

European-wide conservation of the common hamster: what do we need to know?

M.J.J. La Haye^{1,2}, G.J.D.M. Müskens², R.J.M. Van Kats² and A.T. Kuiters²

1 Department of Animal Ecology and Ecophysiology, Institute for Wetland and Water Research, Radboud University Nijmegen, P.O. Box 9010, NL-6500 GL Nijmegen, The Netherlands

2 ALTERRA-Wageningen UR, Centre for Ecosystem Studies PO Box 47, NL-6700 AA Wageningen, The Netherlands

Abstract

The common hamster (*Cricetus cricetus*) has declined in most West European countries by more than 95% in the last decades and is nowadays declining in Eastern European countries as well (NECHAY 2000). This decline has resulted in a strict protection of the species under the EU Habitat Directive and numerous local and regional conservation projects are running (LOSINGER 2008; MÜSKENS et al. 2005; VERBIST 2008; WEINHOLD 2008). Although much effort is put in conservation measures, the decline of common hamster populations is still proceeding in most EU member states. This raises the question, what information do we have about this species and what should we know to stop a further decline and restore viable populations in the near future? In our opinion it is needed that we start to cooperate more between countries and research groups. If we are able to combine our efforts and exchange data, it is possible to be more effective and efficient in solving the problem of the disappearing hamsters.

What information do we have about the common hamster?

The meetings of the International Hamster Workgroup over the last 18 years have learned us much about the common hamster and its ecology: dozens of articles have been published in the proceedings of these annual meetings and much more information has been presented. In summary, it can be stated that: the hamster is in decline in a large part of its geographical range, it is a typical prey species with a low survival and a high fecundity, much is known about its behaviour in urban habitats, we know how to breed hamsters and how to release them into the field, it is clear that the species is sensitive for long and short photoperiods and the genetics of the species has been studied extensively. However, even though we know already much about its ecology, we are not able to take effective measures to stop a further decline of the species!

Balance between survival and reproduction

The sustainability of hamster populations depends on the balance between reproduction and survival, therefore let us focus in more detail on these two population demographic aspects. The survival of adult hamsters has been studied over the last years by several researchers for example: KAYSER (2002), KUITERS et al. (2007), LOSIK et al. (2007), MÜSKENS et al. (2008), WEINHOLD (1998), and important factors affecting the survival rate of individual hamsters have been identified: gender (male or female), season (time of the year) and the presence of sufficient cover. A factor such as genetics (in- or outbred) had no effect on the survival of individual hamsters (LA HAYE pers. comm.), at least not in the Netherlands. Other, sometimes secondary aspects like landscape or weather/climate conditions, might also influence the survival of adult hamsters as well. Weather conditions for example may affect survival of hamsters directly (wet and rainy days may cause pneumonia) or indirectly (dry conditions may negatively influence growth of the vegetation resulting in an enhanced predation risk), differences in climate at different altitudes may influence the period with

snow cover or the amount of rain in certain periods (NEUMANN 2008), and even landscape features may affect survival of hamsters. All these aspects may have a small to large effect on survival of hamsters or may even influence each other, which makes it very difficult to quantify the effect of different aspects. Unfortunately, no research efforts are undertaken to unravel the influence of secondary aspects on survival of hamsters.

Another complicating factor is that most survival studies cannot be compared or are of limited value: researchers used different techniques (implant-transmitters, collar-transmitters, capture-recapture) or the way of calculating survival rates was different. These constraints make it rather difficult to draw general conclusions.

Survival of juveniles

In most species survival differs between juveniles and adults, with adults having most of the time a better survival. However, as far as we know, almost no information is available regarding the survival of juveniles hamsters. A few studies have reported re-trapping rates of juveniles in the next spring (GORECKI 1977; KAYSER 2002), but the numbers of trapped and re-trapped juveniles are mostly too low to draw statistically sound conclusions.

Obviously, it is very difficult to measure the survival of juveniles, not only when they are small, but also when juveniles are somewhat older and heavier (which is probably after an initial period of low/high survival). This problem could be handled if the number of newly born hamsters is known (or more or less accurately estimated) and the number of surviving juveniles is known at a specific age. But so far no reliable technique or life table has been developed to measure the age of juveniles: it seems that the growth and weight of juveniles is variable depending on environmental or other conditions (day-length, etc.) (KIRN 2004). For example, juveniles from the Netherlands that grew up in the wild showed much faster growth rates than juveniles in the Dutch breeding program (LA HAYE & MÜSKENS 2004) or in the urban population of Vienna. Therefore, juvenile survival and growth rate are still poorly understood and largely a scientific ‘terra incognita’.

Reproduction

Reproduction is the other part of the demographic balance. It is known that the reproduction in the common hamster is regulated by internal and external hormonal and light signals (MONECKE & WOLLNIK 2004; MONECKE & WOLLNIK 2008) and that the species is relatively flexible in the start of reproduction (TAUSCHER et al. 2008). However, there is very little information available on the number of litters a hamster can reproduce in one season, on litter size, on the timing of litters or how the condition of females influence the reproduction, etc. The only exception is the well-studied population of hamsters in Vienna (FRANCESCHINI-ZINK & MILLESI 2008), but it can be questioned if the reproduction parameters of this population are similar compared to those in more ‘natural’ agricultural areas. It is expected that the Vienna population shows a major overlap with hamster populations elsewhere with respect to reproductive characteristics, but it is also a population with a relatively high density and clearly different sources of food (it is for example still unknown what food is caged in winter).

Another unsolved mystery in the reproduction ecology of the common hamster is reproduction by juveniles in their year of birth. Although some researchers have been skeptical about this possibility (SAINT GIRONS et al. 1968; GORECKI, 1977), several studies have shown that juveniles can reproduce before their first hibernation (GRULICH 1986; FRANCESCHINI-ZINK & MILLESI 2008). When and how much juveniles (percentage of the population) already reproduce in their year of birth is completely unknown. Again much more research is needed to solve these questions.

Next step: modeling

Collecting more information on the survival of adults and juveniles and to unravel the questions on the reproduction ecology of the common hamster is really interesting. But just collecting this information will not bring us any step forward in stopping the decline of the hamster. A more integrated approach in relation to management is needed and modeling the ecology of the hamster is a good starting point. The more primary and secondary aspects of the hamster ecology are known, the better your model will be. Of course a model is just a simplification of reality, but it can also show the effects of changes in certain life-stages or the effect of a lowered survival on the sustainability of a hamster population (SWINNEN in press). It is even possible to incorporate behavior in a model or physiological constraints or/and habitat suitability in a region, country or at another spatial scale. The possibilities are almost endless. Most important, models can help to identify the bottle-necks in a population. Knowing the bottle-necks may help us to concentrate conservation efforts on those aspect of the hamster ecology which are most critical for the sustainability of a population. The possibilities to improve the sustainability of populations are however limited (LA HAYE et al. 2010). In most cases it is only possible to improve the habitat quality: changing the management and types of crops. However, changing agricultural practices is difficult and expensive and one needs support from farmers, whereas the effects may be highly unknown. Only a few studies have looked in more detail at the effects of changing agricultural practices, but most studies only monitored the number of burrows after implementation of measures and with disappointing results so far. Only very few studies have reported an increase of hamster population size after certain measures had been taken (LA HAYE et al. 2010), but sometimes this increase was only in the first few years! For a better understanding of the basic principles of the ecology of the common hamster more and better research is urgently needed, including more experiments in laboratories and outside in the field. Only when we will have sufficient information about key population parameter values, and the primary and secondary factors affecting them, we will be able to carry out integrative modeling of hamster population demography.

The future

In our opinion it is needed that we all start to collect the same data across Europe under different environmental, climate and landscape conditions. Comparing these results between countries, populations and regions can help us to better understand the ecology of the common hamster and the factors affecting reproduction and survival of juveniles and adults. A first start is to:

- measure female survival in different countries in the same or comparable way;
- use camera-traps to monitor the number and timing of nests;
- use camera-traps to monitor juveniles;
- monitor crops, cover and the moment of harvest;
- arrange some experimental plots without harvest;
- start experiments on the condition of females and its effect on their progeny.

Combining and exchange of information between countries and research groups can bring us further. The possibilities to use certain techniques or the possibilities to collect certain data will differ between countries, because of regulations, climate conditions, visibility of individuals, and available research budget. However, if we can combine our efforts and exchange data, then it is possible to be more effective and efficient in solving the problem of the declining hamster populations. And most important: results should be published and presented at the International Hamster Meetings!

- GORECKI A. (1977); Consumption by and Agricultural impact of the Common Hamster, *Cricetus cricetus* (L.), on Cultivated Fields – EPPO Bull. 7 (2), 423-429.
- GRULICH I. (1986); The reproduction of *Cricetus cricetus* (Rodentia) in Czechoslovakia – Acta Sc. Nat. Brno, 20 : 5-6, 1-56.
- FRANCESCHINE-ZINK C. & MILLESI E. (2008); Reproductive performance in female common hamsters. – Zoology 111: 76-83.
- KAYSER A. (2002); Populationsökologische Studien zum Feldhamster *Cricetus cricetus* (L., 1758) in Sachsen-Anhalt. – Dissertation. Martin-Luther-Universität Halle-Wittenberg.
- KIRN N. (2004); Ontogenese des Europäischen Feldhamsters (*Cricetus cricetus*) unter dem Einfluss verschiedener prä- und postnataler Photoperiode. – Inaugural-dissertation, Tierärztliche Hochschule, Hannover, Deutschland.
- KUITERS L, LA HAYE M, MÜSKENS G, VAN KATS R (2007); Survival analysis to predict the predation risk in reintroduced populations of the Common Hamster (*Cricetus cricetus*) in the Netherlands. V European Congress of Mammalogy, Siena, Italy. – Hystrix The Italian Journal of Mammalogy. Vol. I, supp. 2007.
- LA HAYE M. & MÜSKENS G. (2004); New information about the reproduction of hamsters and its consequences for model-studies. Poster at the 12th International Hamster Congress. October, 2004. Strasbourg, France.
- LA HAYE MJJ, MÜSKENS GJDM, VAN KATS RJM, KUITERS AT & SIEPEL H (2010); Agri-environmental schemes for the Common hamster (*Cricetus cricetus*). Why is the Dutch project successful? – Aspects of Applied Biology **100**: 117-124.
- LOSIK J, LISICKÁ L, HRÍBKOVÁ J TKADLEC E (2007); Demografická struktura a procesy v přírodní populaci křečka polního (*Cricetus cricetus*) na Olomoucku. Demographic structure and processes in a natural population of the Common Hamster (*Cricetus cricetus*) in the Olomouc region (Czech Republic). – Lynx (Phara) N.S., 38: 21-29.
- LOSINGER I (2008); Reinforcement of the populations of common hamsters in the Ried brun sector in the Alsace - ABSTRACT – In: *Proceedings of the 11th, 14th, 15th Meeting of the International Hamster Workgroup; Budapest, Hungary (2003), Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007)*. Wageningen/Nijmegen, the Netherlands. Part I, pp. 41.
- MONECKE S & WOLLNIK F (2004); European Hamsters (*Cricetus cricetus*) Show a Transient Phase of Insensitivity to Long Photoperiods after Gonadal Regression. – Biology of Reproduction 70: 1438-1443.
- MONECKE S & WOLLNIK F (2008); How to increase the reproductive success in Common hamsters: shift work in the breeding colony. – *Biosystematics and Ecology Series No. 25*. Austrin Academy of Sciences Press, Vienna, Austria.
- MÜSKENS GJDM, LA HAYE MJJ & VAN KATS RJM (2005); Reestablishment of a viable network-population of the common hamster in south-Limburg, the Netherlands: impact of crop-management and survival strips on burrow density in the release sites. Preliminary results. – Proceedings of the 12th International Hamster Congress. October, 2004. Strasbourg, France.
- MÜSKENS GJDM, VAN KATS RJM, KUITERS AT (2008); Reintroduction of the Common hamster, *Cricetus cricetus*, in the Netherlands. Preliminary results. – In: *Proceedings of the 11th, 14th, 15th Meeting of the International Hamster Workgroup; Budapest, Hungary*

- (2003), *Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007)*. Wageningen/Nijmegen, the Netherlands. Part I, pp. 33-40.
- NECHAY G (2000); Status of Hamsters: *Cricetus cricetus*, *Cricetus migratorius*, *Mesocricetus newtoni* and other hamster species in Europe. Convention of the conservation of European wildlife and natural habitats. – Nature and Environment Series, No. 106. Council of Europe, Strasbourg. 66p.
- NEUMANN K (2008); Geography and climate: how did the common hamster colonize Central Europe. – In: *Proceedings of the 11th, 14th, 15th Meetings of the International Hamster Workgroup*; Budapest, Hungary (2003), *Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007)*. Wageningen/Nijmegen, the Netherlands. Part III, pp. 21.
- SAINT GIRONS MCh, MOURIK WR, BREE PJH (1968); La croissance ponderale et la cycle annuel du hamster, *Cricetus cricetus canescens* Nehring, 1899, en captivite – *Mammalia*, 32 : 4. pp. 577-602.
- SWINNEN K (in press.) Critical factors in the population dynamics of the Common hamster in the Netherlands. Presentation at the 17th Meeting of the International Hamster Workgroup, Gödollo Hungary.
- TAUSCHER B, FRANCESCHINI C & MILLESI E (2008); Reproductive output of female European Hamsters in an urban environment – In: *Proceedings of the 11th, 14th, 15th Meeting of the International Hamster Workgroup*; Budapest, Hungary (2003), *Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007)*. Wageningen/Nijmegen, the Netherlands. Part I, pp. 23-26.
- VERBIST V (2008); Restocking and protection of the European hamster in Flanders, preliminary results. – In: *Proceedings of the 11th, 14th, 15th Meeting of the International Hamster Workgroup*; Budapest, Hungary (2003), *Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007)*. Wageningen/Nijmegen, the Netherlands. Part III, pp. 5-9.
- WEINHOLD U (2008); Draft European Action Plan for the Conservation of the Common hamster (*Cricetus cricetus*, L. 1758). – Preliminary document T-PVS/Inf (2008) 9, Strasbourg.