COLLATERAL DAMAGE

The Rodenticide Stewardship Scheme – is it working?

WILDjustice

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Review of Second Generation Anticoagulant Rodenticide (SGAR) exposure in the Common Buzzard (*Buteo buteo*) and Red Kite (*Milvus milvus*) in England from 2005 to 2022.

Citation

Wild Justice (2024). The Rodenticide Stewardship Scheme – is it working? Review of data from the Wildlife Incident Investigation Scheme (WIIS) on Second Generation Anticoagulant Rodenticide (SGAR) exposure in the Common Buzzard (*Buteo buteo*) and Red Kite (*Milvus milvus*) in England from 2005 to 2022.

Summary and key findings

1 The secondary poisoning of wildlife by highly toxic anticoagulant rodenticides occurs when scavengers and predators feed on animals that have themselves been poisoned. This is an ongoing problem but one that Government has committed to resolve. In 2015 the Rodenticide Stewardship Scheme (the RSS) was established to develop and promote best practice so that the most toxic anticoagulant rodenticides could continue to be used while achieving a reduction in the harm caused to wildlife.

2 Our report, based on an analysis of Wildlife Incident Investigation Scheme (WIIS) data for 2005-2022, shows that anticoagulant rodenticides are now found in most Buzzards and Red Kites that are tested, often at high levels. The RSS hoped to achieve a significant reduction in wildlife exposure to rodenticides in England but, in fact, exposure has increased substantially in recent years. The RSS has failed to reduce rodenticide exposure in wildlife.

3 Highly-toxic Brodifacoum is the poison most frequently found in Buzzards and Red Kites, often at high levels. Such widespread contamination suggests that exposure results from the widespread, routine use of this poison to kill rodents. There is evidence that this poison is sometimes used illegally through failure to follow statutory guidance and, increasingly, by the apparent deliberate targeting of predators and scavengers.

4 Buzzards and Red Kites serve as indicators of a wider problem that will affect other predators and scavengers, including scarce and declining species. Urgent regulatory changes are needed to limit the availability and use of these products.

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1: Introduction

All Second Generation Anticoagulant Rodenticides (SGARs – commonly known as rat poisons) fail environmental risk assessments for outdoor use due to the risks posed to wildlife from eating poisoned rodents (Health and Safety Executive 2012). Despite this, their continued use has been permitted by the HSE on behalf of the UK Government due to perceived risks to public health posed by rodents.

It is well established that wild birds and mammals are exposed to SGAR poisons (Dowding et al. 2010; McDonald et al. 1998; Newton et al. 1999; Ruiz-Suárez et al. 2016; Sainsbury et al. 2018; Shore et al. 2003a,b; Walker et al. 2008a,b) through active predation and/or scavenging.

The poisoning of a White-tailed Eagle (*Haliaeetus albicilla*) in Dorset by SGARs in 2022 (its liver contained seven times the level of the rodenticide Brodifacoum at which many birds of prey start to die from SGAR poisoning) resulted in public concern, particularly as no one faced prosecution, despite the near impossibility of such a high level of contamination arising from the legal use of this poison.

SGARs act by interfering with the synthesis of blood-clotting factors, which results in haemorrhaging and death. SGARs damage the enzyme vitamin K1-epoxide reductase in the liver causing a gradual depletion of the vitamin and consequently of blood-clotting factors. This results in an increase in blood-clotting time until the point where the clotting mechanism fails.

This process may take several days and in the days prior to death the victim frequently becomes lethargic and insensitive to potential dangers. Many SGAR poisoned victims are killed by trauma or predation during this pre-death lethargy. This can result in SGAR poisoning being under reported, as the scavenger or predator may be assumed to be 'just a victim of a traffic collision' and therefore the incident is closed with no investigation as to why it was in a condition which made the collision more likely.

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In response to growing concerns, the pest control industry, with Government approval, launched the Rodenticide Stewardship Scheme (the RSS) in 2015. The aim of the RSS was to achieve a significant decrease in SGAR poison exposure in wildlife, to be monitored primarily in the Barn Owl (*Tyto alba*), the scheme's chosen sentinel species.

As part of this approach, an industry-led Campaign for Responsible Rodenticide Use (CRRU) was established to promote a regime of good practice, and to better control the professional use of rodenticides. This covered the whole life-cycle of rodenticide products including their manufacture, supply, use, disposal and environmental fate.

Government set out a procedure for monitoring the impact of the RSS on the exposure of wildlife to SGAR poisons to include the following (see Buckle et al. (2024) for more detail):

- The Centre for Ecology and Hydrology (CEH) annual survey of SGAR residues in the livers of Barn Owls;
- An annual CEH-collated survey of Barn Owl breeding performance;
- An annual review of Wildlife Incident Investigation Scheme (WIIS) incidents involving rodenticides (see next section).

Barn Owls are exposed to these poisons primarily through hunting mice and voles. Other species will be exposed by different routes, for example by taking larger prey (e.g. Brown Rats *Rattus norvegicus*) and by scavenging on dead animals. The Red Kite (*Milvus milvus*) is likely to be especially vulnerable as rats are an important part of the diet and it is a habitual scavenger. It also feeds regularly around farm buildings, villages and refuse tips where rodenticides are frequently deployed.

We used English WIIS incidents for Buzzards (*Buteo buteo*) and Red Kites to establish whether the RSS has been successful in reducing SGAR exposure in these birds, using data obtained via Freedom of Information requests. The monitoring period is 2005-2022, thus providing data from before and after the introduction of the RSS in 2015.

We have summarised information on the levels and frequencies of all SGARs in Buzzards and Red Kites, and we have also looked at changes in patterns of exposure to individual SGAR poisons.

At the start of the monitoring period in 2005 the SGAR poisons approved for use in the UK included Bromadiolone, Difenacoum, Brodifacoum and Flocoumafen. Another SGAR poison, Difethialone, became available in June 2011. Initially Brodifacoum and Flocoumafen were restricted to use in 'internal areas' only, this being defined as situations where rodents were living predominantly indoors. Bromadiolone and Difenacoum had a wider remit, and could be used outside of buildings including in fields and along hedgerows. Then, in April 2016, Brodifacoum, Flocoumafen and Difethialone were approved for use in and around buildings, which includes any outside areas that need to be treated to deal with an infestation within buildings. It does not include refuse dumps or open areas such as farmland, parks or golf courses (European Commission 2009).

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2: The role of the WIIS scheme and the data analysed

The UK WIIS scheme has been running for many years. It gathers information about wildlife incidents involving pesticides and is designed to identify any unexpected effects of pesticides in the environment through correct or incorrect use by analysing animals found dead and reported to the scheme.

Although it is not specifically managed to provide data for the RSS, it includes analysis for rodenticides and has provided useful information on rodenticides in wildlife for many years. Further information about the WIIS scheme can be found here.

When the death of birds and mammals is investigated by the WIIS in England, tissue samples are submitted to the Wildlife Incident Unit (WIU) at the Food and Environment Research Agency (Fera). Analysis is carried out to determine the levels of various pesticides, including rodenticides (expressed as mg/kg of SGAR in the liver). These are the data reviewed here.

For an incident to be accepted into WIIS there needs to be some indication that pesticides may have been involved in the death of the animal. These include situations where one or more dead or dying birds were found close to a carcass on which they appeared to have been feeding, particularly if that carcass appeared to have been laced with chemicals.

Data were obtained from 366 Buzzards and 173 Red Kites in England in the period 2005-2022, across most English counties and across all seasons. We have grouped the data into four periods and three geographic regions in the analyses that follow. Sample sizes are shown in Figure 1.

Time periods: 2005-2010 and 2011-15 (which cover the period before the RSS was launched) and 2016-2019 and 2020-212(covering the period after the start of the RSS).

Regions: **North;** Northumberland, Durham, Cleveland, Tyne & Wear, Cumbria, West Yorkshire, North Yorkshire, East Riding of Yorkshire, South Yorkshire, Cheshire, Merseyside, Lancashire, Greater Manchester.

Central; Nottinghamshire, Derbyshire, Lincolnshire, Leicestershire, Rutland, Shropshire, Staffordshire, West Midlands, Herefordshire, Gloucestershire, Worcestershire, Warwickshire, Cambridgeshire, Essex, Hertfordshire, Northamptonshire, Bedfordshire, Norfolk, Suffolk.

South; Buckinghamshire, Berkshire, Oxfordshire, Surrey, London, Somerset, Wiltshire, Avon, Cornwall, Devon, Hampshire, Dorset, Isle of Wight, West Sussex, East Sussex, Kent.

Seasons: **Spring** (Mar-May), **Summer (**Jun-Aug), **Autumn** (Sept-Nov), **Winter** (Dec-Feb).

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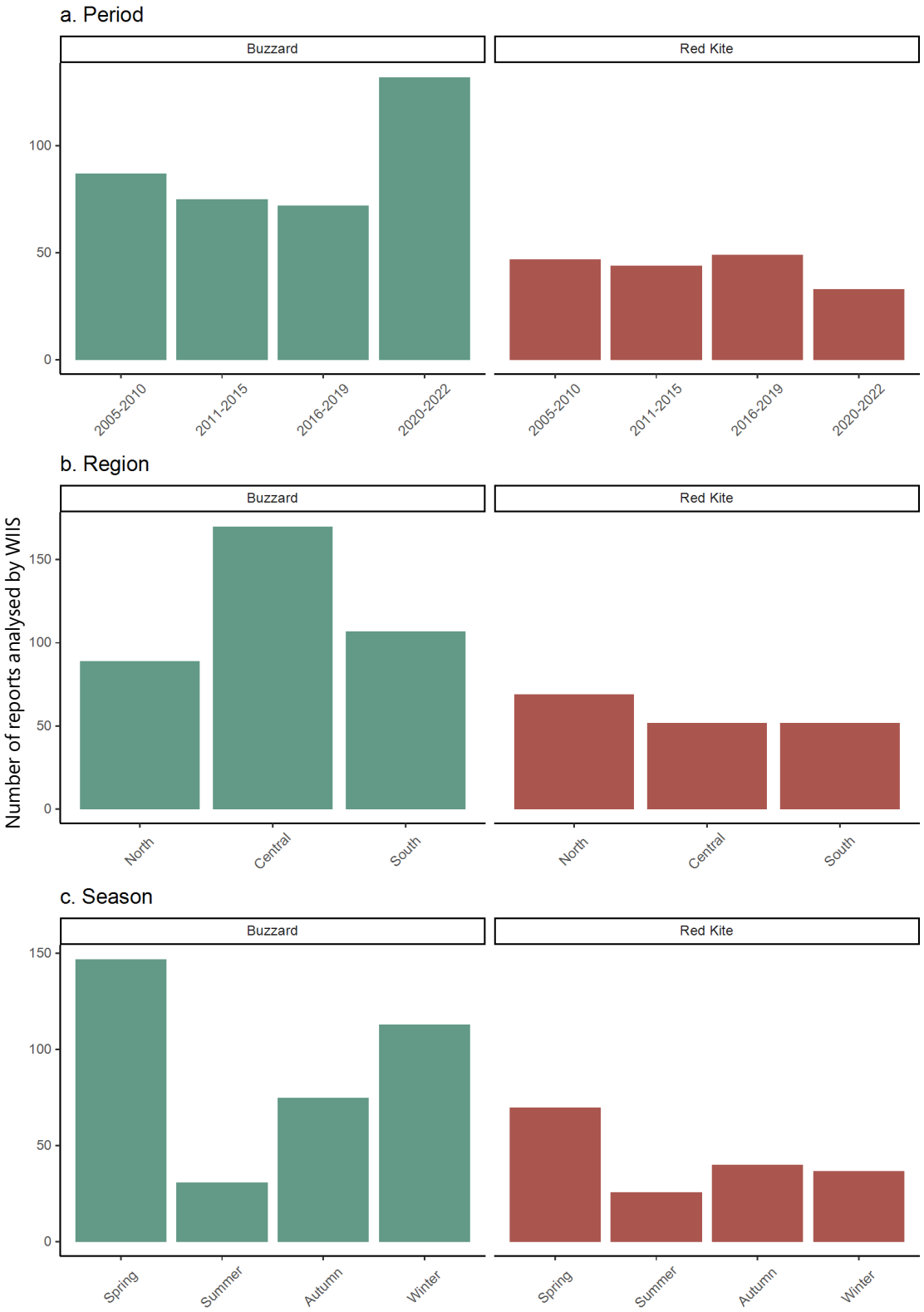

Figure 1. Number of dead **Buzzards** and **Red Kites** analysed after being reported to WIIS broken down by (a) period, (b) region and (c) season.

Note: The data contain many zero values but also small numbers of very high values of liver SGAR residue and so we have avoided using means and opted for medians or other ways to summarise the data.

The full set of raw data derived from WIIS is available from Wild Justice on request by bona fide researchers.

3: Results

Most Red Kites and Buzzards analysed by WIIS since 2005 contained at least traces of SGARs, indicating that exposure is widespread (Figure 2). This was true of both species, but with Red Kite showing higher overall levels of exposure. There was no noticeable reduction in the percentage of birds containing at least some SGAR residue between the period before and after the RSS was introduced. On the face of it, the RSS has had no impact on reducing the proportion of birds exposed to SGARs.

Figure 2 also shows that for both raptor species, the most recent time period (2020-22), long after the RSS had had time to bed in and become established, recorded the highest levels of exposure to SGARs.

In both species the proportion of birds with the highest exposure (dark red in Figure 2)) was larger in 2020-22 than was the proportion of birds in the three highest exposure levels (dark red, light red and orange in Figure 2) in the previous three periods. Residue levels have increased rather than decreased since the advent of the RSS.

The individual SGARs which contribute to the levels of total SGAR found in the two species vary but the overall increase (Figure 2) is driven by an increase in Brodifacoum levels (Figure 3) in both species of raptor.

The increase in Brodifacoum levels appears to be recent and did not coincide with the approval of its use in and around buildings in 2016.

It is notable that in both species there has not been an increase in the concentrations of those SGARs which are approved for use in all areas (Bromadiolone and Difenacoum). The increase is predominantly due to Brodifacoum whose use is restricted by regulation to in and around buildings (Figures 3 and 4).

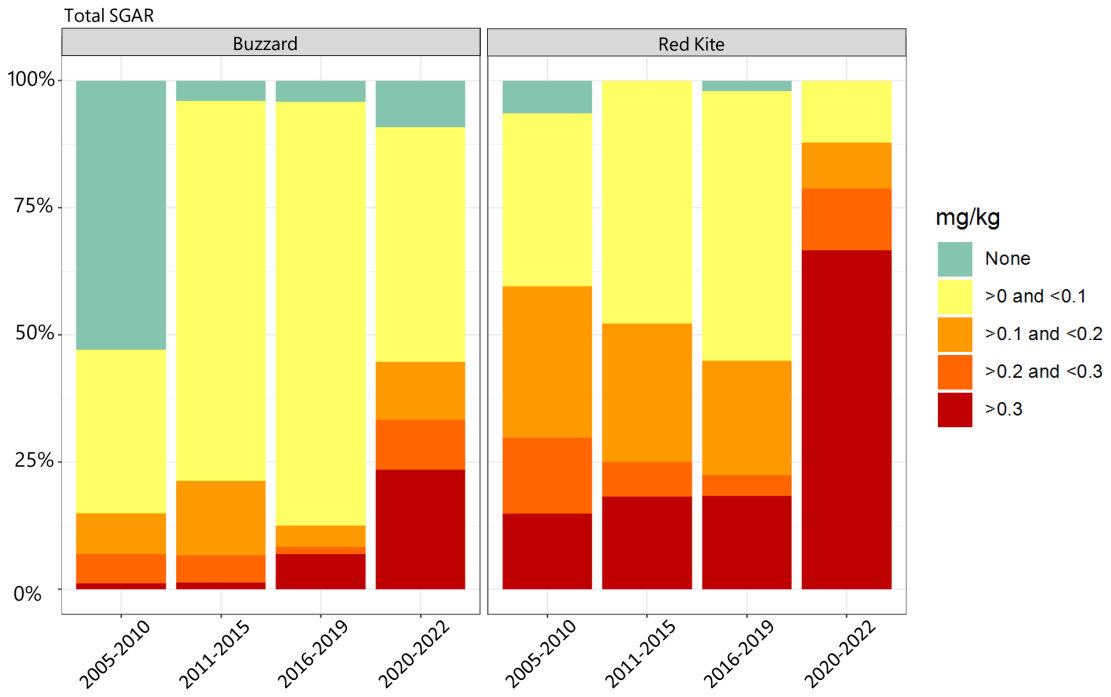

Figure 2. Percentage of Buzzards and Red Kites analysed by WIIS that contained different concentration levels of SGAR (all compounds combined).

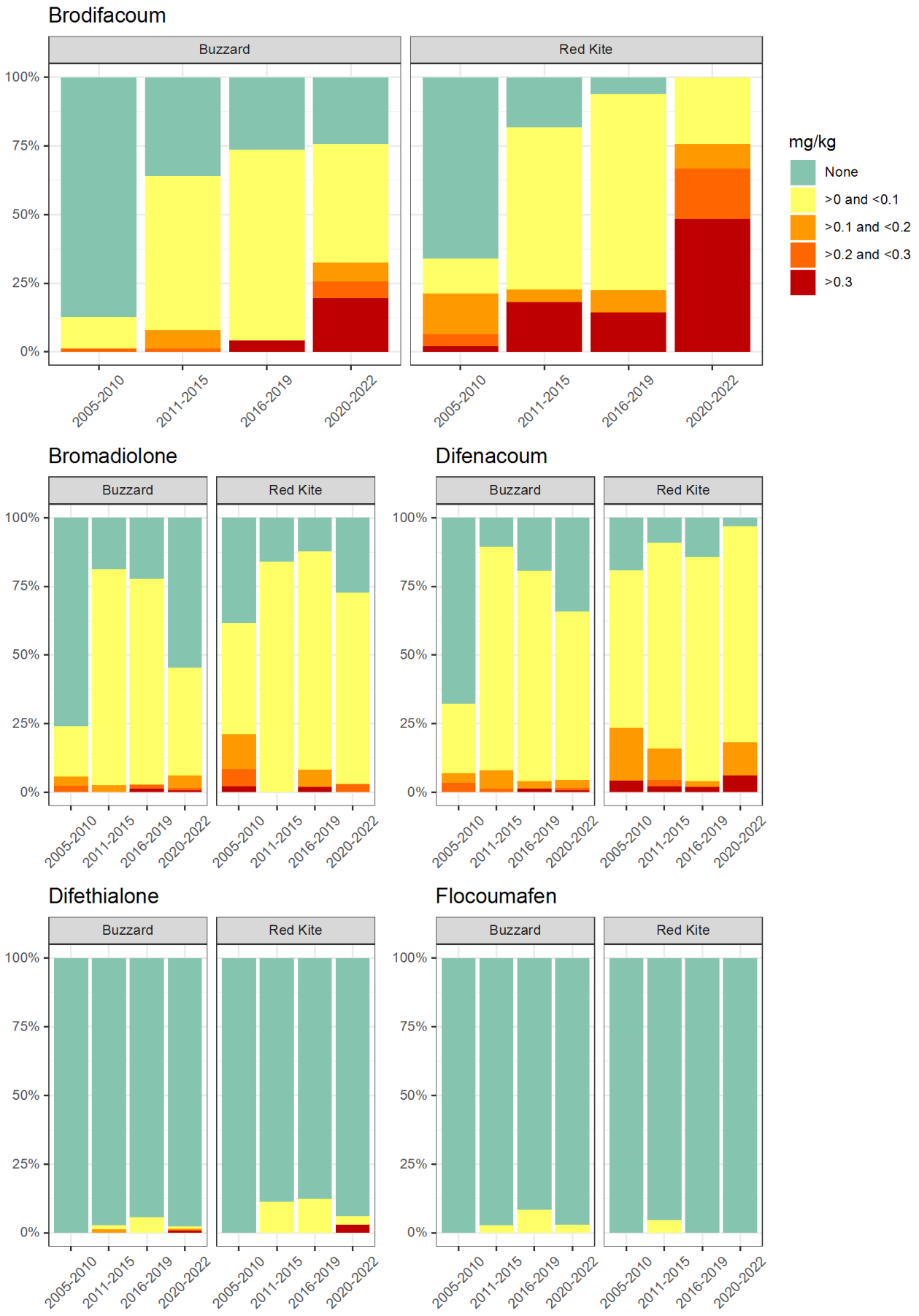

Figure 3. Percentage of Buzzards and Red Kites analysed by WIIS that contained different concentration levels of each SGAR separately.

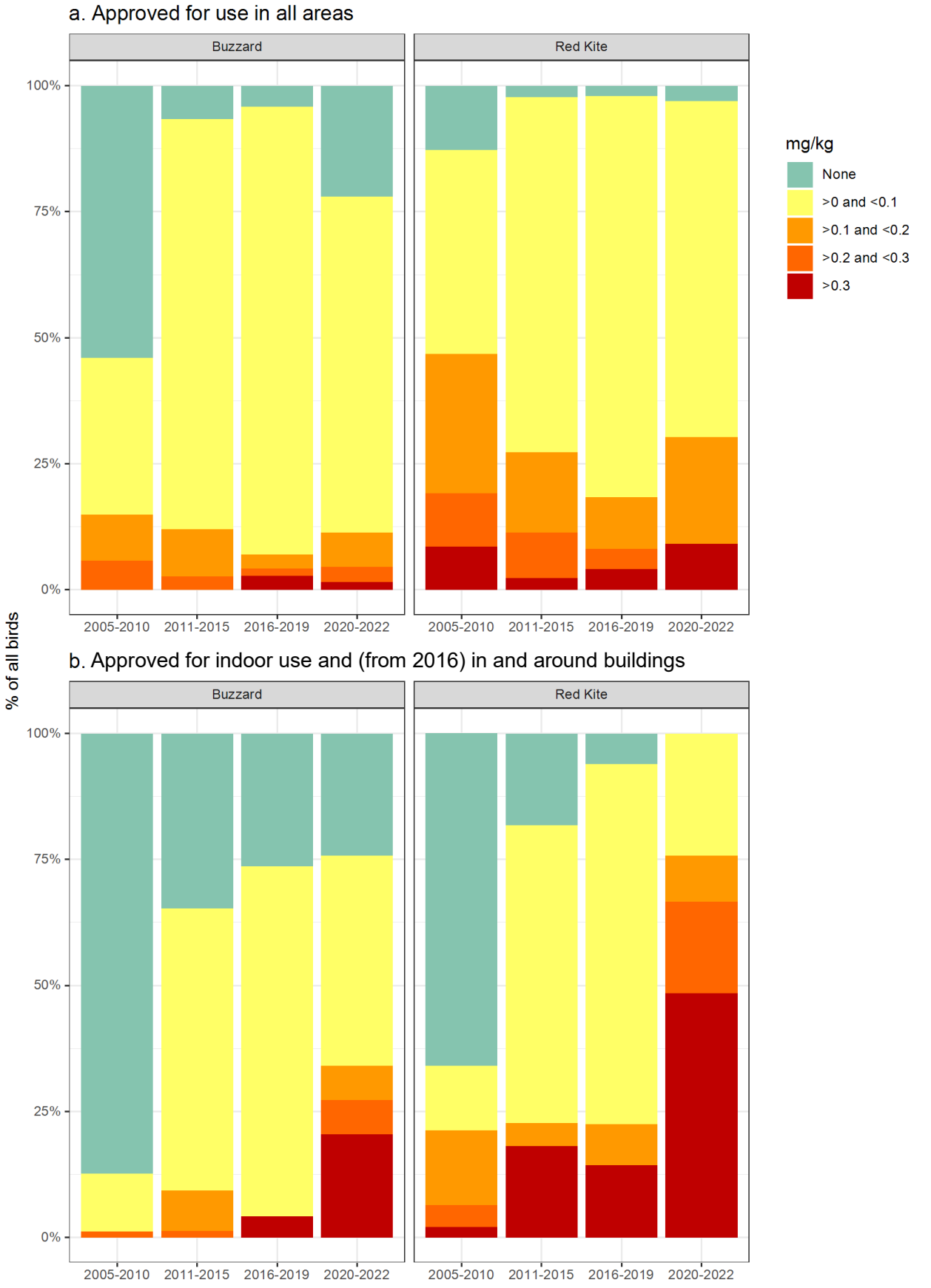

Figure 4. Percentage of Buzzards and Red Kites analysed by WIIS that contained different concentration levels of (a) the two SGARs (Bromadiolone and Difenacoum) that were approved for use in all areas throughout the period of study, and (b) the three SGARs (Brodifacoum, Difethialone and Flocoumafen) that were approved for indoor use only before 2016, and for use in and around buildings from April 2016.

The increase in SGAR incidence, after the introduction of the RSS, was evident in all three regions of England in Buzzards (Figure 5). SGAR levels in Red Kites remained at high levels in all three regions although at this level of analysis sample sizes are small.

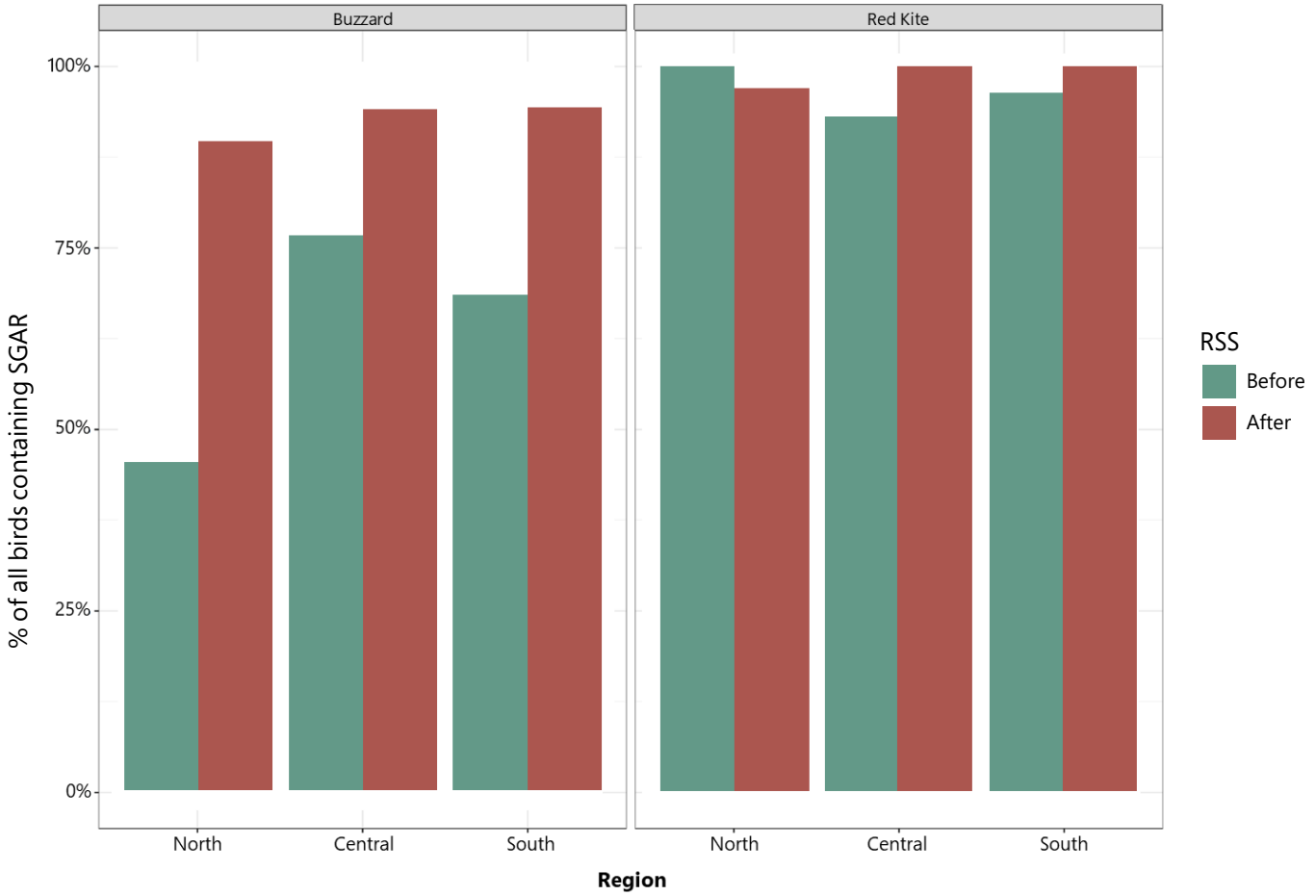

Figure 5. Percentage of all birds showing SGAR contamination (at any level) by region. Periods up to and including the introduction of the RSS in 2015 are shown in **green**, those after in **red**.

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In the seven full calendar years after the introduction of the RSS the proportion of both Buzzards and Red Kites with high levels of SGARs has increased (Figure 2) rather than shown signs of a decrease as was the envisaged outcome of the RSS. This increase is driven by residue levels of Brodifacoum (Figure 3) which was approved for use in and around buildings from 2016 (Figure 4) and is evident for Buzzard across all three English regions and for Red Kite, where levels were high in any case (so there was little scope for increase) levels have shown no signs of declining (Figure 5). These data show that RSS has failed in its aim of reducing wildlife poisoning as illustrated by these two raptors.

Shore et al. (2014) and Rodenticides Stewardship Government Oversight Group (2020) provide suggestions on formal statistical analysis of any impact of RSS, primarily based on the use of the Barn Owl as a sentinel species but with some reference to the need to add other species which focused on Red Kite. They envisaged annual updates of the data. The Rodenticides Stewardship Government Oversight Group (2020) suggested splitting the data, and looking separately at two classes of birds; those with low liver SGAR residues (Low Residue group, < 0.1mg SGAR/kg liver tissue) and those with high residues (High Residue group, >0.1mg SGAR/kg liver tissue). Inspection of Figure 2 indicates that for both Buzzard and Red Kite the Low Residue group shrinks considerably in size in the last three years of this dataset (2020-22) as an inevitable result of growth in the High Residue group.

There is a conceptual difficulty with using these two groups in that, by definition, the Low Residue group can only have SGAR values between 0 and 0.1mg SGAR/kg liver residue so the opportunities for the values to change are highly constrained. In practice, inspection of these two classes of birds and of the combined data show (Figure 6) no evidence for a decline in mean SGAR residues for the Low Residue group, High Residue group or the full dataset.

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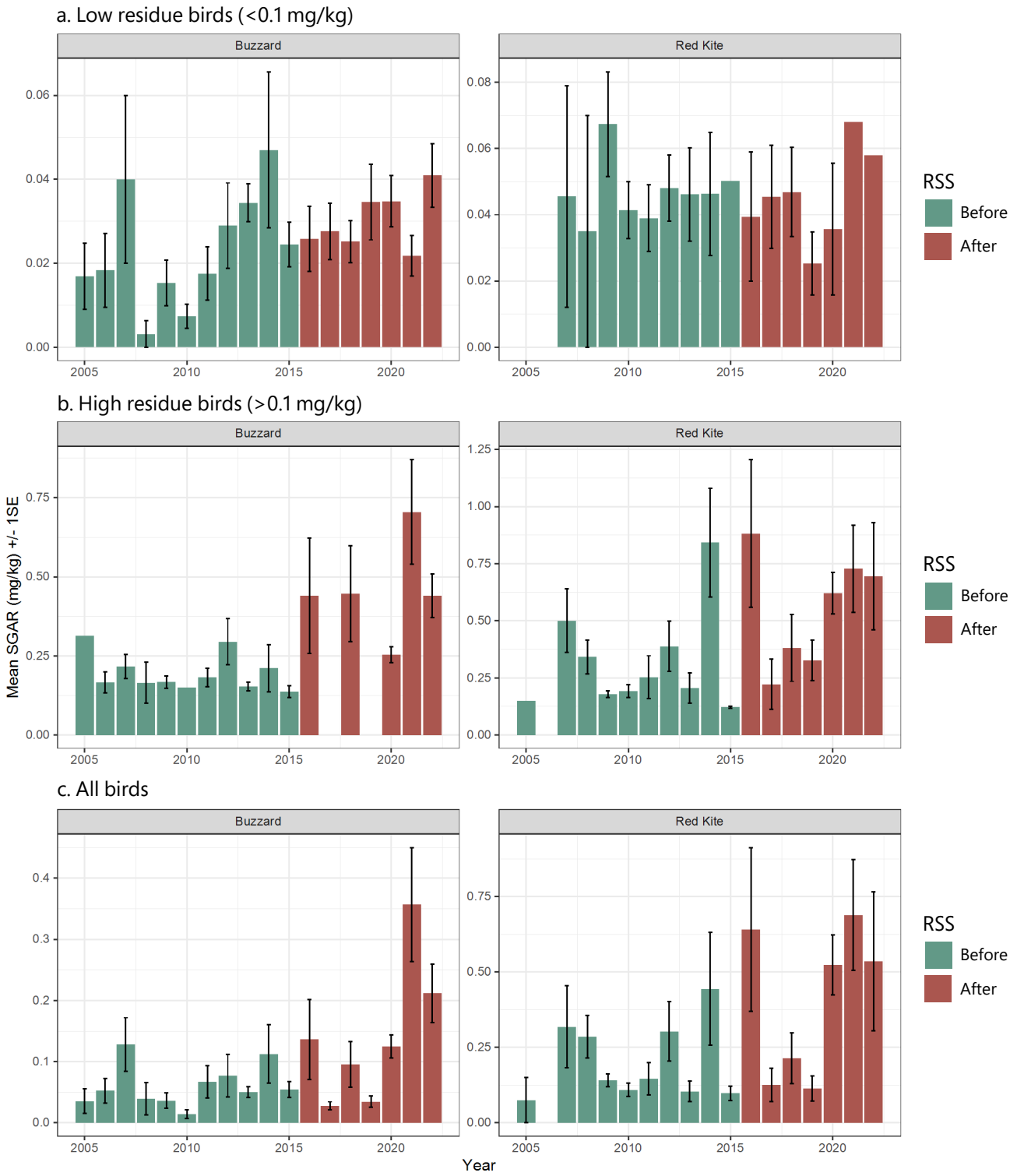

Figure 6. Mean SGAR concentrations (all compounds combined) by year for (a) Low Residue birds (<0.1 mg/kg), (b) High Residue birds (>0.1 mg/kg) and (c) all birds combined. Colours indicate the periods before **(green)** and after **(red)** the introduction of the RSS. Vertical lines indicate standard errors but these should be interpreted with caution given the distribution of the data. Years with no columns had no birds, columns with no standard errors were single birds.

Median SGAR residues for Buzzards increased significantly in both the High Residue and Low Residue birds (Figure 7).

Median SGAR residues for Red Kites increased significantly for High Residue birds and decreased non-significantly for Low Residue ones (Figure 7). Overall residues in Red Kites increased but non-significantly.

For neither species has the aim of the RSS to reduce SGAR levels been achieved.

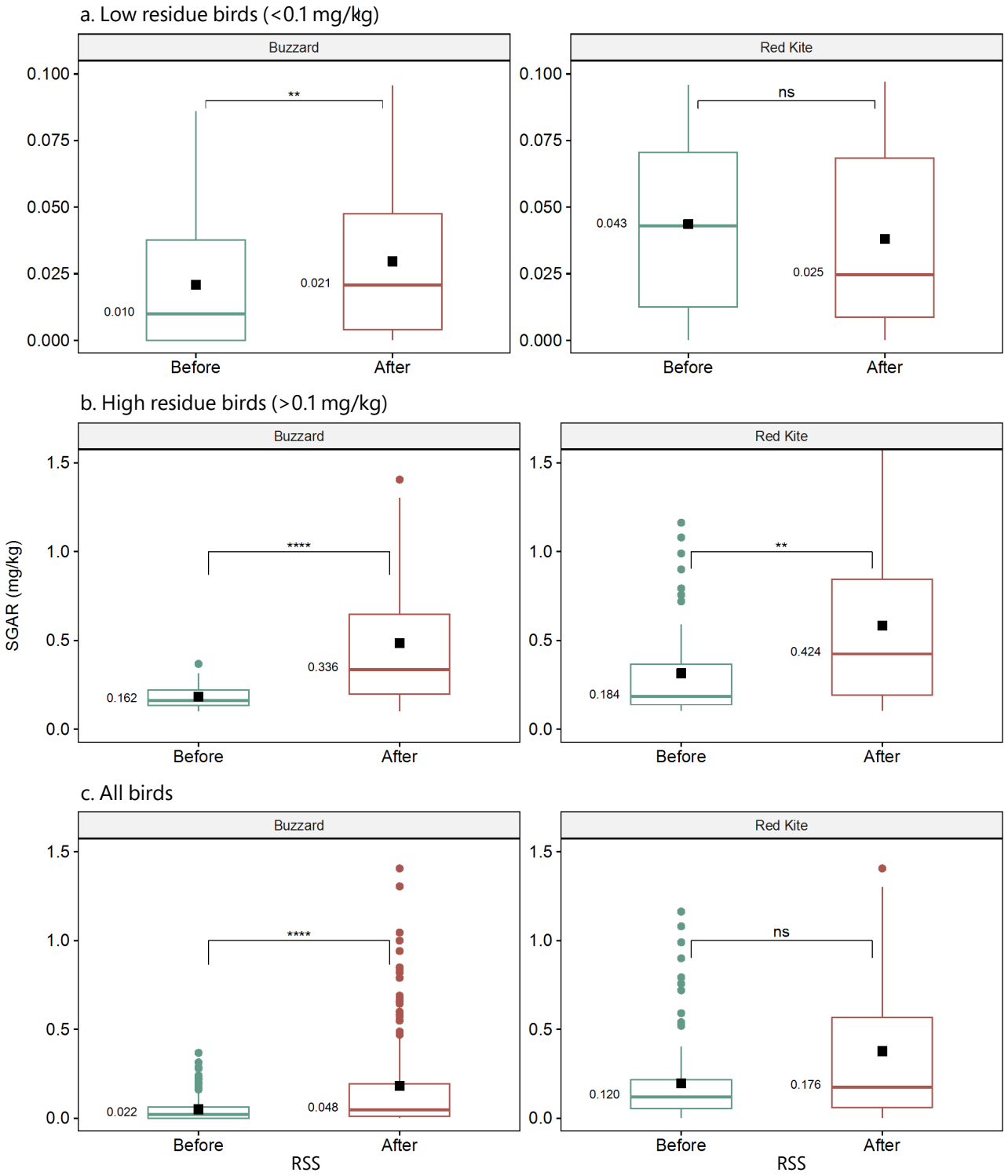

Figure 7. Boxplots of SGAR concentrations (all compounds combined), grouped by periods before **(green)** and after **(red)** the introduction of the RSS for (a) Low Residue birds (<0.1 mg/kg), (b) High Residue birds (>0.1 mg/kg) and (c) all birds combined. The horizontal line shows the median (with values indicated), the box encloses the 25th and 75th percentiles, the whiskers extend to points within 1.5 times the interquartile range and the dots show outliers. The mean is indicated by a black square. To aid display, a small number of Red Kites with particularly high SGAR concentrations are not shown. The significance of statistical tests of differences in medians (non-parametric Wilcoxon tests) is shown: *ns* not significantly different; **significantly different at P<0.01; ****significantly different at P<0.0001.

We can be sure that the RSS has not had the hoped -for impact on SGAR residues in Buzzards and Red Kites after seven full years of existence and there is no indication from these data that the situation will improve; on the contrary, the most recent years were the ones with the highest SGAR levels.

4: Discussion

The adoption of the RSS by the UK Government in 2015 was a response to the environmental problem of increasing levels of secondary poisoning in wildlife through the ingestion of rodents poisoned by SGARs. Environmental risk assessments concluded that the outdoor use of these poisons should be prohibited because of the high risk to wildlife. However, the UK Government permitted their continued use on condition that the industry adopted better practices to reduce exposure in wildlife. These changes were embedded in the RSS, including a legally-binding Code of Practice produced by the Campaign for Responsible Rodenticide Use (CRRU).

Has the RSS reduced exposure to SGARs in Buzzards and Red Kites? The results presented here show that it has not. Mean SGAR levels in Buzzards increased over time and remained high in Red Kites in all English regions. A similar pattern was found for the increased occurrence of Brodifacoum. Whatever the factors causing these increases, they are apparently operating across the country. The problem of secondary wildlife poisoning by rodenticides now appears worse than ever.

These increased SGAR levels may be partly due to a switch to these products from non-SGAR products including First Generation Anticoagulant Rodenticides (FGARs) such as Chlorophacinone and Coumatetralyl. Manufacturers have phased out the sale of these FGARs over the survey period, leaving the more highly toxic (to both rodents and birds of prey) SGARs as the main anticoagulant poisons now available.

The increase in total SGAR exposure is being driven primarily by a dramatic increase in Brodifacoum, both in the frequency of birds exposed and the levels found in the liver.

Brodifacoum is considered to be more highly toxic than Bromadiolone and Difenacoum, and has become the dominant poison involved in the secondary poisoning of birds of prey. It is especially prevalent in birds with high residue levels where adverse impacts on health are likely. Despite this dominance, individual Buzzards and Red Kites are frequently exposed to more than one SGAR. Indeed, 12 of the Buzzards had been exposed to no fewer than four different poisons.

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The regulation of SGARs

In 2020-2022 almost 75% of toxins found in Buzzards involved poisons restricted to use in and around buildings (mostly Brodifacoum, but also Difethialone and Flocoumafen). Information from the WIIS incident reports confirms that this is partly the result of poisons being used illegally away from buildings. At the start of the survey period (2005-2012) these toxins were restricted to use within buildings only and were generally marketed to professional pest controllers, rather than to gamekeepers and farmers. Now they appear to be in regular use by these groups, including illegally in open field situations away from buildings.

Some of the poisons once favoured for use in illegal baits to kill predators have become more difficult to obtain and carry a risk of prosecution if an investigation is undertaken. There is growing concern (RSPB 2022) that some gamekeepers are increasingly resorting to SGARs to target birds of prey (either directly in poison baits or by poisoning rodents outdoors that can then be eaten by birds of prey) because they are more easily available and are less likely to raise alarm bells should residues be detected.

Many SGAR products, including those containing Brodifacoum, are easily available and in wide usage, making it more difficult to determine the source when Birds of prey are found to have been poisoned.

Gamekeepers appear in the crime statistics for illegally killing birds of prey with depressing regularity. That this group is now being entrusted to follow best practice guidelines for the use of SGARs to minimise secondary poisoning is a cause for concern. There have been few prosecutions in England for the misuse and abuse of SGARs, and no doubt this reassures those who continue to use them illegally. The message received is that this is a crime society is willing to tolerate.

Conservation impacts

Buzzards are common and widespread in England having recovered from past declines. Nevertheless, numbers have declined in the last five years and deaths from SGARs may have contributed to this. In any case, unnecessary deaths, even in a common and widespread species are something that we should strive to avoid.

The Red Kite is recovering well following its reintroduction to England. It is increasing and has recolonised parts of its former range. Nevertheless, it remains absent or scarce as a breeding bird across large areas of England with suitable habitat. Unnecessary deaths from SGAR poisoning may slow the rate at which it is able to continue its recovery. The higher levels of SGARs seen in Red Kites compared to Buzzards reflects its greater vulnerability. As a scavenger it frequently takes dead animals that are more likely to have been poisoned. Rats are a frequent component of its diet, and, unlike the Buzzard, it often forages around villages and farm buildings where the most toxic poisons are more likely to be in common use.

Our study in England is complementary to that of George et al. (2024) of Buzzards in Scotland (up to 2022) which also found no evidence of SGAR reductions following the RSS. Our findings add to the earlier studies of Walker et al. (2021) for the Red Kite (in England and Wales up to 2019) and Ozaki et al. (2024) for the Buzzard (across the UK up to 2019), providing data for three more years which confirm that this problem is getting worse rather than better.

Annual surveys of SGAR levels in dead Barn Owls conducted by CEH concluded that 'the lack of significant reductions in SGAR residues in Barn Owls in 2021 suggests that full implementation of stewardship since 2018 has yet to result in a statistically significant reduction in exposure…' (Ozaki, 2022). In a similar vein (Buckle et al. 2024) reported that the targets set by government to reduce wildlife contamination remain unmet based on Barn Owl data.

The data for these three species (Buzzard, Red Kite and Barn Owl) show that after seven years of operation, the RSS is not working as envisaged to reduce SGAR residues in wildlife.

Potential solutions

The RSS is an example of a 'light touch' model of regulation which involves tolerating a practice known to be environmentally damaging while giving a wide range of users (professional pest controllers, farmers, gamekeepers, ordinary citizens) the responsibility for addressing the problem. Where the responsibility is discharged with a code of conduct coupled with adherence to conditions of use for the products then compliance is likely to be low if ignorance of the code of conduct is high and/or deliberate non-adherence to the code and/or the law occurs. We suggest that all these play a part in the increase in rodenticide levels found in Buzzards and Red Kites.

The RSS scheme has not succeeded in its objectives despite the best efforts of some to adopt and promote better working practices. Further changes in the availability or use of these products are clearly required to achieve the desired reduction in the secondary poisoning of wildlife.

From January 2026 there will be a requirement for all professional users of SGARs, including farmers and gamekeepers, to have passed a CRRU-approved examination to be able to purchase these poisons. Given the current widespread misuse of SGARs and the lack of effective enforcement, we doubt that this change will lead to a significant reduction in incidents of secondary poisoning.

From January 2025 the approval status of Bromadiolone and Difenacoum will change, restricting their use to 'in and around buildings'. However, no tighter controls are planned for Brodifacoum, the main contaminant found in birds of prey in recent years, so this too is unlikely to improve things significantly. A better option would be to return Brodifacoum to its pre-April 2016 approval status, so that it can only be used in strict 'internal areas' within buildings, and to limit its use to professional pest control companies.

Image: Oliver Hewitt/Shutterstock

The argument that Brodifacoum is required for external use because rats have become resistant to other SGARs has recently been challenged by the availability of a non-SGAR poison. Cholecalciferol is approved for outdoor use and carries a reduced risk of secondary poisoning of wildlife (Campaign for Responsible Rodenticide Use 2024). Use of this product would fit the legally binding requirements of the CRRU code for professional users to follow a risk hierarchy when controlling rats: all other control techniques should be considered before SGARs, especially Brodifacoum, are used.

Wild Justice says:

1. The Rodenticide Stewardship Scheme did not meet its targets in the period 2016-2022 - it is a failed scheme. Government should recognise that the RSS has failed and that this must have consequences for regulation.

2. Brodifacoum's approval status should revert immediately to 'indoor use only'. It is ridiculous that the SGAR most prevalent in Buzzards and Red Kites is escaping stricter regulation.

3. Rodenticides are killer chemicals. The data we present in this report had already been collected by government agencies over multiple years but they had not been properly analysed or published and Government has ignored their existence. It should not fall to bodies like Wild Justice to bring to Government's and the public's attention that wildlife is still being poisoned by rodenticides.

4. Every stage of the process of collecting suspected poisoned corpses, analysing rodenticide residues and analysing the data is slow. Greater investment of resources might speed things up but so would giving this work a higher priority across the agencies involved. The current situation is a pathetically poor response by government agencies to a threat to wildlife and potentially to people and livestock.

5. Police forces, HSE staff, Natural England staff and others should target the illegal use of SGARs by some sectors of rural society in order to provide a greater deterrent against criminal behaviour and so reduce the extent to which wildlife is poisoned in future.

Acknowledgements

The data in this report have been compiled from WIIS chemical analysis reports produced by the Wildlife Incident Unit at Fera Science Ltd (Food & environment research agency). These were obtained through the submission of Freedom of Information and Environmental Information Regulations requests and we are grateful to the numerous colleagues who helped with this. We are grateful to a number of expert colleagues who commented on drafts of this report and helped with data analysis.

Image: SomprasongWittayanupakorn/Shutterstock

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