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Pesticide Usage in Scotland

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A National Statistics Publication for Scotland



Rodenticide use by Local Authorities 2015

Pesticide Usage in Scotland

Rodenticide Use by Local Authorities 2015

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Executive summary

This report presents the results of a survey of rodenticide use by Scottish local authorities (LAs) in 2015. Of the 32 LAs contacted, rodenticide use data were received from 25, which collectively represented 81 per cent of the Scottish population.

These LAs used 14.9 tonnes of rodenticide bait in 2015. This bait contained less than 1 kg of rodenticide active substance. The majority of rodenticides were used in domestic settings (11.5 tonnes), with a further 1.2 tonnes used in industrial or mixed industrial/domestic settings. Rodenticide baiting of sewers was reported by only 5 LAs (34 kg). In total, non-agricultural baiting accounted for 12.7 tonnes. Some LAs also conducted baiting on agricultural holdings on behalf of farmers (2.2 tonnes, 15 per cent of total LA use).

Almost all rodenticides used were second generation anticoagulant compounds. The principal rodenticide encountered was bromadiolone, accounting for 84 per cent (12.5 tonnes) of total use. Difenacoum and brodifacoum were the second and third most commonly used rodenticides respectively.

LAs reported that they conducted rodenticide baiting throughout the year (99 per cent), without significant seasonal variation. Wax blocks were the most common type of bait encountered (64 per cent of total use), followed by grain baits (35 per cent). The main targets of LA rodenticide baiting were rats (59 per cent) or a combination of rats and mice (35 per cent).

In addition to rodenticide usage data, LAs were asked about other aspects of their rodenticide use and rodent control. Of the 32 LAs contacted, these supplementary data were received from 29, which collectively represented 92 per cent of the Scottish population. The majority (76 per cent) of these LAs used one or more non-chemical rodent control method. These primarily consisted of break-back traps, but also included live capture traps and glue boards. LAs were also asked about rodenticide resistance, and two LAs reported that they were aware of resistance in their administrative regions.

LAs were asked a series of questions about training and compliance with best practice in relation to rodenticide use. All LAs stated that operatives had received training in rodenticide use. In relation to baiting, 100 per cent of LAs reported that they regularly inspected bait and always protected it from non-target animals. Ninety seven per cent of LAs stated that they always recorded the quantity and location of baits, 90 per cent searched for rodent carcasses and 72 per cent removed bait after targeted baiting periods. The majority of LAs disposed of rodent carcasses in landfill sites, with the remainder reporting a range of disposal methods including burial, incineration and use of waste disposal companies.

These results are discussed in relation to previous Scottish agricultural rodenticide surveys and the last UK local authority rodenticide survey. This is the first Scottish LA rodenticide survey. It is intended that, in future, 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 Pesticide Survey Unit at Science and Advice for Scottish Agriculture (SASA), a division of the Scottish Government's Agriculture, Food and Rural Communities Directorate.

As part of this monitoring programme, a survey of 2015 Scottish local authority (LA) rodenticide use was conducted. This is the first survey of this kind carried out in Scotland. All previous Scottish rodenticide surveys have focussed on use in agricultural settings. Rodenticide use on arable and grassland farms are conducted every two and four years respectively⁽¹⁾⁽²⁾. The reason this LA survey was conducted was to 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 was conducted in 2001⁽³⁾. It should be noted that the UK surveys estimated total LA use based on human population from the sample surveyed. In contrast, this survey only reports the data collected and does not attempt to estimate total Scottish LA rodenticide use (refer to survey methodology, Appendix 5).

The Scottish Pesticide Usage reports have been designated as Official Statistics since August 2012 and as National Statistics since October 2014. The Chief Statistician (Roger Halliday) acts as the statistics Head of Profession for the Scottish Government and has overall responsibility for the quality, format, content and timing of all Scottish Government national statistics publications, including the pesticide usage reports. As well as working closely with Scottish Government statisticians, SASA receive survey specific statistical support from Biomathematics and Statistics Scotland ([BioSS](#)).

All reports are produced according to a published timetable. For further information in relation to Pesticide Survey Unit publications and their compliance with the code of practice please refer to the pesticide usage survey section of the [SASA website](#). The website also contains other useful documentation such as [confidentiality](#) and [revision](#) policies, [user feedback](#) and detailed background information on survey [methodology](#).

Additional information regarding pesticide use can be supplied by the Pesticide Survey Unit. Please email psu@sasa.gsi.gov.uk or visit the survey unit webpage:

<http://www.sasa.gov.uk/pesticides/pesticide-usage>

Structure of report and how to use these statistics

This report is intended to provide data in a useful format to a wide variety of data users. The results and comparison section presents the results from this survey and compares the data with results from other rodenticide surveys.

Appendix 1 contains tables of results, including estimates of rodenticide use and responses to questions about compliance with best practice. Appendix 2 summarises survey statistics including survey response rates. Appendix 3 outlines the estimated financial burden to survey respondents. Appendix 4 defines many of the terms used throughout the report. Appendix 5 describes the methods used during sampling and data collection.

Data uses

The data collected by the Pesticide Survey Unit, which includes information about rodenticides and plant protection products as well as other methods of pest control, are used for a number of purposes including:

- Informing UK and Scottish Government Policy about the post-approval use of pesticides
- Aiding Government officials in their response to Scottish Parliamentary and Ministerial questions regarding the use of pesticides
- To inform and complement research projects conducted by agricultural research institutions
- To inform and prioritise monitoring strategies of environmental quality bodies
- To provide data to the pesticide industry to allow insight into the use patterns of pesticidal products
- To provide information to interested or concerned environmental and wildlife groups and members of the public
- To provide an educational resource for teaching and student research projects

[Case studies](#) of how the Scottish dataset has been used are provided on the SASA webpage.

Results and comparison with other surveys

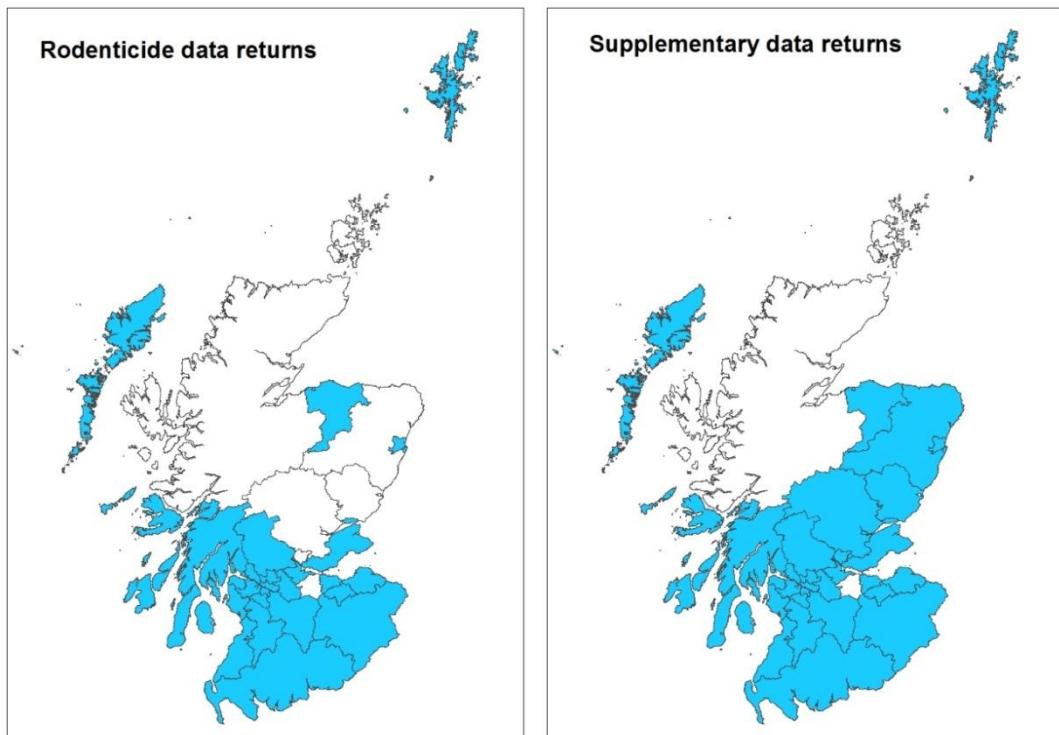
Survey sample

All 32 local authorities (LAs) in Scotland were contacted and asked to supply data relating to their rodenticide use during 2015. Twenty five LAs (78 per cent) supplied the information requested (Figure 1). These LAs collectively represented 81 per cent of the Scottish population (Table 4, 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 nine LAs returned this data, representing 91 per cent of those contacted and 92 per cent of the Scottish population (Figure 1, Table 4). The four LAs who returned the qualitative data but did not supply details of rodenticide use cited time constraints (either for them or their contracted pest control company) as the reason that data could not be provided.

Of the remaining three LAs, two did not respond to the survey and one could not participate as they do not offer a pest control service.

Figure 1 Scottish LAs supplying 2015 data



It should be noted that the information presented in this report only represents the data collected and, unlike previous UK surveys⁽³⁾, does not attempt to estimate total Scottish rodenticide use by LAs (refer to methodology section, Appendix 5). 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.

Rodenticide use data

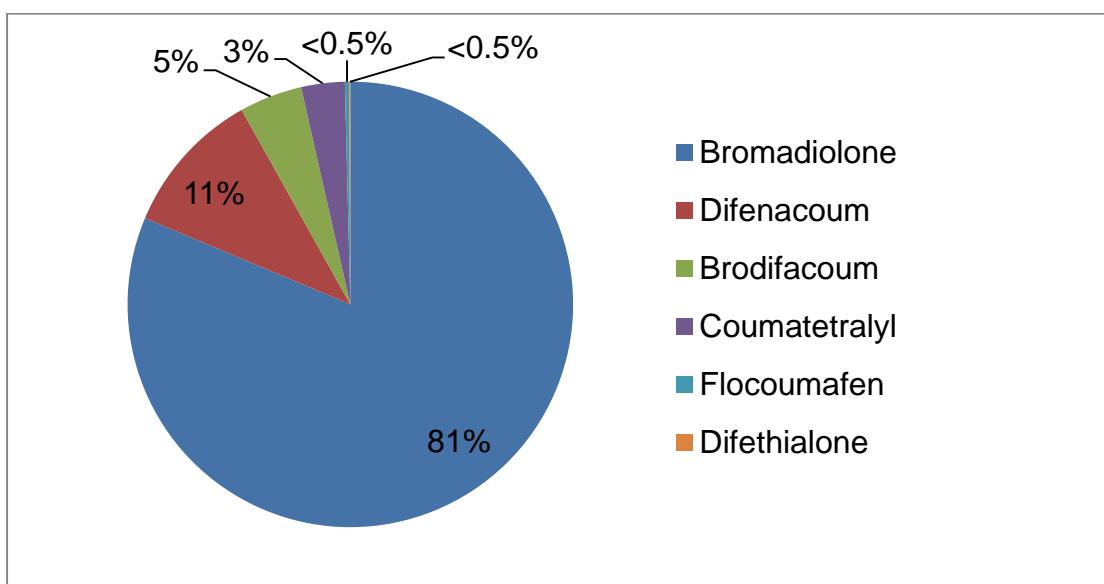
These data represent 25 LAs and 81 per cent of the Scottish population.

Rodenticide active substances encountered

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

All of the rodenticides encountered in this survey were anticoagulants, which prevent the synthesis of blood clotting factors and result in rodent death by haemorrhage. Five of the six compounds were second generation anticoagulant rodenticides (SGARs), with bromadiolone accounting for 81 per cent of the active substance applied. Coumatetralyl was the only first generation anticoagulant rodenticide (FGAR) reported.

Figure 2 Rodenticide active substances used by Scottish LAs in 2015 (percentage by weight)



The range of anticoagulant rodenticides reported in this survey are very similar to those encountered in recent Scottish agricultural surveys in which the rodenticides used are also almost exclusively SGARs with bromadiolone the principal active substance applied⁽¹⁾⁽²⁾. However, in contrast, non-anticoagulant compounds, such as alphachloralose and aluminium phosphide, are routinely encountered in agricultural rodenticides surveys, albeit at very low use levels.

Bromadiolone was also the most commonly used active substance in Scotland in the last UK local authority rodenticide use survey which was conducted in 2001³. However, a wider range of first generation active substances were also encountered in that survey, reflecting the differences in both rodenticide approval and resistance status at that time.

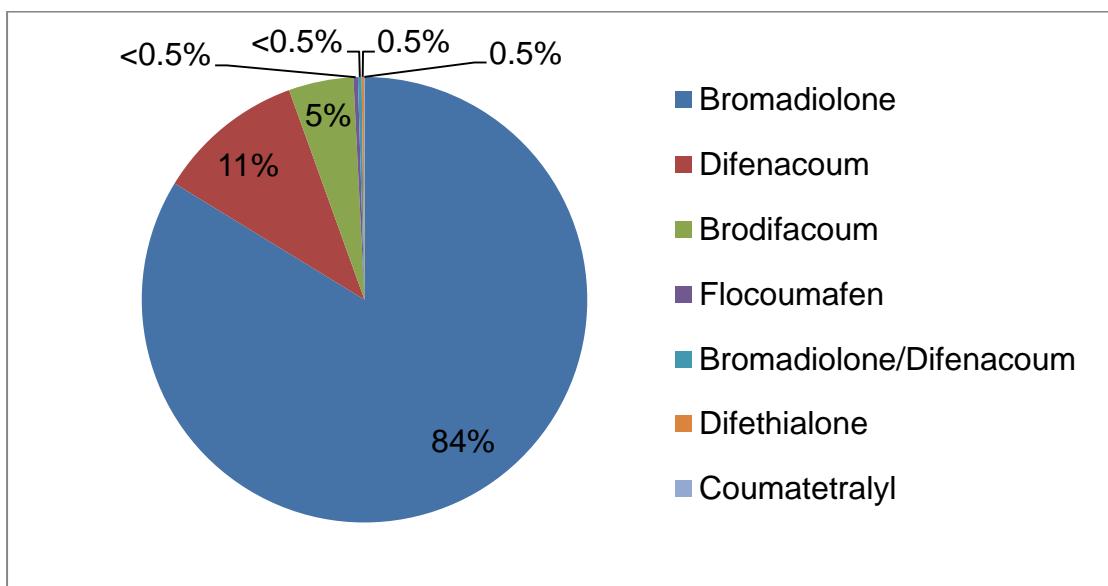
Quantity of rodenticidal products used

The LAs surveyed used ca. 14.9 tonnes of rodenticide products in 2015 (Table 1). As active concentrations of these rodenticidal products are very low (0.0025 to 0.005 per cent of product weight), this equates to less than 1 kg of rodenticidal active substance. The remainder of the product is food bait which is used to attract rodents to consume the rodenticide.

The majority of products encountered contained a single active substance, with the exception of limited use (40 kg) of a product containing both bromadiolone and difenacoum (Table 1, Figure 3).

The most commonly used products were those containing bromadiolone, accounting for ca. 12.5 tonnes of the rodenticide products applied (84 per cent of total use). In addition, ca. 1.6 tonnes of difenacoum containing products (11 per cent) and ca. 0.7 tonnes of brodifacoum products (5 per cent) were used. The remaining rodenticides (containing flocoumafen, difethialone, coumatetralyl and a difenacoum/bromadiolone mix) collectively accounted for 119 kg of rodenticide (less than one per cent of total use). More than 99 per cent of the rodenticidal products used were SGARs (Table 1).

Figure 3 Rodenticide products used by Scottish LAs in 2015 (percentage by weight)



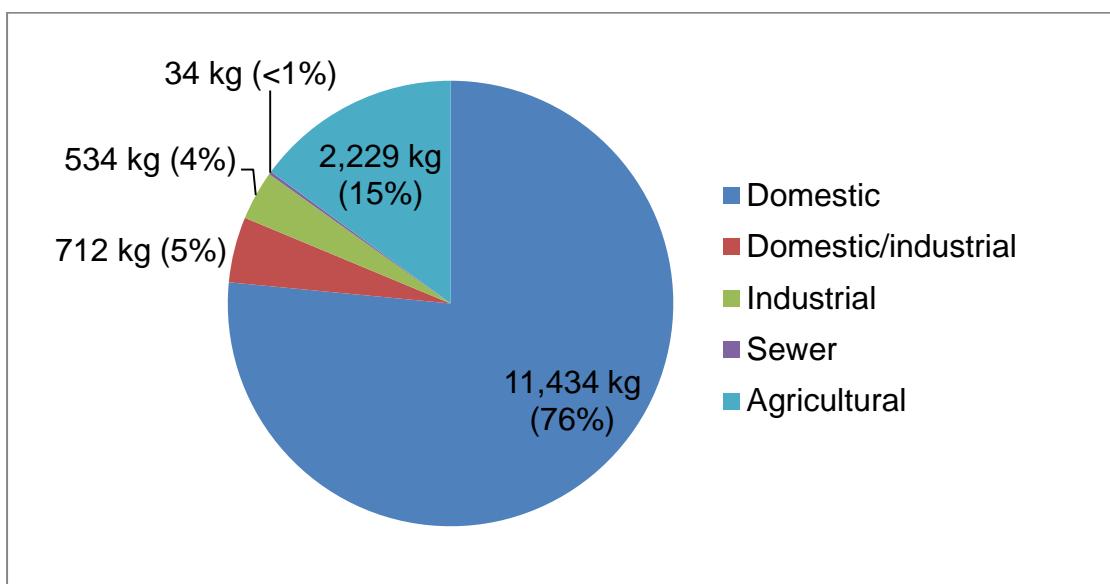
This pattern of rodenticide product use is very similar to that found in the most recent agricultural surveys where bromadiolone was also the most commonly used rodenticide (accounting for 77 and 58 per cent of use by weight on arable⁽¹⁾ and grassland⁽²⁾ farms respectively) with difenacoum and brodifacoum ranking second and third respectively. Bromadiolone, difenacoum and brodifacoum were also the three most commonly used rodenticides in the 2001 UK local authority survey⁽³⁾ (accounting for 67, 17 and 9 per cent of total Scottish rodenticide use respectively).

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 4). All 25 of the LAs who responded to the survey conducted domestic baiting activities and the majority of rodenticide use was in domestic settings (ca. 11.5 tonnes, 77 per cent). A further five per cent of rodenticides (ca. 0.7 tonnes) were recorded as being used in a combination of domestic and industrial settings and four per cent (ca. 0.5 tonnes) in solely industrial settings. Just under half of LAs (48 per cent) reported that they baited in industrial settings in 2015.

Very little use of sewer baiting was encountered in this survey. Only five of the LAs (20 per cent) reported sewer baiting activities with a total combined use of 34 kg.

Figure 4 Setting of rodenticide product use by LAs in 2015



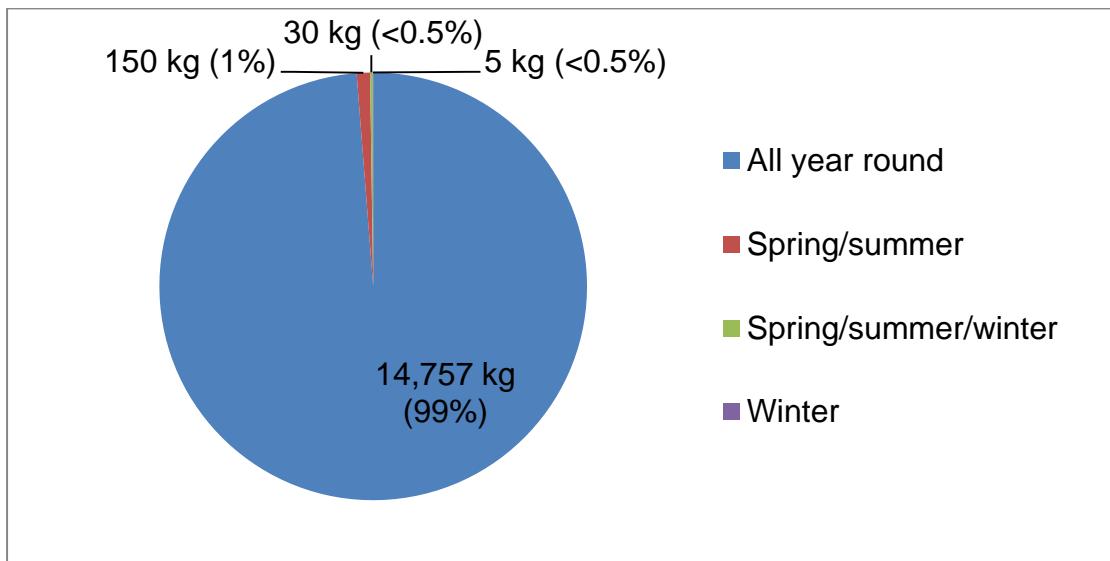
During this survey, we asked about all rodenticide use by LAs. Six of the LAs surveyed conducted baiting on agricultural holdings on behalf of farmers. In this survey, this amounted to just over 2.2 tonnes of bait and 15 per cent of the total recorded use. Whilst this is recorded here for completeness 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. 12.7 tonnes. It should be noted that this data represents only around 80 per cent of Scottish LAs and human population. This is an increase in comparison to total estimated Scottish non-agricultural use of rodenticides (10.9 tonnes) reported in the 2001 UK survey⁽³⁾. However, these data clearly indicate that the quantity of rodenticide used by LAs is considerably less than that reported in the most recent Scottish agricultural surveys of rodenticide use in arable and grassland sectors (113⁽¹⁾ and 217⁽²⁾ tonnes respectively).

Seasonal use of rodenticides

The season of rodenticide use was specified by all LAs returning rodenticide data. Overall, 99 per cent of baiting was reported to occur uniformly throughout the year, with very little rodenticide use being associated with a particular season (Figure 5). This baiting pattern represents multiple baiting operations as well as permanent baiting. This differs from reported use pattern on farms when greater use (approximately 60 per cent) occurs in autumn and winter, coinciding with the storage of harvested crops⁽¹⁾⁽²⁾.

Figure 5 Seasonal use of rodenticide products by LAs in 2015



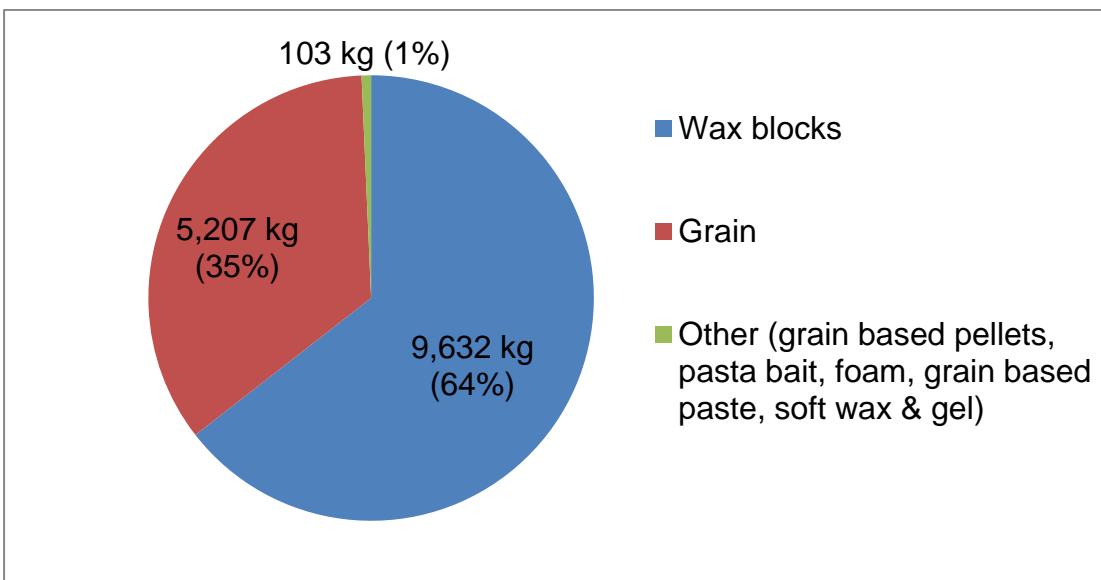
Rodenticide bait type

Wax blocks were the most commonly used bait type in this survey, accounting for 64 per cent of all bait used (Figure 6). A further 35 per cent of the bait was grain. The remaining one per cent of rodenticides used consisted of a range of bait types including gel, pasta bait, grain based pellets and pastes, soft wax and foam. The use of foam as a delivery agent has not been previously encountered in Scottish rodenticide surveys.

The overall composition of the bait types encountered in this survey, are different from those reported in previous agricultural surveys where grain baits dominate and wax baits are far less frequently encountered, making up only around four per cent of total use⁽¹⁾⁽²⁾.

The type of bait selected is influenced by the setting of use. As LA baiting is primarily in domestic settings 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 6 Type of rodenticide bait used by LAs in 2015

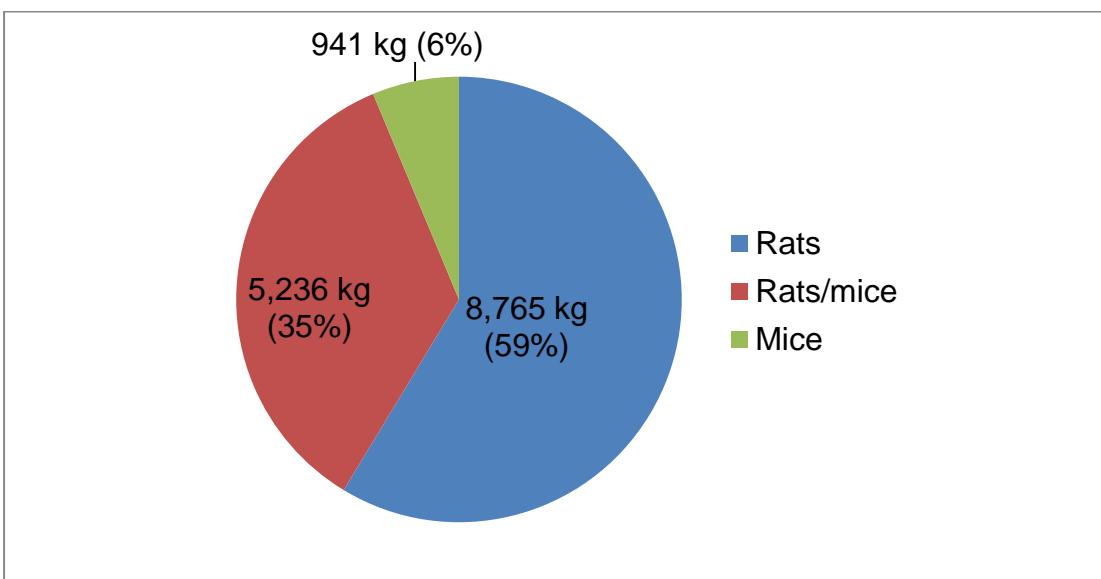


Target of rodenticide baiting

Survey respondents were asked to identify the target of their rodenticide use (Figure 7). Where reason data were supplied the most common target was rats (59 per cent) followed by a combination of rats and mice (35 per cent). Only six per cent of use was targeted at mice alone.

These data are very similar to that reported in the 2014 arable rodenticide survey, in which it was reported that rats, rats/mice and mice were the target of 60, 38 and two per cent of rodenticide use respectively⁽¹⁾.

Figure 7 Target of rodenticide use by LAs in 2015



Supplementary data

These data represent 29 LAs and 92 per cent of the Scottish population.

Non-chemical rodent control

In addition to collecting data about rodenticide use, LAs were also asked whether they employed non-chemical methods of rodent control. Of those who responded, 22 LAs (76 per cent of the sample) stated that they adopted one or more non-chemical control methods. It was reported that alternative control was used to supplement use of rodenticides, or where there were concerns about rodenticide use in domestic settings, due to the presence of pets and children. They are also used in situations where rodenticides were ineffective (e.g. in cases of bait shyness where rodents have learned to associate food bait with discomfort and avoid rodenticides).

Of the methods reported, the most common was the use of break back traps, which were used by 21 LAs (72 per cent of the sample). Other methods of control encountered were live capture traps and glue boards (used by four and two LAs respectively). One LA reported using non-toxic monitor baits to assess pest presence prior to rodenticide use and another stated that rodent proofing and hygiene were improved to aid control of infestations.

Rodenticide resistance

Rodenticide resistance is known to occur in South West Scotland⁽⁴⁾ and all respondents were asked if they had encountered, or were aware of, any rodenticide resistance issues in their LA areas.

Of the 29 who responded, the majority advised that they were not aware of any issues with rodenticide resistance (27 LAs, 93 per cent of responses). One LA, Dumfries & Galloway, which provided a negative response, stated that whilst studies have identified resistance in the west of the region they had not had any issues with control in practice. Two respondents did report known resistance in their LA area. Glasgow City stated that they were aware of difenacoum resistance in mice in some areas of Glasgow and resistance was also reported by South Lanarkshire (active substance not reported).

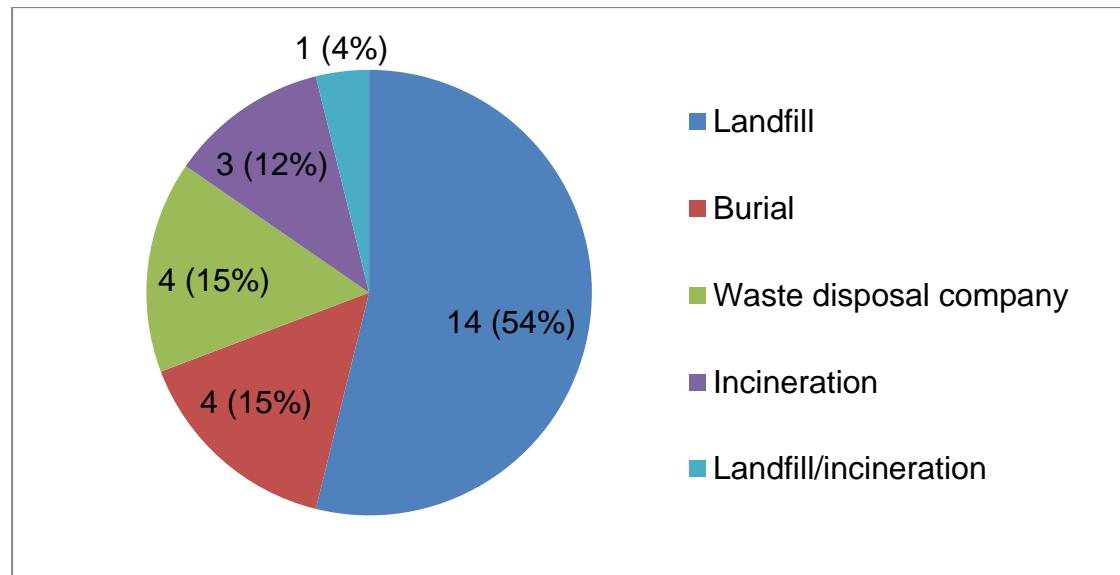
Compliance with best practice for rodenticide use

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)⁽⁵⁾ (Table 3).

Of the LAs that responded, all stated that operatives had received training in rodenticide use. In relation to baiting, 100 per cent of LAs reported that they regularly inspect bait and always protect it from non-target animals. Ninety seven per cent of LAs stated that they always record the quantity and location of baits, 90 per cent search for rodent carcasses and 72 per cent remove bait after targeted baiting periods. The responses from LAs in relation to compliance with best practice are very similar to those provided by pest control professionals (PCPs) who bait on agricultural farms⁽¹⁾⁽²⁾.

LAs were also asked how they disposed of rodent carcasses. Of the 26 LAs that removed carcasses, the majority disposed of them at landfill sites (54 per cent). The remainder used a combination of disposal methods, including burial, incineration and use of waste disposal companies (Figure 8).

Figure 8 Rodent carcass disposal methods (no. of LAs)



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 UK Government must be assured that the risks to non-target animals are properly managed. This has been addressed by the introduction, in April 2016, of an industry led stewardship scheme managed by CRRU⁽⁶⁾.

Arable and grassland agricultural rodenticide surveys are conducted every two and four years respectively. As LA authority 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 use sector each year (arable, grass and fodder, arable and LA in 2016, 2017, 2018 and 2019 respectively). The data collected in this series of usage reports will reflect changes both in use pattern, resulting from changes to authorisation conditions, and in user training and compliance with the conditions of stewardship.

Whilst the LA data set does not capture all urban rodenticide use, its addition to 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⁽⁷⁾.

Appendix 1 – Results tables

Table 1 Rodenticide formulations and products used by Scottish LAs in 2015

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

	Formulation		Product	
	(g)	Percentage of total use	(kg)	Percentage of total use
Brodifacoum	35	5	703	5
Bromadiolone	626	81	12,513	84
Bromadiolone/difenacoum ⁽¹⁾	2	<0.5	40	<0.5
Coumatetralyl	24	3	6	<0.5
Difenacoum	80	10	1,607	11
Difethialone	<1	<0.5	25	<0.5
Flocoumafen	2	<0.5	48	<0.5
Total	771	100	14,942	100
Total first generation anticoagulants ⁽²⁾	24	3	6	<1
Total second generation anticoagulants ⁽³⁾	746	97	14,936	>99

(1) This formulation contains 50/50 bromadiolone and difenacoum

(2) First generation anticoagulant compounds: coumatetralyl

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

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)	Percentage of total use
Domestic	11,434	77
Domestic/industrial ⁽¹⁾	712	5
Industrial	534	4
Sewer	34	<1
Agricultural	2,229	15
Total	14,942	100
Total (non-agricultural)	12,713	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

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 (n = 29)	Percentage yes response
1) Have all pest control officers conducting baiting in 2015 completed a training course on rodenticide use?	29	100
2) Are quantity and location of baits recorded by pest control officers?	28	97
3) Are bait points always protected from non-target animals?	29	100
4) Is bait regularly inspected by pest control officers?	29	100
5) Are rodenticides always removed after targeted baiting periods? (answer no if bait is laid permanently or left after treatment has finished)	21	72
6) Are rodent carcasses searched for / removed?	26	90

Note: These responses are as reported by local authority representatives and no attempt has been made to check their accuracy

Appendix 2 – Survey statistics

Table 4 Survey response rate

	No.	% total LAs	Total Pop ⁿ	% total pop ⁿ
Scottish local authorities	32		5,373,000	
Rodenticide data returns	25	78	4,358,520	81
Supplementary data returns ⁽¹⁾	29	91	4,938,670	92
No return ⁽²⁾	3	9	434,330	8

(1) Includes four LAs which returned qualitative data but no usage data

(2) Two non-returns and one LA with no pest control service

**Table 5 Scottish population and land area by administrative area
2014⁽⁸⁾**

Local Authority	Population	Area (sq km)
Aberdeenshire	261,960	6,313
Angus	116,900	2,182
Argyll & Bute	86,890	6,909
Borders	114,030	4,732
City of Aberdeen	230,350	186
City of Edinburgh	498,810	263
Clackmannanshire	51,360	159
Dumfries and Galloway	149,670	6,427
Dundee	148,210	60
East Ayrshire	122,060	1,262
East Dunbartonshire	106,960	174
East Lothian	103,050	679
East Renfrewshire	92,940	174
Eilean Siar (Western Isles)	27,070	3,060
Falkirk	158,460	297
Fife	368,080	1,325
Glasgow City	606,340	175
Highland	234,110	25,657
Inverclyde	79,500	160
Midlothian	87,390	354
Moray	95,510	2,238
North Ayrshire	136,130	885
North Lanarkshire	338,260	470
Orkney	21,670	989
Perth and Kinross	149,930	5,286
Renfrewshire	174,560	261
Shetland	23,200	1,467
South Ayrshire	112,400	1,222
South Lanarkshire	316,230	1,772
Stirling	92,830	2,187
West Dunbartonshire	89,590	159
West Lothian	178,550	428
Scotland	5,373,000	77,910

Appendix 3 – Financial burden of LA rodenticide survey

In order to minimise the administrative burden on LAs this survey was conducted by post 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 29 LAs who provided information, 26 provided information about how long was spent on the data request.

The median time local authorities took to provide the information was 60 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 £13.45⁽⁹⁾)

The estimated total financial burden, accounting for all local authorities’ participation in the 2015 rodenticide survey, was £390.05.

Appendix 4 – Definitions and notes

- 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** (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 2015 survey period were: FGARs (coumatetralyl and warfarin), SGARs (brodifacoum, bromadiolone, difenacoum, difethialone and flocoumafen) and non-anticoagulant rodenticides (alphachloralose, aluminium phosphide and powdered corn cob). The **rodenticides encountered** in this survey were; brodifacoum, bromadiolone, coumatetralyl, difenacoum, difethialone and flocoumafen.
- 7) In this survey, local authorities were asked to report their rodenticide use in four different **settings**: agricultural, domestic, industrial and sewer. 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) The rodenticide stewardship scheme was implemented in April 2016. It covers professional use of rodenticides outside buildings⁶.
- 10) Due to rounding, there may be slight differences in totals both within and between tables.

Appendix 5 – Survey methodology

Sampling and data collection

There are 32 local authorities in Scotland (Table 5, Figure 9). Each LA was sent a postal survey designed to collect information about their use of rodenticides in 2015 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.

An initial introductory letter and survey forms were sent to each LA. These were followed by a reminder letter, two months after survey initiation, if data had not been received. In some cases follow up phone calls were required for data clarification.

Both the agricultural rodenticide surveys^{(1)(2)}, and the UK local authority survey conducted by CSL in 2001⁽³⁾ 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 UK local authority report estimated total rodenticide use based on human population, stating that there was a strong correlation between rodenticide usage and human population in authority area. 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 per cent of LAs, accounting for 53 per cent of the UK population.

In contrast, 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. It had originally been the intention to use the same raising method as implemented in the 2001 UK survey. However, when the data were analysed it was clear that, in this sample, there was not a 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 BIOSS statistician and the decision was taken that the most appropriate action to avoid mis-estimation, was to present the data as a sample. As the sample covers 78 per cent of LAs and 81 per cent of the Scottish population it is considered to provide a robust overview of how rodenticides are used by Scottish LAs.

Data quality assurance

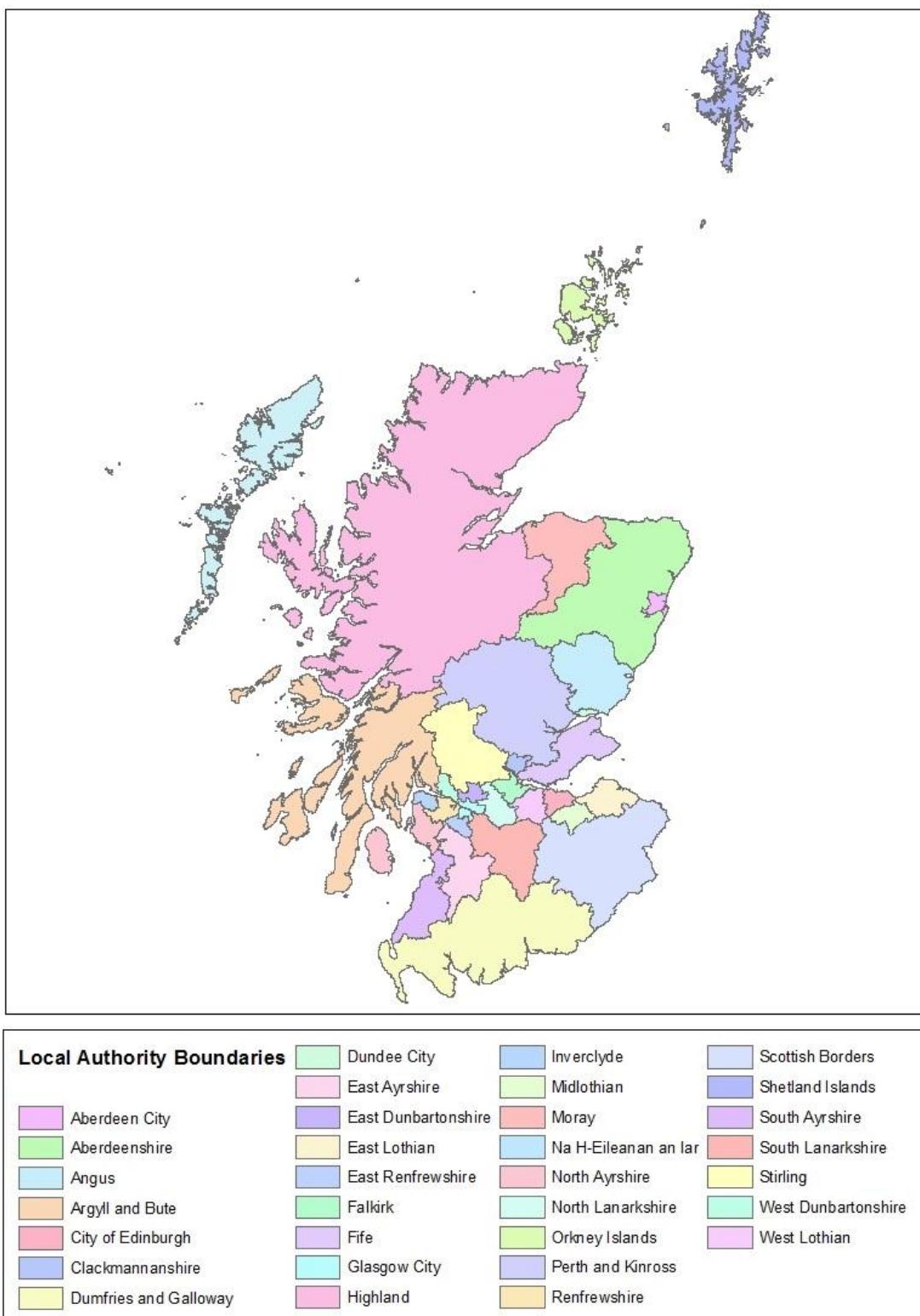
The dataset underwent several validation processes as follows; (i) checking for any obvious errors upon data receipt (ii) checking and identifying inconsistencies with use and approval conditions once entered into the database (iii) 100 per cent checking of data held in the database against the raw data. Where inconsistencies were found these were checked against the records and with the LA if necessary. Additional quality assurance is provided by sending reports for independent review. In addition, the Scottish pesticide

survey unit is accredited to ISO 9001:2008. 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.

Main sources of bias

These surveys may be subject to measurement bias as they are reliant on respondents recording 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 9 Scottish local authority boundaries



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References

1. Wardlaw, J. Hughes, J., Monie, C. & Reay, G. (2015) Rodenticides on Arable Farms 2014. Scottish Government, AFRC, Edinburgh
2. Hughes, J., Watson, J., Monie, C. & Reay, G. (2014) Rodenticide Use on Grassland and Fodder Farms 2013. Scottish Government, AFRC, Edinburgh
3. Dawson, A. & Garthwaite, D. (2002) Rodenticide Usage by Local Authorities in Great Britain 2001. Central Science Laboratory, Department for Environment, Food and Rural Affairs
4. Buckle, A. & Prescott, C. (2012) The Current Status of Anticoagulant Resistance in Rats and Mice in the UK. A Report to HSE from the Rodenticide Resistance Action Group
<http://www.bPCA.org.uk/assets/RRAG-ReportAnticoagulantResistanceintheUK.pdf>
5. Campaign for Responsible Rodenticide Use (CRRU) Best practice guidance <http://www.thinkwildlife.org/crru-code/>
6. Campaign for Responsible Rodenticide Use (CRRU) Rodenticide stewardship guidance <http://www.thinkwildlife.org/important-information-on-stewardship/>
7. Hughes, J., Sharp, E., Taylor, M.J., Melton, L., Hartley, G. (2013) Monitoring agricultural rodenticide use and secondary exposure of raptors in Scotland. Ecotoxicology. 22(6):974-84.
8. National records of Scotland 2014 mid-year population estimate
<http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/mid-2014/list-of-tables>
9. Annual Survey of Hours and Earnings (ASHE) 2015 (Table 8.5a)
<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningandsworkinghours/datasets/placeofresidencebylocalauthorityashetable8>

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