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Campaign for Responsible Rodenticide Use
CRRU Stewardship

Campaign for Responsible Rodenticide Use (CRRU) UK

The UK Rodenticide Stewardship Regime 2019 Annual Report

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Annual Report 2019

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CRRU UK Member Companies:

Babolna Bioenvironmental Centre Ltd
Barrettine Environmental Health
BASF plc
Bayer CropScience Ltd
Bell Laboratories Inc
Killgerm Group Ltd
LiphaTech S.A.S.
LODI UK Ltd
Pelsis Ltd
PelGar International Ltd
Quimica de Munguia S.A.
Rentokil Initial plc
Syngenta Crop Protection AG
Unichem d.o.o.
Zapi SpA

Foreword

In the fourth Annual Report of the UK Rodenticide Stewardship Regime we provide information on the work conducted by CRRU UK during 2019. This is the second year in which all of the provisions of the regime have been fully implemented. Perhaps it is an appropriate time to remind ourselves about what has been achieved in a few short years.

The manufacturers of all professional rodenticides sold in the UK, more than 700 products in total, participate in and contribute towards the stewardship regime. We have implemented a programme of training and certification which means that professional rodenticide products can only be purchased legally by those who are able to show they are sufficiently competent to use them. More than 23,000 practitioners have participated in CRRU-approved training courses and received certification since the regime began. There is an independent audit system that confirms that the rules of 'proof of competence' are applied at all retail outlets for these products country-wide.

Numerous guidelines and codes have been prepared to promote best practice, all with an explicit purpose of reducing wildlife exposure. Compliance with this CRRU guidance is now a condition of product authorisation that is written into product labels, therefore carrying regulatory weight. The farm assurance standards applied on farms across the UK contain reference to, and require compliance with, CRRU guidance on the responsible use of rodenticides. CRRU creates a constant flow of material in the form of press releases so that our mission and messages are frequently brought to those who inform our main user groups – professional pest controllers, farmers and gamekeepers.

At the request of HSE, and the Government Oversight Group, CRRU has established a framework of monitoring that includes periodic assessments of user knowledge and practice, the extent of residues in wildlife (primarily barn owls), the breeding dynamics of this species and the occurrence of anticoagulant resistance among UK rodents.

When brought together, these measures probably represent the most comprehensive attempt anywhere in Europe to bring about change in the use of a class of biocide for the benefit of the environment.

However, at least one important measure of the effectiveness of the scheme in reducing wildlife exposure to rodenticides, the prevalence of anticoagulant residues in the livers of the sentinel species, the barn owl, has again proven stubbornly intractable. According to the latest report from the Centre for Ecology & Hydrology, it shows no statistically significant signs of reduction. It may be too soon for the changes that stewardship has brought about to user competence and behaviour, and their application methods, to be reflected in this complex and highly dynamic biological system. But on the positive side, the regulatory changes that now mean that the most powerful resistance-breaking anticoagulants, brodifacoum, difethialone and flocoumafen, can can be used outdoors for the first time in 30 years have not resulted in a significant increase in overall anticoagulant residues in barn owls, as was feared.

The objectives of the regime will not be achieved without the willing co-operation and provision of resources by the CRRU stakeholder organisations and full compliance with stewardship principles by those who use rodenticides. We can only hope that the dedication of those who operate CRRU structures, and conscientiousness of those who use rodenticides responsibly, will be reflected in the results of the monitoring programmes that we have put in place in the coming years. In 2020, HSE will carry out a full review of the stewardship regime and only then will we know if we are doing enough.

Dr Alan Buckle

Chairman CRRU UK,
University of Reading

2. Summary

During 2019, the UK Rodenticide Stewardship Regime, based on a delivery structure of six work groups, consolidated those components of the regime that had been previously introduced and considered by the Government Oversight Group (GOG) to be fit for purpose (GOG, 2019).

The purpose of this report is to describe the stewardship measures put in place by CRRU UK for the information of those involved in operating the regime and those who apply rodenticides as in the professional pest management, farming and gamekeeping sectors. It is also to provide evidence of these efforts, and their outcomes, to permit the Health and Safety Executive (HSE) and the GOG to assess progress against three stages (see GOG, 2019):

(i) Evidence that the industry has put in place what it said it would

(ii) Evidence/indicators of industry's response/ changes of behaviour

(iii) Evidence/indicators of impact

Government requires benefits to be delivered by the regime in three areas: **1) governance of the supply chain**, which gives governance over, and provides the driver for, later stages; **2) a competent workforce** capable of delivering stewardship standards and of demonstrating an appropriate understanding and attitude toward case-specific control of rodents and use of rodenticides; and **3) monitoring compliance** with the regime and its environmental impacts (see GOG, 2019). Therefore this report describes the work of the stewardship work groups and its outcomes using these headings.

3. Introduction

The UK Rodenticide Stewardship Regime, operated by CRRU UK, is the only stewardship programme that satisfies the 'High Level Principles' set out by the Health and Safety Executive (HSE), the statutory Competent Authority and the lead agency of government policy on biocides in the UK (GOG, 2019; Annex 1). Membership of CRRU UK, and thereby participation in the regime's stewardship programmes, is a condition of authorisation for all rodenticide products sold to UK professional users. These stewardship requirements are in place because many rodenticide active substances fail risk assessments for the environment and human health and, as they satisfy the European Commission's "exclusion criteria", would otherwise not be permitted for sale and use.

Beyond the regulatory requirement for authorisation holders to provide product stewardship that satisfies HSE's principles, all other aspects of the regime are voluntary. Those who work for a wide range of stakeholder organisations, including manufacturers and distributors, trade associations, farming unions, conservation agencies, government organisations, farm levy bodies and those in the retail sector, provide staff time and other resources to ensure the delivery of the regime.

The numbers involved illustrate the scope of the regime and achievements. Forty-eight people, from thirty-two stakeholder organisations participate in the CRRU Task Force to set policy and strategic direction. Fifteen manufacturing companies and distributors contribute funding to CRRU and hold more than seven hundred professional rodenticide product authorisations used by our three user groups: professional pest management, farming and gamekeeping. Four Awarding Organisations provide examination and certification for eleven CRRU-approved training courses presented by 154 training providers. Since the beginning of the regime more than 23,000 people have taken these courses, passed the exams and received certification for proof of competence.

Also contributing to workforce competence, five different CRRU modules for continuing professional development (CPD) have been downloaded from the CRRU website a total of 7,000 times. The module on environmental risk assessment alone has been downloaded 3,000 times. More than 700 outlets have registered with the audit scheme for retailers of professional rodenticides, operated by the independent BASIS (Registration) Ltd., to demonstrate they comply with the rules for proof of competence at point of sale. The numbers involved in the farming sector are even larger with more than 94,000 premises registered with the seventeen Farm Assurance Schemes whose standards for rodent pest management comply with the CRRU Code of Best Practice.

The scope and achievements of these measures are obvious and, when it published its review of the progress of the UK Rodenticide Stewardship Regime at the beginning of 2019 (GOG, 2019), the Government Oversight Group stated that it is" …..content that the Rodenticides Stewardship Regime is fit for purpose and continues to meet the high-level principles…..".

However, another essential component of the regime is monitoring and evaluation. The GOG has set out monitoring requirements to be delivered by CRRU, as well as by other involved agencies and government departments (GOG, 2019). Thus, CRRU contracts independent experts to monitor on an annual basis: 1) the distribution and concentrations of anticoagulant residues in a sample of UK barn owls (the Centre for Ecology & Hydrology), 2) the extent and severity of anticoagulant resistance among UK rat and mouse populations (the Vertebrate Pests Unit, the University of Reading) and 3) the breeding performance of a sample of barn owl nests (the Wildlife Conservation Partnership and the University of Reading). The results of these monitoring programmes are, once again, provided and discussed in subsequent sections of this report.

CRRU continues to report progress to the GOG on an annual basis: this document is the fourth such report. A full appraisal of the regime and its outputs will be made by government in 2020, or soon thereafter. Depending on the outcome of the various monitoring projects and the assessment by GOG of the information they provide, changes may be made ranging from minor modifications to the Rodenticide Stewardship Regime (e.g. improved training or awareness), changes to the approved uses (e.g. amendment of the approval of specific products) or revocation of uses/products.

4. REPORTS FROM THE CRRU UK WORK GROUPS ON PROGRESS DURING 2018

4.1. General

The structure of the regime, involving six work groups, has shown itself to be fit for purpose and has remained in place during 2019.

4.2. Best Practice Work Group (Leader, Dee Ward Thompson, BPCA)

The work of the Best Practice Work Group (BPWG) is to provide guidance and promote the responsible use of rodenticides to ensure a "*competent workforce*" among all professional user groups.

In 2019, for the second consecutive year, CRRU-approved standards were employed across 17 different farm assurance schemes (FAS). Auditors working for the schemes have now visited all of the members' premises at least once to conduct audits of compliance with the new standards. Table 1 shows the schemes involved (note some schemes have changed their names since the last Annual Report), their membership numbers in 2019 and the frequency of audits required to maintain membership. The largest scheme, Red Tractor, has reported to CRRU that there have been some non-conformances but these are expected when new standards are introduced, as members get to grips with the changes to requirements.

More detailed information on the outcome of farm audits with respect to compliance with rodent control best practice on farms would be useful to the regime. CRRU has undertaken to seek this information, with assistance from members of the GOG where relevant.

New rodenticide product labels have resulted in frequent correspondence between the BPWG and user stakeholders. An important topic was label phrases connected with permanent baiting. At issue was the required frequency of visits to check permanent bait points when these are positioned either indoors or outdoors. Also in question was the legal status of the 'guidance' offered to users by CRRU on permanent baiting when product labels carry the phrase "For permanent baiting follow any additional instructions provided by the CRRU Guidance on Permanent Baiting". The Work Group reviewed these matters and published a revision of the guidance document on permanent baiting (CRRU UK, 2019).

CRRU issued its Code of Best Practice in March 2015 (CRRU UK, 2015). Since that time there have been some changes to authorised use patterns and product labels, beyond those concerned with permanent baiting mentioned previously. There have also been public announcements about the impending entry into the UK market of rodenticide products containing the active substance cholecalciferol. These changes, and others, have required a review of the existing Code of Best Practice with an objective of the publication of a revision during the first part of 2020.

4.3. Training and Certification Work Group (Leader, Matthew Davies, Killgerm Chemicals Ltd.)

All aspects of the work of the Training and Certification Work Group (T&CWG) are intended to support the development and maintenance of a "*competent workforce*" and to disseminate the fundamental requirements of the responsible use of rodenticides across the three user sectors. "*Governance of the supply chain*" is also implemented through the certification procedure applied by the T&CWG.

The major deliverable of the work group continues to be the provision of CRRU-approved training through 154 training providers serving four awarding organisations, namely BASIS Registration Ltd., City and Guilds/National Proficiency Tests Council (NPTC), Royal Society for Public Health (RSPH) and LANTRA. In the period August 2018 to July 2019, nine different CRRU-approved courses were offered and examined. A total of 4,711 certificates were awarded to training participants during the period, bringing the total number of certificates awarded for CRRU-approved courses to 23,538 during the three years of the regime (Table 2). This continues to be a very substantial contribution to the maintenance of a "*competent workforce*". A report containing more details of the courses provided and certificates awarded has been provided in confidence to the GOG, and for the first time all the awarding organisations provided information on examination pass rates.

The Continuing Professional Development (CPD) component of the stewardship scheme continues to be available. The expertise of CRRU UK member companies, stakeholder organisations and individuals has been harnessed to create a series of CPD training modules made freely available at the CRRU UK website (http://www.thinkwildlife.org/training-certification/continuing-professional-development-cpd-and-stewardship). The modules, each comprising a PowerPoint presentation taking 45-60 minutes for completion, are supported by detailed trainers' notes. The modules are viewed independently by professional rodenticide users as a method of self-teaching. Additionally, they are downloaded by training organisations and used

during face-to-face or online education events. Trainers have been registering these events with relevant CPD awarding organisations (see Table 3) and participants have claimed CPD awards from such activities. An additional CPD scheme has been developed for the professional pest control sector in 2019, noted in Table 3, in addition to existing long-standing and successful schemes for this sector and others. Membership of a registered CPD scheme is strongly promoted by CRRU UK for all competent professional rodenticide users although it is not presently a mandatory condition for proof of competence at point of sale.

A module on the status of anticoagulant resistance in rats and mice in the UK was published in 2019 and five CPD modules currently available are:

1. Environmental Risk Assessments
2. Exposure of Wildlife to Rodenticides
3. Direct application of bait in burrows. Justification and mitigation measures
4. Changes to the classification of anticoagulants and permitted pack sizes
5. Anticoagulant rodenticide resistance in rats and mice

There have been a total of 7,632 CRRU CPD module downloads since the introduction of the scheme on 31st July 2018, which is up from 2,091 quoted in the 2018 annual report. The module on Environmental Risk Assessment has proved particularly popular, with 3,258 downloads since the scheme was established.

Further CPD modules are scheduled for release from 2020. These include, among others, a module to support the correct application of permanent baiting, an update on the objectives, achievements and progress of the UK Rodenticide Stewardship Regime and module to explain the scientific background and role of wildlife residue monitoring in the assessment of the scheme's effectiveness.

Table 1. The CRRU-approved farm assurance schemes, their membership numbers and the frequency of audits conducted in 2019.

Assurance scheme	**No. of members**	**Geographical Coverage**	**Audit Frequency**
Agricultural Industries Confederation	515	UK	12months
British Egg Industry Council Code of Practice for Lion Eggs	1,850	UK	6 months
Red Tractor Farm Assurance - Beef and Lamb	23,812	England	18 months
Red Tractor Farm Assurance - Dairy	10,951	UK	18 months
Red Tractor Farm Assurance - Crops	16,641	England, Wales	12months
Red Tractor Farm Assurance - Fresh Produce	2,169	UK	12 months
Red Tractor Farm Assurance - Pigs	2,211	England, Wales, NI	12months
Red Tractor Farm Assurance – Chickens	2,053	UK	12 months
Quality Meat Scotland - Beef & Lamb	9,772	Scotland.	12 months
Quality Meat Scotland - Pigs	139	Scotland	12 months
Farm Assured Welsh Livestock - Beef & Lamb	7,168	Wales	18 months
Scottish Quality Crops	3,386	Scotland	12 months
Northern Ireland Farm Quality Assurance Scheme - Beef and Lamb	12,082	NI	18 months
Northern Ireland Farm Quality Assurance Cereals Scheme	820	NI	18 months
"Laid in Britain"	35	England, Wales, Scotland	12 months
Red Tractor Farm Assurance – Turkeys	424	UK	12 months
Red Tractor Farm Assurance – Ducks	60	UK	12 months
Total	94,088		

Table 2. The total numbers of CRRU-approved training certificates and qualifications awarded by the following awarding organisations: BASIS (Registration) Ltd., City & Guilds, Lantra, Royal Society for Public Health.

Time Period	**Total number of certificates/qualifications issued**
August 2015 to July 2016	7,285
August 2016 to July 2017	6,044
August 2017 to July 2018	5,498
August 2018 to July 2019	4,711
total	23,538

Table 3. Those involved in rodent control are encouraged to maintain their knowledge gained from achieving approved certification, by joining an established CPD scheme. The following established CPD schemes are available to those in the professional pest management, farming and gamekeeping sectors. Note: CRRU signposts users to these schemes and promotes scheme membership, but does provide formal approval.

Established CPD schemes	
Scheme Name	**Provider (Awarding Organisations administering CRRU-approved training and certification)**
NRoSO (National Register of Sprayer Operators)	City & Guilds/NPTC (National Proficiency Tests Council)
PIPR (Pig Industry Professional Register)	City & Guilds/NPTC (National Proficiency Tests Council)
BASIS Professional Register	BASIS Registration Ltd.
BASIS PROMPT Register	BASIS Registration Ltd.
BASIS Amenity Training Register	BASIS Registration Ltd.
Lantra Skills Plus	Lantra
Other schemes	**Other providers**
AHDB Dairy Pro	AHDB (Agriculture and Horticulture Development Board)
BPCA Registered	British Pest Control Association
PestWise	Skills Passport
In-house schemes are available in the professional pest management sector	
An alternative option	**Awarding Organisations**
Training and Certification: users can repeat the approved training and certification options at regular intervals, in order to maintain their knowledge to stewardship levels	BASIS, City & Guilds, Lantra, RSPH

4.4. Regulatory Work Group (Leader, Sarah Bull, BASF plc)

The role of the Regulatory Work Group is to ensure that CRRU operates within the regulatory framework imposed by the European Union's Biocidal Products Regulation, as implemented by the UK Competent Authority, HSE. The Work Group provides a single voice for authorisation holders in dialogue with HSE and seeks, where feasible, to harmonise label recommendations and application procedures to provide safe, effective, simple and consistent instructions to users.

The work group has made significant contributions to CRRU guidance documents (CRRU UK, 2015 and 2019) and to the CPD materials made available at the CRRU UK website (see above).

A requirement for the grant of authorisation for a professional rodenticide product to be placed on the UK market by HSE is the provision by the authorisation holder of a full range of product stewardship actions meeting the 'High Level Principles' published by HSE (see http://www.hse.gov.uk/biocides/eu-bpr/rodenticides.htm). This requirement is satisfied by membership of CRRU UK, and thereby participation in the UK Rodenticide Stewardship Regime. During 2019, the Spanish company Quimica de Munguia S.A. (Quimunsa) joined CRRU UK bringing to fifteen the number of UK-based and international companies that are members of the UK Rodenticide Stewardship Regime. The names of these companies are listed inside the front cover of this report.

A total of 702 professional rodenticide products are currently supported by the work of CRRU and the stewardship regime and therefore carry labels requiring the implementation of stewardship conditions (see: http://www.hse.gov.uk/biocides/eu-bpr/rodenticides.htm). This number has decreased since the previous report because of the phase-out of products of authorisation holders who either did not apply for or were not granted renewals. Seven different anticoagulant active substances are used in 'stewardship' products, as follows: difenacoum (282 products available), bromadiolone (220), brodifacoum (170), difethialone (21), flocoumafen (13), coumatetralyl (3) and warfarin (2). The majority (690) of these stewardship products are permitted for use outdoors around buildings, while 363 products are also authorised for use outdoors in open areas, 354 outdoors at waste dumps and 419 in sewers. [N.B. Figures quoted for numbers of products were correct on 9th October 2019.]

4.5. Point of Sale Work Group (Leader Rupert Broome, Killgerm Chemicals Ltd.)

The projects implemented by the Point of Sale Work Group within the stewardship regime are focused on "governance of the supply chain".

A corner-stone of the stewardship regime is the imposition of competence checks at the point-of-sale. As well as "supply chain governance", these checks drive the "competent workforce" benefit because only appropriately competent personnel can purchase professional rodenticides. The fundamental importance of this measure within the regime overall made necessary a procedure to audit its application. Following the successful pilot project in 2017, a full Rodenticide Point of Sale (RPOS) audit procedure was implemented in 2018 and this has continued throughout 2019.

The RPOS audit process is conducted by an independent agency, BASIS (Registration) Ltd. It is the responsibility of all product authorisation holders to ensure that their products are placed on the market only through outlets which are registered with the new RPOS audit scheme run by BASIS and have passed an audit.

The primary highlights of the RPOS audit outcomes in full year 2018 and year to date to end September 2019 are as follows:

- An increase of 23 % in the numbers of premises registered to undergo the RPOS audit. (706 year-to-date to end September 2019 versus 572 throughout full year 2018.) See Figure 1.
- The number of RPOS audits completed to September 2019 was 603.
- In 2019 the regional split of premises registered to undergo the RPOS audit is:
    - England - 70 %
    - Scotland - 12 %
    - Northern Ireland - 8 %
    - Wales - 10 %
- Of the premises audited, there has been an increase in the proportion of outright passes which now stands at 72 % (up from 67 % in 2018).
- There has been a reduction in the proportion of premises passing with minor issues, down to 8 %, however the number of premises obtaining a qualified pass has risen slightly to 19 %.
- The number of premises which failed to pass the audit (which includes premises for which an audit visit failed to occur) remained broadly stable at 2 %. See Figure 2.

In addition, it is worth noting that in 2019 the first premises on the island of Jersey has registered for and successfully passed the RPOS audit, as the UK scheme has now extended to the Bailiwick of Jersey.

To ensure the RPOS audit process remains up to date and opportunities for improvement are identified, CRRU UK and BASIS conduct an annual review of the process.

Since October 2017, an additional supporting measure for the governance of the supply chain has been put in place by CRRU UK in the form of the operation of the on-line tool for reporting allegations of incidents where a failure to comply with point-of-sale competence checks, or a wider failure to comply with the Stewardship Regime, is said to have been observed. https://www.thinkwildlife.org/stewardship-regime/report-a-concern/.

During the period 1st January to 1st October 2019, the following allegations have been received via the on-line reporting tool:

- 10 allegations of non-compliance have been submitted, of which, 9 are "unique" allegations.
- 7 of these allegations have been submitted by one complainant.
- 9 of the 10 allegations related to sales of rodenticide on the internet. Of these :
    - 6 investigations resulted in the listings being removed, or the website in question being closed.
    - 2 investigations related to potentially illegal sale of rodenticide, and these were reported to HSE and the internet platform concerned.
    - 1 investigation is ongoing.
- One allegation could not be progressed due to a lack of information from the complainant.

Since October 2017, when the on-line reporting tool went live, CRRU UK has received a total of 37 allegations via the reporting tool.

- 34 of these have been unique complaints.
- Of these 37 allegations in total, 32 have related to internet sales of rodenticide.
- Of those complaints relating to internet sales :
    - 10 relate to allegations which were not upheld.
    - 9 resulted in the listing being removed, or in one instance the website being taken down.

Figure 1. Numbers of UK premises that were registered for a BASIS (Registration) Ltd. Rodenticide point of sale audit in 2018 (blue bars) and 2019 (red bars). Total number of premises 706 in year-to-date to end of September 2019 (includes one in Jersey).

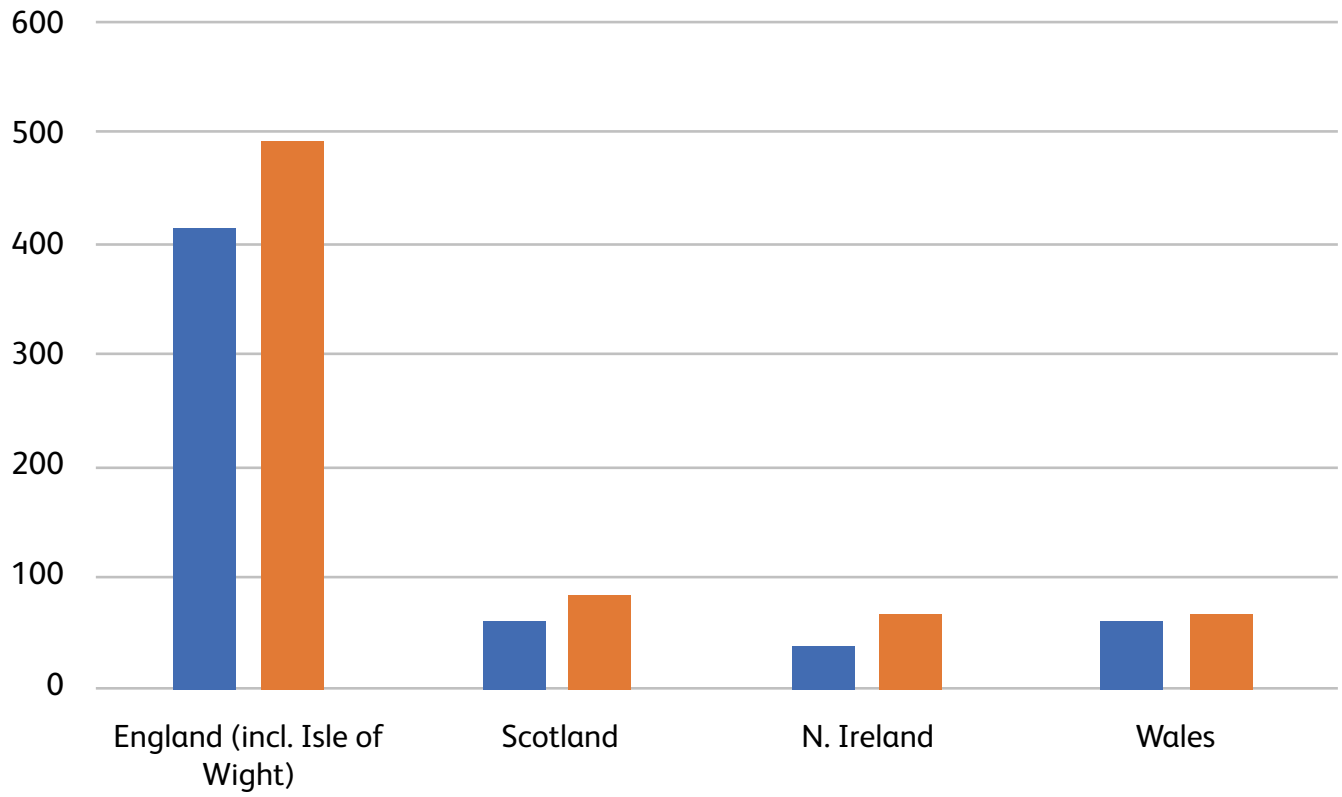
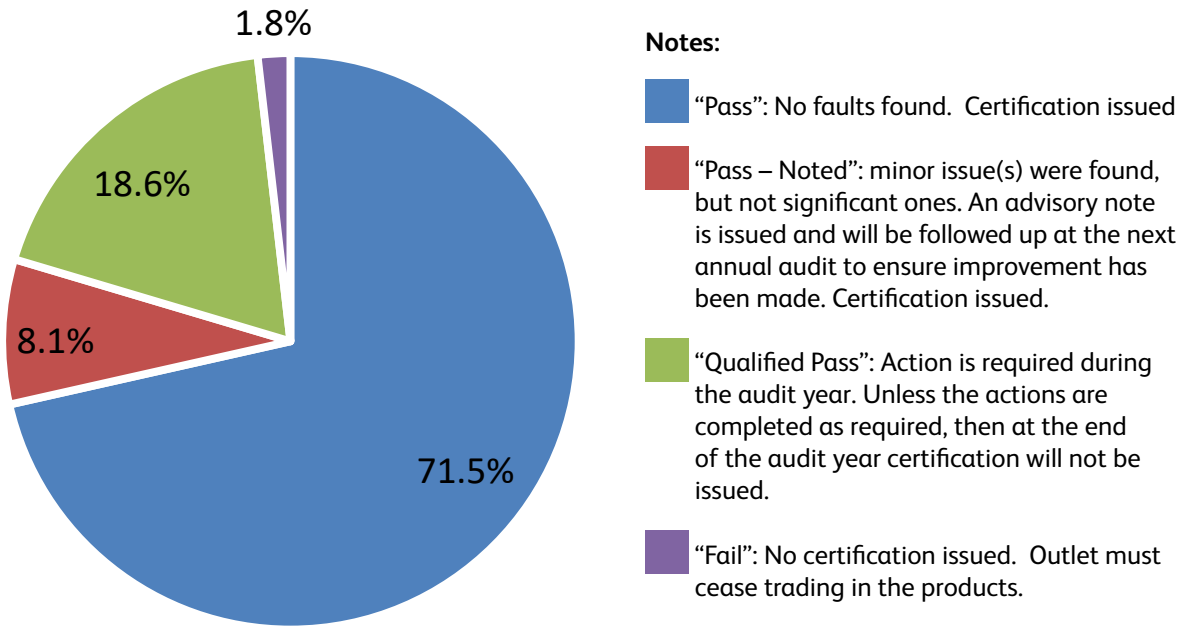


Figure 2. The outcomes of a total of 603 Rodenticide Point of sale audits conducted by BASIS (Registration) Ltd. on premises in the UK. Year-to-date end of September 2019.



- 4 relate to instances where the wording of the listing was amended to become compliant.
- 6 related to apparently illegal sale of rodenticide and these were reported to HSE.

Looking forward, in 2020 the primary focus for the CRRU UK Point of Sale Work Group will continue to be to ensure the RPOS audit process is effectively implemented across the whole of the supply chain in the UK. To support this, and to reflect various aspects of the evolution of the regime, in the near future the Work Group will also look to update the CRRU UK Point of Sale Declaration templates, and also the CRRU UK Point of Sale Question & Answer guidance for the supply chain.

4.6. Monitoring Work Group (Leader, Richard Moseley, Bayer CropScience Ltd.)

The Monitoring Work Group provides oversight of and reports on studies from independent contracted agencies on the progress of the stewardship regime in order to meeting the HSE/GOG key benefit "monitoring compliance".

Anticoagulant residues in barn owls (Centre for Ecology & Hydrology)

As in previous years a report has been provided by the Centre of Ecology & Hydrology (CEH) on the distribution and concentrations of anticoagulant residues in a sample of barn owls (*Tyto alba*) collected during the year 2018 (Shore et al., 2019). The following paragraphs are directly quoted from the CEH report and summarise the results in respect of the HSE/GOG metrics for stewardship monitoring:

- As in the baseline years, the compounds detected most frequently in barn owls that died in 2018 were bromadiolone, difenacoum and brodifacoum. Overall, 87 % of the owls had detectable liver residues of one or more SGAR.
- The metrics to be used for stewardship monitoring are reported below in terms of differences between owls that died in 2018 and in baseline years.
    - Numbers of barn owls containing detectable residues of flocoumafen and difethialone. There was no significant difference in the proportion of barn owls with detectable liver residues of flocoumafen between the baseline years and 2018. There was a significantly higher proportion of barn owls with detectable liver residues of difethialone in 2018 compared to baseline years (8 % vs 0.3 %).
    - The ratio of birds with "low" (<100 ng/g ww) vs "high" (>100 ng/g wet wt.) concentrations for any single SGAR or for ∑SGARs. There was no significant difference between barn owls from baseline years and from 2018 for any individual compound or for summed SGARs (∑SGARs), although a decrease in the proportion of birds with "high" difenacoum residues approached significance.
    - Average concentrations of brodifacoum, difenacoum, bromadiolone and ∑SGARs in the cohort of owls with "low" residues (<100 ng/g ww) and "high" residues (>100 ng/g ww). There was no significant difference between barn owls from baseline years and from 2018 in the concentrations of either "low" or "high" residues for bromadiolone, difenacoum (data tested statistically only for "low residues"), all residues summed (∑SGARs), or "high" brodifacoum residues. The median concentration of "low" brodifacoum residues was higher in birds from 2018 than in baseline years.
- Overall, there were few differences in liver SGAR accumulation between barn owls that died in baseline years and in 2018. The lack of significant reductions in SGAR residues in barn owls in 2018 suggests that full implementation of stewardship since 2016 has yet to result in a reduction in exposure of barn owls to SGARs.

These results show that the overall burden of anticoagulant residues in the livers of barn owls collected during 2018 was not significantly different to that found in owls collected in the baseline years (2007 to 2012). There were, however, some differences detected for individual active substances. For example, in birds collected in 2017 the median low difenacoum concentration was significantly lower than in baseline years, whereas for birds collected in 2018 this difenacoum parameter was significantly higher. In 2018, low residues of brodifacoum were also marginally, but significantly, higher. The finding that more birds carried difethialone residues is likely to reflect that this active substance has been introduced to the UK market since the baseline years, and is therefore latterly more widely used.

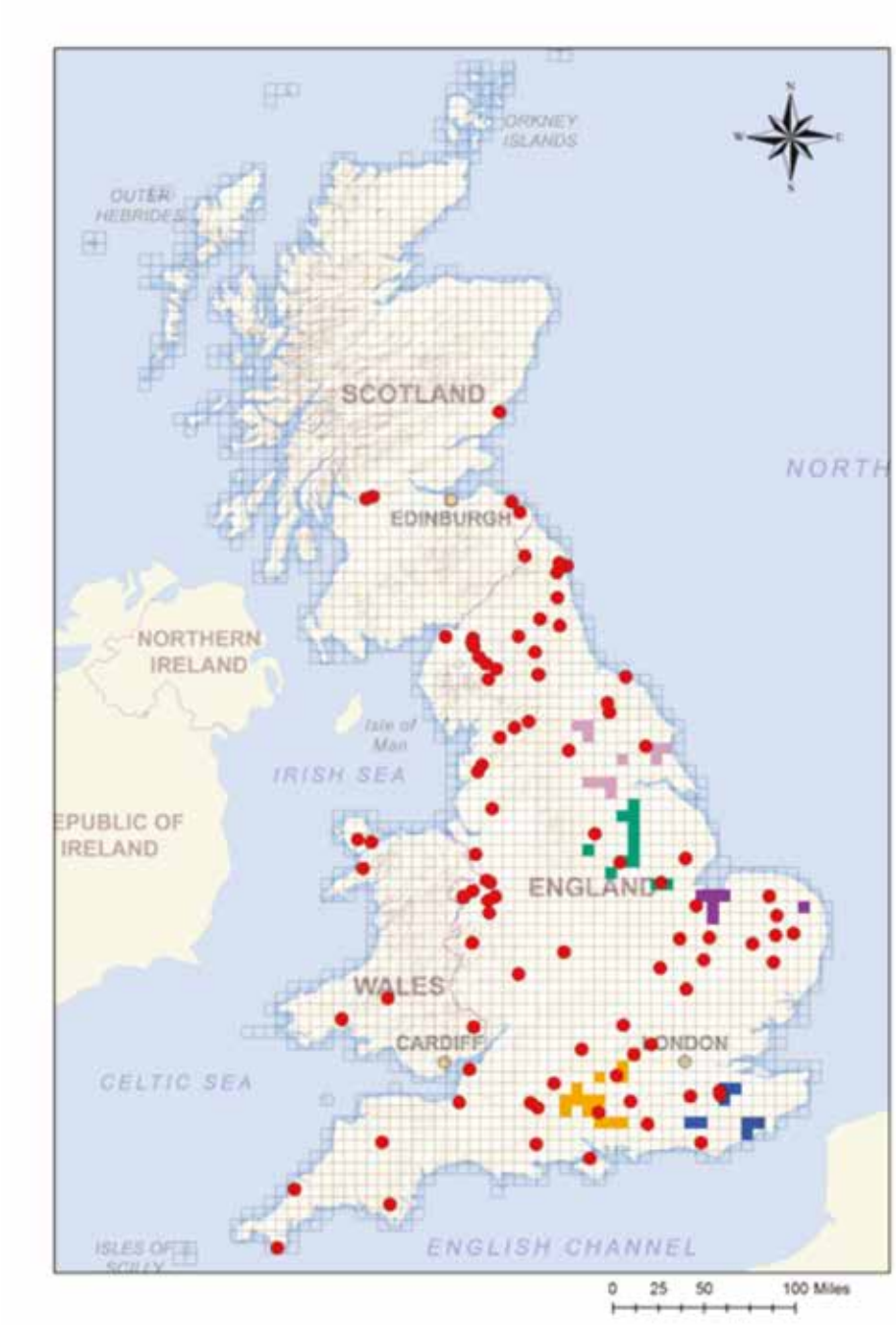
Once again it is also apparent from these data that the changes to use patterns and user behaviour, and the introduction of competence checks at point of sale brought about by the introduction of rodenticide stewardship has not yet resulted in the hoped-for reduction in anticoagulant residues among UK barn owls. On a more positive note, the data also show that regulatory changes implemented in 2016, that permitted the more

potent anticoagulants brodifacoum, difethialone and flocoumafen to be used outdoors for the first time has led to no statistically significant increase in total SGAR residues in barn owls.

Barn owl breeding performance (University of Reading and Wildlife Conservation Partnership)

The Barn Owl Monitoring Survey (BOMS) was carried out once more in 2018 to measure key breeding performance metrics in a sample of UK barn owl nests (Prescott et al., 2019). The geographical distribution of the birds sampled in 2018 is shown in Figure 3; and it can be seen that in eastern and central-southern England there is good concurrence in the locations of those birds collected for CEH liver analysis and the locations of the nests studied in the BOMS investigation of barn owl breeding performance.

Figure 3. A map of the United Kingdom showing the locations of the 10 kilometre squares in each of the five Regions containing the barn owl nest sites surveyed in 2018. The location of the barn owls obtained by CEH for the CRRU liver residue analysis survey in the same year are also presented (red circles). [We gratefully acknowledge the kind co-operation of CEH for the provision of the latter information.]



A total of 121 nests, from five different regions of the UK, were observed during 2018 and the metrics recorded were: nest site occupancy rate, nest productivity (i.e. mean number of chicks fledged in productive nests) and records of birds (both chicks and adults) that show any abnormal growth development. Of the nest sites monitored (Prescott et al., 2019), a total of 122 young birds fledged from 45 successful nests, with mean nest productivity of 2.71 chicks per successful nest, and a range across the five regions of 2.0 to 2.9 chicks per successful nest. No eggs or chicks showing abnormal development/growth were observed.

BOMS breeding data show annual fluctuations in the breeding productivity of UK barn owl populations. Mean nest productivity in 2018, 2.71 chicks per successful nest, was higher than in the preceding years 2015-2017 (Table 4). However at 122, the numbers of chicks fledged from BOMS nests in 2018 was somewhat lower than in previous years and nest productivity in the BOMS nests in the northern and eastern regions was especially poor. It is generally considered that such fluctuations in breeding performance are caused by factors including climatic conditions, the availability of prey, the availability of nest sites and the numbers of birds in breeding condition (Prescott et al., 2019).

Resistance in UK Rats and Mice (University of Reading)

Further work has been conducted at the University of Reading in 2019 to collect rat and mouse tissue samples and to sequence DNA from them to detect common anticoagulant resistance mutations (Jones et al., 2019). During 2019, a particular effort was made to obtain samples from parts of the UK which had not been sampled previously. However, this was only partially successful (see Figure 4).

The report submitted to CRRU by the University of Reading presents new resistance data for tissue samples from Norway rats (*Rattus norvegicus*) and house mice (*Mus musculus*) collected in the period September 2018 to September 2019. A total of 140 Norway rat tissue samples were analysed, among which 55 were anticoagulant-susceptible and 85 carried one of five different resistance mutations (Y139S, Y139C, Y139F, L120Q, L128Q), in either the homozygous or heterozygous form.

Table 4. Summary of barn owl breeding data from the BOMS study from Prescott et al., 2019.

Year	Parameter	Region 1 (N)	Region 2 (E)	Region 3 (C)	Region 4 (SE)	Region 5 (Midlands)	All Regions
2015	**Total number of nests**	**25**	**25**	**25**	**25**	**30**	**130**
	Nests that produced fledgling birds	**5**	**4**	**13**	**12**	**7**	**41**
	Total number of birds fledged	**13**	**10**	**31**	**31**	**18**	**103**
	Mean productivity per successful nest	**2.60**	**2.50**	**2.38**	**2.58**	**2.57**	**2.51**
2016	**Total number of nests**	**25**	**25**	**25**	**25**	**30**	**130**
	Nests that produced fledgling birds	**7**	**9**	**11**	**16**	**18**	**61**
	Total number of birds fledged	39	21	**25**	**39**	**51**	**154**
	Mean productivity per successful nest	2.57	**2.33**	**2.27**	**2.44**	**2.83**	**2.52**
2017	**Total number of nests**	**25**	**25**	**25**	**25**	**30**	**130**
	Nests that produced fledgling birds	**8**	**9**	**13**	**15**	**16**	**61**
	Total number of birds fledged	**16**	**24**	**34**	**45**	**34**	**153**
	Mean productivity per successful nest	**2.00**	**2.67**	**2.62**	**3.00**	**2.13**	**2.51**
2018	**Total number of nests**	**22**	**23**	**24**	**22**	**30**	**121**
	Nests that produced fledgling birds	**5**	**1**	**11**	**11**	**17**	**45**
	Total number of birds fledged	**10**	**2**	**29**	**32**	**49**	**122**
	Mean productivity per successful nest	**2.00**	**2.00**	**2.64**	**2.91**	**2.88**	**2.71**

Therefore the prevalence of anticoagulant resistance in the 2019 Norway rat sample was 60.7 %. These new Norway rat resistance records extended the known area of the extensive L120Q resistance across the south of England, provided for the first time information about the prevalence of resistance in rats in Greater Manchester and identified a third new resistance mutation (Y139F) among rats in Greater London. The records also appear better to define the extent of the Y139C focus in the western counties along the course of the river Severn and the extent of a focus of the same mutation among the sub-counties of Yorkshire. Also, for the first time, the report records the occurrence of the Y139S (i.e. Welsh) mutation from sites far removed from its origin on the Anglo-Welsh border.

The map of all records of resistance in Norway rats (Figure 4) also shows the areas wherein resistance to bromadiolone and difenacoum is prevalent (i.e. the Y139C, Y139F and L129Q mutations, see RRAG 2018). A consequence of this, and the new European Commission rules which permit baiting only with bromadiolone and difenacoum, is that there are no fully effective products for use in permanent baiting against Norway rat over large parts of the UK.

A total of 35 house mouse tissue samples were collected, all showing one or other of the highly prevalent Y139C and L128S mutations. Although the total number of records for house mouse is small, these new data show the wide extent of house mouse resistance to anticoagulants across the UK and bring to 93.2 % the prevalence of resistance in that species. The report from the University draws attention to the anomalous situation in which permanent indoor anticoagulant baiting is the predominant method for the management of the house mouse among professional pest control practitioners, house mice are widely resistant to difenacoum and bromadiolone, these two active substances are not recommended for use against house mice (RRAG, 2018) but are the only ones permitted for use in permanent baiting.

Once again, few samples of either Norway rats of house mice have been obtained from Scotland, Wales and Northern Ireland. There also remains a very large geographical area in the centre of England from which few samples have been obtained. Where they have been obtained in the latter area, rats tend to be predominantly anticoagulant-susceptible. More samples from these areas are urgently required and efforts will continue to obtain them.

KAP Surveys

No comprehensive Knowledge, Attitudes and Practice (KAP) survey was conducted in 2019, although one is planned in 2020.

However, CRRU conducted a limited survey of rodenticide use practices among farmers attending an exhibition for the agricultural community in England. Reports of the results of this work published in the farming press stimulated further academic research at Ulster University, Newtownabbey, Northern Ireland (NI). An undergraduate student subsequently conducted an extended version of the CRRU survey among farmers in NI, under the supervision of Lindsay Shaw.

Interesting observations emerged showing differences in behaviour between farmers in Northern Ireland and the rest of the United Kingdom with respect to rodenticide use. For example, almost 80 % of farmers in England use rodenticides, where in NI only about 60 % do so. In England, 50 % of farmers have never considered employing a pest control professional but in NI this figure is 70 %. In both surveys, just over 30 % of farmers consider permanent baiting to be essential and consequently, in both England and NI, about 30 % of farmers employ this practice. Extended questioning in the survey in NI showed that 40 % of farmers were not members of farm assurance schemes and only 20 % of those questioned reported some awareness of the stewardship regime. Among those who purchased 'a large quantity of rodenticide' in the last two years the survey was conducted in February 2019, 80 % reported that they were not asked for proof of competence. Data were obtained that showed that there was a correlation between those farmers who had attended a training course and the use of alternative methods of rodent control, such as clearing vegetation and proofing. Similarly, trained farmers in NI were more likely to employ a professional than those who were not.

[CRRU would like to express grateful thanks to Lindsay Shaw and Environmental Health Graduate Amy McShane from Ulster University for permission to summarise these results.]

The Scottish government conducts periodic surveys of rodenticide use among different user groups. The report published in 2019 involved a survey conducted in 2018 of rodenticides used on arable farms (Reay et al., 2019). The report findings show a reduction in the number of farms using rodenticides from 78 % in 2016 to 55 % in 2018. There was also a significant reduction in the quantity of rodenticide applied (47 %), the amounts being 49 tonnes of formulated products applied in 2018 and 91 tonnes in 2016. However, although less rodenticide was used, there was a 46 % increase in year-round (i.e. permanent) applications. 86 % of farmers had heard about rodenticide stewardship, an increase from 68 % in 2016. The reasons for these significant changes in knowledge and usage practice in Scotland are complex but the report concluded "It is likely that the decreased rodenticide usage, increased adoption of non-chemical control and increased uptake of best practice reported in 2018 has been influenced by the introduction of the stewardship and regulatory changes".

4.7 Communications Work Group

The work on communication conducted by CRRU promotes all aspects of the regime, in particular a "competent workforce" and "governance of the

supply chain". Press releases on CRRU monitoring programmes, for example, frequently generate considerable attention in publications serving the three CRRU user constituencies.

CRRU communications are intended to promote widespread awareness of the regime's principles and defined practices among users of stewardship-label rodenticides, people working in the supply chain, and stakeholders. As defined in original 2016 regime documentation, this is pursued by 'Dissemination of information from CRRU to external agencies about CRRU's co-ordination of the Stewardship Regime'.

In practice, this is enacted via CRRU-originated reader-centric, plain English narrative, mainly in press release format, distributed through multiple printed and online/digital information channels. This information is sent to independent publishers in farming, gamekeeping and professional pest control sectors; to supply chain businesses and stakeholders; and to rodenticide user membership organisations (e.g. the four farming unions, National Gamekeepers' Organisation, Game and Wildlife Conservation Trust, and Agriculture & Horticulture Development Board) and CRRU Task Force members.

Recurring themes in CRRU's communications are to convey the universal imperatives of disciplined supply chain governance; consistently responsible rodenticide application (when such applications are justified) by a competent workforce; and lower rodenticide residues in sentinel non-target species being the acid test of success.

The following themes are included wherever relevant in communication materials:

- Users and suppliers of stewardship-labelled rodenticides have personal and professional responsibility for consistent and constant best practice, as defined in regime documentation.
- Assessment of the stewardship regime's impact by GOG will include levels of rodenticide residues found in sentinel non-target species.
- If this assessment finds insufficient beneficial impact, future changes in rodenticide availability and application may be introduced.

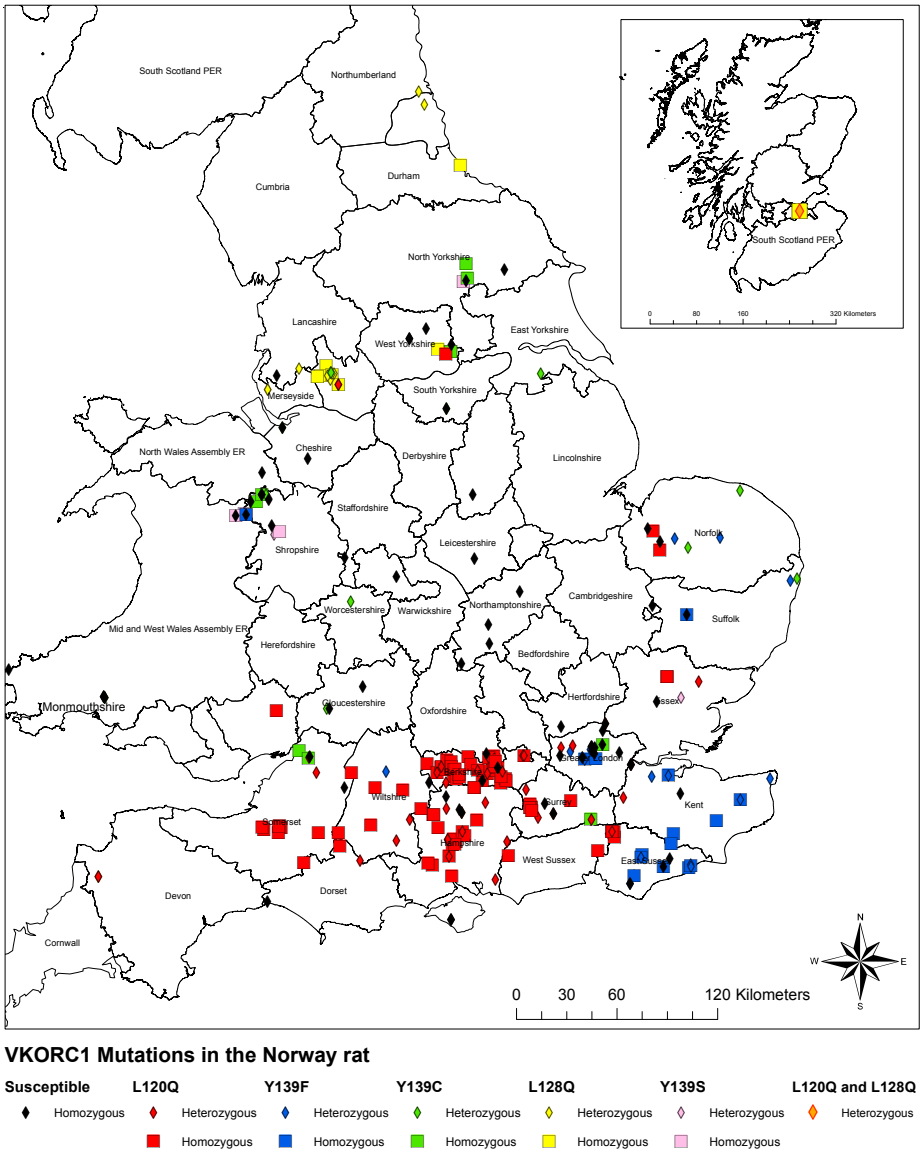


Figure 4. Available data on the geographical distribution of VKORC1 mutations in Norway rats across the UK.
From Jones et al. (2019)

Table 5. CRRU UK Press releases October 2017 to September 2018.

Date	Title	Content highlight(s)
Year-round	CRRU website (thinkwildlife.org)	For all users and stakeholders, the CRRU website (thinkwildlife.org) provides a comprehensive reservoir of information about the stewardship regime and responsible rodenticide use.
29/11/18	Super rat hotspots N, S, E and W surround central data void	New hotspots of rats that are resistant to anticoagulant rodenticides have been identified by monitoring carried out at The University of Reading.
10/01/19	Significant developments from rodenticide stewardship in 2018	The UK rodenticide stewardship regime implemented a number of commitments in 2018 including point of sale audits for compliance with regime rules on purchaser proof of competence; audits of approved farm assurance scheme members' premises to meet new standards aligned with the CRRU Code of Best Practice; and new professional development (CPD) modules provided by CRRU to support user training and competence.
07/02/19	Good news but early days for rodenticide stewardship on farms and game shoots	Rat control is changing for the better on UK farms and game shoots. From 2015 to 2017, a detailed independent study has found planned prevention of infestations is taking over from control in reaction to the presence of rats. It finds gamekeepers leading the way, their use of a planned approach increasing from 30 % to 59 % over the two years. Among farmers, the less desirable option of reactive control has declined from 43 % to 38 %.
28/02/19	New backer for CRRU UK and rodenticide stewardship	The Campaign for Responsible Rodenticide Use (CRRU) has a new member company, contributing financially and providing expertise to the UK Rodenticide Stewardship Regime. It is Quimunsa, based in Spain, specialising in applied chemistry R&D and manufacturing for industry.
24/04/19	Free tests and new guide tackle spread of resistant rats	All professionals involved in rodent control have a role in tackling the spread of rats that survive high potency rodenticides, according to Campaign for Responsible Rodenticide Use chairman Dr Alan Buckle. In November last year, resistant rats were identified in new locations by a University of Reading study [ref 1]. To help pest control contractors, farmers, rural estate managers and gamekeepers address this, a new continuing professional development (CPD) guide has been published by CRRU, available to download at bit.ly/2Iw0ig5.
19/07/19	Government of Jersey adopts UK rodenticide stewardship regime	The Government of Jersey is introducing rodenticide stewardship covering the sale and use of professional rodenticides, modelled on the Campaign for Responsible Rodenticide Use UK's regime.
22/07/19	Critical update to permanent rodenticide baiting conditions	Conditions under which permanent baiting with rodenticide is allowed have been updated by the Campaign for Responsible Rodenticide Use UK to cover a critical difference between outdoor and indoor locations.
20/08/19	Scourge of resistant rats in several new areas (commissioned feature article for Pig World magazine)	Are there many rat-free pig units in the UK? If so, we'd love to hear how some of you do it. Alarming news for all the rest is that rats resistant to some of the most widely-used high potency rodenticides have been identified in new locations by a University of Reading study. Responsibility for tackling this spread of resistant rats is shared by farm users of professional rodenticides with pest control contractors and gamekeepers, according to Campaign for Responsible Rodenticide Use chairman Dr Alan Buckle.
30/09/19	Scourge of resistant rats in several new areas (x5 items)	Adaptation of item immediately above for specialist publishers covering other farming enterprises: Dairy, Beef & Sheep, Poultry, Arable Cropping, Horticulture.
30/09/19	Majority of farmers no longer permanent baiting for rats	Just over two-thirds of UK farmers now avoid using rodenticides continuously around farmsteads. Instead, they employ measures such as tidy yards and rat-proofed buildings, cats or terriers, traps and shooting, in combination with tactical rodenticide only when needed. These are common findings of two different studies by Ulster University and Campaign for Responsible Rodenticide Use involving 247 farmers in total.
Imminent	Farmers Weekly feature article: On-farm rodent control update	Interview with CRRU chairman, reviewing current rodent control challenges, best practice control measures, and rodenticide stewardship context.
Imminent	PEST magazine feature article: Rodenticide resistance update	Status report from University of Reading's Vertebrate Pest Unit based on its latest study and report.

5. CONCLUSIONS

The Regime is evaluated by GOG in stages according to the delivery of three key benefits: 'supply chain governance', 'competent workforce' and 'monitoring compliance' (GOG, 2019). The information that CRRU is required to present comprises eleven data sets, presented under six heads (see Annex 2), although not all are produced annually.

5.1 Environmental Impacts (Monitoring Compliance)

CEH annual survey of residues in livers of 100 barn owls

Shore et al. (2019) reported to CRRU the results of the annual study to monitor residues of anticoagulants in barn owls that were collected during 2018. All 100 barn owl carcasses received by CEH were autopsied and were found to have died from various causes, but mainly from road traffic collisions or starvation. Among the barn owls examined 87 % carried residues of one or more second generation anticoagulant rodenticide. However, any haemorrhaging detected in birds at post mortem was always associated with signs of physical trauma. Therefore, there was no clear evidence that any individual had died from anticoagulant rodenticide poisoning among those birds collected in 2018. Similar findings were reported in the equivalent report produced by CEH in 2018 for birds collected in 2017 (Shore et al., 2018). These findings continue to demonstrate that, although the UK population of barn owls is widely contaminated with low level anticoagulant residues, few individuals are affected severely enough to produce overt physical and physiological effects.

The CEH annual survey, conducted by studying birds collected in 2015 to 2018, has revealed no significant diminution in either the frequencies or concentrations of anticoagulant residues in the livers of these barn owls, in comparison with data from the base-line years of 2007 to 2012. Although some of the metrics recorded in previous studies showed limited reduction in residue levels, none reached the level required for scientific statistical significance. However, among birds collected in 2018 there were some statistically significant increases. More birds were found to carry residues of the active substance difethialone. This may be explained by the fact that difethialone was introduced to the UK market only during the years of the base-line study and has since gained wider use. Also, the median concentration of "low" brodifacoum residues was higher in birds from 2018 than in baseline years. We must wait to see if a change in this parameter is either repeated or accelerates in subsequent surveys. However, some increases in residues of active substances such as brodifacoum and difethialone might be anticipated because they are effective against rats and mice that are resistant to difenacoum and bromadiolone, and such infestations are increasingly widespread (Figure 4 and see below).

The authors of the CEH report summarise the 2018 study with the comment that "Overall, there were few differences in liver SGAR accumulation between barn owls that died in baseline years and in 2018. The lack of significant reductions in SGAR residues in barn owls in 2018 suggests that full implementation of stewardship since 2016 has yet to result in a reduction in exposure of barn owls to SGARs".

Annual survey of barn owl breeding performance

The survey of barn owl liver residues conducted by CEH for CRRU is used as a sentinel for those UK wildlife species that rely for food mainly on live small rodents. Interest in the breeding performance of the sentinel species is incidental to that prime purpose.

As a species, the barn owl in the UK has been moved from the Birds of Conservation Concern (BoCC) 4 red list onto the amber list, taking account of the population increases reported annually by the BTO's Breeding Bird Survey since 1995, ranging between 217 % and 501 % (see Eaton et al., 2015). These increases have been due to a number of factors; probably most important among them are the intensive efforts of conservation organisations such as the Barn Owl Trust (https://www.barnowltrust.org.uk/) and the Barn Owl Conservation Network (http://www.bocn.org/). The most recent census of the UK barn owl population was conducted during the years 1995-97 and resulted in an estimate for the UK of about 4,000 breeding pairs (Toms et al., 2001). More recent estimates have placed the population at between 9,000 and 12,000 breeding pairs (Prescott et al., 2019).

Barn owl breeding in five regions of the UK in the year 2018 was found to be at a level that was consistent with the two previous years (Prescott et al., 2019). None of the years 2015 to 2018 was particularly bad, as had been 2013, nor particularly good, as had been 2014, in terms of numbers of fledged chicks. In a BTO Research Report (Henderson et al., 1993), barn owl annual mean productivity was presented for six regions of England and Wales between 1988 and 1990, and ranged between 2.6 and 4.2 (n=246). Similarly an internal report to the Environment Agency reported an annual mean productivity between 2000 and 2009 ranging between 2.6 and 3.5 (n=581) (see Prescott et al., 2019). These values are comparable with the data presented by the BOMS study, although the values for the years 2015-2018, at 2.51, 2.52, 2.51 and 2.71 (Table 4) respectively, are at the lower end of these ranges.

Annual Review of WIIS Incidents.

According to the government report (GOG, 2018), HSE/GOG is examining the feasibility of using data on several species from a variety of sources (PBMS and WIIS) as a further qualitative, or possibly quantitative, assessment of changes in the possible environmental impact of anticoagulant rodenticides. CRRU awaits the outcome of this assessment before further consideration of WIIS data for monitoring the outcomes of the regime.

5.2 Whether the rodenticides are effective (Competent Workforce)

Annual Report of training uptake and award of certification/qualification by CRRU-approved awarding bodies

Information on the award of certification/ qualification is commercially sensitive and submitted to GOG in confidence. Aggregated figures for all awarding bodies (Table 2) show some reduction in the numbers of course participants receiving awards on an annual basis during the years 2015-2019. There was an initial surge in numbers caused by the requirement, introduced for the first time in 2016, for proof of professional competence at point of sale. After this, it seems likely that annual numbers acquiring certification/qualification will stabilise at a somewhat lower figure that reflects the expansion of the professional pest control industry, the move towards greater professionalism across all user sectors and industry personnel turnover.

Annual Report of members of CRRU-approved farm assurance schemes

A strategic decision was made by the CRRU UK Task Force, and approved by HSE/GOG, that the most effective way to introduce new rodenticide stewardship requirements into the agricultural sector was by embedding CRRU guidance into the technical standards operated by the Farm Assurance Schemes (FAS) (Table 1). From 1st January 2018 all CRRU-approved FASs operated to new standards which followed CRRU best practice guidance. It is anticipated that, as they impact such large numbers of audited premises (Table 1), changes in use practices will be translated into reductions in wildlife exposure to rodenticide in the coming years.

Provision of up to date, relevant best practice guidance

CRRU has been active both to develop new guidelines and to review and re-issue existing guidance. These documents are made available as both in print format (both hard copy and electronic) and as CPD training modules, for free download from the CRRU website. All aspects of best practice and responsible use are covered.

During 2019 CRRU issued a revision of its guidance on permanent baiting (CRRU 2019) to clarify new rules adopted across the European Union which had appeared on UK product labels.

The CRRU Code of Best Practice (CRRU UK, 2015) has been widely adopted by all user groups. It is under review by the CRRU BPWG to determine which elements of the document require reconsideration. A revision will be issued in 2020.

Promotion of regime objectives and raising awareness by stakeholder organisations

A requirement to inform and engage with all user groups, in order to raise awareness and change behaviour in respect of responsible rodenticide use, has been a primary objective since the start of the regime. Changes in these parameters are measured in periodic KAP surveys. A KAP survey is planned for completion during 2020.

5.3 Resistance Monitoring (Competent Workforce): Annual report of the status of resistance monitoring in the UK and elsewhere in EU.

The resistance information provided by this University of Reading survey, and published by CRRU, supports a '*competent workforce*' because it permits practitioners to avoid the use of resisted active substances in resistance foci. The benefits of this are twofold: 1) the use of ineffective rodenticides, often applied in excessive quantities and remaining as residues in the bodies of rodents that survive failed treatments, contribute disproportionately to residues in wildlife (Smith, 2001) and 2) the use of fully effective substances in resistance foci prevents the spread of resistance and increases in its severity (RRAG, 2018).

The report provided to HSE/GOG by CRRU UK, and prepared by the University of Reading (Jones et al., 2019), is the most comprehensive continuing resistance monitoring programme conducted in the EU. The severity and geographical extent of anticoagulant resistance among UK Norway rats and house mouse infestations is documented. The data cannot tell us whether newly-discovered resistance foci have been present undetected for some time or have only recently developed. However, there is no doubt that resistance to anticoagulants in UK rodents is a significant impediment to effective rodent control in some areas and drives the necessity, across large areas of the UK to use of the most powerful anticoagulant rodenticides to combat resistant rats and mice. This has obvious consequences for the stewardship regime and its objective to reduce wildlife exposure.

The University of Reading UK data are provided to

the CropLife International Rodenticide Resistance Action Committee (RRAC) and are mapped into on-line software that makes resistance information for the whole of Europe available in real time to rodenticide users (see http://guide.rrac.info/resistance-maps/resistance-maps/). The RRAC project also provides free DNA resistance testing of samples sent to the University of Reading, provided they carry the necessary information on location of collection and are from areas that increase our understanding of resistance distribution. The RRAC mapping tool is accompanied by resistance management guidance specific to each user, having different requirements according to resistance mutations found.

5.4 Awareness using the Knowledge, Attitude and Practice (KAP) survey

(Competent Workforce/Monitoring Compliance)

No KAP survey was conducted in 2019. However, small scale surveys conducted among farmers in UK and Northern Ireland provided some interesting insights into rodenticide use among this user group.

5.5 Point-of-Sale Information

(Supply Chain Governance): Output from the Point of Sale Audit.

A corner-stone of the stewardship regime is the imposition of competence checks at the point of sale. As well as "*supply chain governance*", these checks drive the "*competent workforce*" benefit because only appropriately certificated personnel can purchase professional rodenticides. The importance of this measure, within the regime overall, makes necessary a procedure to audit its application and this audit process is carried out by the independent authority, BASIS (Registration) Ltd..

The audit process operated in full for the first time in 2018 and that year was a permitted 'implementation period', which ended on 31st December 2018. Currently, all sales outlets that either fail to register for a RPOS audit, or do not satisfy BASIS auditors when one is conducted, are not permitted to sell authorised rodenticide products carrying 'stewardship conditions'. It is the responsibility of the authorisation holders, applied to them through the condition of authorisation for each product they put on the market, to ensure that their products are sold only through outlets that have satisfactorily passed an annual BASIS audit.

The numbers of registered outlets increased from 526 in 2018 to 706 in 2019 (to September) Likewise, the number of completed audits increased from 427 to 603.

5.6 Training (Competent Workforce)

This aspect of the regime is covered in section 5.2 above.

5.7 General Conclusion and plan for 2020

With the developments described in the preceding sections of this report from the six stewardship work groups, all the substantive elements of the stewardship regime are in place. Therefore, the work of these groups will be continue to ensure that all elements of stewardship are being fully implemented and monitoring is carried out to confirm that expected outcomes are delivered.

Annual reports on the delivery and achievements of the UK Rodenticide Stewardship Regime, such as this document, are presented to HSE/GOG and a full review of the process will be conducted by Government in 2020 (GOG, 2018). Therefore, a major element of the work of CRRU and the regime work groups in 2020 will be to assemble the information required to permit HSE/GOG to carry out the planned review.

NB. Throughout this document, where the acronym CRRU is used for the Campaign for Responsible Rodenticide Use, it refers to CRRU UK.

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ANNEXES

ANNEX 1. The Government Oversight Group "High-Level Principles" and the key benefits they deliver (GOG 2018). Available at: http://www.hse.gov.uk/biocides/eu-bpr/rodenticides.htm. Date accessed: 08.11.19.

Government set the following principles for the UK's anticoagulant Rodenticides Stewardship Regime.

a. Use of Integrated Pest Management, including use of rodenticides, involving a hierarchy of risk controls for rodents.

b. Responsible use of rodenticides, when demonstrated they are needed, because of their potential threat to human, animal health and the environment.

c. Applicability to all suppliers, handlers and professional users of rodenticides approved under stewardship to address these risks.

d. The need for the regime to be robust, effective and workable, while remaining as simple as possible.

e. The need for the regime to cover the whole life-cycle of the rodenticide products: manufacture, supply chain, end-use, disposal and environmental fate.

f. The enabling of good practice in the control of rodent populations, as part of an Integrated Pest Management system, while minimising resistance build-up and secondary poisoning in non-target species.

Delivery of key benefits, such as:

- governance of the supply chain, which gives governance over, and provides the driver for, later stages;
- a competent workforce capable of delivering stewardship standards and of demonstrating an appropriate understanding and attitude toward case-specific control of rodents and use of rodenticides; and
- monitoring compliance with the regime and its environmental impacts, and if possible of the level of conflict reduction – i.e. an assessment of whether rodenticides and stewardship together are actually tackling the problems.

ANNEX 2. Overview of CRRU evaluation data to be provided to the GOG.

Required data		Data to be provided
1	Environmental Impacts (Monitoring Compliance)	1. CEH annual survey of residues in livers of 100 barn owls
		2. Annual survey of barn owl breeding performance
		3. Annual review of WIIS incidents
2	Whether the rodenticides are effective (Competent Workforce)	1. Annual report of training uptake and award of certification/ qualification by CRRU-approved awarding bodies
		2. Annual report of number of members of CRRU-approved farm assurance schemes
		3. Provision of up to date, relevant best practice guidance documents
		4.Promotion of regime objectives and raising awareness by stakeholder organisations
3	Resistance monitoring (Competent Workforce)	1. Annual report of status of resistance monitoring in UK and elsewhere in EU
4	Awareness using the Knowledge, Attitude and Practice (KAP) survey (Competent Workforce/Monitoring Compliance)	1. KAP survey baseline study (published)
		2. Repeated KAP surveys in 2017 and 2019
5	Point of sale information (Supply Chain Governance)	1. Output from the Point of Sale Audit. Interim results provided by June 2018.
6	Training (Competent Workforce)	(see point 2 above)

[1] Government is currently examining the feasibility of using data on several species from a variety of sources (PBMS and WIIS) as a further qualitative, or possibly quantitative, assessment of changes in the environmental impact of anticoagulant rodenticides.

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CRRU Stewardship