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Reintroduction and restocking programmes for the Common Hamster (*Cricetus cricetus*) – issues and protocols

Programme zur Wiederansiedlung und Bestandsstützung des Feldhamsters (*Cricetus cricetus*) – Fragen und Vorgehensweise

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Kurzfassung: Das Aussetzen von Tieren in die freie Wildbahn ist mit zahlreichen komplexen Fragen und Auswirkungen verbunden, die sich zudem in Abhängigkeit von den jeweiligen Umständen der Aussetzung unterscheiden. All dies muss bei der Entscheidung, ob eine Aussetzung überhaupt angemessen ist und dann gegebenenfalls bei der Erarbeitung einer für die jeweilige Art geeigneten Vorgehensweise, berücksichtigt werden. Die allgemeinen Richtlinien der IUCN zur Wiederansiedlung und Umsiedlung müssen einerseits eingehalten, andererseits aber auch in einer für die jeweilige Art spezifischen Weise umgesetzt werden. Die Aussetzung sich relativ schnell fortpflanzender Arten mit kurzer Lebensdauer (r-Strategen) wirft dabei ganz spezielle Probleme auf.

Die Aussetzung von Feldhamstern (*Cricetus cricetus*) wird als Teil einer integrierten Schutzstrategie für diese Art in West- und Mitteleuropa wahrscheinlich eine zunehmende Rolle spielen. Alle Hauptphasen eines Aussetzungsprogrammes werden nachfolgend vorgestellt, um eine geeignete Vorgehensweise (release protocol) zu formulieren. Die unterschiedlichen Probleme und Überlegungen zwischen Wiederansiedlungen für Naturschutzzwecke und Bestandsstützungen (Hinzusetzen von Tieren zu einer Population) in dünn besiedelten Gebieten werden dargestellt und verglichen.

Wiederansiedlung kann ein kostenintensiver Teil der Schutzstrategie für eine Tierart sein. Die Abschätzung der Kosten sowie der mit der Gefangenschaftshaltung verbundenen Auswirkungen verschiedener Management- und Aussetzungstechniken im Vergleich mit deren Erfolgswahrscheinlichkeit ist daher wichtig. Das Ziel des Artikels ist es nicht, eine bestimmte Vorgehensweise vorzuschreiben, sondern mögliche Optionen vorzuschlagen sowie die gute fachliche Praxis für die Wiederansiedlung von Kleinsäugern zu diskutieren. Dies wird künftig zur erfolgreichen Nutzung von Wiederansiedlungen als einer Schutzstrategie für den Feldhamster beitragen.

Introduction

The reintroduction or restocking of any species involves a complex series of issues, all of which have to be addressed in order to formulate a release protocol suitable for the species and to conduct and monitor the actual release. However despite the complexity, the release of animals is increasingly being viewed as a worthwhile and integrated part of the conservation strategy for a variety of species.

As the Common Hamster (*Cricetus cricetus*) undergoes an apparent catastrophic decline in numbers and distribution across Western Europe then the likelihood increases that managed breeding and release programmes will become an important and necessary part of conservation for the species. There has already been the formation of a European breeding programme for the species under the auspices of the European Association of Zoos and Aquaria (EAZA) (JORDAN 2000a) and the species is recognised as a recommended species under the EAZA Regional collec-

tion plan for the Rodentia (JORDAN & RUDLOFF 2001). This combined with the management of specific projects and breeding programmes within the Netherlands and France as part of their respective National Action Plans make the prospects of large scale releases very likely in the near future (APELDOORN & NIEUWENHUIZEN 1998; WENCEL 1999).

The current paper will consider each of the four main phases of a reintroduction or restocking exercise, drawing upon biological information on the Common Hamster and experience involving other rodent release programmes to highlight the key issues and suggest protocols that should be considered for the release of Common Hamsters. The broad guidelines of the World Conservation Union (IUCN) (IUCN, 1987, 1995) have to be considered and interpreted in a species-specific manner and the release of relatively fast breeding and short life span (*r* selected) species have their own unique issues which are discussed and formulated into a prospective protocol.

Increasingly conflict is arising between Hamster populations and impending development or habitat loss. Translocation is often seen as a simple solution to this conflict and a number of schemes have moved Hamsters or are considering such action as part of mitigation measures. The processes involved in such translocations are as complex as those involved in planning any a reintroduction or restocking programme and the following issues and considerations should be taken into account as part of the planning process for any translocation schemes.

Captive production and management

Common Hamsters have been successfully bred in the past in a variety of indoor and outdoor enclosures and successfully held for long periods in captivity. Reproductive success has proved variable often with only some individuals reproducing but nevertheless productivity can be high. For successful conservation breeding and release programmes with small mammals the prediction of productivity is important and greatly eases the planning process. Whilst initially the emphasis may be on producing as many animals as possible to secure the survival of the breeding programme and enable release, in the medium-term a more predictive approach may be required.

With conservation breeding programmes involving potentially fast breeding rodents such as the Common Hamster, the management of large numbers of offspring is often one of the key issues (JORDAN 2000b). The management of large numbers of surplus stock can be a very real problem and the most successful solution is a predictive breeding programme aiming to produce target numbers of animals required for release and to maintain background captive stocks. Thus preplanning of the number of animals required for the following year and then initiating breeding with an appropriate number of pairs to match this demand is likely to be the most appropriate and cost-effective long-term strategy for Common

Hamster. In practice this can be a lot more complex than it appears, careful consideration has to be paid to many factors; the dates at which animals are required for release, captive mortality rates, productivity per female, proportions of females failing to reproduce, and genetic considerations. It is simple to assume that literally a couple of pairs of breeding adults can produce enough animals for an entire release, however to populate an area with such a high proportion of full siblings would be genetically undesirable and this has to be considered when planning reproduction.

Reintroduction and restocking programmes

The release of animals to repopulate areas from which they are extirpated (reintroduction) or to support existing populations (restocking or supplementation) is becoming an increasingly necessary conservation action. The whole process is incredibly complex with a multitude of issues and considerations to be borne in mind and it is not a conservation action that should be taken lightly (JORDAN & CHESTNUTT 2000). Addressing each of these issues methodically leads towards an effective protocol which ultimately has to be species specific and flexible enough to cope with varying circumstances. However there are also general guidelines which are appropriate for all and any releases. The World Conservation Union Species Survival Commission Reintroduction Specialist Group (IUCN SSC RSG) produces such fundamental guidelines for reintroduction and these should be borne in mind when planning any release.

Devising a release protocol and scientifically testing each of the issues independently are two very different things. Often practicality dictates a combination of the two, for it is only once releases are actually being conducted that many of the key issues can be properly tested and monitored. However it is important that every opportunity is taken to validate protocols and compare optional strategies, thus the primary aims behind any initial releases should be as much research as conservation.

The release process can be broadly divided into four phases:

- Feasibility study (1.)
- Pre-release phase (2.)
- Release phase (3.)
- Post-release phase (4.)

The key considerations of which, with regard to the Common Hamster are discussed below:

1. Feasibility study. This should be the pre-cursor to any planned release. The scale of the operation may well effect the scale and formality of the feasibility study but nevertheless a gathering together of all relevant information and an appraisal of the options and likelihood of success should be carried out. It is a useful time to appraise the aims of the release project, these may seem ob-

vious, however the aims of a small scale translocation and restocking on mitigation grounds may be very different to those of a larger scale reintroduction on conservation grounds.

The feasibility study should also consider funding sources and the cost implications of different options before embarking upon the process. Most of the key considerations of the feasibility study are enlarged upon and discussed further under the other three release phases, however it is important that a realistic approach to problems and likelihood of success is considered in relation to the biology of the species concerned. Release should also be viewed in the wider context of the conservation strategy for the Common Hamster as a whole.

The feasibility study should consider such issues as:

- Researching the base biology of the Common Hamster.
- Understanding the species' habitat requirements.
- Setting up a successful captive breeding programme.
- Availability of suitable release sites
- Funding, over both the short-term (release) and long-term (site protection).

2. Pre-release phase. This is the most complex and often critical phase of the work. All aspects of the project have to be considered, decided upon and relevant resources obtained. There are a number of key considerations.

- Donor and release sites: If animals are to be translocated then donor site/s for stock have to be considered. In the case of the Common Hamster translocation is unlikely to provide regular and long-term sources for reintroduction programmes. Regular translocation as a conservation strategy requires secure donor sites producing a regular surplus of animals, the removal of which in no way jeopardises the donor population, or a continual supply of sites from which Common Hamsters need to be removed, neither of which seems probable. However smaller scale translocation may be required for mitigation purposes.

The choice of release site/s will radically influence the protocol and considerations of the release, the presence of Common Hamsters dictating whether the release is considered a reintroduction or restocking. As a general principle restocking can be a more fraught process with the potential to negatively affect an existing Common Hamster population and make the situation worse!

The issue of habitat is of course important, particularly as the Common Hamster in Western Europe principally occupies arable agricultural land. Inevitable management conflicts occur and compromises will have to be made to accommodate Common Hamsters, both the habitat quality and size will influence the likelihood of success. The site must be considered adequate to support a viable self-sustaining population if animals are reintroduced, or be capable of supporting the increased numbers of individuals resulting from a restocking. Estimating what exactly constitutes a viable population is always difficult, particularly with small mammals, which undergo large seasonal population changes. However if a realistically viable peak population of 250 animals were considered and peak densi-

ties of 5 Common Hamsters ha^{-1} are assumed (STUBBE, SELUGA & WEIDLING 1998), this population would require around 50ha of suitable habitat. Even an autumn population of this size would of course be much lower in the spring prior to breeding.

Site management will have to be considered and carefully planned, the implications of releasing animals onto a site where long-term favourable management is not guaranteed may limit the choice of release sites. The release of animals must be treated as part of an integrated conservation strategy including habitat management.

- Sources of animals: The fundamental issue of whether to use captive bred or wild translocated stock is always of concern, although as mentioned previously sources for wild translocation seem unlikely in the Common Hamster. If the removal of wild individuals from a site prior to development or destruction, or as a result of agricultural damage is unavoidable, then an alternative still exists. Whether to translocate and release immediately, or to move the animals into captivity as part of a breeding scheme to subsequently release offspring, the latter is often preferable when numbers are very low. The timing of removal of stock from the donor site may also influence whether immediate release is appropriate, this is discussed under 'Timing of release'.

Captive breeding may allow for a more predictable and sustainable programme of releases over a number of years. It also can allow the rapid multiplication of limited numbers so as to enable large-scale releases, although the survivorship may vary between the two different sources.

- Provenance of stock: As a general principle stock should be of as local an origin as possible although common sense and genetic evidence has to be borne in mind. A balance has to be met that combines the need to conserve genetic uniqueness or ecological types, whilst considering the practicalities of conducting many separate and totally unnecessary captive breeding exercises. When populations are subjected to very high levels of inbreeding then the addition of unrelated animals may be critical to the long-term survivorship. Breeding programme management should be a compromise of genetic information and practicality rather than based on national or district boundaries.
- Health screening: Some form of pre-release health screening should be carried out prior to release. This should combine both biological and veterinary considerations, thus adherence to normal weight limits is appropriate as well as faecal screening and other physiological and anatomical checks. This is important for both individual welfare of the release animals and for ecological considerations of disease/parasite introduction. Health issues become even more important when conducting restocking exercises with the potential to introduce a disease or parasite to the already present wild individuals at the site.

When setting release dates it must considered that the health screening process may take several weeks in order to conduct tests and receive results prior to release, particularly if repeat faecal screenings for organisms such as *Salmonella* are

conducted. When setting target numbers of animals for release, consideration also has to be given to likely reductions in the number of individuals available due to removal of any animals that fail to pass the health screening. Often a realistic contingency of around a 10 % increase in numbers of animals is required to compensate for this process.

- Funding: During the pre-release phase funding must be secured to ensure that once the process is embarked upon sufficient funds are available to fully complete all the sequential steps involved in release. This means that budgets must include sufficient provision for activities that may not actually occur until one or more years after the process starts. The issues over the funding of captive breeding are slightly more complex as this may well be a necessary pre-cursor to large-scale releases, yet the process starts a year or years prior to the release programme. Funding often then has to be either independent of release, or incorporated retrospectively into release budgets.

There are of course many other issues to be considered pre-release, such as release and monitoring techniques. Whilst these actual actions themselves are associated with later phases of the project both have to actually be decided upon pre-release in order to budget and obtain resources.

3. Release phase. A well conducted pre-release phase can make the release process much more straightforward. Nevertheless there are many issues associated with the actual release of the animals themselves.

- Timing of release: The time of year at which to release animals is a fundamental issue, particularly with species subject to large annual fluctuations and varying mortality such as the Common Hamster. There are however some basic conflicts concerning captive breeding or the translocation of animals from sites and optimum times for release. Theoretically, releasing individuals to coincide with population troughs when mortality is often lowest and reproduction about to commence is favourable, thus in Common Hamsters spring may well be the optimum time for release, particularly as the Common Hamster hibernates and over-wintering mortality is high (Figure 1). However in captivity there is often pressure to release animals in the autumn when all the offspring of the year are weaned and stocks in captivity high. Similarly when removing animals from sites as part of translocation schemes then autumn may be preferable when populations are highest, easily trappable and about to undergo large over-winter mortality.

This dilemma has to be considered particularly when budgeting for releases as programmes may incur extra resource implications from having to hold large numbers of animals through the winter. In the case of Common Hamster then separate accommodation suitable for hibernation may be required for each individual that is to be released the following spring. Similarly for translocations then to accommodate the optimal removal and release times, this may involve the removal of animals in the autumn, the subsequent holding in captivity over winter followed by a spring release.

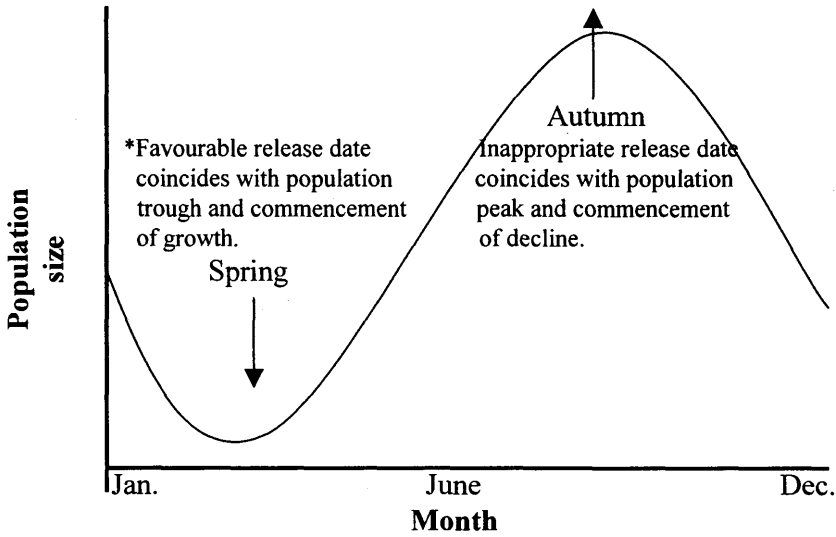

Figure 1: Theoretical rodent annual cycle in relation to optimum dates
Abbildung 1: Theoretischer Jahreszyklus von Nagetieren in Bezug zum optimalen Zeitpunkt der Aussetzung

- Number of releases to each site: The option exists of whether to release as a single 'one-off' event or a series of several 'top-up' releases. Generally from a scientific perspective measuring success following a single release is more straightforward. It should be considered that releasing again to the same site later technically represents a restocking of the original release, involving a whole series of new issues. However for purposes of practicality and resources then sometimes a sequential series of releases may be unavoidable.
- Location of releases within a site: Within the chosen release site decisions still have to be made about the exact release location/s. This may be particularly important with territorial species such as Common Hamster. Releasing all animals at a single point within the site may inevitably 'force' the animals into dispersal as a result of territoriality. Conversely spreading a few animals very thinly across a site may jeopardise success. A compromise of releasing pairs appropriately spaced across the site may be best. The spacing of release locations must reflect numbers released and habitat size and quality. In the case of Common Hamster releasing pairs at centres of around 60 m apart equate to establishing a population of approximately 5 ha^{-1}, although the established density may well not remain stable due to differences in movements and home range between the sexes.
- Number of animals released: The number of animals released may be related to the habitat size and quality and the timing of release. Common Hamsters are however a typical *r* selected species with a high reproductive rate to compen-

sate for high natural mortality. Therefore release numbers may well have to be high, releases of 30+ animals may well be normal, but the timing of release will dramatically affect this. The number of animals potentially able to breed is critical to success in short-lived species, therefore an individual can be viewed as having a different intrinsic value to the population depending upon the time of year (Table 1). Assuming Common Hamsters typically undergo 65 % over-winter mortality (WEINHOLD 1998) then 30 animals released in the autumn only equates to a population of approximately 10 surviving until the spring to breed, if the released animals 'only' suffer normal natural mortality, in reality mortality post-release may be higher!

Table 1:The effect of varying release date and over-winter mortality on the intrinsic value of individuals to the population
Tabelle 1: Einfluss des Freilassungszeitpunktes und der Wintermortalität auf den „inneren Wert" von Individuen für die Population

	Instrinsic value of each individual			
Theoretical over-	Spring release		Autumn release	
winter mortality	Spring	previous autumn	Autumn	Following spring
55%	1	2.22	1	0.45
60%	1	2.5	1	0.40
65%	1	2.86	1	0.35
70%	1	3.33	1	0.30
75%	1	4	1	0.25

The maximum value of individuals is achieved by releasing at a time when mortality is lowest and all individuals can potentially breed. Thus spring release following hibernation is preferable but incurs added resource costs.

- Demography of animals released: Demography has to be carefully considered. The ages, sexes and reproductive status of individuals may all affect the success of the release. In fast breeding and relatively short-lived species age is particularly important and is one of the key reasons behind having to specifically breed individuals for release rather than just draw individuals from existing captive stocks. Releasing juveniles in the year of birth has implications on the release timing and intrinsic value discussed above and also potential problems in post-release monitoring if radio collaring is to be used. Release of animals in the spring following birth is generally preferable. Obviously the sexes of individuals released is important too, female biases may seem favourable although skewed sex ratios have both genetic implications and implications for captive breeding where animals are produced in a 1:1 sex ratio.

The reproductive status of individuals released may well be important but will of course be related to the timing of release. In spring immediately following hibernation all individuals may be effectively adults although some individuals may be in non-breeding condition. Caution should be exercised concerning the release of pregnant females, whilst this may result in almost immediate births at the release site, pregnancy does place increased energetic demands on females and so may adversely affect survivorship.

- Release technique: The key consideration is whether to release animals directly to the site with no period of acclimatisation, termed a 'hard' release, or to retain animals at the release site for a period within enclosures or release pens, termed a 'soft' release. Such 'soft' releases are often designed to help reduce dispersal and immediate mortality upon release. There are obvious cost implications to the construction of pens in which to house animals, although Common Hamsters are effectively a 'prey' species that rely upon subterranean burrows and so the 'hard' release of animals may render them very susceptible to predation in the short term. Allowing individuals to construct a burrow or even use an artificial burrow within a predator-excluded enclosure prior to release may well be preferable.

4. Post-release phase. Although at this phase it may seem as though the bulk of work is complete and the release has finished, this is actually one of the most important and protracted stages. This represents the stage at which results are actually obtained and success is measured so it is critical to the evaluation of the whole process. As already stated research is important for devising and testing release protocols for Common Hamsters and so the post-release stage is vital.

- Monitoring: The techniques used for post-release monitoring have to be decided upon at the pre-release stage in order to budget and obtain equipment, however it is post-release that the monitoring actually occurs. It is important to consider what information is required in order to decide upon the most appropriate techniques to be used. Fundamental to the process though is marking and individual recognition of the actual animals released, a number of techniques are available for this although subcutaneous transpondering is the technique by which Common Hamsters within the captive breeding programme are marked and is an effective, permanent and unique marking system.

Radio-tagging is particularly useful for monitoring dispersal and mortality, two of the key concerns post-release, however it is costly and time consuming and it may be decided that only a sub-sample of animals can be radio-tagged to reduce costs. Trapping is important to monitor individual health or reproduction in the released animals and also has the advantage of allowing animals born at the site to be monitored. Population level monitoring may occur via the use of field signs, however it is only really appropriate for reintroductions and of limited use in restocking exercises. Tissue sampling of released animals may allow subsequent genetic analysis of the population and the evaluation of individual contribution to the population and dispersal.

- Measuring success: This is critically important in terms of assessing the conservation potential of releases and comparing the efficacy of different release options. It is important for funding to be able to measure success of programmes, although by definition success may not be a short-term issue. Determining success in restocking programmes may be fundamentally more difficult than with reintroductions. The aims of any releases will obviously effect the

determination of success, although generally the establishment of a self-sustaining and viable population would be the aim for most reintroductions. Success may not be something that can easily be assessed in the short-term although failure may be more easily determined.

Releases that do not succeed may still be deemed useful exercises if appropriate post-release monitoring has allowed an indication of the causes leading to the lack of success, this may well be important in devising and refining protocols for the future. However, failed releases without appropriate post-release monitoring and with no attributable cause are of limited value and may be counter productive.

- Site Management: Continued site management is important for securing the viability of reintroduced populations. As captive breeding and reintroduction is a costly, time consuming process it is important not to expend resources and time on re-establishing populations only to subsequently fail to safeguard them. This may be particularly pertinent with Common Hamster given the agricultural nature of its habitat. Securing a long-term commitment to a favourable management regime is a vital pre-cursor to actual reintroduction.

Predator management may also be a controversial issue requiring consideration, especially in the very early stages after release, when release enclosure may create an unnaturally focussed situation and Common Hamster numbers are still low. Ultimately of course it would be hoped that established populations should be able to withstand natural predation.

- Intervention: Following release there may well be a moral or welfare issue concerning potential intervention in the fate of the animals. Supplementary feeding or veterinary treatment may be called for but a decision needs to be taken on the degree to which individual animals will be manipulated or even brought back into captivity post-release.

The captive breeding, translocation and release of animals is not a strategy that should be entered into superficially. It is a complex and time consuming conservation action but nevertheless can complement fieldwork and public awareness as a combined strategy for conservation of the Common Hamster. The long-term success of any release programme though is likely to be largely dependent upon securing sufficient, well managed habitat to enable the establishment of large viable populations.

There are a number of different issues between reintroduction and restocking programmes, but as a general rule great care needs to be exercised when considering restocking, particularly with species like the Common Hamster with a high reproductive rate. The addition of extra animals is unlikely to be a solution for low numbers without the removal of some causal factor, and once this is removed then populations probably have the potential to recover quickly naturally. In certain circumstances though there may be genetic reasons for considering restocking exercises in order to provide new founder animals to existing highly inbred

populations. Under such circumstances very specific protocols may be appropriate involving small numbers of animals and possibly even replacing individuals within the population.

The driving force behind releases should not be the disposal of surplus stock or the need to relocate small numbers of animals but rather sound conservation reasons and the need to re-establish populations at key sites, or for research purposes and the requirement to test and formulate successful protocols. Reintroduction can be a worthwhile and successful conservation tool as part of a coordinated action plan and various aspects of the biology of the Common Hamster make it a likely candidate for successful conservation breeding and release programmes.

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