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Research Article

Saving the common hamster (*Cricetus cricetus*) from extinction in Alsace (France): potential flagship conservation or an exercise in futility?

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Abstract

Following censure by the European Court of Justice on 09 June 2011 (Case C-383/09) for failing to provide sufficient protection for the common hamster (*Cricetus cricetus*, Linn. 1758) on its territory, the French government, in concert with local stakeholders, has endeavoured to enact measures to prevent the localised extinction of this species in France. Although the common hamster has a wide distribution in Europe, in France it is restricted to a tiny pocket west of the Rhine in Alsace (representing the westernmost tip of its range). With an uncommitted official administration, saving a species with a history of causing significant agricultural damage was always going to prove challenging. However, as a species strongly tied to agriculture, the common hamster has the potential to highlight the problems of intensive farming practices for biodiversity in this region and thereby promote more sustainable alternatives. The story of the conservation effort for common hamsters in Alsace has lessons for other species and areas, perhaps not in terms of the approach used, but with regard to the difficulties that must be overcome.

Introduction

Given that hamsters are a well-recognised laboratory animal and pet, the common hamster could command considerable charismatic status for conservation campaigns and, yet, it does not. Widely regarded as an agricultural pest, the species has been extensively hunted, with concerted campaigns to exterminate the species from certain localities. Though it occurs across a broad swath of Central and Eastern Europe, the distribution of the common hamster has been contracting and becoming more fragmentary (Reiners et al., 2014), with this scenario predominating in the western-most part of its range. Changing agricultural practices, which once contributed to range expansion and seemingly exponential population growth, now threaten the species with regional extinction.

In France, only an isolated population remains in the area surrounding the city of Strasbourg, west of the river Rhine (Alsace) (see Fig. 1). This population has declined so dramatically in the past two decades that, in 2011, the European Court of Justice (ECJ) was prompted to warn France of its obligations under the Habitats Directive to protect the species on its territory and to prevent it from disappearing from the Alsace plains. Cognisant of the punitive sentence that the ECJ could inflict, the French Government, together with relevant local partners, had endeavoured to employ various conservation strategies in the lead up to the ECJ hearing. However, despite two conservation plans having been completed (and another still on-going), the plight of the common hamster in Alsace remains unchanged. Whether this predicament is due to inadequate government protection, apathy among the local populace or an artefact of isolation at the edge of its range, the outcome of the protective measures for the common hamster in France is relevant to many threatened species in this intensively-managed agricultural landscape.

An endearing pest...

The common hamster is a medium-sized fossorial rodent (weight=150-550 g, length=23–34 cm) (Capber, 2011). They live singly in individual burrows, making census easy since a re-opened burrow in April (following over-winter hibernation) corresponds to one individual. Hibernation is followed by a frenetic reproductive period from April to August, during which a female can produce 1–3 litters of 3–15 pups (though more than eight is rare; Hoffmann, 2012) and pups can be reproductively active in their first year (Capber, 2011). Lactation can overlap with gestation of the next litter (Hufnagl, 2009), thereby condensing the reproductive season. Together, these factors contribute to a very high reproductive potential that should facilitate conservation measures by promoting rapid population growth. However, it should be noted that this reproductive potential is deemed to have diminished in recent decades (Monecke, 2013) and, combined with reduced population densities (Weinhold, 2008), extinction risk has now become greatly enhanced. Following the reproductive period, common hamsters concentrate on caching sufficient food reserves to see them through the encroaching winter. The vast majority (up to 80%) of the diet consists of vegetation (clover, wheat, barley, rye and alfalfa), which can occasionally be supplemented by earthworms, insects and even voles (Capber, 2011).

The species currently has a very broad distribution range; from the Sajan-Altai Massif in Central Russia west to Alsace (France) and Belgium. This range appears to be particularly tied to loess and soft loam soils (Vohralik, 2011; Banaszek et al., 2012). Coincidentally, such soils also tend to be the most fertile for agriculture, thereby explaining the incongruence of the current dependence of common hamsters on farming. Although arguments have been presented for the classification of a sub-species in Western Europe (*C. c. canescens*) (Weinhold, 1999), recent molecular evidence does not support this assertion. In fact, molecular data point to a northern and southern clade (Neumann et al., 2005); these cryptic lineages having consequences for conservation strategies in terms of reinforcing threatened populations.

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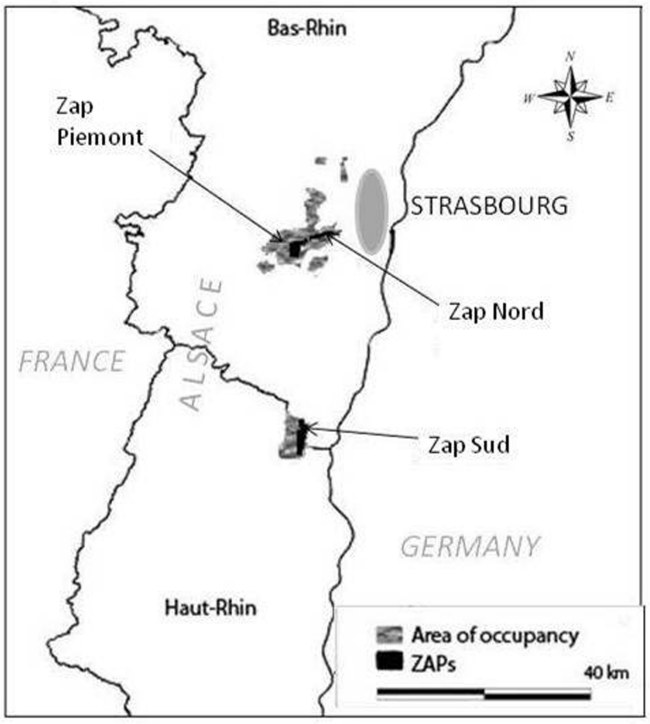

Figure 1 – Current distribution of the common hamster in Alsace and location of ZAPs.

The species has been considered an agricultural pest due to crop damage and was commercially trapped for its fur – in the late 1960s, over 1 million animals per year were caught in the Saxony-Anhalt region of Germany alone (Neumann et al., 2004). Common hamster populations are characterised by considerable natural population fluctuations (Pauly, 2007), and population explosions have been documented in Alsace in the 20th Century (Baumgarth, 1996). Currently, the species is listed as Least Concern globally in the IUCN's Red List of Threatened Species (IUCN, 2013). However, national populations in Belgium and France are critically endangered and recent population declines have been documented in Germany, Poland and Ukraine (Council of Europe, 2011; Monecke, 2013; Rusin et al., 2013; Korbut et al., 2014). Common hamsters are listed as Annex IV in the European Union (EU) Habitats Directive (92/43/EEC), and broader geographic protection is afforded under Appendix II of the Bern Convention; both of which categorise the species as "strictly protected".

Current status and threats in Alsace

The common hamster first populated Alsace in the Pleistocene (Baumgarth, 1996). In 1972, it was recorded in 329 communities (districts) in Alsace (MEDDE, 2012a), even though the 1960s were characterised by a government-funded extermination campaign (Baumgarth, 1996; Méchin, 2011). By 2012, hamsters only occurred in 19 communities (see Fig. 2) and 82% of the population lived in only 5 communities (MEDDE, 2012a). Even these last remaining areas are not contiguous, so this last remnant of the western-most range of the species is comprised of "dissociated populations", i.e. disconnected remnants of a metapopulation (Allentoft and O'Brien, 2011).

Though the causes of population declines across Europe are likely to vary (Monecke, 2013), a satellite imagery study demonstrated some of the threats faced by common hamsters in Alsace; extensive bare soils on emergence following hibernation and fragmentation of populations by road infrastructure (Battison et al., 2011). It is perhaps these two elements combined that are proving the greatest obstacle to recovery of the population in Alsace, although other factors (described below) undoubtedly play a contributory role or will prove influential in the future.

The relatively recent switch to maize monoculture on the plains of Alsace deprives hamsters of a food source in April when they emerge from their burrows. Previously, a mosaic of crop types (particularly winter cereals and alfalfa), arising from diversified farming practices in the region, ensured a ready supply of food during the active period of the hamsters' lifecycle. Nowadays, over 80% of the Alsatian plain is devoted to maize (Méchin, 2011). Once maize has been harvested in early autumn, the fields are typically deeply ploughed and left bare over the winter before being re-seeded in spring. Thus, for an extensive period of time and over an extensive area, the Alsace plain is bereft of vegetative cover. Not only does this situation mean a paucity of food for hamsters when they emerge following hibernation, but it also means a lack of cover, making the hamster more prone to predation (Weinhold, 2008). Complete harvesting of other relevant crops to the hamster in the late summer and autumn, followed by ploughing, often means that hamsters also do not have sufficient food stores built up (1–3 kg) by the time they hibernate (Wendt, 1991). Thus, not only are hamsters entering hibernation with inadequate food caches to see them through the winter, but there are limited food sources available to replenish reserves on emergence for those that do survive the winter. This shortage of vegetative cover is also a considerable problem for much of the wildlife on the Alsace plains.

Alsace is the third most populated metropolitan region in France (209 persons/km²) (Council of Europe, 2011) and it is growing rapidly through urbanisation (Méchin, 2011). A number of infrastructural projects have been undertaken and are envisaged to facilitate this economic growth, all of which serve to further isolate remnant populations of hamster and other fauna from each other. Despite its broad distribution, the common hamster is a sedentary species, with males and females only occasionally dispersing short distances (Van Wijk et al., 2011; Banaszek et al., 2012) from small home ranges (1.85 ha for males, 0.22 ha for females; Ulbrich and Kayser, 2004). Three infrastructural projects pose a particular concern for common hamsters: Grand Contournement Ouest de Strasbourg, Rocade Sud de Strasbourg and Voie Rapide du Piémont des Vosges. The two latter projects have already received, by ministerial decree in 2010, derogations to the prohibition against destroying hamster habitat and the first two will bisect two special conservation areas assigned to hamsters.

The extremely cold winter of 2012 in Alsace hit the species hard following some years of population stability (MEDDE, 2012b), since the few farmers that grew hamster-favourable winter cereals had to switch to spring crops. Similarly, following a harsh winter in 2005, Hufnagl (2009) reported that reproductive output halved due to later emergence and a shorter reproductive period. Thus, climatic variability can have a profound impact on hamsters, particularly on small and isolated populations (Monecke, 2013). Therefore, climate change is an imminent threat to these remnant populations and could impact the hamsters in two ways: directly via alterations to the environmental pocket in which they are adapted and, indirectly, due to changes in agricultural practices by farmers.

Frankham et al. (2002) highlighted the genetic threat of an "extinction vortex", whereby small, fragmented, isolated populations exhibit inbreeding and loss of genetic diversity with consequent reduced adaptability, survival and reproductive capability and concomitant population decline. The Alsatian population possesses moderate genetic diversity in comparison to other isolated and reintroduced populations in Belgium, Netherlands and western Germany (Reiners et al., 2014). Alsatian hamsters appear to be fixed for one allele of the typically variable MHC DRB locus (Smulders et al., 2003), but have a unique mtDNA D-loop haplotype (Neumann et al., 2004). Intriguingly, microsatellite diversity in Alsace [5.365 (0.834), n=67] is slightly higher than that of a population across the Rhine in Baden-Württemberg (Germany) [4.091 (0.456), n=32] (Neumann et al., 2004).

Given these multi-faceted threats, it might have been expected that the French authorities would have been alarmed by the drastic population declines in the remnant population of common hamsters on its territory and would have responded swiftly and accordingly. However, in fact, the response has largely been slow, disjointed and uncoordinated.

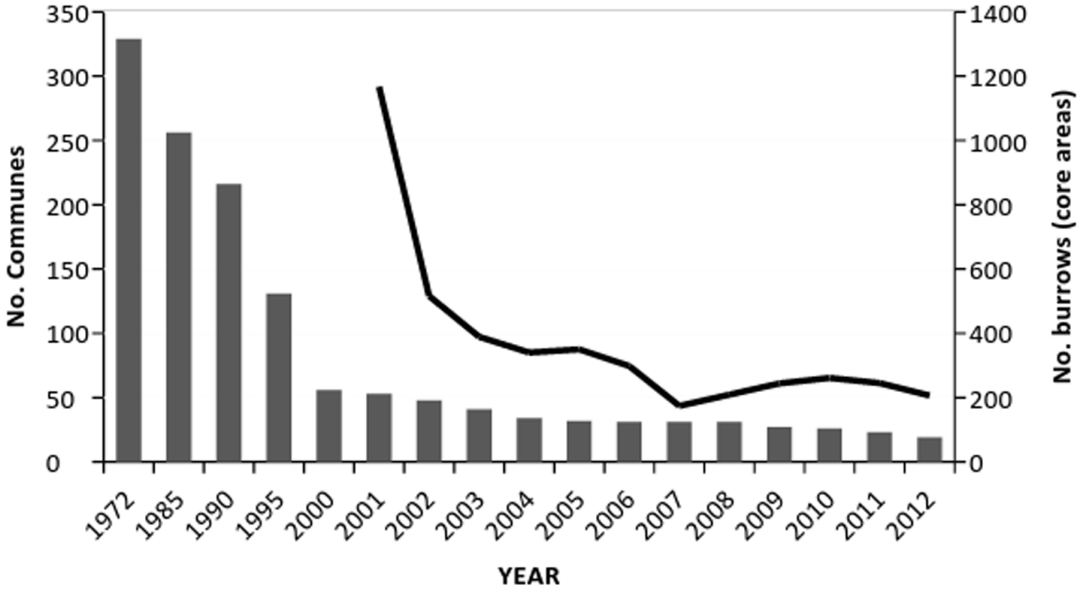

Figure 2 – Range contraction and population decline in common hamsters in Alsace. Grey bars refer to number of communities (districts) where hamsters were recorded during census years (representing range contraction). Black line represents number of burrows counted in a core area (representing 7 communities and not equivalent to ZAPs) systematically censused by ONCFS since 2001 (representing population decline). All data taken from Eidenschenck and Grandadam (2012).

Such administrative lethargy in terms of putting appropriate protective measures and conservation strategies in place has clearly contributed to the drastic decline of this species, perhaps giving rise to an "extermination through inaction" mentality because the costs of such measures are deemed to outweigh the benefits of protection. The perception of the hamster among officialdom is not that of a flagship species, which makes promotion of conservation measures difficult and compounds the general attitude that a strong response to population declines is not warranted, thereby rendering bleak the future of the species in Alsace.

French legal protection and official conservation plans for the Alsace population

Despite drastic population declines for hamsters in Alsace first becoming apparent in the late 1960s, French legislators were slow to react. The common hamster was only indirectly granted protected status in France in 1993, when ratification of the Bern Convention by France in 1990 was transposed into the French legislature. Three years later, the common hamster was first afforded some protection by specific French law under a legal decree issued on 10 October 1996. However, it was not endowed with full legal protection until a law was passed on 23 April 2007 (MEDDE, 2012a). Following the decision of the European Court of Justice in 2011, an additional law was passed on 30 August 2012 to better protect the species. This law more clearly defined hamster hibernating dens and reproductive sites. It also clarified the criteria that allowed damage to protected areas for hamsters (derogations from the 23 April 2007 decree) (MEDDE, 2012a). Most recently, a decree issued on 31 October 2012 focused on protection of hamster-favourable habitat, covering almost the entire area of occupancy in the years 2010–2012 (MEDDE, 2012a). However, this focus on areas occupied by hamsters only in the previous two years has been strongly criticised since it means that other areas where the hamster used to be observed up to 2010 are not afforded strong legal protection.

A bewildering array of agencies and local government services has been responsible for various elements of the three conservation plans produced to date (see Box 1). State input is combined with representations from the agricultural and research sectors and multiple non-governmental conservation organizations. Criticisms of inconsistency, bias and a lack of transparency have been levelled at all partners (Méchin, 2011). The first conservation plan covered the years 2000–2004 and focused on awareness-raising among the public, reinforcement of the wild population with captive-bred specimens, and forging contracts with farmers to grow hamster-friendly crops (such as winter cereals and alfalfa). However, in all aspects of its stated aims, this plan appeared to have had limited success (MEDDE, 2012a). A second action plan, initially covering the years 2007–2011 (but later extended to 2013), focussed on three "Zones d'Actions Prioritaires" (ZAP Nord, ZAP Centre and ZAP Sud, see Fig. 1) corresponding largely to the last remaining strongholds of the species. These ZAPs represented only 2% of the favourable habitat occupied by the species in 1972 before its decline and at least a quarter of the communities where the species had existed historically were exempt from having to protect any favourable habitat at all (Weinhold, 2008). Today, the ZAPs cover 3,810 hectares in just 20 communities. A prime focus of the 2007–2011 Plan was consolidation of the contracts with farmers to grow favourable crops for hamsters in these ZAPs. The primary aim was to achieve 22% of favourable crops in each ZAP (20% winter cereal and 2% alfalfa) (MEDDE, 2011). Then, a 2012–2016 National Plan was published with the stated aim of tripling the population of 2010–2011 so as to attain a viable population of 1,500 individuals in each of the ZAPs (i.e. a total population of 4,500 animals) (MEDDE, 2012a). The French Government has assigned € 10.3 million to the 2012–2016 Conservation Plan but, considering it was being threatened with a € 17 million fine for not enacting protective measures (Murphy, 2007), French authorities may be playing a "zero-sum game" when it comes to hamster conservation policy. However, given that only € 1.2 million was assigned to the earlier 2007–2011 Action Plan (MEDDE, 2011), and even then that Action Plan stated the need to reduce costs, it is a significant improvement in resource allocation to hamster conservation. More recently, a consortium of stakeholders launched an EU-funded Life grant (LIFE12 BIO/FR/000979), called LIFE ALISTER on 5 May 2014 (see http://www.region.alsace/actualites/2014/05/06/lancement-du-projet-life-alister-2810). With a budget of € 3 million and a duration of 5 years, the focus is to promote hamster conservation in Alsace and to test new farming practices and modes of habitat connectivity.

The first three conservation plans have been repeatedly criticised (Méchin, 2011). Bizarrely, the north-eastern part of Alsace was not included in either the 2007–2011 or 2012–2016 Conservation Plans, even though the species had been present there in at least 20 communities between 1987 and 1990 (though there have been no recent records) and this area is less populated, less urbanised and less fragmented than

Box 1 – State agencies involved in hamster conservation in France.

CNRS – *Centre National de la Recherche Scientifique*. Scientific research.

CNPN – *Conseil National de la Protection de la Nature*. Awarding of derogations to hamster protection legislation.

DDAF – *Directions Départementales de l'Agriculture et de la Forêt*. Responsibility for agri-environmental contracts.

DIREN – *Direction Régionale de l'Environnement* (subsumed into DREAL). Responsibility for agri-environmental contracts.

DREAL – *Direction Régionale de l'Environnement, de l'Aménagement et du Logement*. Management of MEDDE conservation strategy and DDAF agri-environmental contracts.

MEDDE – *Ministère de l'Écologie, du Développement Durable et de l'Énergie*. Overall responsibility for conservation strategy via its regional DREAL/DIREN offices.

ONCFS – *L'Office Nationale de la Chasse et la Faune Sauvage*. Research, action plans, reinforcement project and agri-environmental contracts.

Prefectures of Bas-Rhin and Haut-Rhin, and Municipality of Strasbourg – Alsace is divided into two prefectures and, together with the municipality, they are each responsible for putting DREAL's conservation strategy into action within their respective jurisdictions and dealing with developers of projects that might negatively impact hamsters.

the periphery of Strasbourg (where ZAP Nord and ZAP Centre are located) and, thus, is possibly of greater conservation potential for reintroduction efforts (CERPEA, 2008). Regrettably, there is no connectivity between the three ZAPs (even between the two proximal northerly ones). Counterintuitively for conservation measures, the concept of "orphan burrows" was introduced in 2009, which permitted destruction of isolated burrows (Méchin, 2011). Perhaps predictably, the National Plan for 2012–2016 makes no direct mention of the three infrastructural projects of concern except for ambiguous references, despite the fact that other significant threats are discussed in detail. Thus, even the most recent efforts by the French authorities would seem to be insufficient – an open letter dated 16th November 2012 and signed by several animal protection associations set out the limitations of the 2012–2016 National Plan and highlighted their frustration with French government policy (Wintz et al., 2012). It remains to be seen how effective the LIFE ALISTER project (2014–2018) is in terms of contributing to hamster conservation in Alsace.

Since the identified threats to population persistence have not been resolved by recent legal or conservation plans, and given that population size plummeted despite initial efforts (see Fig. 2), the question remains as to whether the Alsace population is doomed to extirpation from the French territory, in which case current funding on the hamster in Alsace might be better applied to conservation of other threatened species in the region. In order to avoid this objectionable outcome, the commitment of all relevant stakeholders to the conservation of hamsters must be reinforced and efforts to enact conservation measures must be redoubled.

Conservation measures

Conservation measures to protect existing populations of common hamster typically involve a three-pronged approach: legal protection, reintroduction/reinforcement/translocation and agri-environmental contracts.

Though initially it had been slow to enact legislation to protect the common hamster in Alsace, the French Government has ensured the protected status of the species through a series of ministerial decrees. However, against this background of legal protection, the Alsace population declined 7-fold between 2001 and 2007 (see Fig. 2) and is showing few signs of recovery. Clearly, room for improvement remains, particularly in terms of the awarding of derogations to this legislation, which essentially allow destruction of "protected" hamster habitat. Such derogations are granted by MEDDE (via CNPN) and are facilitated by only requiring that a burrow has not been surveyed at a potential development site in both of the previous two years (Méchin, 2011). Indeed, the awarding of derogations in return for compensatory measures, such as protecting favourable hamster habitat elsewhere, over-shadow the efforts to mitigate developmental impacts and simply offer developers a "get-out" clause for conservation legislation. This scenario is most apparent in the case of the three large-scale road projects planned for Alsace, (for which 325 ha of compensatory habitat has been assigned or is envisaged, MEDDE, 2011). Though common hamsters are known to use underpasses along roads elsewhere (Mammen and Mammen, 2011) and this is one element of study of the new LIFE ALISTER project, the disturbances around these road projects even before they become operational are likely to have a long-lasting impact on the surrounding hamster populations and other fauna.

Reinforcement of the wild population in Alsace has been carried out since 2003, but with little impact on the overall population (Eidenschenck and Villemey, 2011). Reintroduction projects elsewhere have had a modicum of success, most notably in the Netherlands (Council of Europe, 2011). Success has also been achieved for reintroductions in Germany (Schaffrath and Weinhold, 2011), although Hoffmann (2012) reported that due to habituation to humans, some reintroduced specimens there would appear above ground at the sound of human voices and beg for food. Predation on a reintroduced population in Mannheim (Germany) was reported as being high (accounting for 90% of mortality) (Schaffrath and Weinhold, 2011), but higher survival in reintroduced individuals has been reported in France if the animals are released inside anti-predator electric fences (Eidenschenck and Villemey, 2011). Efforts for reinforcements in Alsace have focused solely on the captive populations held by Sauvegarde Faune Sauvage (based in Alsace). Perhaps because the perception remains that the common hamster in Alsace is somewhat "different" from other populations, translocation of hamsters from other countries does not appear to have been considered despite the potential drawbacks of using a single source of captive specimens. Clearly, the north/south clades alluded to above would need to be borne in mind if individuals are sourced from outside of France. The costs of the current reinforcement project are considerable (almost one-fifth of the € 10.3 million budget of the 2012–2016 National Plan alone), but translocating captive-bred individuals to areas where threats have not been adequately addressed (evidenced by the lack of a rebound in the population in ZAPs) would not appear to be an optimal use of scarce resources. In fact, significant expenditure on facets of a conservation plan that do not work is likely to cause resentment among local communities, which may explain in part the relatively poor uptake among farmers of hamster-friendly practices.

It is clear that there is a pervasive attitude that the fate of the hamster in Alsace lies with farmers. Indeed, this perception is clearly stated in the 2007–2011 Action Plan which states that "Farmers are the leading players in the conservation and restoration of the species, the common hamster." (page 11, author's translation). Yet, changing agricultural practices may not have precipitated population declines throughout the range of the hamster and other factors have been implicated (Monecke, 2013). Alhough older farmers in Alsace fear the damage the species can do, most young farmers have never seen a common hamster (Méchin, 2011). Most of the emphasis on involving farmers in saving the hamster population in Alsace pertains to agri-environmental contracts to

promote hamster-friendly practices. These include growing favourable crops such as winter cereals and alfalfa, retaining strips/zones of vegetative cover in hamster areas, delayed/modified harvesting or ploughing regimes, and avoiding the use of rodenticides, irrigation and liquid fertilizers/manure. The aim of having 22% of favourable crops has almost been achieved for two of the three ZAPs (ZAP Nord and ZAP Sud), but not for ZAP Centre (the largest) (MEDDE, 2011) where, in fact, coverage has been declining in recent years (MEDDE, 2012a). Uptake of these contracts has been slow and it has proven difficult to keep farmers engaged in them long-term, in part because they may not be a sufficiently viable alternative to intensive agricultural practices (Méchin, 2011). The new LIFE ALISTER project will endeavour to study other hamster-favourable farming practices.

Thus, there are a number of problems with the current conservation measures that are impeding progress and these urgently need to be addressed, firstly, to ensure that a viable population of common hamsters persists in Alsace in the long-term and, secondly, if the species is to act as a talisman for the plight of other threatened species in the region for the benefit of all biodiversity.

Recommendations

- *What is a reasonable agri-environmental contract?* Although contracts have improved, it remains difficult to encourage farmers to sign up. This is partly because there are problems in generating a critical mass of appropriate local markets for alfalfa and winter cereals to stimulate farmers to switch from maize (Méchin, 2011), partly because of the additional work involved and partly because maize is so lucrative. Thus, the contracts are of insufficient value to financially incentivise farmers to adopt them. In order for the ZAPs to succeed as refuges for the species in Alsace, a much greater financial package must be committed to these contracts. The potential for the success of agri-environment schemes has already been highlighted for grassland birds in France (Princé and Jiguet, 2013), and perhaps elements of these successful projects should be adopted for mammals. Importantly, such schemes need to be carefully considered and targeted – similar schemes in the UK have been shown to not benefit mammal species of conservation concern (*Lepus timidus hibernicus*), but instead enhanced populations of mammalian pests (*Oryctolagus cuniculus* and *Vulpes vulpes*) (Reid et al., 2007).

- *How can conservation and agricultural authorities better cooperate?* The multiple state agencies involved have greatly complicated communication between stakeholders. This problem has been alleviated somewhat by the establishment of a Steering Committee comprising representatives of all interested stakeholders as part of the 2012–2016 Plan. The consortium of stakeholders spear-heading the LIFE ALISTER project lends hope to greater future collaborations. Conservation efforts must be framed more in terms of a broad drive towards sustainability and biodiversity protection in France in general and less as a response to directives coming from European institutions. The reintroduction and conservation project for vultures (*Gyps fulvus* and *Aegypius monachus*) in France has been hugely successful (Terrasse et al., 2004), involving considerable collaboration between scientists and farming communities and could represent a template for hamster projects.

- *How can conservation of the hamster be better promoted in Alsace?* There is considerable potential to incorporate hamster conservation into a broader biodiversity plan for Alsace including other threatened species in the region, e.g. corncrake (*Crex crex*). In fact, the decline in predator species such as harriers (*Circus sp.*) in Alsace mirrors that of the hamster and therein is an opportunity to demonstrate the importance of the species in the food web. Méchin (2011) reported that discussions on habitat protection with farmers became complicated if hamster preservation was placed too high on the agenda, but when negotiations took place under the guise of sustainable practices, farmers were more amenable to the idea.

- *How can the impact of infrastructural projects be ameliorated?* Eppink and Watzold (2009) found that hamster conservation costs in terms of changes to spatial planning (rejecting, modifying or delaying development projects) were an order of magnitude greater than compensation payments to farmers and conservation management measures. Thus, greater emphasis needs to be placed on incorporating hamster conservation in the early stages of urban planning. The legal loopholes afforded to developers via derogations to legislation need to be closed or severely restricted. The three infrastructural projects of greatest concern should be delayed until the hamsters in the ZAPs affected have at least attained the stated aim of the 2012–2016 Plan of a viable population. A study such as that carried out by Brehme et al. (2013) on other small mammals should be carried out to determine the permeability of the Alsatian road network for common hamsters.

- *How can the reinforcement project be optimised?* An enhanced multinational approach needs to be taken for the reinforcement/reintroduction project and consideration should be given to sourcing additional specimens from secure populations further east. The project in Alsace should also look beyond the ZAPs to found new core populations, particularly in the north-east of the region. Again, the success of the French vulture reintroduction programme (Terrasse et al., 2004) can be used as a template for the common hamster, especially considering the initial antipathy of farmers to a return of this scavenger.

- *How can the public's perception of hamsters be enhanced?* Within France, the species occurs only in Alsace, which should endow hamsters with emblematic status. A captive breeding facility for hamsters, open to the public, should be established in Strasbourg city to raise awareness among the local population about the biodiversity in the region and to promote hamsters as a flagship species for conservation in Alsace. In fact, the common hamster has proven itself to be adaptable to coexisting with humans in the past. Even today, apparently self-sustaining urban/suburban populations exist in Prague, Vienna and Simferopol (Lebl and Millesi, 2008; Vohralik, 2011) so, if properly sited, the facility could form the core of a new ZAP.

Conclusions

Inconsistencies in the conservation measures being enacted and prioritisation of vested interests are clearly counter-productive and contribute further to a lack of trust between stakeholders. Until such issues are comprehensively tackled, the fate of the common hamster in Alsace looks set to remain in the balance. Given that agricultural policy in the Alsace region is unlikely to change dramatically in the near future, it is improbable that the common hamster will ever re-populate its prior territory or expand into neighbouring regions. Thus, the Alsatian population will always likely remain an isolated relict, constantly in danger of extinction. Although hamster conservation needs the support of the farming community to succeed, the French state must provide adequate incentives in order for that community to become actively involved. At an even broader scale, the profile of the common hamster in Alsace needs to be enhanced, particularly as a unique element of France's faunal assemblage. That status could lend itself well to promoting biodiversity conservation in the region, acting as a talisman for protective measures for it and other threatened species. The common hamster represents an ideal model species to examine how an animal that is tied to human farming practices can be conserved in the face of the increasing intensification and commercialisation of agricultural activities evident not only in Western Europe, but now worldwide.

Regrettably, to date in the case of the common hamster in Alsace, conservation efforts are proving ineffective and therein lie the lessons for other species and regions. The French government's delayed use of the legislative tools available to it to slow the precipitous decline in the

Alsatian population demonstrates the need for prompt action. And if economic considerations remain the sole driving force behind conservation action, distrust between stakeholders will persist. Whether the current French conservation plan is sufficiently robust to prevent localised extinction and ensure the long-term viability of the Alsatian population remains to be seen. However, other jurisdictions cannot wait to view the outcome of these conservation activities before undertaking conservation efforts for their own fragmented populations.

Once the hamster has become extinct in a locality due to changing agricultural practices, it is unlikely that it will re-colonise while unfavourable factors persist. And once it has disappeared from a locality, there is little incentive for farmers to revert to hamster-friendly farming methods which might promote its return. Furthermore, since the profile of the common hamster in Alsace is currently so low, it is not likely to be missed by the general public if it does disappear from the Alsace plains. However, if it does disappear, so too may other more "charismatic" species, as has already occurred with Montagu's harrier (*Circus pygargus*), which disappeared from Alsace in 2008 (Méchin, 2011). The fact that the hamster population in Alsace retains some unique genetic diversity also supports the need for its protection. Given that a number of other species tied to agriculture in Alsace are under threat (e.g. red kite *Milvus milvus*, corncrake *Crex crex*, lapwing *Vanellus vanellus*, green toad *Bufotes* [syn. *Pseudepidalea*] *viridis*; Méchin, 2011), the common hamster has the potential to act as a flagship species for conservation in the region. It is vital that where such threatened species are currently in existence, all efforts must be expended to ensure their persistence.

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