

People's Trust for Endangered Species'
case for retaining mountain hare on Schedule 5 (Scotland) and
adding on Schedule 5 (England & Wales) in response to
JNCC's consultation on Wildlife & Countryside Act (1981) Quinquennial Review 7
28 January 2022

Mountain hare (*Lepus timidus*) is the only native lagomorph in Britain. Populations are mainly restricted to Scotland's high ground and a small population remains in the Peak District in England. In Scotland the species' conservation status was downgraded from 'Favourable' (JNCC 2013) to 'Unfavourable-Inadequate' in a 2012–2018 assessment. Hunting and management of game were highlighted as key pressures on mountain hares. The lack of data to provide robust population estimates and trends was also cited as an issue (JNCC 2019). Consequently, in March 2021, mountain hares were included on Schedule 5 of the Wildlife & Countryside Act 1981 (as amended), giving them full protection. Moves to reverse this recent increase in protection would seriously undermine conservation efforts to protect this species. JNCC is strongly urged to maintain their position on this species and give it full protection in Scotland and England under Schedule 5.

Eligibility criteria

It is required that the species is considered for country protection under international obligations, since it is listed on Bern Convention Appendix III. The mountain hare is also a species of 'Community interest' listed on Annex V of the Habitats Directive and so has some protection under the Habitats Regulations 1994 (as amended).

It is unclear how the species will be assessed for eligibility under the criteria relating to Red List status. In the UK the mountain hare is categorised as Near Threatened. Current JNCC proposals recommend that species categorised as Near Threatened (IUCN Red List) can be considered for scheduling where *there is demonstrable evidence that the species is likely to become so [Endangered] unless conservation measures are taken.*

We assert that both populations of mountain hares in Scotland and England are eligible for substantive reasons based on different aspects of their population dynamics. In both countries the species faces similar threats which we describe further below.

Scotland

The central tendency of census estimates for Scotland has decreased from 350,000 (95% CI: 93,000-709,000) (JNCC 2007) to 132,000 individuals (95% CI: 79,000-516,000) (JNCC 2019).

We reject the Mammal Society's information regarding its justification for Red List category for two reasons. 1) Their assessment was based on game bag data, susceptible to bias. 2) The description of a 40% decline from 1995 to 2006 as "not significant" was based on the classical frequentist statistical definition of "significance" based on comparing mean estimates having different distributions measured with 2 standard deviations. However in cases of wide population estimate variance it is often preferable to refer to median values, rather than mean frequency distributions (Mills 2013). Yet we consider even such median values as inadequate and too simplistic for describing population dynamics. Instead, population assessments should instead estimate probability and time to extinction (Mills 2013). Notwithstanding, if this definition of "significant" were applied to the above JNCC 2007 values, the mean estimate would require to decline to a mean of ~ 98,000 to be considered "significant". Already the JNCC (2019) estimate shows a decrease by 77% to 132,000. This is a substantial downward trajectory approaching ~98,000 and requires mitigation.

Therefore we recommend corrective legal protection and management be both maintained and implemented to help recover mountain hare population to former levels.

England

The mountain hare's Red List status in England is Not Evaluated. Although the species died out in England around 6,000BP¹, according to JNCC's eligibility criteria, it is still a native species². However, under the IUCN Red List guidelines, only species present after the year 1500 CE are eligible, so the English mountain hare population was not assessed.

The English mountain hare population is small, with no inward migration. Systematic survey estimates by Bedson and colleagues at Manchester Metropolitan University report overall population for mountain hares in the Peak District as 3,500 individuals (95% CI: 2,000-5,600) (Bedson Thesis unpublished). This is below the minimum viable population threshold of 4,000 individuals for medium-sized herbivores, rendering this population at substantial risk of extinction (Traill *et al.* 2007)

Decision criteria

UK mountain hare populations face numerous threats which are likely to compound one another. In Scotland climate change forecasts suggest the mountain hare range will shift northwards (Anderson *et al.* 2009). There is also evidence that mountain hares are camouflage mis-matched with 35 days less snow cover per year making the species increasingly vulnerable to predation (Zimova *et al.* 2020). In England it is predicted the mountain hare range will shrink from 168km² to 20km² rendering this population high unviable (Bedson *et al.* 2021). More widely climate change is driving lagomorphs in the northern Hemisphere to higher ground or northwards (Leach *et al.* 2015).

In Scotland the distribution of the population appears stable, although areas of southern Scotland show >50% decrease over the last twenty years (Hesford *et al.* 2020). There are further conflicting reports. Watson & Wilson (2018) showed population declines of up to 99% on surveys of 48 grouse moors. By contrast Hesford *et al.* 2019 reported medium densities (~20 hares / km²) on their surveyed grouse moors. However, in England, systematic surveys report 60% fewer mountain hares on grouse moors than blanket bog (Bedson, Thesis unpublished).

In Scotland the mountain hare lies at the very edge of its range across Europe and has the lowest genetic diversity of all hare species across Europe (Hamill *et al.* 2006). It has inbreeding coefficient 0.31 and is thus similar to cheetah (0.39) and Mexican wolf (0.42). Such low genetic diversity values are often contributors to extinction risk (Frankham *et al.* 2013). Investigations of genetic diversity in England are under way and it is anticipated this will also be reported as low.

In Sweden and Ireland mountain hares are becoming increasingly outcompeted, hybridised or replaced by European brown hares (Thulin *et al.* 2021; Caravaggi *et al.* 2015). For Scotland there is no information regarding the increasing risk to mountain hares from European brown hares. In England the two species were described as not presently sharing habitat, although climate change scenarios suggest the two species may converge in future (Bedson *et al.* 2021).

Mountain hare populations are known to cycle with amplitude of 90%, caused by intestinal parasites affecting fecundity (Newey *et al.* 2007). The most recent disease threat is RHDV2 virus which can reduce lagomorph populations by 80% (Buehler *et al.* 2020).

¹ Yalden, D.W. and Harris, S., 2008. Mammals of the British Isles: handbook.

² https://consult.defra.gov.uk/joint-nature-conservation-committee/911c8988/QQR7_stakeholder_consultation_25-01-2022.docx

In England roadkill accounts for losses of 150 - 300 mountain hares per year (Bedson Thesis, unpublished). In Scotland roadkill is known to occur extensively at some locations in the Cairngorms.

Whilst none of the above threats can be addressed by listing on Schedule 5, they provide evidence of the mounting pressures the species faces both in Scotland and England. What listing can and does do is provide protection from the additional pressure of culling which, without protection, has the opportunity to escalate to levels that are unsustainable when considering these other threats. Mountain hares are under pressure across their range due to intentional (or reckless³) killing or injuring due to persecution (coursing, shooting, snaring, hunting with dogs) and therefore require continued and extended protection under Section 9(1). Lethal control measures carried out on game estates in Scotland resulted in an average 25,000 mountain hares being killed annually.⁴ Evidence has been reported of at least 33 lethal control incidences in England over the past eight years (Bedson Thesis, unpublished). Substantial changes in the species' range have been reported over a twenty-year period varying across region and different management types, suggesting further studies are needed to understand population dynamics at a more local scale⁵. Local population impacts are likely where lethal control is intensive, given the relative difficulty of recolonisation. Consequently lethal control could represent a significant limiting factor in mountain hare distribution, range and population.

We recognise that for practical reasons the present criteria for assigning legal protections and conservation measures are based on rule of thumb measures e.g. population size, habitat size. We have concerns regarding these since philosophically they imply "what is the least number of individuals that would ensure the survival of a species?" With such logic, one would set the minimum population target for mountain hares in Scotland to just 4,000 individuals which would match that of the persisting population in England. Clearly such a move would be deleterious to the present population of Scotland.

Instead we advocate philosophies such as "population stocks should not be permitted to diminish beyond the point at which they cease to be important functioning elements of the ecosystem of which they are a part". We recommend that conservation assessments should provide probabilistic models of the extinction risk for a species and set goals of maintaining for example <1% risk of extinction in 100 years. Such models require detailed knowledge of population structure and dynamics, demographics and environmental stochasticity. Accordingly we recommend full legal protections to be maintained until at least as sufficient monitoring research has been produced which can robustly inform such assessments.

The large decline in the UK mountain hare population in 2007-2017 and the range of current threats, some of which are projected to intensify, make it imperative that the mountain hare is listed on Schedule 5 across its current range.

This evidence has been collated and is being submitted jointly by People's Trust for Endangered Species and the Hare Preservation Trust.

Annex 1. Mammal Society's justification for the UK Red List category⁶:

³ Only applies in Scotland

⁴ <https://theferret.scot/38000-mountain-hares-killed/>

⁵ <https://www.gwct.org.uk/wildlife/research/mammals/mountain-hare/distribution-of-mountain-hare-populations-in-scotland-across-20-years/>

⁶ Mathews F, and Harrower C. (2020). IUCN – compliant Red List for Britain's Terrestrial Mammals. Assessment by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage. Natural England, Peterborough ISBN 978-1-78354-485-1

Population size estimation is extremely difficult for this species due to lack of data, highly variable population density and population cycles, and potential for species misidentification. The only substantial dataset with reliable identification covering the species' full range is the National Gamebag Census, which suggests cyclical fluctuations in culls. The confidence intervals for trends are extremely wide, partly reflecting this cyclical variability, and whilst the trend between 1995 and 2006 is for a 40% decline, this is not statistically significant (95% CI -70% to 22%). Similar patterns are observed over longer time-frames in this dataset. However, beyond suggesting cyclical fluctuations, the data are difficult to interpret in terms of population trends owing to the status of the species as quarry. As in the Review of the Population and Conservation Status of British Mammals (Mathews *et al.* 2018), data from the BTO breeding bird survey are considered unreliable for this species. Patton *et al.* (2010) estimated that 25,000 mountain hares were shot in 2006-07 in Scotland: this is a substantial proportion of the total population estimated here. Recently, an analysis of spring transect counts at 42 moorland sites suggested that the population index had declined by 31% per year between 1999 and 2014, with the most severe reductions being on sites subjected to burning for grouse-habitat management (Wilson & Watson 2018). If these results were replicated nationally then it would clearly result in a classification of CR under A2bcd+4bcd. However, these catastrophic declines contrast with trends presented by Hesford *et al.* (2019), based on spring transect counts at 76 blocks on 33 moors, which imply a stable population over the last 16 years, with some evidence of population increases in sites most actively used for grouse-shooting. In both cases, sites were not studied in every year, and there are potential confounding effects from the stage of the population cycle that the site was at in at the time of the counts. Importantly, it is not clear whether either study can be generalised, as the study sites were not randomly selected. The population impacts of culls at a national scale are therefore unclear; but local population impacts are likely where culling is intensive, given the relative difficulty of recolonisation; and this may have a wider-scale impact on population viability. Declines $\geq 20\%$ in 10 years are plausible which gives a classification of NT under A2bcd+4bcd. Further evidence is urgently required since re-evaluation may move the species to the Vulnerable.

References

- Anderson, B.J., Ackakaya, H.R., Araujo, M.B., Fordham, D.A., Martinez-Meyer, E., Thuiller, W. & Brook, B.W. (2009). Dynamics of range margins for metapopulations under climate change. *Proceedings of the Royal Society* (276): 1415-1420 <https://doi.org/10.1098/rspb.2008.1681>
- Bedson, Thesis, Unpublished. Population assessment of the mountain hares (*Lepus timidus*) of England: distribution, abundance and genetics. Submitted 10 August 2021 as requirement for PhD Manchester Metropolitan University, UK.
- Bedson, C.P.E., Devenish, C., Symeonakis, E., Mallon, D., Reid, N., Harris, W.E. & Preziosi, R. (2021b). Splitting hares: Current and future ecological niches predicated as distinctly different for two congeneric lagomorphs. *Acta Oecologica* 111: 103742 <https://doi.org/10.1016/j.actao.2021.103742>
- Buehler, M., Jesse, S.T., Kueck, H., Lange, B., Koenig, P., Jo, W.K., Osterhaus, A. & Beineke, A. (2020). Lagovirus europeus GI.2 (rabbit hemorrhagic disease virus 2) infection in captive mountain hares (*Lepus timidus*) in Germany. *BMC Veterinary Research* 16: 166 <https://doi.org/10.1186/s12917-020-02386-4>

Caravaggi, A. *et al.* 2016. An invasive-native mammalian species replacement process captured by camera trap survey random encounter models. – *Remote Sens. Ecol. Conserv.* 2(1): 45–58.

Frankham, R., Ballou, J.D. & Briscoe, D.A. 2013. *Introduction to Conservation Genetics*. Cambridge University Press.

Hamill, R.M., Doyle, D. & Duke, E.J. 2006 Spatial patterns of genetic diversity across European subspecies of the mountain hare, *Lepus timidus* L. *Heredity* (97) 355-365

Hesford, N., Fletcher, K., Howarth, D., Smith, A.A., Aebischer, N.J. & Baines, D. (2019). Spatial and temporal variation in mountain hare (*Lepus timidus*) abundance in relation to red grouse (*Lagopus lagopus scotica*) management in Scotland. *European Journal of Wildlife Research* 65: 33 DOI 10.1007/s10344-019-1273-7

Hesford, N., Baines, D., Smith, A.A. & Ewald, J.A. (2020). Distribution of mountain hares *Lepus timidus* in Scotland in 2016/2017 and changes relative to earlier surveys in 1995/1996 and 2006/2007. *Wildlife Biology* 2020 doi: 10.2981/wlb.00650

JNCC (2007). Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Conservation Assessment for: S1334: *Lepus timidus* – Mountain hare. Peterborough: JNCC.. Available from: www.jncc.gov.uk/article17

JNCC (2019). Fourth Report by the UK Under Article on the implementation of the Directive from January 2013 to December 2018. Conservation Assessment for: S1334: *Lepus timidus* – Mountain hare. Peterborough: JNCC.. Available from: www.jncc.gov.uk/article17

Leach, K., Kelly, R., Cameron, A., Montgomery, W.I. & Reid, N. (2015b). Expertly validated models and phylogenetically-controlled analysis suggests responses to climate change are related to species traits in the Order Lagomorpha. *PLoS ONE* 10(4): e0122267. doi:10.1371/journal.pone.0122267

Mills, L.S. 2013. *Conservation of wildlife populations*. Wiley Blackwell. Chichester UK.

Newey, S., Willebrand, T., Haydon, D.T., Dahl, D.T., Aebischer, N.J. Smith, A.A. & Thirgood, S.J. (2007). Do mountain hare populations cycle? *Oikos* 116 (9): 1547-1557 <http://www.jstor.org/stable/40235205>

Thulin, C-G., Winiger, A., Tallian, A.G. & Kindberg, J. 2021. Hunting harvest data in Sweden indicates precipitous decline in the native mountain hare subspecies *Lepus timidus sylvaticus* (heath hare). *Journal for Nature Conservation* 64:126069. <https://doi.org/10.1016/j.jnc.2021.126069>

Traill, L.W., Bradshaw, C.J.A. and Brook, B.W. 2007. Minimum viable population size: A meta-analysis of 30 years of published estimates. *Biological Conservation* 139: 159-166 doi:10.1016/j.biocon.2007.06.011

Watson, A. & Wilson, J.D. (2018). Seven decades of mountain hare counts show severe declines where high-yield recreational game bird hunting is practised. *Journal of Applied Ecology* DOI: 10.1111/1365-2664.13235

Zimova M., Giery S.T., Newey, S., Nowak J.J., Spencer M., Mills L.S.. 2020 Lack of phenological shift leads to increased camouflage mismatch in mountain hares. *Proceedings of the Royal Society of Biological Sciences* 287 (1941) 20201786. <https://doi.org/10.1098/rspb.2020.1786>