NoCheRo

Non-Chemical Alternatives for Rodent Control

Guidance for the Evaluation of Rodent Traps

Part A Break back/Snap traps

Version 1.0

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SUMMARY

The guidance for the evaluation of rodent traps, Part A break back/snap traps, describes the assessment of rodent traps used as pest control measure. In mechanical and experimental tests, the welfare impact and the efficacy of traps are assessed. Therefore, detailed test methods are provided in the guidance. Criteria on welfare impact of a trap depend on the time until unconsciousness of trapped target rodents. Two classes of welfare impact are achievable depending on different time spans. Basic efficacy is given by the general trap acceptance shown in the semi-field trial testing the animal welfare impact. Extended efficacy is tested in a field trial under real pest control measure conditions. 90% of the rodent population must be eradicated to prove extended efficacy of the trap system. This assessment is comparable to efficacy testing of the guidance on the Biocidal Products Regulation.

BACKGROUND: NON-CHEMICAL ALTERNATIVES FOR RODENT CONTROL (NOCHERO)

The control of commensal rodents (rats, mice) today mainly relies on the use of anticoagulant rodenticides. Anticoagulants meet the exclusion criteria (persistent, bio-accumulative and/or toxic) according to the European Biocidal Products Regulation 528/2012. Nevertheless, in 2017, the approval of all anticoagulant rodenticides was renewed for another five years. This decision mainly relied on the need of rodent management due to infection prevention and limited availability of alternatives to anticoagulant rodenticides. Traps were not evaluated as an alternative because criteria to assess their efficacy and animal welfare impact are lacking.

Against this background, the German Environment Agency together with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety hosted a European workshop with 50 stakeholders from authorities, the European Commission, academics, pest control associations as well as the non-chemical and chemical industry in Brussels in November 2018. During the workshop, representatives of the pest control industry, authorities and academics highlighted the relevance of non-chemical alternatives in rodent control. Existing trap type approval and certification systems in Sweden and New Zealand were presented. Finally, it was discussed how the gap of the missing assessment of most rodent traps used in Europe could be closed.

As a result of the 1st workshop, the NoCheRo Working Party was established with experts from authorities, pest control industry and scientific organisations to develop a technical guidance on trap testing and evaluation. After three meetings of the working party and several commenting rounds, a draft guidance was presented at the 2nd NoCheRo workshop in Brussels organized by the European Commission Department for Health and Food Safety and chaired by the German Environment Agency. Participants were representatives from the EU Member States authorities on biocides, the European Commission, the scientific community, NGOs and industry. Overall, the guidance received acceptance. The few critique points were implemented by the working party in this version of the guidance.

For further information on the NoCheRo initiative, please visit:

https://www.umweltbundesamt.de/en/topics/chemicals/biocides/non-chemical-alternatives-for-rodent-control

If you have questions or comments in relation to this document, please send them to nochero@uba.de.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
AIHTS	Agreement on International Humane Trapping Standards
AVBayJG	Act Regulation of the Bavarian game law (Verordnung zur Ausführung des Bayerischen Jagdgesetzes)
AVMA	American Veterinary Medical Association https://www.avma.org/
BASC	British Association for Shooting & Conservation https://basc.org.uk/
BayJG	Bavarian game law (Bayerisches Jagdgesetz)
CIEH	Chartered Institute of Environmental Health
BPCA	British Pest Control Association https://bpca.org.uk/
Defra	UK Department for Environment, Food and Rural Affairs https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
ECHA	European Chemicals Agency https://www.echa.europa.eu/
EPA	United States Environmental Protection Agency https://www.epa.gov/
EU	European Union
ISO	International Organization for Standardisation https://www.iso.org/
NAWAC	NZ National Animal Welfare Advisory Committee https://www.agriculture.govt.nz/protection-and-response/animal-welfare/national-animal-welfare-advisory-committee/
NoCheRo	Non-chemical rodent control
UK	United Kingdom
NZ	New Zealand

GLOSSARY OF TERMS

Standard term	Explanation
Animal welfare	Good animal welfare exists if the 'Five Freedoms' are achieved (Freedom from hunger and thirst; from discomfort; from pain, injury and disease; to express normal behaviour; from fear and distress; Council Directive 98/58/EC). Here, animal welfare of a trap is determined by the time until unconsciousness.
Break back/Snap trap	Spring-powered killing devices with a flat treadle or bait pan which releases a metal loop or plastic jaws closing down on the target (CIEH, 2014).
Clamping force	Force exerted by a trap on a trapped animal after the strike (Talling and Inglis, 2009).
Efficacy	The ability of a product or active substance to produce an effect as described in the label claims made for it, when used under actual use conditions. Here, efficacy of a product is determined by its attractiveness to the target organism and its ability to kill a rodent and is measured as population reduction.
Impact momentum	Force exerted on a trapped animal when it is hit by the striking bar (Talling and Inglis, 2009).
Incineration	Thermal waste treatment that involves the combustion of organic substances.
Safety box	An enclosure designed to contain a killing device and which fulfils two specific requirements: 1. The size of the entrance(s) limits access to animals no larger than the size of the target species. 2. The safety box must be able to be opened, so that humans have access to dead and alive animals in the trap.
Semi-field trial	Test under simulated field conditions and under controlled laboratory conditions.
Trap system	Rodent traps with all supporting elements, such as safety boxes, covers, lures, fixing mechanisms or installations, especially when their function is to direct rodents into the trap.
Triggering force	Force that the target animal must exert on the trigger to activate the trap.

LEGAL NOTE

This document aims to give information about how to conduct trials for the assessment of welfare impact and efficacy of break back/snap traps against pest rodents. However, please note that this document is neither legally binding nor does it constitute legal advice. This guidance was written and has been extensively reviewed by experts of the NoCheRo Working Party[1]. The German Environment Agency does not accept any liability with regard to the use that may be made of the information contained in this document.

GENERAL INTRODUCTION

Management of rodents relies on either chemical or non-chemical methods. The authorization of rodenticides against commensal rodents is regulated according to EU Regulation 528/2012 on biocides. All authorized rodenticides have been assessed, amongst others, for their physical-chemical stability, efficacy and for their effects on the environment and human health. The use of traps against rodents is undergoing a renaissance. However, there is no Europe-wide system for authorizing traps, and there are no agreed methods with which to evaluate them.

This guidance document tries to close this knowledge gap and provides methods for the unbiased testing of traps. Where appropriate, for example, in the description of target organisms, intended use and efficacy testing, this guidance has been adapted from the ECHA[2] (2018) guidance on the Biocidal Products Regulation. Hence, traps which have been tested for their efficacy in a similar way to rodenticides can therefore be compared to rodenticides. Therefore, users (general public and professionals alike) can make informed decisions about which methods may be used for best controlling rodents. Additionally, this guidance describes how to assess the animal welfare impact of break back/snap traps.

1. INTRODUCTION

This document covers break back/snap traps (herein after referred to as traps) which are used for the control of the house mouse (*Mus musculus*), brown rat (*Rattus norvegicus*) and the roof rat (*Rattus rattus*). Also, other target species such as water voles (*Arvicola terrestris*), bank voles (*Clethrionomys glareolus*), common voles (*Microtus arvalis*) and field or wood mice (*Apodemus* spp.) are considered. The four standard fields of use are given below with examples of possible fields of use:

- In and around buildings
    - in and around residential homes and other places in which people are accommodated;
    - in and around rooms intended for the preparation, processing or storage of food and beverages;
    - in and around stores, ships' holds, factories and silos;
- At waste dumps;
- In sewers
    - in moist/wet environments such as sewers and watersides;
- Open areas
    - open areas such as airports or leisure areas;

[1] List of NoCheRo Working Party participants can be found in Appendix 1.
[2] List of Abbreviation can be found in the beginning of the document.

- on animal husbandry farms (pigs, poultry, cattle, etc.).

1.1 Aim

The aim of this document is to provide guidance on how to assess the welfare impact and efficacy of traps against rodents, in order to provide users and authorities with information based on agreed methods.

1.2 Global structure of the assessment

Information on (basic) efficacy, welfare impact and intended use(s) of the trap must be sufficient to permit an evaluation of the product and to define its conditions of use. Furthermore, extended efficacy tested in field trials makes efficacy testing comparable to those of rodenticide approval.

Testing can be successful in four different ways:

Table 1: Possible certificates evaluating welfare impact and efficacy of rodent traps that can be achieved by specifics tests and criteria.

Possible certificates	**Test requirements and criteria**
Certified for animal welfare and basic efficacy	Test of welfare impact including general trap acceptance in a semi-field trial Criteria: Time span to unconsciousness meets criteria of Category B (cf. Table 3), and 90% of test animals have visited the trap
Certified for improved animal welfare and basic efficacy	Test of welfare impact including general trap acceptance in a semi-field trial Criteria: Time span to unconsciousness meets criteria of Category A (cf. Table 3), and 90% of test animals have visited the trap
Certified for animal welfare and extended efficacy	Test of welfare impact including general trap acceptance in a semi-field trial **and** efficacy test in the field Criteria: Time span to unconsciousness meets criteria of Category B, and 90% of test animals have visited the trap, **and** 90% target population eradication in a field trial
Certified for improved animal welfare and extended efficacy	Test of welfare impact including general trap acceptance in a semi-field trial **and** efficacy test in the field Criteria: Time span to unconsciousness meets criteria of Category A, and 90% of test animals have visited the trap, **and** 90% target population eradication in a field trial

The applicant can choose whether the trap is evaluated for animal welfare and basic efficacy (requires a semi-field trial testing the welfare impact and general trap acceptance) or for animal welfare and extended efficacy (requires additionally a field trial for efficacy).

Tests of technical/mechanical properties, welfare impact and efficacy should be performed with the product to evaluate whether it is in accordance with animal welfare and effective for the intended

use(s) (decision-making scheme, Appendix 2). Any data on welfare impact and efficacy from the scientific literature are considered only as supportive data and should not replace data obtained from tests. Data on the welfare impact of the trap are compared with the specified criteria to determine whether the trap meets the requirements for Category A or Category B (Table 3), or fails the test. The classification of traps in Categories A and B provides the basis to exclude traps that are less humane (Category B) when a sufficient number of traps were assigned to Category A. The basis for the evaluation is the use(s) specified in the application submitted by the applicant.

2. DOSSIER REQUIREMENTS

Data on technical/ mechanical properties, welfare impact and efficacy (basic efficacy in a semi-field trial or extended efficacy in a field trial) are required for every application for certification. The following information is required for each trap:

- Mode of action (type of trap);
- Representative organism(s) to be controlled and products, organisms or objects to be protected;
- The intended uses of the product;
- Basic or extended efficacy data to support these intended uses, including any available standard protocol used, including performance standards where appropriate and relevant;
- Welfare impact data, including any available standard protocols used, including performance standards where appropriate and relevant;
- Observations on undesirable or unintended side effects, for example on non-target organisms;
- Instructions for use, e.g., Best Practice Code Trapping (Appendix 3);
- A detailed technical description of the trap including:
    - dimensions such as height, width and length of the trap and its components;
    - the weight and the angles of the trap;
    - type and quality of materials;
    - clamping force, impact momentum and triggering force;
    - description of the bait device; if applicable, description of specific lure/bait to be used;
    - description of the safety box (if the trap is intended to be used in a safety box);
- High quality photographs and drawings of the entire trap and its inside, including the design of any box or tunnel that is to be used. The drawing must depict the information specified in the technical description.

The technical description, the photographs and the drawings can also be used to identify a trap and to decide whether the specific type of trap is already tested and approved/declined.

If the trap is intended to be used in a safety box, access to captured animals must be possible. Sealed plastic units containing a killing device and designed to be disposed of with the trapped animal inside are not considered humane. Such traps have been reported to capture mice alive, but without providing access to the animal to release it (Baker and Sharp, 2015).

Rat traps for use in sewer systems additionally need to fulfil specific requirements for enclosed spaces of waste water facilities according to local laws.

Technical/mechanical properties testing

A trap must be subjected to a preliminary assessment of its likely welfare impact to determine whether it should proceed to tests involving animals. Such an assessment should facilitate the exclusion of traps

that are clearly inadequate from a welfare perspective. Preliminary tests should be based on measurements of three mechanical forces - clamping force, impact momentum and triggering force - produced by a trap (for description, see section 2.2 below). Clamping force and Impact momentum are widely accepted as indicators of welfare performance among spring-powered traps internationally (ISO, 1999) and in Europe (Talling and Inglis, 2009), with stronger traps tending to result more quickly in death or irreversible unconsciousness. Triggering force is a partial indicator of both efficacy and welfare performance. Although, at the moment, there are no known thresholds defining sufficient mechanical forces, the evaluation of several traps with known mechanical properties could lead to a specification of acceptable thresholds.

Welfare impact and efficacy testing

It should be noted that any testing conducted in the European Union on rodents should be in accordance with the principles set under Directive 2010/63/EU on the protection of animals used for scientific purposes. For all types of traps, welfare impact must be demonstrated in a semi-field trial for the target organisms of the intended use. Only traps that were approved in terms of welfare impact are tested for efficacy. In advance of testing welfare impact, target animals must generally accept the trap (basic efficacy). Therefore, at least 90% of test animals should enter a (not activated) trap during the conditioning period of the welfare impact test.

Extended efficacy should be demonstrated in a field trial for each target organism named in the application, unless specified otherwise in this guidance. For roof rats, it is also acceptable to demonstrate extended efficacy in two (or more) well-conducted semi-field trials (for description, see section 2.4.1 below), since in some regions infestations of roof rats are quite rare. In general, it applies that tests should be of high quality to be considered for evaluation. For animal welfare reasons, in semi-field trials, the number of animals per test should be restricted to a minimum (n=12, recommended by AIHTS). Nevertheless, meaningful evaluation should be possible.

The following guidance is designed to be flexible and does not specify rigid protocols to which tests must be conducted. Published or unpublished data from any source will be considered provided the data are scientifically valid and relevant to the application. In all cases, the methods must be described in sufficient detail to make the data reproducible. Ideally, data should be generated using nationally or internationally recognised testing methods. However, applicants can also submit data generated using their own testing strategies where these are conducted and well reported to a sound scientific standard. In all cases, the data must allow a specific assessment of welfare impact and efficacy. Anecdotal evidence will not be acceptable.

Assessment will be made in relation to the welfare impact and efficacy of the product for the intended uses. The target species selected for testing should be appropriate to the geographic regions in which the product will be used. Please note that in some countries specific rodent species are protected by national nature conservation acts, and no control action against them is permitted.

Intended uses

Examples of intended uses associated with the target organisms are:

<u>For use against house mice</u>

- This will require testing against *Mus musculus*.[3]

For use against rats

- This will require testing against *Rattus norvegicus* and *Rattus rattus*.

For use against brown rats

- This will require testing against *Rattus norvegicus*.

For use against rats and house mice

- This will require testing against R*attus norvegicus, Rattus rattus* and *Mus musculus*.

For use against rats in sewers

- This will require testing against *Rattus norvegicus* in a sewer situation in the field test.

For use against small voles

- This will require testing against at least two vole species, for example, bank vole (*Clethrionomys glareolus*) and common vole (*Microtus arvalis*).

For use against water voles

- This will require testing against *Arvicola terrestris*.

For use against field mice (*Apodemus* spec.)

- This will require testing against the specified target species, for example the long-tailed field mouse/wood mouse (*Apodemus sylvaticus*) or yellow-necked field mouse (*Apodemus flavicollis*).

General intended uses, such as 'for use against mice', with no further clarification of the target species are not acceptable within this guidance. This is because it would allow use against rodent species for which the product is not tested and/or not intended. Concerning the target species, intended uses must be species-specific.

Therefore, testing of extended efficacy must also be species-specific, and so for each target organism tests must be conducted. This is because the biology and behaviour of the target species, even within taxonomic groups such as rats, voles or mice, may differ considerably. For example, the roof rat (*R. rattus*) is more neophobic than the brown rat (*R. norvegicus*) and will be less likely to accept baits in traps than the brown rat. Mice are taxonomically very unspecific, and the term may be applied to a broad range of species (e.g., *Mus musculus* or various *Apodemus* species) with different biology, behaviour and body size. Therefore, all target organisms must be tested to assess extended efficacy.

2.1 Test animals

In accordance with Directive 2010/63/EU, Articles 7 and 9 and Section A, 3.2. of Annex III, the test of extended efficacy (field trial) must be conducted using wild rodents or their offspring. For the test of welfare impact and basic efficacy (conditioning period of the welfare impact test), it is possible to use strains that resemble wild strains as an alternative. These strains should be outbred strains (e.g., Long Evans or Lister Hooded rats) which retain the behavioural characteristics of wild rodents, including neophobia, anxiety, and fully capable sensory organs (no impairment of sight, hearing, smelling or

[3] In general, data generated using either *M. musculus musculus* or *M. musculus domesticus* would be acceptable.

taste). When laboratory strains that resemble wild strains are used, a short description of the behavioural characteristics, as well as reasoning for the choice of the respective strain as test animals, should be provided. Where wild animals are used, these may be live trapped from the wild, reared in either outdoor colonies or under laboratory conditions allowing animals to retain much of their natural physiological and behavioural characteristics. Breeding stock used for rearing wild rodents should not be selected for docile qualities or other characteristics that significantly alter their wild tendencies.

Unnecessary suffering must be avoided and animals should be checked regularly. Moribund animals should be euthanized in line with the requirements to apply humane end-points by using clinical signs to determine impending death.

Field trials should be conducted on wild rodent infestations provided that the respective tests on mechanical properties and welfare impact confirm an accordance with animal welfare. The number of animals involved in testing should be minimized. While this objective is clear for semi-field trials, for which the animals are used on purpose, for field trials, the situation can be seen from a different perspective. Where a field trial is carried out under real life conditions and the rodents subjected to such a field trial would anyway have been killed/controlled using traps or rodenticides, then it is considered that such a field trial does not involve any duplication of testing.

2.2 Testing technical/mechanical properties

The first stage of trap assessment should be to measure the clamping force, impact momentum and triggering force before and after a quality/reliability test; either to accumulate data for identifying a suitable lower threshold for each force or, once this has been established, to compare with the established thresholds and exclude any traps that are weaker. For testing mechanical forces, the tests in Appendix 4 are recommended.

Clamping force and impact momentum

When a break back/snap trap is triggered by an animal, the striking bar of the trap should hit the animal either on the back of the head or in the upper cervical area; this should cause death in one of three ways (Parrott et al., 2009). Ideally, the striking bar will strike the correct body location with sufficient impact momentum to cause cranial or upper vertebrae fracturing, rendering the animal immediately insensible before death. The impact momentum generated by a trap will also cause physical damage, e.g., to the nervous system, blood vessels and organs (Baker et al., 2012). Alternatively, the clamping force of the trap may cause death in one of two ways (Parrott et al., 2009). If the striking bar falls across the neck, it can cause occlusion of blood vessels supplying the brain. If the striking bar falls across the body, thoracic compression can cause hypoxia as a result of asphyxiation. Clamping force will also retain an injured animal in the trap and may increase damage if the animal struggles in the trap (Baker et al., 2012). Clamping force is also known to lessen any bounce-back of the striking components and ''*provides an extra degree of insurance that a humane kill will be affected* [sic]'' (Newcombe, 1981). While clamping force and impact momentum can each, in some circumstances, cause death in isolation, together they are known to act synergistically (Benn et al., 1980; Warburton and Hall, 1995). However, traps with greater impact momentums are likely to cause more immediate damage (Warburton and Hall, 1995). Spring-powered traps that crush the skull are considered the most efficient and should be in accordance with animal welfare (Mason and Littin 2003; Proulx and Barrett, 1991), because damage to the skull or upper cervical vertebrae may cause immediate unconsciousness (Parrott et al., 2009).

Trigger mode and triggering force

Leg hold traps have been banned in Europe and other countries since 1991. The key feature of leg hold traps are step-on triggers. However, step-on triggers remain the standard triggering mechanism for mechanical rodent traps. Step-on triggers are the major source of failed catches and killing of non-target animals (AvBayJG, 1983; Talling and Inglis, 2009). Any animal stepping on the trigger from any direction (front, side or back) will trigger the trap.

Step-on triggers should only be used in combination with safety boxes or trap tunnels that direct target-animals to position their head or neck appropriately for an efficient kill (BayJG, 1978; BPCA, 2017; Gillies, 2013; Talling and Inglis, 2009). Traps that can only be triggered when the animal is at the correct position in the trap (e.g., pulling or lifting trigger) may achieve a perfect strike location without a safety box (AvBayJG, 1983; Talling and Inglis, 2009).

Assessment of the triggering force is important for good trapping results and animal welfare (Talling and Inglis, 2009). If the triggering force is too low or too high, the trap will strike before or after the target is well positioned and will cause failed catches. A well-selected triggering force should prevent smaller non-target animals from activating the trap without reducing efficacy for trapping target animals (Talling and Inglis, 2009).

Quality/Reliability tests

Traps degrade with use, over time or as a result of ambient conditions. In particular, cheap or poor-quality springs wear out rapidly. As clamping force, impact momentum and triggering force are regarded as essential indicators for animal welfare, the stability /reliability of these mechanical features must be proven by specified test procedures.

Additional information

In some circumstances, clamping force and impact momentum continue to be used as part of the formal approvals process in the UK (see Baker et al., 2012). For example, new spring-powered traps submitted for approval to the UK Department for Environment, Food and Rural Affairs (Defra) and being deemed equivalent in all relevant respects (e.g., ''*in construction, in materials, in impact force or momentum, and in all other respects which are relevant to its effect or manner of operation as a trap*'') to one with existing approval, e.g., by virtue of s. 2(1) (b) of The Spring Traps Approval (England) Order 2012, are considered to be approved without testing.

While current trap approval criteria generally require killing-tests (see 2.3 below), there may be scope in future for designing animal analogues (or 'Trap-test dummies'), e.g., standard animal models, to be used in place of live animals in trap tests (Baker et al., 2012).

2.3 Testing welfare impact and basic efficacy

The aim of this test is to determine the welfare impact and general acceptance of the trap. A trap is considered to have an acceptable welfare impact if animals are irreversibly unconscious within a defined time span. The time to irreversible unconsciousness can depend on the body strike location (where on the animal's body it was struck by the striking bar of the trap), and this is affected by how the animal entered the trap. Therefore, animals should be free to choose whether to enter the trap, but the attractiveness of the trap can be maximized. An attractive bait (according to manufacturers' instructions or standard rodent bait) and unattractive alternative food can be offered. Furthermore, animals should be allowed to condition to traps for 3 to 14 days prior to testing. The necessary duration of the conditioning period will depend on the species, because for example rats tend to be more neophobic than house mice. Visits to traps during the conditioning period should be recorded. Only if

at least 90% of the test animals visit the traps during the conditioning period, welfare impact tests should be conducted, thus limiting the number of test animals used and avoiding experiments with unattractive traps (basic efficacy).

During the welfare impact test, time until unconsciousness must be determined for about equal numbers of adult rodents of two weight classes. The two weight classes are:

1. < 22 g for mice and small voles; < 150 g for rats and water voles
2. > 22 g for mice and small voles; > 150 g for rats and water voles

Weight classes values may be varied slightly according to species and availability of individuals from the local breed.

The test should be aborted if welfare impact criteria can no longer be met or are already met. Tests should be conducted according to Appendix 5, but other data will be considered on their merits. Wild strain testing is preferable. However, since this is probably impractical for some applicants, an outbreed lab strain which is likely to exhibit traits of the wild strain may be accepted as surrogate.

2.4 Testing extended efficacy

Provided that a trap has met the welfare impact criteria, then, if applied for, the trap can progress to extended efficacy testing (Appendix 2). The aim of efficacy testing is to determine the reliability and efficacy of the trap system (trap and its supporting elements, e.g., safety box, cover, lure, fixing mechanisms) under actual or in-use conditions (field trial). A field trial should be conducted according to Appendix 6 to demonstrate extended efficacy of the trap. Other data will be considered on their merits. The study must be representative for the intended use of the trap. All relevant species for which the trap is intended should be used as the test species. Wild strain testing is mandatory for testing efficacy. For roof rats, efficacy can be demonstrated in two semi-field trials according to Appendix 7.

Field trial with rats and mice

For demonstrating extended efficacy of traps against all rodent species except roof rats, the trap systems must be proven under field conditions. Ideally, sites chosen for field trials should be representative of the range of locations where the trap system is to be used (indoor/outdoor). Sites should be infested with sufficient numbers of the target rodents so that the efficacy of the product can be clearly demonstrated. An example for a field trial protocol is given in Appendix 6.

It is advantageous if the rodent infestations on the sites chosen are, as far as possible, discrete and not subject to potential rapid re-invasion. Rodent activity on the site should be determined before and after treatments using at least two standard census techniques. These techniques should also be independent of the trap system, so as not to alter rodent behaviour towards the traps when placed. The site owner and trapping personnel need to be aware of the intended trial, so that their actions do not affect the scientific validity of the result.

Sketch maps of the sites to an indicated scale should be provided. These should show all the important features including signs of infestation and location of traps. Data should be presented to indicate levels of rodent activity both before and after treatment, and all relevant information regarding treatment details. Number or density/distribution of traps should be selected according to the instructions of the manufacturer.

Field trial with voles

For efficacy testing of traps for voles, the field trial protocols for house mice and rats are only suitable when the infestation is inside a building. Efficacy testing outside of buildings should be conducted with a specific protocol. In contrast to rats and house mice, voles excavate and inhabit galleries (tunnels beneath the surface) for food exploration and nesting.

For a field trial with voles, one test plot and one control plot should be investigated. The pre-treatment and post-treatment censuses are conducted by counting occupied galleries. For this, at least ten galleries should be opened on each plot (treatment and control). After 24 h, the number of refilled galleries is then counted. The number of refilled single openings is compared to the number of openings that have not been refilled as an indicator for vole activity. Depending on the vole species, an alternative census method could be the closing of burrow openings, e.g., for field voles. Reopening of burrows is then counted as a sign of activity.

Trapping should be undertaken in spring or autumn, as in the winter not much activity is to be expected, and in summer other food sources than the bait in the trap are too abundant. Application of the traps should follow the use instructions for the product. Control of the traps should follow intervals required by responsible authorities for trapping or, if not applicable, given in the use instructions. Traps should be placed for a maximum 14-day test period if no particular recommendation was given by the manufacturer.
After the treatment, vole activity should be controlled with the same method applied as for the pre-treatment census. The efficacy is then calculated as:

$$E = 100 * \left(1 - \frac{t2 * c1}{t1 * c2}\right)$$

Where:
E is the efficacy,
t are treated plots
c are control plots,
t1 and *c1* are the ratios of refilled galleries/open galleries before treatment, or active/in-active burrows.
t2 and *c2* are the ratios of refilled galleries/open galleries after treatment, or active/in-active burrows.

Semi-field trial with roof rats (*Rattus rattus*)

To evaluate extended efficacy of traps against roof rats two semi-field trails or a field trial are applicable. Using a semi-field approach, general acceptance of trap systems should be proven under simulated management conditions (see Appendix 7). For example, animals should be free to choose whether or not to enter a trap and must be allowed to learn socially to avoid a trap. Furthermore, the test should be adjusted to the particular pest control situation. Traps should be placed between feeding and nesting sites and should be positioned against a wall. This semi-natural approach corresponds to pest control in infested buildings, during which traps would be positioned on travel paths of the target species.

Full details of the methods used should be provided, and data should be presented showing the percentage of female and male rodents that are trapped or activated at least one trap. When no significant differences exist between the sexes, the data from the two sexes may be combined.

3. METHODOLOGY OF ASSESSMENT

There are some standard test methods currently available that may be appropriate for the assessment of the efficacy of rodent trap systems. A list of such test standards is presented in Appendix 8.

In addition to the standard test methods presented in Appendix 8, specimen protocols for welfare impact testing (semi-field trial) and efficacy testing (semi-field or field trial) are presented in Appendices 5, 6 and 7 respectively. These Appendices are intended to provide further information regarding the types of studies that may be used to assess the efficacy of some traps, and some of the factors that should be considered.

Any known limitations on efficacy should be considered during the assessment such as:

- Possible restrictions/recommendations concerning the use of the product in specific environmental or other conditions that can reduce the efficacy, for instance:
    - hot, cold or humid environments
    - the presence of rodenticides or food alternatives
- Possible recommendations/explanations concerning avoidance of continuous use of the product in order to prevent the development of trap avoidance.

The study results are compared directly with the criteria for welfare impact and efficacy.

4. ASSESSMENT

4.1 Norms and criteria

A rodent trap-system may only be acceptable if it has an acceptable welfare impact and basic or extended efficacy. Rodent traps are considered to have an acceptable welfare impact and efficacy (see Table 1) if they satisfy the following criteria:

- Welfare impact and basic efficacy (cf. 2.3): The percentages of 12 animals shown in Table 3 must be irreversibly unconscious within a defined limit (welfare impact), after ≥ 90% of animals have visited at least one trap during the prior conditioning phase (basic efficacy).

  Depending on the species and the time between the animal triggering the trap and the animal becoming irreversibly unconscious, a trap is assigned to Category A (improved animal welfare) or B (animal welfare):

  Table 3: The time until irreversible unconsciousness [s] of at least 80% and 90% of trapped animals determines the category that a mouse, rat or vole trap is assigned to.

	Mouse and small vole traps		Rat and water vole traps	
	≥ 80% of animals	≥ 90% of animals	≥ 80% of animals	≥ 90% of animals
Category A	≤ 30 s	≤ 60 s	≤ 45 s	≤ 90 s
Category B	≤ 60 s	≤ 120 s	≤ 90 s	≤ 120 s

  These time criteria are developed according to AIHTS and NAWAC Guideline 09 with shorter time limits. This is due to the smaller body size of target animals here compared to target species of AIHTS (and some of NAWAC). Smaller body size correlates with greater breathing and heart rates. Therefore, unconsciousness is likely to occur more quickly than in larger animals, and consequently acceptable time limits are shorter. If an animal triggers the trap but

can escape, it is counted as an animal that suffered longer than 120 s. Although the animal might not be injured, it cannot be assured that the animal is unharmed.

In the future, the criteria could be adapted after some traps have been successfully tested in accordance with the intention to continuously improve traps.

- Extended efficacy (cf. 2.4): 90% of the rodent population in a field trial must be eradicated after rodent control operation using the trap system only.

  In the field trial, the percentage of census bait consumed after the control operation compared to the amount of bait consumed before the control operation should be ≤ 10%. For other types of test population monitoring, such as tracking activity measurement or electronic records, these should indicate a similar decrease in the population. Findings regarding reliability, welfare impact, and every non-target capture should be recorded. These data are accumulated to develop an assessment of risks for non-target species.

  For roof rats, extended efficacy can be shown in a field or two semi-field trials. In semi-field trials, the efficacy under simulated operating conditions is considered as sufficient if ≥ 90% of animals have each activated at least one trap or are trapped when using a lethal test method.

The mechanical properties before and after the reliability test (cf. 2.2) are measured to generate data that can be related to results of the animal welfare test. However, at the moment, thresholds on mechanical properties cannot be defined due to the lack of data. Therefore, results of the mechanical testing are accumulated and extrapolated to the efficacy/welfare test results. This may facilitate the test procedure prospectively if tests of mechanical properties can be related to and replace the tests with animals.

5. ADDRESSING RISKS FOR NON-TARGET SPECIES

Non-target assessment is not focused on in this guidance, however, the use of break back/snap traps should be considered to pose a risk to some non-target vertebrates. Mammals and birds in the same weight and size class as the target species may enter and activate a trap and may be killed or injured as a result. Larger species, including wildlife and pets, and even humans, might at least be injured, especially by rat traps. Therefore, it is essential to address the risks posed by traps to non-target organisms as outlined in this section. However, once traps have been activated, they pose no further risk either to the environment or to non-target species (provided they are not self-reactivating traps). Traps do not pose a risk of secondary harm (analogous to secondary poisoning), unlike some rodenticides, which can be accumulated in food chains. Unlike some anticoagulant rodenticides, traps are therefore neither persistent, bio-accumulative nor toxic in their effects.

Exposure scenarios and risk characterisation

1) No risks are expected for non-target species if traps are applied in sewer systems. Apart from the brown rat, no other mammals (or birds) live or occur in sewers. Therefore, the risk to non-target organisms of being accidently caught or struck by a trap is considered negligible when traps are applied in sewer systems and no risk assessment for non-target species is required.

2) If traps are intended to be used indoors, the operator should confirm that children and non-target species, such as pets, have no access to the areas in buildings or premises where the traps are set. The risk to non-target species can then be considered negligible and no further

risk assessment for non-targets is required. If, however, non-target organisms cannot be excluded, risk mitigation measures will need to be applied (see point 3).

3) If the trap is used outdoors (or other areas where non-target animals may be present), risk mitigation measures will need to be taken in order to prevent non-target organisms from being injured or killed. Thus, a trap should only be used outdoors if access by non-target organisms is minimised as much as possible, e.g., by placing the trap inside a safety box. This will reduce the impact on birds (because they cannot fly directly into the trap) and prevent bigger non-target animals from being harmed.

There is potential for any vertebrate in the same weight and size class as the target species to enter and activate a trap. It has been shown that *Apodemus* species, bank voles (*Clethrionomys glareolus*), greater white toothed shrews (*Crocidura russula*), *Sorex* spp. and *Microtus* spp. may be caught in mouse snap traps (Geduhn et al., 2014). Granivorous and omnivorous birds and mammals are attracted to traps if a cereal-based bait is used.

Risks for shrews and smaller mammals may be reduced if they do not exert the triggering force necessary to trigger the trap; this may be the case with some rat traps. However, in the case of rat traps, their higher clamping force and impact momentum can also injure pets and children. Triggers other than step-on triggers can reduce the risks for non-target species because they are unlikely to be caught while running over or flying into the trap. For example, if target animals have to lift the trigger, or pull bait from the trigger, this is likely to reduce accidental trapping of non-target animals.

If safety boxes are used, species that are larger than the target species are excluded by the size of the entry holes. The risk for birds is reduced because they cannot fly directly into the trap. However, house sparrows (*Passer domesticus*) have been observed entering safety boxes to feed on rodenticide baits inside them (Elliot et al., 2014). The risk of birds entering traps within safety boxes might be less than with rodenticides because a smaller amount of bait is used, meaning it is less likely to be spilled. Nevertheless, if small mammals or birds enter a trap, the risk of them being killed or injured must be assumed to be very high. Furthermore, non-target animals of the same size as, or bigger than, the target species could activate the trap.

If the applicant can demonstrate that the risk of non-target capture or injury is minimized, e.g., by means of their construction, design, trigger specification or mode of operation (Fig. 1), then a safety box may not be needed when using traps outdoors.

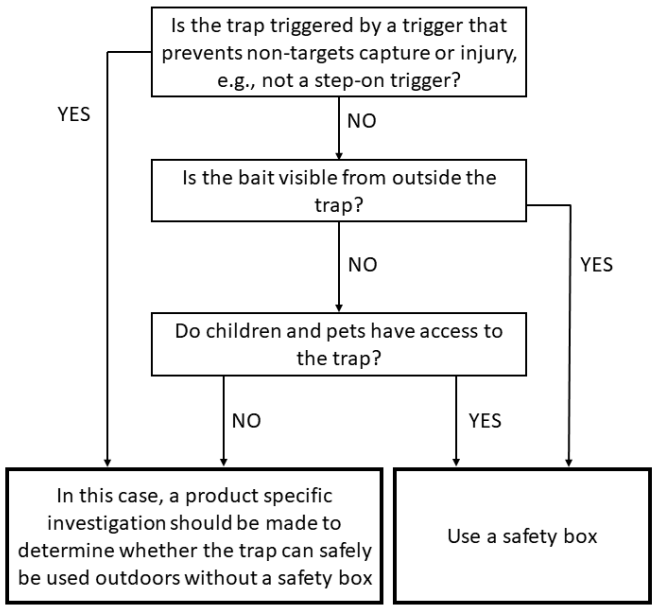

Figure 1: Decision scheme for implementing risk mitigation measures.

If the trap is intended for professional use, a field trial is mandatory for proving efficacy. Currently, there are no scientific data with which to assess the risk of non-target capture. During the field trial, every non-target capture should be recorded (cf. 4.1) and, in future, accumulated data could be used to assess the risk of non-target species being trapped more reliably. It is possible that mechanical properties, specific locations or certain baits could be associated with the capture of a higher percentage of certain non-target species.

APPENDIX 1 LIST OF NOCHERO WORKING PARTY PARTICIPANTS

Name	Affiliation	Country
Baker, Sandra	University of Oxford, Department of Zoology	UK
Brigham, Andy	Rentokil Initial plc	UK
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Fischer, Juliane	German Environment Agency	DE
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Kjellberg, Håkan	Anticimex AB	SE
Klute, Oliver	Futura GmbH	DE
Le Laidier, Gabriel	Swissinno Solutions AG	CH
Lombardi, Luca	Enthomos srl	IT
Martenson, Nils	Swedish Environmental Protection Agency	SE
Nugent, Hannah	Health and Safety Executive	UK
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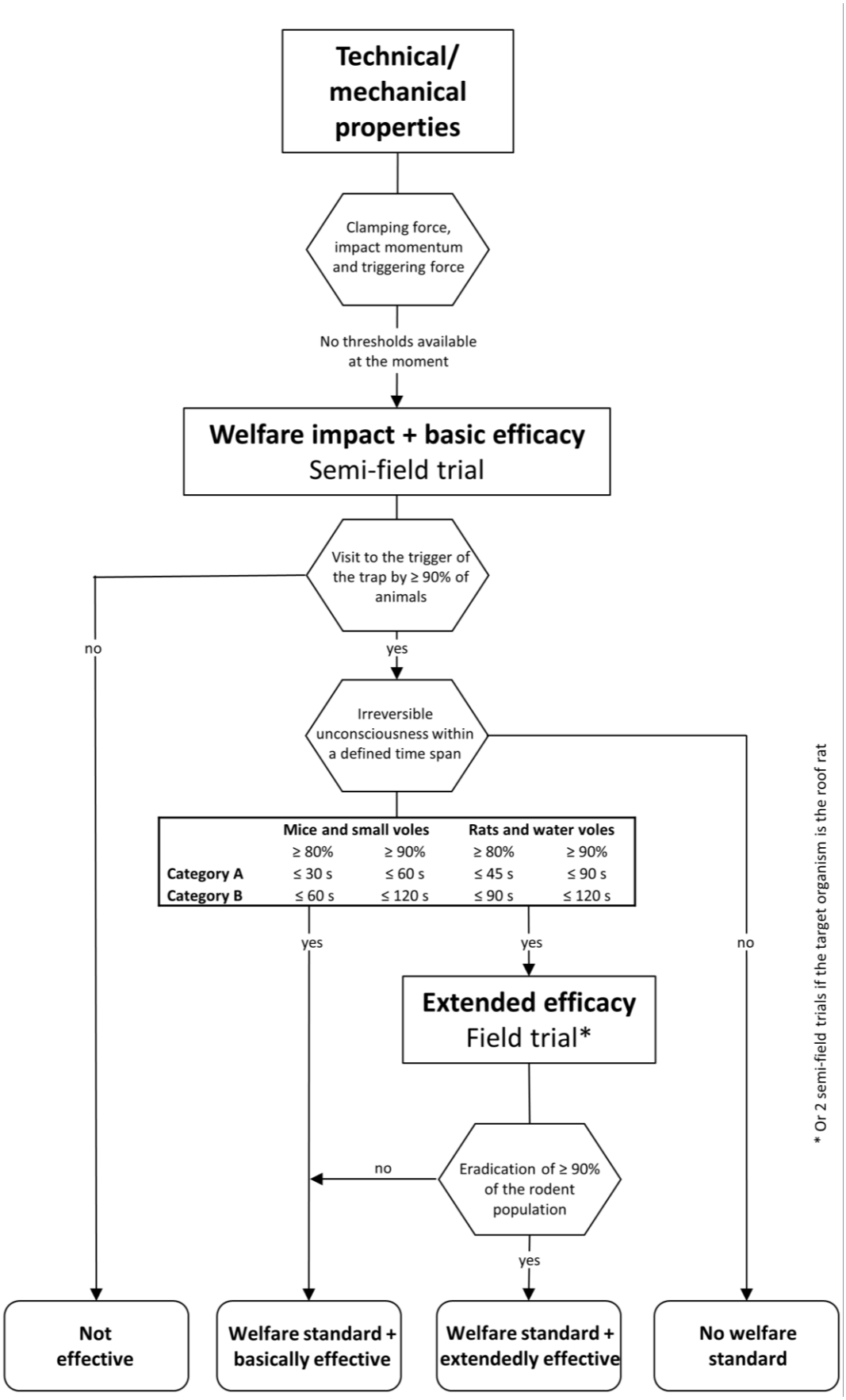
Schmolz, Erik	German Environment Agency	DE
Schlötelburg, Annika	German Environment Agency	DE
Schroeer, Daniel	Futura GmbH	DE
Urzinger, Markus	Swissinno Solutions AG	DE
Warburton, Bruce	Manaaki Whenua - Landcare Research	NZ
Wiesener, Robert	GSG Urban Guard GmbH	DE

APPENDIX 2 DECISION MAKING SCHEME FOR ASSESSMENT OF BREAK BACK/SNAP TRAPS



APPENDIX 3 CODE OF BEST PRACTICE – THE USE OF BREAK BACK TRAPS/SNAP TRAPS

The Code of Best Practice for the use of break back traps/snap traps is based on that of the BPCA (2017) and CIEH (2019):

- Traps must be set and handled according to the manufacturer's instructions regarding pest species and trap location. If in any doubt, a trap should not be set.
- Every effort must be made to avoid trapping individuals of non-target species. Traps should be set in an artificial or natural tunnel/safety box that prevents access by non-target species and protects children and pets. If the manufacturer specifies a tunnel or box type, then this should be used.
- Signs and evidence of pest activity need to be determined prior to setting a trap. This can be achieved by surveying the location or by using non-toxic monitoring solutions to detect current rodent activity. If rodent activity cannot be assured, other monitoring means should be considered prior to trapping.
- Traps should never be set without coverage outdoors or in open or accessible areas where members of the public, wild or domestic animals and pets might gain access to them.
- Trapping indoors is generally considered less harmful to non-targets than outdoor trapping, but, nevertheless, the safety of users and other people, pets etc. needs to be considered before placing traps. Safety boxes should be chosen in line with a risk assessment. A risk assessment and justification for placement of a trap rather than a non-toxic monitoring device should be made available upon request.
- When placed outdoors, safety boxes and break-back traps should be firmly anchored in the treatment area.
- The intervals for checking traps should be selected according to the functionality of the trap. The risk of suffering of caught animals has to be minimized.
- Any alive and almost unharmed non-target individual must be immediately released when traps are checked. Severely injured animals must be euthanized.
- Always wear suitable personal protective equipment when dealing with dead bodies and traps to prevent the transmission of rodent borne diseases.
- Trapped animals should be checked for death before their carcases are disposed of.
- Dead animals should be disposed according to the Regulation (EC) No 1069/2009. Animals killed for disease control purposes have to be disposed by incineration. Disposal in an authorised landfill, the use for the manufacturing of organic fertilisers or soil improvers, composting or the transformation into biogas is possible if pressure sterilisation and permanent marking of the resulting material follow.
- If trapping is unsuccessful, switch to alternative professional, non-toxic baits or lures to ensure a variety of scents as rodents vary in their tastes.
- It must be ensured that the application of the trap complies with the legal requirements of the respective country. If in any doubt, the supplier or relevant authorities should be consulted.
- Traps should be cleaned when they are applied for a different rodent population to avoid the transmission of rodent borne diseases. Traps should be stored sealed in dry places to prevent rusting and taking odours that may repel the target species.

APPENDIX 4 TESTING TECHNICAL/MECHANICAL PROPERTIES

Standard trap apertures for mechanical testing

The measuring equipment must be set up to measure impact momentum or clamping force at a standard aperture size (the gap between trap jaws at impact). This size will depend on whether impact momentum or clamping force is being measured and whether measurements are being made for rat or mouse traps. The aperture sizes for measuring impact momentum are 40 mm for rat traps and 20 mm for mouse traps.[4] These are based on an estimate of the diameter of the target animal at the likely point of capture (e.g., immediately behind the forelegs). The aperture sizes for measuring clamping force are 5 mm for rats and 1 mm for mice. These are based on an estimate of the thickness of the target animal's body at the point of capture, once compressed by the striking bar of the trap. These standard aperture sizes must always be used when measuring impact momentum or clamping force to ensure that measurements made by different organizations are comparable. Even small deviations in aperture size could affect the measurements made, so the aperture size needs to be carefully arranged. The electronic load cells used for measuring clamping force and impact momentum should be adapted accordingly, using aluminum 'spacers' where necessary.

Measuring protocol

Ten traps of the type under test are required. Before testing, the traps should each be set and released 10 times. To begin making measurements, the trap should be stretched to its fully open position (as if to set it) and then released gently onto the sensor for measuring clamping force (thus mimicking the trap being set and triggered, but only measuring clamping force). Then the trap should be set and released under its own spring power as normal onto the sensor for measuring impact momentum. This should be repeated for each of the ten traps. The measuring methodology is detailed below. The raw data should be used to produce an average measurement of clamping force and an average measurement of impact momentum for the type of trap under test.

Measuring clamping force and impact momentum

The forces to be measured are the static clamping force F_0 and the dynamic force versus time series $F(t)$ exerted by the trap at selected trap-openings, representative of the size of target animals at the intended body strike location. The dynamic force versus time series then needs to be integrated in time, in order to calculate the trap impulse $\int F(t)dt$. This is equal to the equivalent linear momentum (impact momentum) possessed by the moving part of the traps at the selected trap-opening according to Newton's Second Law (Cassidy et al., 2002).

$$\int F(t)dt = \Delta(mv)$$

Static clamping forces can be measured using a resistive load cell (e.g., R.D.P. Electronics Ltd, Sole UK; model 31; Sensitivity = 16.54 mV/N) with a 10V DC excitation. The load cell should be physically clamped between the striking elements of the trap such that force is measured directly. Load cell output can be amplified (by a Fylde, 351UA amplifier of gain = 1000) and the amplified signal then

[4] These diameter estimates are based on reports in the literature (Macdonald and Barrett, 1993), and, for mice, post-mortem measurements were also supplied by the Vet Services Department at the University of Oxford (Baker et al., 2012).

recorded by an oscilloscope (e.g., Tektronix; model DPO 3014). The load cell calibration factors are used to convert the amplifier's output voltage to clamping force (in Newton [N]).

Dynamic force histories can be measured using a piezoelectric load cell (e.g., Omega Technologies Ltd, UK; model DLC101-500; Sensitivity = 2.383 mV/N). Traps should be triggered so that the dynamic load cell is caught between the striking elements (as would be a trapped animal), and the measured dynamic force versus time histories should be employed to calculate the impact momentum (Ns) of traps at the selected opening, for the species, as described above.

The measured clamping force and impact momentum will be independent of the load cell type and will depend only on the trap mechanics. Load cells should be supplied with their own calibration certificates, and they should be calibrated in the lab to confirm the figures therein. The test jig must be rigid and have minimum mass (e.g., aluminium), in order to ensure that inertia forces associated with the jig's moving parts are negligible compared to impact forces. 'Softer', 'flexible' or 'heavier' parts, within the test jig, will underestimate the impulsive force, but by an amount that is extremely difficult to quantify. Therefore, it is better to aim for a 'massless, rigid' ideal for the fixtures, in which case all traps tested will be measured equitably, meaning that results will be comparable.

Measuring triggering force

A sample of 10 traps shall be tested. Before testing, the traps should each be set and released 10 times. Triggering force shall be tested by a gauge (digital or mechanical). To prevent the killing bar hitting the instrument, the trap must be secured or blocked in such a way that it can be triggered, but so that the killing bar is stopped just after activation. The probe must press at the trigger just where the animal would normally interact. Typically, this is the front part of the trigger or the side closest to the opening. The force applied by the instrument should be perpendicular to the trigger movement (usually vertically for step-on or lifting style triggers). For each trap, 5 measurements must be taken and a median calculated.

Recommended values of clamping force, impact momentum and triggering force

First results of mechanical testing indicate the following minimum and ideal values (Table 2) as recommendations:

Table 2: Recommendations for ideal and minimum clamping force, impact momentum and triggering force based on first mechanical tests of rat and mouse traps.

Rat Traps	**Ideal**	**Minimum**
Clamping force at 5 mm	40 N	10 N
Impact momentum	7 Joule	3 Joule
Triggering force	0.1 N	0.05 – 0.9 N
Mouse Traps	**Ideal**	**Minimum**
Clamping force at 5 mm	6 N	2 N
Impact momentum	1 Joule	0.3 Joule
Triggering force	0.03 N	0.01 – 0.1 N

Measuring quality/reliability:

After the initial measuring of the mechanical properties, the traps must undergo a stress treatment. That could be:

- Vibration test
- Setting and firing a trap 20 times, using a foam or rubber element as damping element or animal body simulator. This last shall prevent damage from firing the traps without animal.

After these tests, the mechanical features, clamping force, impact momentum and triggering force must continue to meet the (to be defined) thresholds.

APPENDIX 5 SEMI-FIELD STUDIES FOR RODENT TRAPS: WELFARE IMPACT TESTING

This appendix describes a protocol for a semi-field study to determine the welfare impact of traps against the house mouse, brown rat, roof rat and small voles, as examples. The study consists of a conditioning period, followed by the test period. The duration of both periods depends on the target species. House mice/small voles should be conditioned for a maximum duration of 7 days; rats for a maximum duration of 14 days. The duration of the test period depends on how long it takes for 12 animals to enter the trap.

For the test, normally 15-20 wild or laboratory strain rodents are required. Laboratory rodents of known strain (STATE) or offspring of wild rodents should be healthy and non-pregnant. If wild rodents are used, they should be healthy and obtained from free-living populations (STATE WHERE) in accordance with Directive 2010/63/EU, Articles 7 and 9 and Section A, 3.2 of Annex III. On arrival at the laboratory, the wild strains should be treated with an appropriate insecticide, to kill ectoparasites, and then housed in small groups (no more than five per cage) of the same sex and treatment group if no aggressive behaviour is expected, preferably in solid floor cages with appropriate environmental enrichment. Animals may be housed individually only if scientifically justified. Wild rodents should be acclimatised to laboratory conditions for at least 3 weeks to ensure that no females are pregnant when the test begins. During this time, rodents should be offered a laboratory animal diet, and water should be freely available.

Before trials, animals are weighed and equally assigned to the two weight classes that are tested. Animals are tagged with a passive-integrated transponder (PIT/RFID) for individual identification. Rats are anesthetized if the injection of a transponder is not possible otherwise.

Conditioning period

Test animals are released to two connected chambers. Minimum size of test chambers should be 0.1 m^2 per test animal. One room provides nest boxes, while the other provides the traps to be tested, a feeding dish filled with ground laboratory diet or EPA meal and water *ad libitum*. Preferably, 4 non-activated traps are positioned on flat platforms covering the antennas-logger-system and protecting it from gnawing by rodents. The number of traps can vary, depending on their mode of action (single vs multi-catch) and size. The antennas are positioned directly under the triggers of the traps. If an animal enters the trap, the antennas registers the individual transponder of the animal. Traps are baited with a rodent attractive bait according to manufacturers' instructions or with a standard rodent bait (e.g., peanut butter for mice and fish for rats).

During the conditioning period, the number of visits to the trigger of the trap of each animal is determined. The deciding criterion is that ≥ 90% of animals have visited a trap at least once. If < 90% of animals have visited a trap, the trap is excluded from further tests.

Test period

If the trap is generally accepted by the animals, the welfare impact of killing is examined with the prior conditioned animals. One day before the test starts, traps are not baited, but ground laboratory diet or EPA meal is provided (no starving). On the first day of the test, traps are baited and activated. Once some animals have entered the test chamber (with traps), the feeding/nesting chamber is separated from the test chamber. After an animal has triggered a trap, the experimenter enters the room and measures the time until irreversible unconsciousness of the trapped animal. Occurrence of unconsciousness is determined repeatedly by blowing air at the target animal's eyes with an air-filled

rubber ball to determine whether the corneal reflex is absent. If the trap strikes the animal at a peripheral region (e.g., tail or legs), the animal is euthanized immediately. An animal that has not entered the trap after an hour is transferred to a third chamber with water and nesting opportunities.

This procedure is repeated until 12 animals have triggered the trap unless the trap can no longer meet the criteria for a trap classified as category B, or the criteria related to 12 test animals have already been achieved. If an animal is not dead within 120 seconds, it must be killed using a recognized humane method. Such humane methods should be in accordance with the AVMA guidance (2020) and can be for example cervical dislocation (mice) or isoflurane.

Results

Results should be given as the percentage of animals reaching irreversible unconsciousness within each of the relevant time spans for the species under test. The body strike location should be recorded. It should also be mentioned how many days were necessary until ≥ 90% of animals have visited the trap.

APPENDIX 6 FIELD STUDIES FOR RODENT TRAPS: EFFICACY TESTING

This appendix describes a protocol and factors to be considered when conducting a field trial to determine the efficacy of a rodent trap system against the house mouse, brown rat or roof rat, as examples.

Ideally field trials should:

- be conducted with separate rodent populations (as appropriate to the intended uses);
- be carried out at sites that are representative of the intended use to manage medium and large infestations in industry and farming;
- be carried out at sites that have had no rodent trap treatments over the past 6 weeks;
- be carried out at sites that have had no rodenticide treatment over the past 6 weeks;
- incorporate lag phases before and after the treatment phase;
- be conducted if the customer agrees not to alter the site in any way that may confound the trial's findings or enhance the operation of the trap system, e.g., by improving housekeeping, proofing rodent access points, or removing significant food sources;
- include the whole trap system in the test, e.g., specific safety boxes/tunnels or any additional means;

The following suggested method details the extent of the data required, but the methods may be replaced or supplemented by new techniques as appropriate.

Suggested procedure for testing rodent trap systems

Trial site

The trial site should, as far as possible, comprise a discrete infestation of one target species, with little chance of rapid reinvasion from adjoining areas.

During the entire trial, the trap locations should remain at exactly the same locations, as specified in the use instructions, which later shall be part of the product labels. Details of where the traps should be located as given by the applicant must be followed and documented.

Before the trial begins, the entire site is surveyed, examining for signs of rodent activity, such as droppings, burrows, damaged building fabric and smear marks. Draw a sketch map showing all significant features of the site including signs of infestation.

Data on field efficacy is likely to be more reliable if infestations of the target species are selected on the basis that a stable level of activity is obtained during the pre-treatment assessment. The level of activity can be determined by two of the following (as appropriate to the situation, species etc.):

- Census baiting
- Tracking
- Electronic census

Pre-treatment activity measurement/estimation of numbers

Indices of the target species population should be obtained both before and after the test treatment, normally using at least 2 of the following quantitative methods:

<u>Census baiting</u>

The position of the census bait points should be indicated on the site sketch plan. Census bait should be laid at each bait point for at least 4 days to cover the whole infestation in quantities at each bait point which, as far as possible, exceed the maximum daily take by rodents. The number of bait points should be approximately the same as the planned number of test traps. Census points should not be located at the same place chosen for the test traps, but should be at different (intermediate) positions.

The census bait used must be of a type and quality likely to be readily acceptable to the rodent population, e.g., cereal bait such as pinhead oatmeal or whole wheat. The type of census bait, along with manufacturer details and batch number, should be recorded, as far as available.

The number of points from which census bait has been taken, and the amount taken from each point, should be recorded daily. An indication of the change in weight of the bait due to moisture loss or uptake should be included.

The bait points are topped up daily if bait has only been partially taken. If all the bait has been consumed, then the quantity should be increased or an extra bait should be placed alongside and recorded in order to ensure an accurate pre-treatment census.

At the end of the bait census all census baits should be removed from the trial site. The total amount of census bait consumed per time period will give an index of population size.

Tracking

This is recommended for both rats and mice and should be measured over at least 3 days, simultaneously with the bait census, using tracking patches/boards laid around the site in numbers similar to the census bait points but not in the same locations if possible. The locations of the patches/boards should be indicated on the plan.

The patches/boards should be inspected for signs of activity and resurfaced daily. A simple scoring system can be devised to assess the number of rodent footprints per patch/board: summing the individual scores gives a daily activity index. When the pre-treatment assessment is complete, the tracking patches/boards may be removed from the site or maintained to provide supplementary information on rodent activity.

Electronic census

This is recommended for both rats and mice and should be measured over at least 4 days. Such electronic methods, e.g., using infrared-detection, can be used according to the instructions of the manufacturer. The whole test area must be covered with sensors, similar to the distribution of tracking patches. The design of any sensors, or sensor boxes, should be different to the trap system, and due consideration of rodent behaviour (avoidance) towards such boxes taken into count in order to ensure sufficient census data can be gathered.

Pre-treatment lag period

Once the pre-treatment population measurement has been conducted there should be a lag period, normally 3-14 days with no experimental interference (other than tracking) on the site.

Test treatment

The test trap system must be installed in accordance with the label or proposed label, for an appropriate period (normally[5] up to 30 days). The locations of test traps should, as far as possible, be different from those of the census bait points, motion sensors and tracking patches/boards.

Where applicable the following items should be recorded:

- The locations of all traps on the site plan;
- The kind of boxes, tunnels, covers, baits / lures, fixing mechanisms / installations (if applicable). Photographs to illustrate a typical trap system in place;
- The number and species of rodents and other animals found dead and alive in and around the trap system, and the dates on which they were found;
- The dates of all observations, treatments and censuses. Observations should include any trap activations with no capture, any broken or damaged or unrepairable traps and any animals found trapped but alive;
- Any other information deemed relevant. This may include, for example, weather conditions, temperature data, site changes instituted by the occupier (including improvements in hygiene and structure proofing), or supplementary information on rodent tracking activity;
- All effects on non-target animals must be recorded, including kind of interference, damage to the animal, species concerned, kills and live captures, etc.

If an animal is found alive in the trap, it must be killed using a recognized humane method. Such humane methods must be in accordance with the AVMA guidance (2020) and can be for example cervical dislocation (mice) or isoflurane. On completion of the treatment all trap systems should be removed from the trial sites.

Post-treatment lag period

On completion of the treatment there should be a lag period of 3-14 days, depending on previous observations of rodent behaviour. During this period there should be no experimental interference with the site other than tracking.

Post-treatment activity measurement/estimation of numbers

Once the post-treatment lag period is completed, the methods employed to measure pre-treatment activity should be repeated in exactly the same way. Monitor sensors, baits, and tracking patches should be laid in exactly the same places as in the pre-treatment census. Census baits should be identical, and preferably from the same batch as that used in the pre-treatment census.

After the field trial, a comparison of population indices before and after treatment determines how successful the product has been in controlling the target population. The degree of control is expressed as a percentage reduction in the pre-treatment food uptake index. If post-treatment census bait consumption is ≤ 10% of pre-treatment bait consumption, then the trap is considered effective.

In addition, any trap activations with no capture, any broken or damaged or unrepairable traps and any animals found trapped but alive should also be reported. These can be expressed as a percentage

[5] Deviation from this norm is possible but should be explained in the application

of the total number of ‘trap nights’ (number of traps x number of nights) during the course of the treatment.

APPENDIX 7 SEMI-FIELD STUDIES FOR RODENT TRAPS: EFFICACY TESTING FOR ROOF RATS

This appendix describes a protocol for a semi-field study to determine the efficacy of traps against the roof rat. This test is conducted to determine the extent to which roof rats will visit the trap under simulated pest control conditions. The study consists of a habituation period of 3 days, followed by a test period of normally 28 days for roof rats.

Pre-test period

For the test, normally, a group of 10 wild strain rodents or their offspring (ideally 5 males and 5 females) are required. Rodents should be healthy and non-pregnant adults. Wild rodents should be obtained from free-living populations (STATE WHERE) in accordance with Directive 2010/63/EU, Articles 7 and 9 and Section A, 3.2 of Annex III. On arrival at the laboratory, the wild strains should be treated with an appropriate insecticide, to kill ectoparasites, and then housed in small groups (no more than five per cage) of the same sex and treatment group if no aggressive behaviour is expected, preferably in solid floor cages with appropriate environmental enrichment. Animals may be housed individually only if scientifically justified. Wild rodents should be acclimatised to laboratory conditions for at least 3 weeks to ensure that no females are pregnant when the test begins. During this time, they should be offered a laboratory animal diet, and water should be freely available. To encourage variation in response, animals with body weights throughout the range normally expected for the species should be used as far as possible.

Test period

The test animals are released to three connected test chambers (nesting chamber, test chamber, food chamber). Animals must cross the test chamber to access the food chamber from the nesting chamber. This semi-natural approach corresponds to pest control in infested buildings where traps are positioned on travel paths of the target species. Minimum size of test chambers should be 0.1 m^2 per test animal.

After 3 days of acclimatization, preferably, 4 traps are positioned at the wall. Traps are baited according to use instructions. When the first trap is visited, one test animal is humanely killed and its carcass is placed inside one trap to simulate a situation facilitating social learning.

If a lethal testing is preferred, traps are activated. Otherwise, traps should be anchored (e.g., with cable tie) to allow the test animals to 'trigger' traps without being trapped. Identity of the animal that activated a trap then can be determined via video recording and individually visually marked animals (e.g., stripes on the tail) or in combination of a logger and video system.

Regularly, the number of trapped animals (lethal trap testing) or the animals activating a trap should be evaluated. A trap is considered as generally effective if ≥ 90% of animals have activated a trap within a maximum test duration of 28 days.

Results

Results should be shown as percentage of test animals that activated a trap or have been caught by a trap.

APPENDIX 8 LIST OF CURRENTLY AVAILABLE STANDARD TEST METHODS FOR TRAPS

This list may not be exhaustive and makes no comment on the suitability of particular test methods for efficacy testing.

Standard/Source	Title (+ web link)	Where	Target organism(s)	Mode of operation	Scope
Agreement on International Humane Trapping Standards (AIHTS)	AIHTS	All EU member states, Canada, Russian Federation	Fur-bearing animals	Restraining and killing traps	Agreement concerning animal welfare testing of traps
International Organization for Standardization	ISO 10990-4 Animal (mammal) traps Part 4: Methods for testing killing-trap systems used on land or underwater	International	Mammals	Killing-trap systems used on land or underwater	Trap testing norm concerning mechanical properties, efficacy, user safety, selectivity and animal welfare
The Spring Traps Approval (England) Order, 2018 (based on AIHTS)	The Humane Trapping Standards Regulations 2019	UK	Rats and mice among others mammals	Restraining and killing traps	Approval of traps concerning animal welfare
National Animal Welfare Advisory Committee (NAWAC)	NAWAC Guideline	NZ	Rats and mice among others mammals	Restraining and killing traps	Trap testing guideline concerning animal welfare
BPCA Code of Best Practice	The Use of Break Back Traps/Snap Traps	UK	Rodents	Killing traps	Use instructions
British Association for Shooting & Conservation (BASC)	Trapping Pest Mammals	UK	Rats and mice among others mammals	Spring-powered traps and cage traps	General information on legal aspects of trapping, use instruction, list of approved traps
Chartered Institute of Environmental Health (CIEH)	Code of practice for the use of vertebrate traps	UK	Rats and mice among other vertebrates	Restraining and spring-powered traps	Use instructions
Meerburg et al., 2008	The ethics of rodent control		Particularly rodents		Lab rodents / welfare impact
Proulx and Barrett, 1991	Evaluation of the Bionic® trap to quickly kill mink (*Mustela vison*)		American mink (*Neovison vison*)	Killing trap	Trap testing concerning animal welfare
Proulx, 1999	Review of current mammal trap technology in North America		Mammals (particularly minks, martens, raccoons)	Restraining and killing traps	Trap testing concerning animal welfare

REFERENCES

AvBayJG (1983) Amendment to the Bavarian hunting act, March 1983, §12.b 1.

AVMA (2020) Guidelines for the euthanasia of animals: 2020 Edition. 121 p. [https://www.avma.org/sites/default/files/2020-01/2020_Euthanasia_Final_1-15-20.pdf].

Baker, S. E., Ellwood, S. A., Tagarielli, V. L. and Macdonald, D. W. (2012) Mechanical performance of rat, mouse and mole spring traps, and possible implications for welfare performance. PLoS ONE, 7(6), e39334.

Baker, S. E. and Sharp, T. M. (2015) Welfare in commensal rodent trapping: One step forward, two steps back. Animal Welfare, 24(3), pp. 369–371.

BayJG (1978) Bavarian hunting act, October 1978, Art. 29a (2).

Benn, D. M., Zelin, S., Lee, E. and Archibald, J. (1980) The effect of clamping force upon impact threshold values. A report submitted to the Federal Provincial Committee for Humane Trapping. 206 p.

BPCA (2017) Code of practice: The use of break back traps/snap traps. [https://bpca.org.uk/pest-advice/documents-and-codes/codes-of-practice].

Cassidy, D. C., Holton, G. and Rutherford, F. J. (2002) Understanding physics. Springer, New York, US. 851 p.

CIEH (2014) Code of practice for the use of vertebrate traps. Chartered Institute of Environmental Health, London, UK. [https://www.pestmagazine.co.uk/media/231920/cieh-code-of-practice-for-use-of-vertebrate-traps-sep-2014.pdf.].

CIEH (2019) Rat and mouse control procedures manual - A practical guide for pest control technicians working in urban environments. [https://www.urbanpestsbook.com/downloads/].

ECHA (2018) Guidance on the Biocidal Products Regulation, Volume II Efficacy - Assessment and Evaluation (Parts B+C), Version 3.0. 385 p.

Elliott, J. E., Hindmarch, S., Albert, C. A., Emery, J., Mineau, P. and Maisonneuve, F. (2014) Exposure pathways of anticoagulant rodenticides to nontarget wildlife. Environmental Monitoring and Assessment, 186(2), pp. 895−906.

Geduhn, A., Esther, A., Schenke, D., Mattes, H. and Jacob, J. (2014) Spatial and temporal exposure patterns in non-target small mammals during brodifacoum rat control. Science of the Total Environment, 496, pp. 328−338.

Gillies, C. A. (2013) DOC snap trap guide v1.3: Using snap traps to index rodent abundance. Department of Conservation, Science & Capability Group, Hamilton, New Zealand. 12 p. [https://www.doc.govt.nz/Documents/science-and-technical/inventory-monitoring/im-toolbox-animal-pests-using-snap-traps-to-index-rodent-abundance.pdf].

ISO (1999) ISO 10990 – 4:1999 Animal (mammal) traps – Part 4: Methods for testing killing-trap systems used on land or underwater. First edition. International Standards Office, Geneva, Switzerland. 28 p. [https://www.iso.org/standard/26355.html].

Macdonald, D. W. and Barrett, P. (1993) Mammals of Britain and Europe. Collins Field Guide. Harper-Collins, London, UK. 312 p.

Mason, G. and Littin, K. E. (2003) The humaneness of rodent pest control. Animal Welfare, 12(1), pp 1–37.

Meerburg, B. G., Brom, F. W. and Kijlstra, A. (2008) The ethics of rodent control. Pest Management Science, 64(12), pp. 1205–1211.

Newcombe, W. R. (1981) The mechanics of spring powered animal traps. In: Chapman, J. A. and Pursley, D. (eds.) Worldwide Furbearer Conference Proceedings. R.R. Donnelly & Sons Co., Falls Church Virginia, US, pp. 1612–1629.

Parrott, D., Quy, R., Van Driel, K., Lurz, P., Rushton, S., Gurnell, J., Aebischer, N. and Reynolds, J. (2009) Review of red squirrel conservation activity in northern England. Natural England Commissioned Report NECR019. Natural England, Sheffield, UK. 112 p. ISSN 2040-5545.

Proulx, G. and Barrett, M. W. (1991) Evaluation of the Bionic trap to quickly kill mink (*Mustela vison*) in simulated natural environments. Journal of Wildlife Diseases, 27(2), pp. 276–280.

Proulx, G. (1999) Review of current mammal trap technology in North America. In: Proulx, G. (ed.) Mammal trapping. Alpha Wildlife Research and Management Ltd., Alberta, Canada, pp. 1–46.

Talling, J. C. and Inglis, I. R. (2009) Improvements to trapping standards. DG ENV. 361 p. [https://ec.europa.eu/environment/biodiversity/animal_welfare/hts/pdf/final_report.pdf]

Warburton, B. and Hall, J. V. (1995) Impact momentum and clamping force thresholds for developing standards for possum kill traps. New Zealand Journal of Zoology, 22(1), pp. 39–44.