An assessment of animal welfare impacts in wild Norway rat (*Rattus norvegicus*) management

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Online Resource 13: Welfare assessment for anticoagulant baiting; Scenario 1. Median confidence score is given.

CONTROL METHOD: ANTI-COAGULANT POISONING UKRAT004
Assumptions

Best practice is followed in accordance with the Standard Operating Procedure UKRAT004.
Any bait boxes/tunnels or trays that are to be used are deployed (without bait) a few days in advance of beginning anti-coagulant baiting treatment. Existing food sources are removed wherever possible.

Part A: Assessment of welfare impact excluding killing method

Domain 1 Water or food restriction, malnutrition				
No impact	Mild impact	Moderate impact	Severe impact	Extreme impact

Evidence

Obvious existing food sources have been removed where possible. Rats tend to follow foraging trails made by other members of their colony (Galef & Buckley, 1996). If these trails are interupted and key food sources have been removed, then foraging success may be reduced. Together, reduced foraging success and bait shyness towards the anti-coagulant treated baits, when these are deployed, will have a mild impact under this domain.

Domain 2 Environmental challenge				
No impact	Mild impact	Moderate impact	Severe impact	Extreme impact

Evidence
No impact.

Domain 3 Injury, disease, functional impairment				
No impact	Mild impact	Moderate impact	Severe impact	Extreme impact

Evidence
No impact.

Domain 4 Behavioural or interactive restriction				
No impact	Mild impact	Moderate impact	Severe impact	Extreme impact

Evidence

There is a mild impact under this domain. Rats tend to follow foraging trails made by other members of their colony (Galef & Buckley, 1996). If these trails are interupted and key food sources have been removed, then foraging behaviour will increase to compensate for disrupted foraging. Rats are often described as neophobic but their foraging behaviour is the outcome of conflicting motivations between curiosity (neophilia) and caution

(neophobia), known as 'the omnivore's paradox' (Berdoy & Drickamer, 2007). Exposure of rats to an unfamiliar environment interferes with object recognition, and opposing drives to avoid and explore novel objects (Ennaceur et al, 2009) may have a mild impact under this domain when boxes/tunnels are first deployed.

Domain 5 Anxiety, fear, pain, distress, thirst, hunger				
No impact	**Mild impact**	Moderate impact	Severe impact	Extreme impact

Evidence

Rats may experience mild anxiety because of hunger and because of opposing drives to explore novel objects (Ennaceur et al, 2009).

Overall impact
Mild impact
Confidence score = 3

Duration of impact				
Immediate to seconds	Minutes	Hours	**Days**	Weeks
			Confidence score = 3	

Evidence

Observations indicate that rats take a few days to become sufficiently habituated to the presence of the boxes/tunnels, to enter these and to eat anti-coagulant baits, when these are deployed.

Score Part A
5

CONTROL METHOD: ANTI-COAGULANT POISONING UKRAT004

Part B: Assessment of killing method

Level of suffering				
No impact	Mild impact	Moderate impact	**Severe impact**	**Extreme impact**
			Confidence score = 2	

Time to insensibility				
Immediate to seconds	Minutes	Hours	**Days**	Weeks
			Confidence score = 3	

Score Part B
G-H

Summary of evidence

Duration

The timing of effects varies with bait uptake and individual. The time between first bait uptake and death typically ranges between 4-11 days. Signs are apparent for multiple days (Mason & Littin, 2003).

Suffering

The quantity of poison ingested and site of haemorrhage will affect type and severity of impacts under all domains. Bleeding in the gut will reduce appetite; rats are anorexic for several days before death and experience significant weight loss (Fisher et al 2010) under Domain 1. Poisoned rodents are seen above ground in exposed positions (Fisher et al 2010), which could lead to environmental impacts under Domain 2. Impacts under Domain 3 include haemorrhages into organs and body cavities including: muscles, joints (or articular cavities), the gastrointestinal tract, abdominal cavity, eye or reproductive organs. Depending on the body systems involved, these are likely to cause severe impairment and poisoned animals ultimately die of anaemia or hypovolaemic shock (Fisher et al 2010). Bleeding into the lungs may compromise respiratory function (Fisher et al 2010). If haemorrhaging occurs in the brain or central nervous system, ataxia or convulsions may occur. Some animals are paralysed (Littin et al 2000 in Fisher et al 2010). Poisoned animals exhibit poor overall condition (Mason & Littin, 2003) and a hunched posture. Behavioural impacts under Domain 4 include reduced grooming, struggling movements (Mason & Littin, 2003), reduced home range sizes (Walther et al, 2021) and reduced or altered activity (Cox & Smith, 1992; Fisher et al 2010). Poisoned rats spend time in exposed positions away from cover, lose their flight response and make no effort to protect themselves, rendering them more vulnerable to predation (Cox, 1991, cited in Fisher et al 2010). For the last couple of days before death, they tend to hide in cover and hardly move. Under Domain 5, haemorrhages in multiple enclosed spaces (especially gastro-intestinal tract, orbital, intra-cranial) are likely to cause severe pain (P.S.D., 1997). Bleeding into lungs may cause breathlessness (Broom, 1999; Beausoleil & Mellor, 2015). Other impacts include lethargy and weakness (Fisher et al 2010). Hypovolaemia will also lead to thirst and dizziness. Animals may experience anxiety and fear because they are unable to escape or defend themselves normally. Rats typically remain conscious throughout anti-coagulant poisoning until death (Mason & Littin, 2003) and thus will have the capacity for these sorts of unpleasant experiences from the start of signs to the time of death. The impact of the killing process caused by anti-coagulant poisoning is likely to be 'severe suffering' to 'extreme suffering'. The range of scores reflects variation in the location of haemorrhaging and the speed of blood loss and thus loss of consciousness.

Summary

CONTROL METHOD	**ANTI-COAGULANT POISONING**	**UKRAT004**
OVERALL HUMANENESS SCORE	**5G-H**	

Comments

Rats can be poisoned year-round and may breed at any time depending on conditions. Poisoning during breeding, as assessed here, could have welfare impacts for dependent pups. If lactating females are killed, efforts should be made to find any nests containing dependent pups and humanely kill them to prevent them from dying of starvation or dehydration.

Unused bait and poisoned rat carcases should be collected and disposed of in accordance with local requirements to avoid primary and secondary poisoning of non-target animals.

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