* 1998; Schulte-Hostedde & Millar 2002). Further investigation of correlates with running speed in hares may provide means for the selection of animals at the point of capture, thereby potentially reducing the number taken from the wild.

Implications for wild populations

This paper deals only with the direct impact of coursing on hares as conducted under ICC rules and demonstrates that hare mortality between capture and release was lower following the implementation of compulsory dog muzzling and continues to decline each year. However, the dual effects of removing hares from the source population and of returning coursed hares to the wild are not considered here and remain poorly understood. Hare populations are relatively resilient to culling pressure due to high potential productivity (Macdonald *et al* 2000) and previous authors have suggested annual adult removal rates of < 20–49% may be sustainable (Bröekhuizen 1976; Stoate & Tapper

1993; Marboutin *et al* 2003). The most recent estimates of the total hare population of the Republic of Ireland (233,000 and 535,000 hares, during 2006 and 2007 respectively; Reid *et al* 2007) suggest that mortality during coursing (assuming mean mortality post-1993) removes $\leq$ 0.1% of the total adult population annually. Therefore, at its current level, mortality during coursing is likely to have negligible effect on the hare population of Ireland. Nevertheless, familiarity of individual hares with their home range appears key for survival and reduced mortality (Dahl 2005) and this may be affected by removal from their range, albeit temporarily. Moreover, many mammal populations are genetically subdivided resulting from social organisation, specific mating systems and low dispersal rates (Chepko-Sade & Halpin 1987). Localised social hierarchies of hares (Graf 1985; Holley 1986) may be disrupted by animal removal and replacement, causing social instability that may lead to reduced reproductive success for individuals and a population. Conversely, periods of captivity, veterinary attention, treatment with anthelmintics and artificial feeding during captivity may actually improve pre-breeding condition and subsequent fitness (Murray *et al* 1998; Dyrcz *et al* 2005; Molony *et al* 2006). For example, overwinter survival of Scottish mountain hares (*Lepus timidus scoticus*) can be significantly improved by supplementary feeding, increasing male body mass and allowing females to breed earlier while treatment with Ivermectin (22, 23 dihydroavermectin B_{1a} + 22, 23 dihydroavermectin B_{1b} — a broad spectrum anti-parasite medication) can significantly improve female fecundity (Newey *et al* 2007). Furthermore, translocation of animals among subpopulations may increase genetic heterosis and combat problems such as inbreeding, associated with habitat fragmentation. Recent translocation experiments have been successful in determining the effect of short- and long-term captivity and handling stress on mammals, as well as post-release survival, behaviour and the impact of translocations on donor and recipient populations (Molony *et al* 2006; Paci *et al* 2006). Similar work is necessary to establish the overall impact of coursing activities on wild hare populations.

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