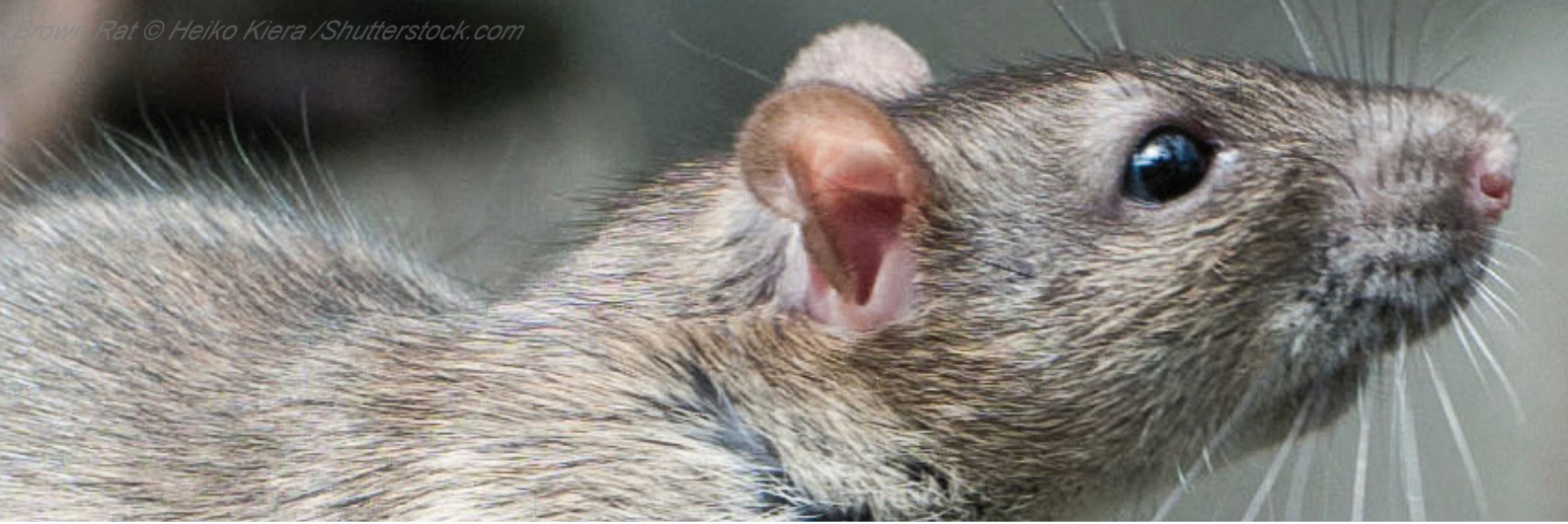


# Pesticide Usage in Scotland

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A National Statistics Publication for Scotland



# Rodenticide use by Local Authorities 2023

Accredited Official Statistics



# **Pesticide usage in Scotland: Rodenticide use by Local Authorities 2023**

**March 2025**

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## Key Points

- This report presents results of a survey of rodenticide use by Scottish local authorities (LAs) in 2023. Data were received from 27 of 32 LAs, collectively representing 91% of the Scottish population. This is the second in a series of LA rodenticide use surveys since 2015.
- Responding LAs used 12.2 tonnes of rodenticide bait in 2023, down from 14.9 tonnes in 2015. These baits contained less than 1 kg of active substance. The majority of rodenticides were used in domestic settings (8.8 tonnes), with a further 1.6 tonnes used in industrial or mixed industrial/domestic settings. No rodenticide baiting of sewers was reported. In total, non-agricultural baiting accounted for 10.3 tonnes, compared to 12.7 tonnes in 2015. Some LAs also conducted baiting on agricultural holdings on behalf of farmers (1.9 tonnes, 15% of total LA use, the same proportion as 2015).
- Almost all rodenticides used were second generation anticoagulant compounds (>99%). The principal rodenticide encountered was bromadiolone, accounting for 9.3 tonnes of product used (76% of total use, down from 84% in 2015). Brodifacoum and difenacoum and were the second and third most commonly used rodenticides respectively, with their relative importance reversed compared to 2015.
- LAs reported that they conducted rodenticide baiting throughout the year (99%), with little seasonal variation. Wax blocks were the most common bait type encountered (49% of total use), followed by grain baits (43%), a change in relative proportions from 2015 (64% and 35% respectively). The main targets of rodenticide baiting were a combination of rats and mice (59%).
- Supplementary data were received from 26 of the 32 LAs contacted, collectively representing 84% of the Scottish population. A majority (80%) of responding LAs used one or more non-chemical rodent control methods, most commonly break back traps. Five LAs reported awareness of issues with rodenticide resistance in their region, up from two in 2015.
- When asked about training and best practice in relation to rodenticide use, all responding LAs stated that operatives were trained in rodenticide use. All LAs reported regular bait inspection and 96% always protected it from non-target animals. Eighty eight per cent of LAs stated that they recorded quantity and location of baits, 88% searched for rodent carcasses and 88% removed bait after targeted baiting periods. The majority of LAs disposed of rodent carcasses in landfill sites.
- Results are compared to LA rodenticide use in 2015, and previous Scottish agricultural rodenticide surveys. This is the second Scottish LA rodenticide survey. It is intended that these surveys will be conducted every four years.

# Introduction

The Scottish Government (SG) monitors post-approval use of rodenticides. This surveillance is conducted by the Wildlife Management Unit and the Pesticide Survey Unit at SASA, a division of the Scottish Government's Agriculture and Rural Economy Directorate.

As part of this monitoring programme, a survey was conducted of Scottish local authority (LA) rodenticide use during 2023. This is the second survey of its type carried out in Scotland, following a survey of usage in 2015<sup>(1)</sup>. An intervening survey of usage during 2019 was cancelled due to the Covid-19 pandemic. All other Scottish rodenticide surveys have focused on their use in agricultural settings. Surveys on arable and grassland farms are conducted every two and four years respectively<sup>(2, 3)</sup>. This LA survey was conducted to help address the lack of data relating to rodenticide use in urban and non-agricultural settings in Scotland.

UK level LA rodenticide surveys have been published in the past by the Central Science Laboratory (CSL), now Fera Science Ltd. The last UK survey of LAs was conducted in 2001<sup>(4)</sup>. All LAs in Scotland have a duty to control rats and mice on their own land and properties, and the enforcement power to order other landowners or occupiers to do likewise if necessary. The level of pest control service provided by individual LAs varies. Some have an in-house team of pest controllers who provide both domestic and commercial control services, others contract out services to professional pest control companies. Some only provide a service to domestic properties, in some cases social housing only, but in other LAs owner-occupied properties may also be included.

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These statistics are [accredited official statistics](#). The Office for Statistics Regulation has independently reviewed and accredited these statistics as complying with the standards of trustworthiness, quality, and value in the [Code of Practice for Statistics](#).

The Scottish Pesticide Usage reports have been [accredited official statistics since October 2014](#).

Accredited official statistics are called National Statistics in the [Statistics and Registration Service Act 2007](#).

Scottish Government statistics are regulated by the Office for Statistics Regulation (OSR). OSR sets the standards of trustworthiness, quality



and value in the [Code of Practice for Statistics](#) that all producers of official statistics should adhere to.

More information about Scottish Government statistics is available on the [Scottish Government website](#).

## Survey Sample

All 32 local authorities (LAs) in Scotland were contacted and asked to supply data relating to their rodenticide use during 2023. Twenty seven LAs (84%) responded to this voluntary survey (Figure 1). These LAs collectively represented 91% of the Scottish population (Table 5, Appendix 2).

In addition to collecting rodenticide use data, LA representatives were asked to respond to a series of supplementary questions. These questions related to their operatives' compliance with best practice in relation to rodenticide use, their use of non-chemical control methods and their experience of rodenticide resistance. Twenty six LAs returned these data, representing 81% of those contacted and 84% of the Scottish population (Figure 1, Table 5). Some LAs only provided usage data and others only provided supplementary data. Reasons, if given, were related to time constraints and/or the ability to easily access the requested data. Some LAs kept records on individual sites and treatments, but they may not be stored in a format enabling easy summarisation.

LAs were not specifically asked whether they undertook rodent control operations in-house using their own staff, or if they contracted out. However, some did volunteer this information either by asking us to contact the contractor directly, involving the contractor in the response, or by mentioning that the data was supplied or held by a contractor. Of the 27 responding LAs, nine of them are known to have used a contractor for rodent control services. At least one of these used a combination of contractor and council staff. One contractor indicated that they had done work for another LA but no information was received from that LA. It is possible that some of the remaining LAs also used a contractor but did not indicate this when providing their data.

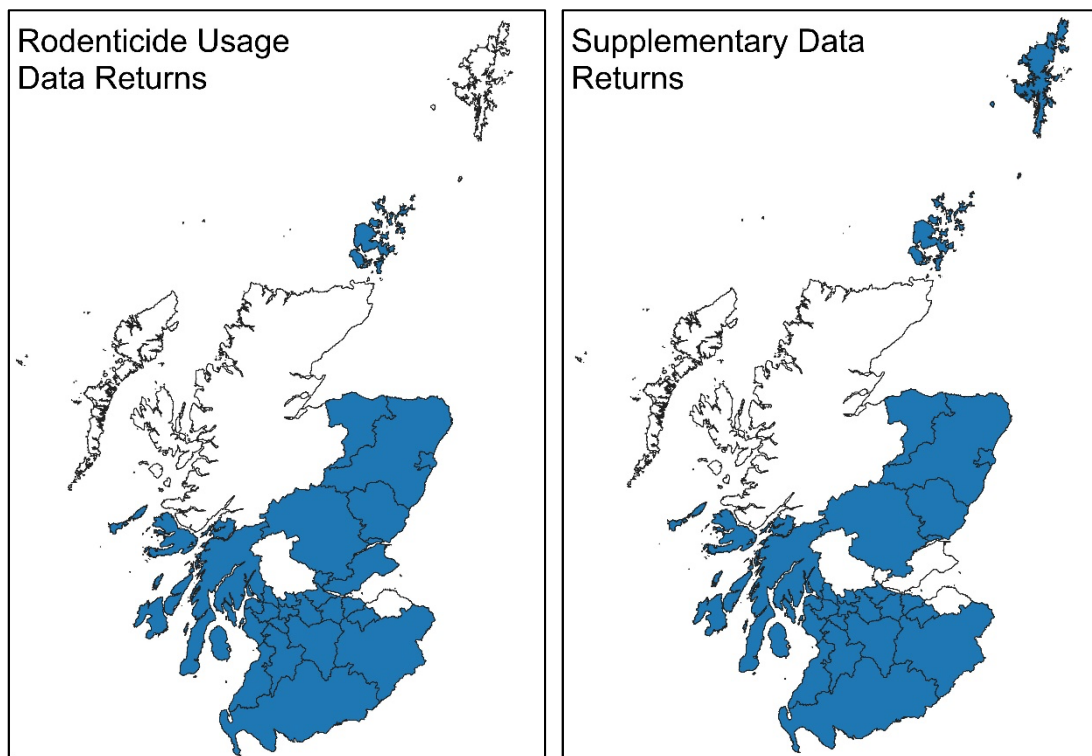
Of the five LAs who provided no rodenticide data, one indicated that they had used an external contractor. However, the contractor was unable to provide a response due to delays in the request being passed on.

Comparative data for use of external contractors during the 2015 survey period are not available.

It should be noted that the information presented in this report only represents the data collected and, unlike previous UK surveys<sup>(4)</sup>, does not attempt to estimate total Scottish rodenticide use by LAs (refer to methodology section). It should also be noted that LA use of rodenticides does not represent all rodenticide use in non-agricultural settings. Baiting in industrial, domestic and sewer settings which is not conducted by, or on behalf of, Scottish LAs is not captured by this survey.

### Figure 1 Scottish LAs supplying data for 2023

The map on the left represents data on rodenticide usage. The map on the right represents availability of supplementary data. Both maps show an outline of Scotland with LAs marked in blue if they provided data returns. White LAs represent those that did not provide data.



# Rodenticide use 2023

## Rodenticide active substances encountered

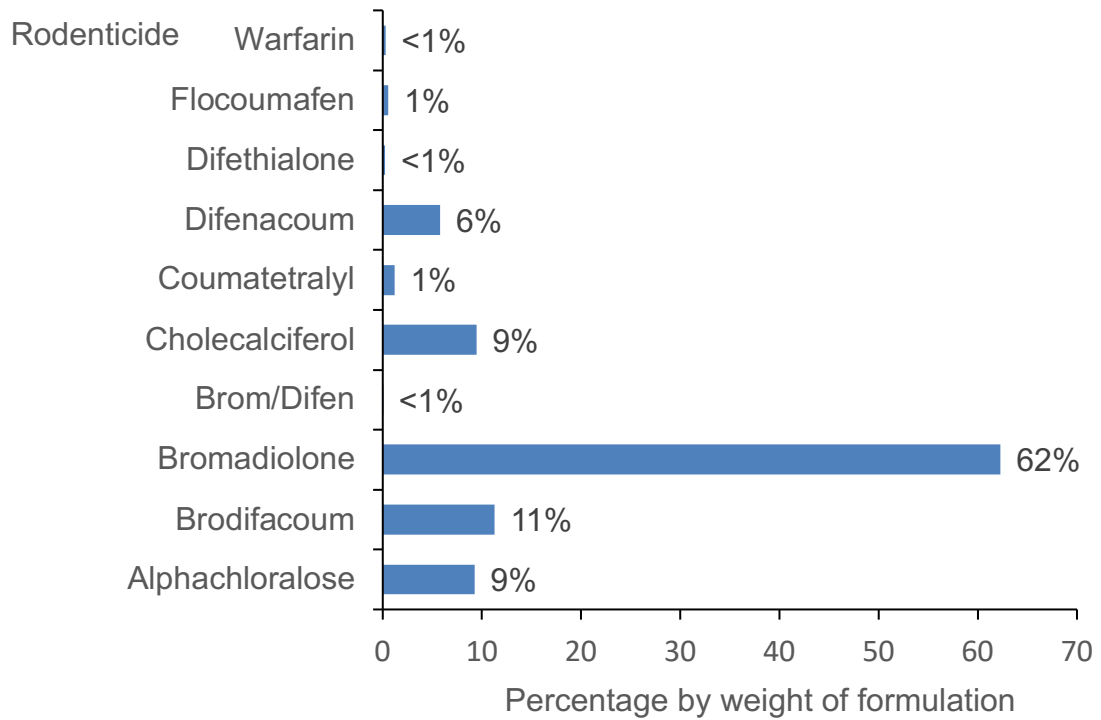
Nine active substances were used by the LAs providing data for this survey: alphachloralose, brodifacoum, bromadiolone, cholecalciferol, coumatetralyl, difenacoum, difethialone, flocoumafen and warfarin (Table 1 & Figure 2).

The majority of rodenticides encountered in this survey were anticoagulants (ARs), which prevent the synthesis of blood clotting factors and result in rodent death by haemorrhage. Five of the compounds reported were second generation anticoagulant rodenticides (SGARs), accounting for 80% (595 g) of the active substance applied. This was a 20% decrease compared to the 2015 <sup>(1)</sup> figure (746g). Coumatetralyl and warfarin were the only two first generation anticoagulant rodenticides (FGARs) reported, accounting for 1% (<10 g) of active substance used, compared to 3% (24g) in 2015<sup>(2)</sup>. Two non-AR rodenticides, alphachloralose and cholecalciferol, accounted for 18% (139 g) of active substance used (9% each). No non-AR rodenticides were reported in 2015<sup>(1)</sup>. The large increase in non-AR actives is associated with a much smaller proportional use in non-AR products. These non-AR active substances are formulated with much higher levels of active ingredients than the SGAR products. While SGARs are typically found at up to 0.005% active ingredient in professional formulations, the currently available cholecalciferol products have 0.075% active (15 times maximum SGAR concentration), and alphachloralose products are typically up to 4% active ingredient, which is 800 times the concentration of SGARs. Hence a relatively small use of alphachloralose product use may equate to a comparatively large amount of active ingredient.

Despite a reduction in contribution from 81% to 62% of total usage compared to the 2015 survey<sup>(1)</sup>, bromadiolone remained the most common active substance used by LAs in Scotland in 2023. Use of difenacoum fell from 11% to 6% while brodifacoum increased from 5% to 11% (Figure 3).

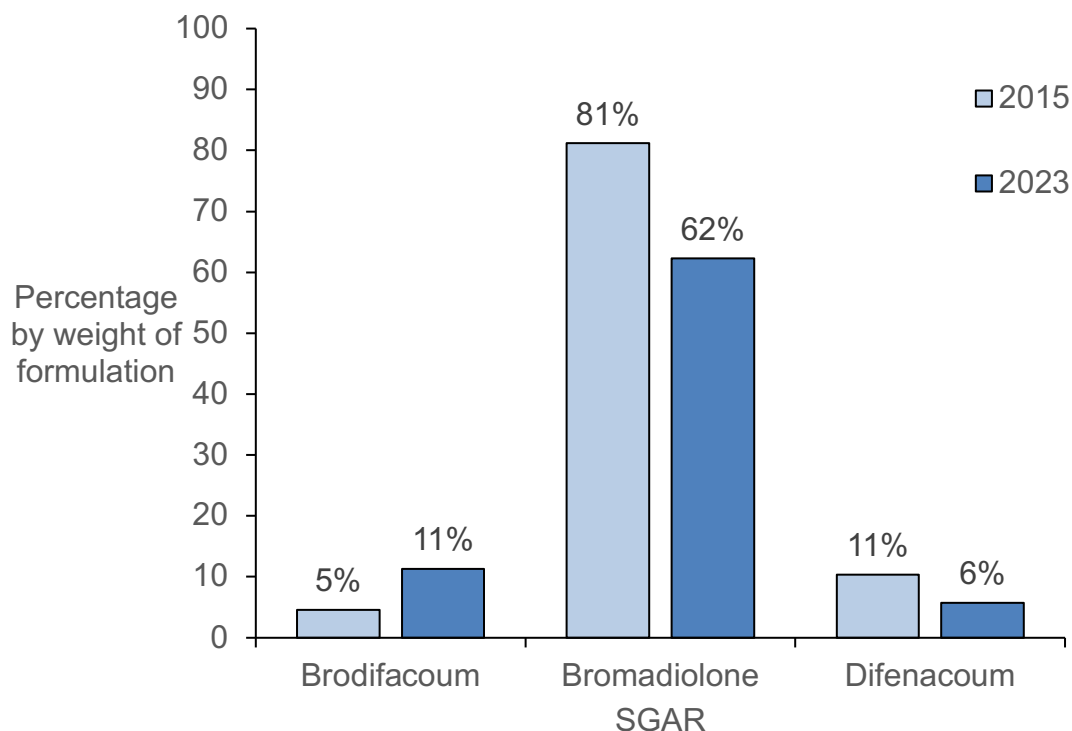
**Figure 2 Rodenticide active substances used by Local Authorities in 2023 (percentage by weight)**

A bar chart showing the percentage by weight of each rodenticide active substance used in 2023. Bromadiolone is the most prevalent active substance, accounting for over 60% of the total.



**Figure 3 Dominant SGAR active substances used by LAs in 2023 compared to 2015 (percentage by weight)**

A column chart comparing percentage weight of the most frequently used active substances between 2015 and 2023



### Quantity of rodenticide products used

Responding LAs used ca. 12.2 tonnes of rodenticide products in 2023 (Table 1), compared to 14.9 tonnes in 2015<sup>(1)</sup>, an 18.1% decrease. As active concentrations of the vast majority of these rodenticidal products are very low (0.0025% to 0.005% of product weight for SGARs). This equates to less than 1 kg of rodenticidal active substance. The remainder of the product is food bait which attracts rodents to consume the rodenticide.

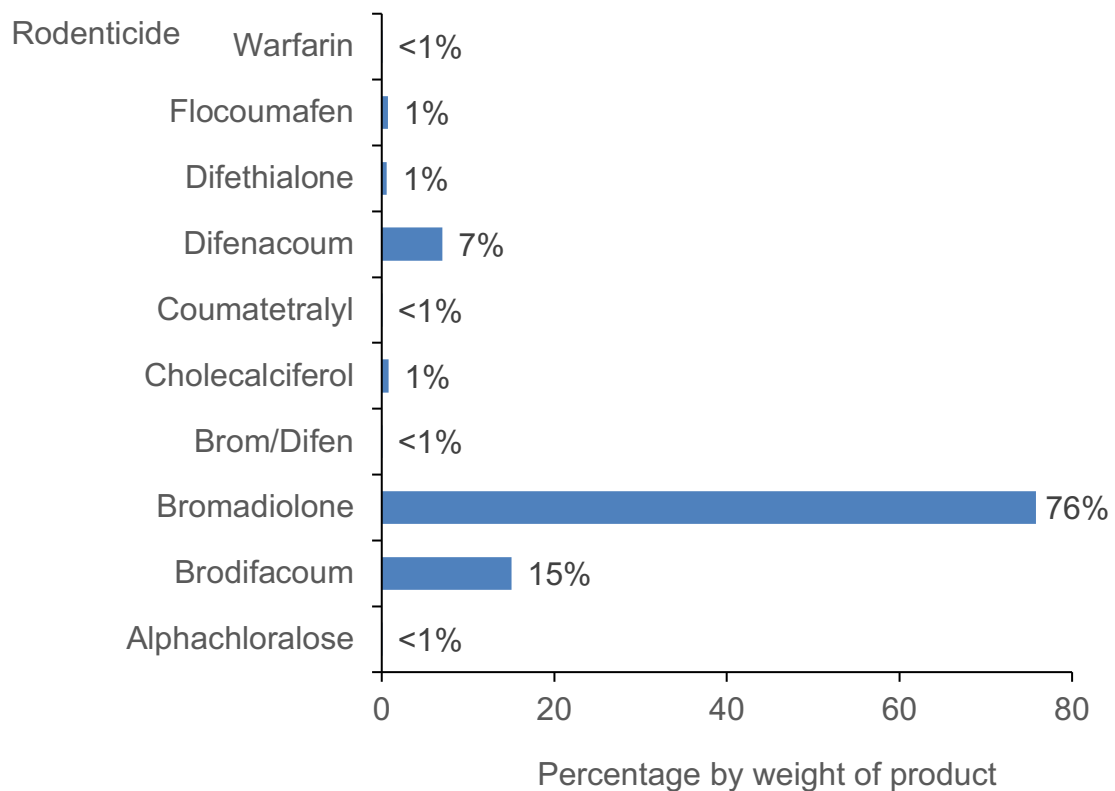
The majority of products encountered contained a single active substance, with the exception of very limited use (1 kg) of a product containing both bromadiolone and difenacoum (Table 1, Figure 4).

The most commonly used products were those containing bromadiolone, accounting for ca. 9.3 tonnes of the rodenticide products applied (76% of total use, compared to 84% in 2015). In addition, ca. 1.8 tonnes of products containing brodifacoum (15%) were used and ca. 0.86 tonnes of difenacoum products (7%). This again demonstrates a change in the relative usage of brodifacoum and difenacoum compared

to 2015<sup>(1)</sup>, when they accounted for 0.7 tonnes (5%) and 1.6 tonnes (11%) respectively (Figure 5). The remaining SGAR products (containing flocoumafen, difethialone and a bromadiolone/difenacoum mixed formulation, accounted for 155 kg (1%) of use. FGAR products (coumatetralyl and warfarin) comprised just 7 kg of use and the non-ARs (alphachloralose and cholecalciferol) equalled 96 kg, of which >94 kg was cholecalciferol. Collectively these other compounds comprised less than 1% of product use, thus more than 99% of the rodenticidal products used were SGARs (Table 1).

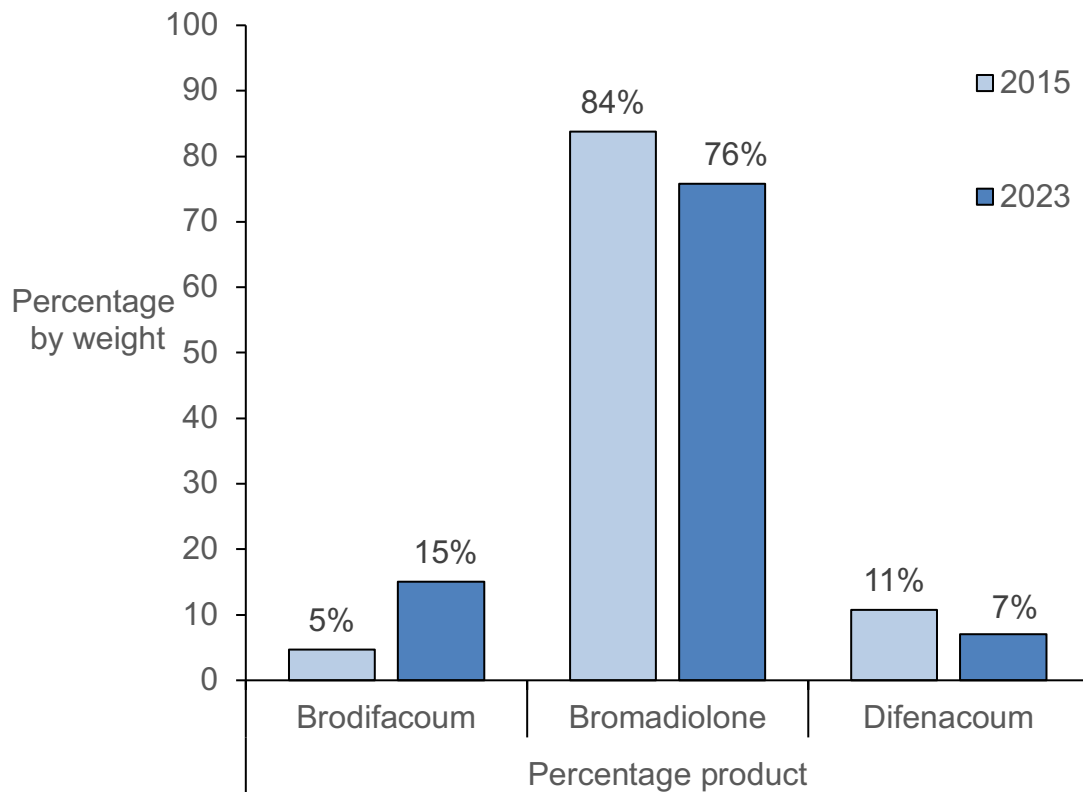
**Figure 4 Rodenticide products used by LAs in 2023 (percentage by weight of bait)**

A bar chart showing the percentage by weight of each rodenticide bait used in 2023 by LAs. Bromadiolone baits are the dominant bait type, accounting for 76% of the total.



**Figure 5 Dominant SGAR products used by LAs in 2023 compared to 2015 (percentage by weight)**

A column chart comparing percentage weight of the most frequently used bait products between 2015 and 2023.



### Rodenticide use by setting

Survey respondents were asked to record, where possible, their rodenticide baiting activities in relation to the setting of use (Table 2, Figure 6). All 27 of the LAs who responded to the survey conducted domestic baiting activities and the majority of rodenticide use was in domestic settings (ca.8.8 tonnes, 72%). A further 5% of rodenticides (ca. 0.6 tonnes) were recorded as being used in a combination of domestic and industrial settings and 8% (ca. 1 tonne) in solely industrial settings. Over half of LAs (56%) reported that they baited in industrial settings in 2023, but two (7%) were unable to separate out their domestic and Industrial use. Of the remaining LAs it is considered possible that some non-domestic (i.e. industrial) baiting may be incorporated in the domestic figure. The data are reported here as provided by LAs.

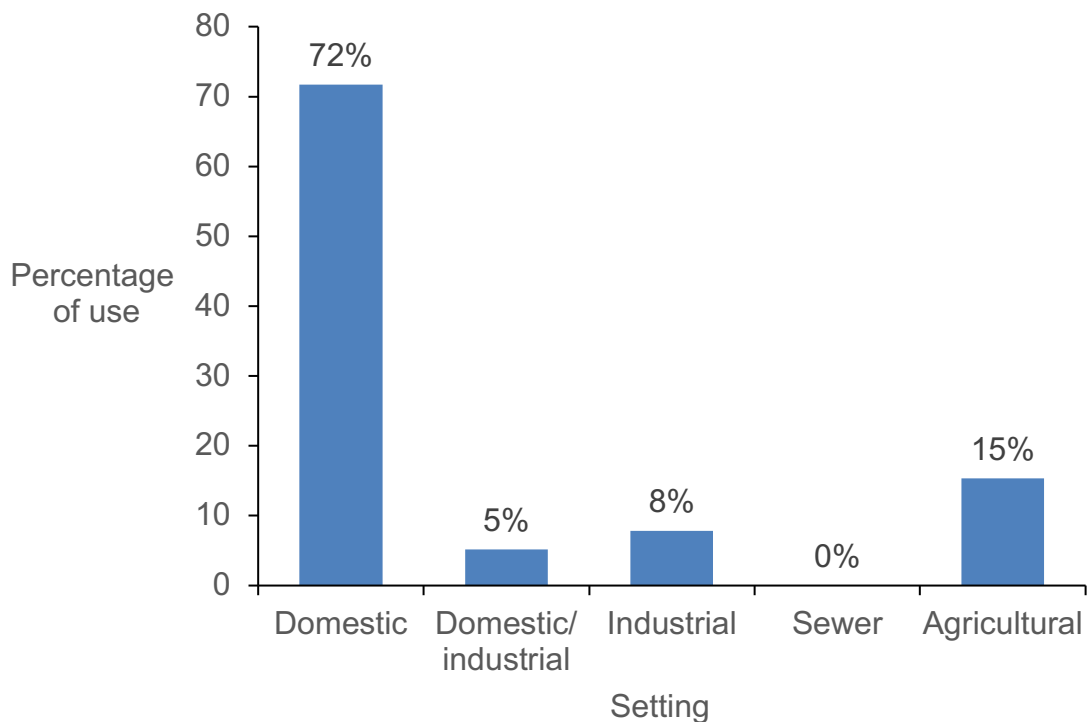
No use of sewer baiting was encountered in this survey. This contrasts with the 2015 LA survey<sup>(1)</sup> where five of the LAs (20%) reported sewer baiting activities with a total combined use of 34 kg.

During this survey, we asked about all rodenticide use by LAs. Three of the responding LAs conducted baiting on agricultural holdings on behalf of farmers. This amounted to just under 1.9 tonnes of bait and 15% of the total recorded use, the same percentage as 2015<sup>(1)</sup>. Whilst this is recorded here for completeness in relation to LA baiting activities, it should be noted that agricultural baiting conducted by LAs is also included in the agricultural rodenticide surveys therefore caution should be exercised if compiling data from both LA and agricultural rodenticide reports to avoid double counting of LA baiting on farms.

Overall, the total LA baiting in non-agricultural settings was reported to be ca. 10.3 tonnes (Table 2). These data represent around 84% and 91% of Scottish LAs and human population respectively. This is a decrease from the estimated 12.7 tonnes in the 2015 survey<sup>(1)</sup>, although a slightly different group of LAs responded to each survey. These data indicate that the overall quantity of rodenticide used by LAs is considerably lower than that reported in the most recent Scottish agricultural surveys of rodenticide use in arable<sup>(2)</sup> and grassland<sup>(3)</sup> sectors (an estimated 40 and 85 tonnes respectively).

### Figure 6 Setting of rodenticide product use by LAs in 2023

A column chart showing the percentage of products applied in each setting by LAs in 2023. Products were most commonly applied in a domestic setting, accounting for 72% of use.



## **Seasonal use of rodenticides**

The season of rodenticide use was specified by all LAs returning rodenticide data. However, in at least one case, there were some sites for which the data were omitted. Overall, 99% of baiting was reported to occur “all year round”, with very little rodenticide use being allocated to a particular season. This baiting pattern represents multiple baiting operations as well as permanent baiting. This differs from recent agricultural surveys, where approximately 60% of use occurs in autumn and winter, coinciding with the storage of harvested crops<sup>(2, 3)</sup>. While this difference may be due to the different types of sites that dominate in LA rodenticide rodent operations, it is also possible that some LAs may have simply reported based on their policy of use rather than their actual use for 2023, or that data for application by season could not be easily extracted. Therefore, this seasonal distribution should be interpreted with caution.

## **Rodenticide bait type**

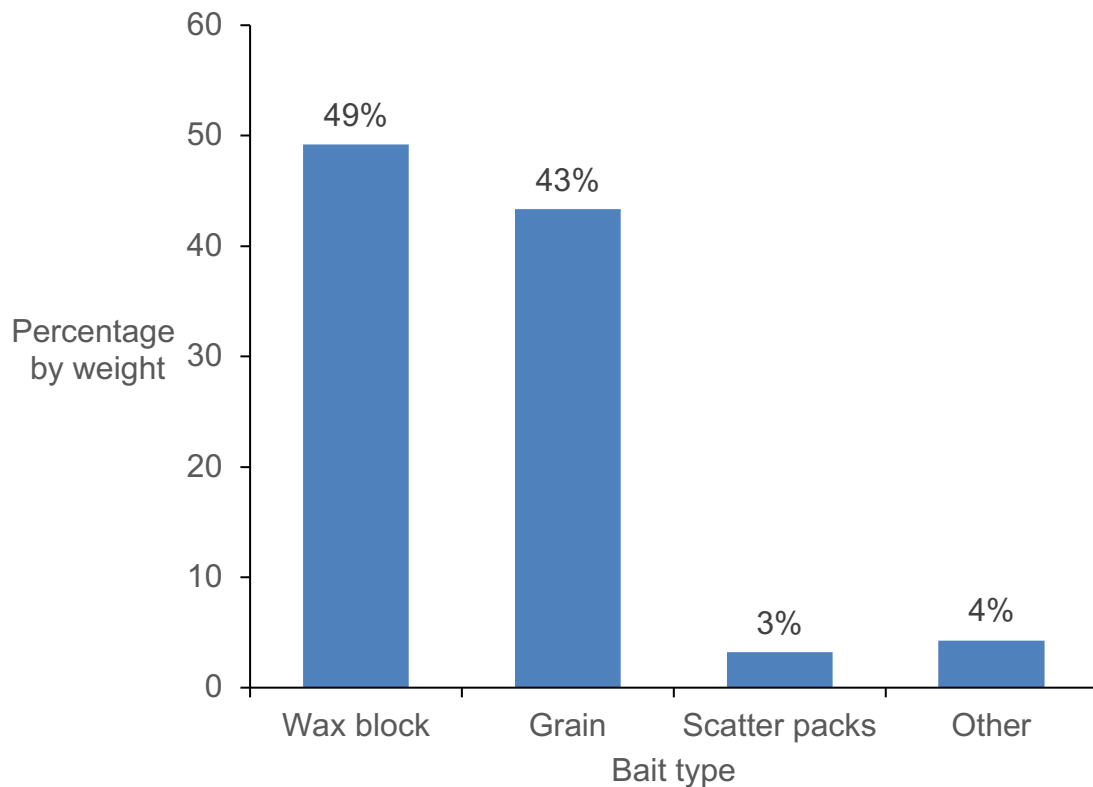
Wax blocks were the most commonly used bait type in this survey, accounting for 49% by weight of all bait used (Figure 7). Grain baits were used in similar volumes, accounting for 43% by weight. Scatter packs, gel, pasta bait, grain-based pellets, pastes, soft wax and foam collectively made up the remaining 8% of bait types by weight. Of these, scatter packs accounted for 3.2% and pasta, soft wax and pellets for just over 1% each. The combined use of foam, paste and gel was less than 1%, by weight, of bait used.

The overall composition of the bait types encountered in this survey is similar to that reported in the 2015 LA survey<sup>(1)</sup>, with both wax block and grain dominating. However, in 2015, wax block use was much greater than grain baits, with a respective 64% to 35% split compared to the much more even split in this survey. These LA survey findings are markedly different from those reported in previous agricultural surveys where grain baits dominate and wax baits are far less frequently encountered, making up only around five to 10% of total use<sup>(2, 3)</sup>.

The type of bait selected is influenced by the setting of use. The high proportion of wax blocks being used is likely to be linked to the high proportion of baiting that LAs undertake in domestic settings, where it may be advantageous to use wax blocks which are manufactured with a central hole to allow them to be secured within bait boxes. The use of wax blocks in bait stations reduces the likelihood of spillage and bait transference by rodents. This may be particularly important in domestic settings where exposure to domestic animals and householders, including children, must be prevented.

### Figure 7 Type of rodenticide bait used by LAs in 2023

A column chart showing the percentage by weight of each bait type used by LAs in Scotland. Wax blocks and grain are the most commonly used bait types, accounting for 49% and 43% of baits respectively.

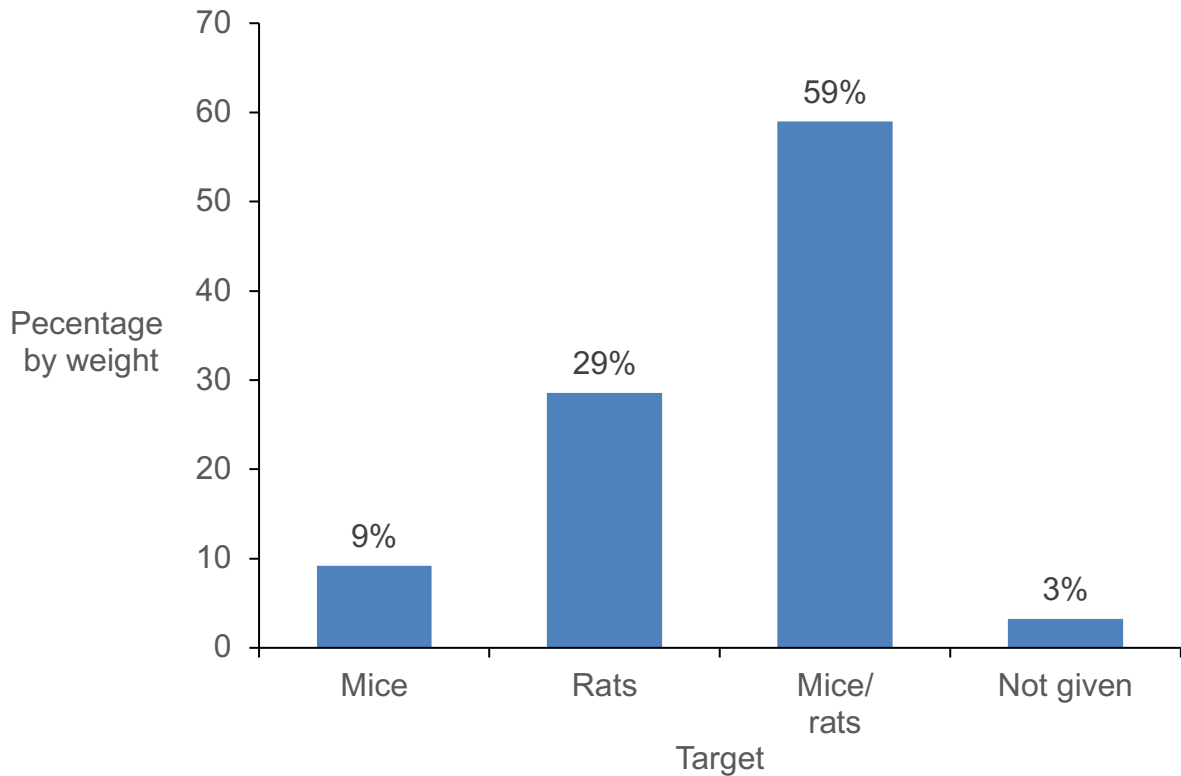


### Target of rodenticide baiting

Survey respondents were asked to identify the target of their rodenticide use (Figure 8). Where these data were supplied, the most common target was recorded as a combination of rats and mice (59%), followed by rats (29%) and then mice (9%), with 3% of cases having no target stated. This contrasts with the 2015 survey<sup>(1)</sup> when rats alone dominated (59%) followed by a combination of rats and mice (35%) and 6% of use was targeted at mice alone. While the apparent substantial increase in baiting targeting both rats and mice might be reflective of an increase in combined infestations, it may also suggest that some LAs were unable to accurately summarise usage patterns and simply listed all use as 'rats and mice'.

### Figure 8 Target of rodenticide use by LAs in 2023

A column chart showing the percentage by weight of rodenticide used for each target species by LAs in 2023. Rats and mice combined were the most common target, accounting for 59% of use.



### Numbers of locations and visits

LAs were asked to provide data on the number of premises/locations at which rodent control took place and the number of visits undertaken. They were asked to separate their responses, if possible, by four categories of setting (Agricultural, Domestic, Industrial and Sewer), the 'Industrial' category included all other non-domestic, settings not covered by other categories.

Twenty seven LAs provided data on the number of locations/premises treated and the number of associated visits. Three of the responding LAs undertook rodent control on agricultural premises and only one of those in substantial numbers (>10 farms). The total number of agricultural premises covered was 66. The data is not considered further here as agricultural use of rodenticides is covered in other surveys<sup>(2, 3)</sup>. No LAs reported undertaking any sewer baiting.

All 27 responding LAs undertook rodent control on domestic properties, but 10 of these provided no industrial data. Some local authorities stated that they were unable to separate out their domestic and

industrial sites and some others indicated that they may have included some non-domestic properties in the domestic category. For the purposes of calculating the numbers of sites treated and the number of domestic and industrial visits have been combined.

There was a total of 26,591 domestic and industrial locations where rodent control took place. The total number of reported visits associated with these locations was 89,937. Some LAs acknowledged that their total visit data were estimated, and it is likely that additional LAs may have estimated visits but not stated this. Three LAs provided an estimated rate of visits per location that was then used to calculate a total figure.

A single LA provided raw location and visit data but around one third of locations had missing visit data. The average of visits per location for those locations with complete data was used to estimate the number of visits for locations with missing data.

Three LAs, reporting control at 4,769 locations, provided no visit data. Excluding these LAs, the average number of rodent control visits undertaken per location across the remaining LAs was 4.12 visits.

## **Non-chemical rodent control**

LAs were also asked if they employed non-chemical methods of rodent control. A response was received from 25 LAs, of which 20 (80% of the sample) stated that they utilised one or more non-chemical control methods, up from 72% in the 2015 survey<sup>(1)</sup>.

Traps were the most common method reported, used by 20 LAs (80% of the sample). One LA noted it had not used traps in 2023, but would have if it had been necessary (as a “last resort”). A further follow-up question regarding the type of trap used found that 20 LAs used snap/breakback traps or other spring traps (i.e. traps on the Spring Trap Approval Order). Two also used glue boards and one used live traps, with some LAs using more than one type. Other methods of control encountered were proofing and exclusion and habitat management (reported by two and one LAs respectively). The mix of methods used is similar to that found in the 2015 survey<sup>(1)</sup> (Table 4)

## **Rodenticide resistance**

Rodenticide resistance is known to occur at a number of locations in Central and South Scotland<sup>(5)</sup> and all respondents were asked if they had encountered, or were aware of, any rodenticide resistance issues in their LA areas.

Of the 26 responding LAs, 21 (81%) advised that they were not aware of any issues with rodenticide resistance. Five respondents (19%) did report resistance in their area, an increase from the two reporting it in 2015<sup>(1)</sup>. These were Argyll and Bute, Edinburgh, Moray, South Lanarkshire and Orkney. Of these, only South Lanarkshire had reported resistance in the 2015 survey<sup>(1)</sup>. Moray reported resistance but specified that there was none evident in rats (indicating resistance in mice). All responding LAs indicated that they dealt with suspected resistance by changing bait type to one with a different active ingredient, including in one case to cholecalciferol. One LA also used trapping as an additional alternative response.

## **Compliance with best practice for rodenticide use**

All local authorities were asked to complete a questionnaire in relation to their training history and their compliance with the principles of best practice for rodenticide use identified by the Campaign for Responsible Rodenticide Usage (CRRU)<sup>(6)</sup> (Table 3).

Twenty six LAs responded to this part of the survey, although some did not respond to every question. All 26 stated that operatives had received training in rodenticide use. In relation to baiting, all 26 LAs reported that they regularly inspect bait and 25 (96%) said that they always protect it from non-target animals. Twenty two out of 24 responding LAs (92%) indicated that they used tamper proof bait stations, with only two stating that they did not. Twenty two of 26 LAs (85%) stated that they always record the quantity and location of baits (down from 97% in 2015<sup>(1)</sup>), 23 (88%) of 26 LAs conduct searches for rodent carcasses (90% in 2015) and 23 (88%) removed bait after targeted baiting periods (up from 72% in 2015). Two LAs explained why they did not search for carcasses; one cited time constraints and the other said that they would if requested, but did not do it routinely as most baiting was internal and it was rare for rodents to die “in situ”.

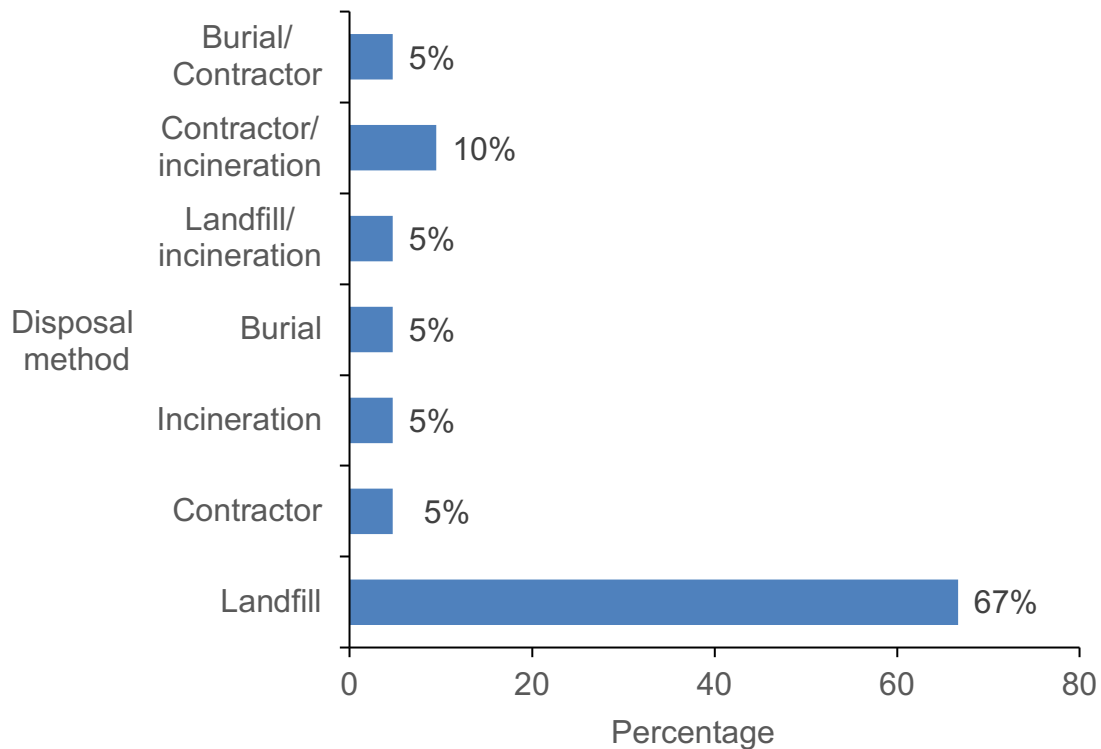
Of those LAs that did not remove all baits, two indicated that this applied to more than 20% of baits laid. An additional LA indicated that it accounted for 5-10% of baits laid. The responses from LAs in relation to compliance with best practice are broadly similar to those provided in the 2015 survey<sup>(1)</sup>.

LAs were also asked how they disposed of rodent carcasses. Of the 24 LAs that removed carcasses, 21 (88%) provided a response to this question. The majority disposed of them at landfill sites (67%). The remainder used a combination of disposal methods, including burial,

incineration and use of waste disposal companies, often in combination. (Figure 9).

### Figure 9 Disposal methods used by LAs and their contractors in 2023

A bar chart showing percentage use of different disposal methods by LAs and their contractors in 2023. Landfill was the most common method of disposal, accounting for 67% of responses.



## Open area baiting

LAs were asked if they undertook any open area baiting (i.e. laying baits that are not associated with buildings). Of 25 responding LAs, 16 (64%) indicated that they did undertake open area baiting, although they were not asked about the extent of this. Approval for the use of SGARs in this practice will cease at the end of 2024. There will no longer be any SGAR products approved for open area baiting and this will necessitate future changes to the products or methods that are used, and this could influence future LA usage statistics.

## Covid-19 impact

In response to widespread suggestion that rodent populations and/or rodent problems increased during and after the Covid-19 pandemic<sup>(9)</sup>,

LAs were asked “Do you consider that rodent infestation has increased in public areas following the COVID pandemic?”. Of 26 responding LAs, 18 (69%) said that there had been an increase. Some LAs suggested that this was due to the closure of food related businesses that had previously sustained rodents, causing rodents to move into residential locations. Others suggested it may be due to people being at home more and noticing rodents. One LA noted an increase in rodent activity at the beginning of the pandemic but said that this had now returned to normal. Issues with bin collection timings were also raised by a contractor working for some LAs, although it is not clear that these are exclusively pandemic related.

## **Future rodenticide monitoring and stewardship**

EU and UK regulatory risk assessments have concluded that the use of anticoagulant rodenticides outdoors present a higher level of risk to non-target animals (such as predatory birds and mammals) than would normally be considered acceptable. However, regulators recognise that, despite these risks, their use is necessary as part of a properly managed rodent control strategy. In order to be able to authorise these rodenticides, the UK Government must be assured that the risks to non-target animals are properly managed. This requirement was addressed by the introduction, in April 2016, of an industry led stewardship scheme managed by CRRU<sup>(7)</sup> with government oversight.

Arable and grassland agricultural rodenticide surveys are conducted in Scotland every two and four years respectively. As LA use of rodenticides is considerably less than that reported in agricultural settings, it is intended that this survey will be conducted every four years. This allows rodenticide use to be surveyed in a different sector each year, although a survey of 2019 LA usage scheduled for 2020 was cancelled due to the Covid-19 pandemic.

The data collected in this series of usage reports will reflect changes both in pattern of use, resulting from changes to authorisation conditions, and in user training and compliance with the conditions of stewardship. Significant post-stewardship changes in usage patterns have been described in other surveys in this series<sup>(2, 3)</sup>.

Whilst the LA dataset does not capture all urban rodenticide use, its inclusion in the Scottish survey series may help to inform data on rodenticide residues in urban non-target species, as previous surveys have done in agricultural settings<sup>(8)</sup>.

# Glossary

1. **Rodenticide** is used throughout this report to describe a substance used to kill or control rodents.
2. An **active substance** is any substance which has a general or specific action against harmful organisms. In this report an active substance refers to a substance which has a detrimental effect on rodents.
3. The term **product** is used to describe a marketed rodenticide product which contains active substances, bait and other co-formulants.
4. The term **formulation(s)** is used to describe an active substance or mixture of active substances formulated together in a product.
5. Rodenticides are classified in this report as **anticoagulant (AR)** (which prevent the synthesis of blood clotting factors resulting in rodent death by haemorrhage) or **non-anticoagulant** compounds. The anticoagulant rodenticides are broken down further into first and second generation compounds (**FGARs** and **SGARs** respectively). The FGARs, which were the first anticoagulant compounds to be developed, are generally less acutely toxic than SGARs.
6. The **rodenticides approved for use** in the UK during the 2023 survey period were: FGARs (coumatetralyl and warfarin), SGARs (brodifacoum, bromadiolone, difenacoum, difethialone and flocoumafen) and non-anticoagulant rodenticides (alphachloralose, cholecalciferol, and aluminium phosphide). All but aluminium phosphide were **encountered** during this survey
7. In this survey, local authorities were asked to report their rodenticide use in four different **settings**: agricultural, domestic, industrial and sewer. Industrial use includes all non-domestic use not described by other categories. In some cases it was not possible for LAs to easily split domestic and industrial use from their records and some use was recorded as domestic/industrial.
8. When collecting information regarding **seasonal use** of rodenticides, local authorities were asked to report seasonal baiting patterns. The definition of season may vary among respondents. Where exact dates of use were provided these were assigned to season as follows: spring (March, April, May), summer (June, July, August), autumn (September, October, November) and winter (December, January, February).
9. Local Authorities are abbreviated to **LAs** throughout the document
10. The **rodenticide stewardship** scheme was implemented in April 2016 to reduce risks to wildlife and the environment from anticoagulant rodenticides. By mitigating these risks to the environment, the scheme aims to provide the Health and Safety

Executive (HSE) with the confidence it requires to permit the continued authorisation of anticoagulant rodenticides for rodent pest management. It covers professional use of rodenticides<sup>(7)</sup>.

## Data and Methodology

There are 32 local authorities in Scotland (Table 6, Figure 10). Each LA was sent an e-mail survey designed to collect information about their use of rodenticides in 2023 in relation to season, setting and target of use. The survey also included questions about compliance with best practice in relation to rodenticide use, use of non-chemical control methods and experience of rodenticide resistance.

Prior to the start of the survey an attempt was made to establish a named contact at each LA to whom the survey could be sent. In some cases this was the same person who had responded to the 2015 survey, or a new person identified via telephone call or e-mail to the council. With a number of councils it was difficult to make contact or enquiries went unanswered. Once this was done, an initial introductory letter and survey form was sent to each LA by e-mail to the named contact where possible, or to an enquiries e-mail for the Environmental Health team. These were followed by a reminder e-mail, ten weeks after survey initiation, if data had not been received. In some cases further follow-up telephone calls were required to elicit a response or for data clarification.

Both previous agricultural rodenticide surveys<sup>(2, 3)</sup>, and the UK local authority survey conducted by CSL in 2001<sup>(4)</sup> estimated total rodenticide use statistically based on the sample data collected. The agricultural reports are based on data from a random stratified sample of agricultural holdings and total agricultural use is estimated by ratio raising (comparing data from the sample of farms with the total population within each stratum reported in the June agricultural census). The 2001 UK local authority report data were raised within counties/metropolitan districts by a factor accounting for the human population represented by nil returns, to give an estimate of national rodenticide use. The UK survey received returns from 51% of LAs, accounting for 53% of the UK population.

In contrast to the above rodenticide surveys, in this report the data have been collated and presented as a sample rather than using ratio raising to produce a statistical estimate of total use. When the 2015 Local Authority survey<sup>(1)</sup> was analysed there was no correlation between human population or population density with rodenticide use, either in relation to Scotland as a whole or within geographical regions. This was discussed with a BLOSS statistician and the decision was taken that the most appropriate action to avoid mis-estimation was to present the data as a sample. This survey has taken the same approach. As the sample covers 84% of LAs representing 91% of the Scottish population it is considered to provide a robust overview of how rodenticides are used

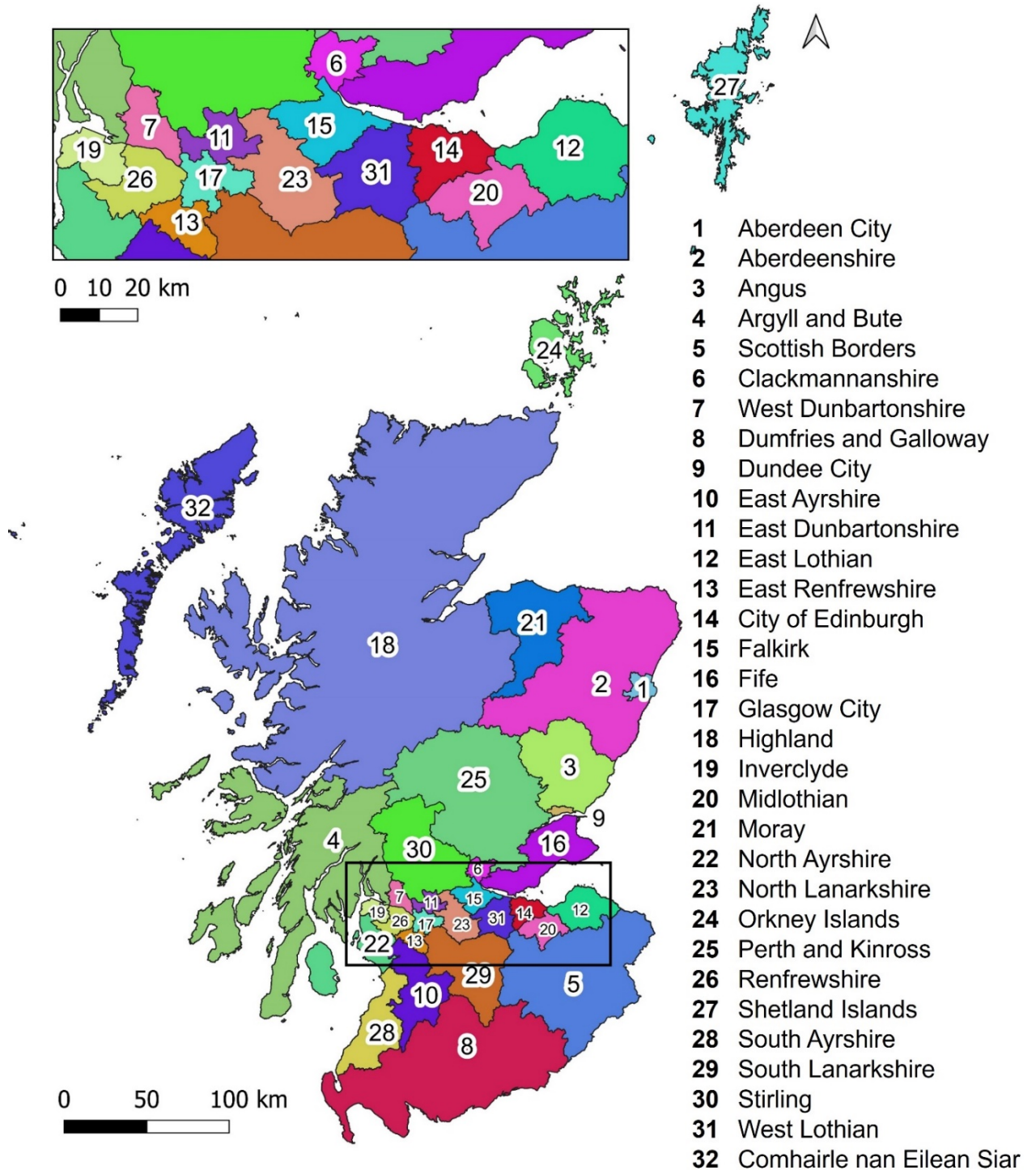
by Scottish LAs. Each LA operates different levels of rodent control, with some only undertaking or arranging it (via contractor) on their own properties and perhaps for social housing tenants, some LAs also offer a service to private domestic housing, while some others offer a full commercial service to both domestic and industrial customers. The level of rodenticide use in each LA is likely to be heavily influenced by these differences, and it may explain why no correlation was previously found with population.

The dataset underwent several validation processes as follows; (i) checking for any obvious errors upon data receipt (ii) checking and identifying inconsistencies with use and approval conditions once entered into the database (iii) 100% checking of data held in the database against the raw data. Where inconsistencies or a lack of clarity relating to products were found these were checked against the records and with the LA if necessary. Due to rounding, there may be slight differences in totals both within and between tables. Additional quality assurance is provided by sending reports for independent review. In addition, the Wildlife Management Unit and Scottish pesticide survey unit are accredited to ISO 9001:2015. All survey related processes are documented in Standard Operating Procedures (SOPs) and our output is audited against these SOPs by internal auditors annually and by external auditors every three years.

These surveys may be subject to measurement bias as they are reliant on respondents recording or reporting data accurately. As this survey is not compulsory it may also be subject to non-response bias, as some LAs could be more likely to respond to the survey than others.

**Figure 10 Scottish LA boundaries**

Map shows the boundaries and locations of all surveyed LAs in Scotland. An inset box provides a close up of LAs across central Scotland.



# Appendix 1 – Results tables

**Table 1 Rodenticide formulations and products used by LAs in 2023**

Weight of rodenticides applied, expressed as formulations (combination of active substances) and products (active substances, bait and other co-formulants)

Rodenticide	Formulation (g)	Formulation (% use)	Product (kg)	Product (% use)
Alphachloralose	69	9	2	<1
Brodifacoum	84	11	1,837	15
Bromadiolone	463	62	9,256	76
Bromadiolone/ difenacoum <sup>(1)</sup>	<1	<1	1	<1
Cholecalciferol	70	9	94	<1
Coumatetralyl	9	1	3	<1
Difenacoum	43	6	860	7
Difethialone	2	<1	70	<1
Flocoumafen	4	1	84	<1
Warfarin	<1	<1	4	<1
Total	743	100	12,211	100
Total first generation anticoagulants <sup>(2)</sup>	9	1	7	<1
Total second generation anticoagulants <sup>(3)</sup>	595	80	12,109	>99

Total non-anticoagulants	139	19	96	<1
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(1) This formulation contains 50/50 bromadiolone and difenacoum

(2) First generation anticoagulant compounds: coumatetralyl, warfarin

(3) Second generation anticoagulant compounds: brodifacoum, bromadiolone, difenacoum, difethialone, flocoumafen

Note that individual figures and percentages have been rounded thus may not add up to the separately calculated totals

## Table 2 Weight of rodenticide products by use setting

Weight of rodenticides applied, expressed as products (active substances, bait and other co-formulants) in relation to setting of use

Use Setting	Product (kg)	Product (% use)
Domestic <sup>(1)</sup>	8,755	72
Domestic/industrial <sup>(1)</sup>	626	5
Industrial	954	8
Sewer	0	0
Agricultural	1,876	15
Total	12,211	100
Total (non-agricultural)	10,336	85

(1) Local authorities were asked to split rodenticide use by setting but in some cases this wasn't possible and data were supplied in relation to mixed domestic and industrial use, one LA stated that their domestic figure might include some industrial data and it is possible that this is the case for some other LAs that only supplied domestic data.

**Table 3 Response to training and compliance questions**

Response to questions regarding training and compliance with best practice of rodenticide use in relation to local authority baiting

Question	Number of yes responses (total responses)	Percentage yes response
1) Have all pest control officers conducting baiting in 2015 completed a training course on rodenticide use?	26 (26)	100
2) Are quantity and location of baits recorded by pest control officers?	22 (26)	85
3) Are bait points always protected from non-target animals?	25 (26)	96
4) Are these tamper proof bait stations?	22 (24)	92
5) Is bait regularly inspected by pest control officers?	26 (26)	100
6) Are rodenticides always removed after targeted baiting periods?	23 (26)	88
7) Are rodent carcasses searched for / removed?	23 (26)	88

**Table 4 Number of LAs using each type of non-chemical control in 2023 compared to 2015**

Comparison of responses to questions regarding LA use of non-chemical control methods in 2015 and 2023

Non Chemical Method Used	2023	2015
Snap/breakback and spring traps	20	21
Glue	2	2
Live trap	1	4
Proofing, housekeep, hygiene and habitat	3	1

## Appendix 2 – Survey statistics

**Table 5 Survey response rate**

Summary of the number of responses received to each data request and the proportion of the population represented by responding LAs

Return type	No.	% of LAs	Total Pop <sup>n</sup>	% of total pop <sup>n</sup>
Scottish local authorities	32		5,490,100	
Rodenticide data returns	27	84	4,997,450	91
Supplementary data returns <sup>(1) (2)</sup>	26	81	4,595,300	84
Location data only <sup>(2)</sup>	1	3	93,550	2
No return	3	9	376,100	7

(1) Includes one LA which returned qualitative data but no usage data

(2) 26 LAs returned the supplementary questionnaire, but some did not answer all questions.

(3) One LA which provided neither usage or supplementary data, but did provide information on the number of locations treated

**Table 6 Scottish population and land area by administrative area 2023<sup>(10)</sup>**

Summary of the population size and area of each LA surveyed

Local Authority	Population	Area (sq. km)
Aberdeen City	227,750	186
Aberdeenshire	264,320	6,313
Angus	114,820	2,181
Argyll & Bute	87,810	6,907
City of Edinburgh	523,250	263
Clackmannanshire	51,940	159
Dumfries and Galloway	145,670	6,426
Dundee City	150,390	60
East Ayrshire	120,750	1,262
East Dunbartonshire	109,230	174
East Lothian	113,740	679
East Renfrewshire	98,600	174
Falkirk	158,620	297
Fife	373,210	1,325
Glasgow City	631,970	175
Highland	236,330	25,653
Inverclyde	78,330	160
Midlothian	98,260	354
Moray	94,670	2,238
Na h-Eileanan Siar (Western Isles)	26,030	3,056
North Ayrshire	133,570	885
North Lanarkshire	341,890	470
Orkney Islands	22,000	990
Perth and Kinross	152,560	5,286
Renfrewshire	186,540	261
Scottish Borders	116,630	4,732
Shetland Islands	23,000	1,467
South Ayrshire	111,830	1,222
South Lanarkshire	330,280	1,772
Stirling	93,550	2,186
West Dunbartonshire	88,750	159
West Lothian	183,810	428
<b>Scotland</b>	<b>5,490,100</b>	<b>77,901</b>

# Appendix 3 – Financial burden of LA rodenticide survey

In order to minimise the administrative burden on LAs this survey was conducted by e-mail with a follow up telephone call if necessary.

To determine the total burden that the survey placed on those providing the information, respondents were asked to estimate the time taken to provide the data requested.

Of the 27 responding LAs, 22 provided information about how long was spent on the data request.

The time local authorities took to provide the information varied widely due to the different ways each LA and/or contractors involved store their information, ranging from 10 minutes to 2 days The median time taken was 105 minutes.

The following formula was used to estimate the total cost of participating:

Burden (£) = No. surveyed x median time taken (hours) x typical hourly rate\*

(\* using median “full time” gross hourly pay for Scotland of £18.16<sup>(11)</sup>)

The estimated total financial burden, accounting for all local authorities' participation in the 2023 rodenticide survey, was £735.48.

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