Scottish Beekeepers' Association
Survey 2013 Report

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1 Introduction

1.1 Background

In 2013 the Scottish Beekeepers' Association (SBA) again supported the carrying out of a survey of its members in late spring and early summer in order to continue monitoring the state of beekeeping in Scotland. These surveys began in 2006 and have all been designed and carried out from the University of Strathclyde, with the help of the SBA.

As in each of the last three years, the data from the survey provided the basis of a return from Scotland to the COLOSS organisation (`www.coloss.org`) which monitors honey-bee colony losses internationally.

1.2 Summary of key findings

Before the detailed description and analysis of the survey which follows, this section states for quick reference some of the key findings of the analysis.

1.2.1 Sampling and response rate

The sample size was 300. The response rate to the electronic questionnaire was 69% (142 out of 206) and to the postal questionnaire 34% (32 out of 94). Of the respondents 74.7% (130 out of 174) were active beekeepers during the period covered by the survey.

1.2.2 Sample profile

As far as age distribution was concerned, most beekeepers were over 40 years of age, and more than half were over 50 years of age: 63.3% were male and 36.7% female of the 128 respondents who provided this information.

1.2.3 Request for further support from the SBA

Most did not request any further support, but there were 5 requests for more preparatory courses for the SBA's advanced examinations.

1.2.4 Sizes of beekeeping enterprises

Most respondents were managing only one apiary and only 11% were managing more than 2 apiaries.

In April 2012, only 29 of 129 respondents to this question were managing more than 4 colonies of bees. Most (64 out of 129) were managing just 1 or 2 colonies.

1.2.5 Colony losses

- **Summer losses in 2012**

  Over the summer of 2012, the losses reported were 58 colonies lost out of 466 being kept in April 2012, a loss rate of 12.4%, which is much higher than the loss rate reported for summer 2011 (7.4%).

  The most frequently reported cause of summer loss was queen problems (28 colonies out of 58 lost).

- **Winter losses 2012–13**

  Over the winter of 2012–13 the total reported losses were 158 colonies lost out of a total of 500 colonies being kept in October 2012. This loss rate of 31.6% is the highest winter loss rate ever reported in our series of surveys.

  Of the beekeepers responding, 61 out of 108 reported having some winter loss, a rate of 56.5% of the beekeepers, again the highest ever reported rate.

  The leading reported cause of winter loss was isolation starvation (62 losses out of 158).

  By April 2013, of the 118 beekeepers who responded to this question, 24 stated that they had lost all their bees over the winter of 2012–13 (20.3%).

  Continuing the investigations carried out in recent years, differences in loss rates between different regions of Scotland and also between colonies which had, and which had not foraged on Oil Seed Rape were analysed. The results were strikingly different to those in earlier years.

  Splitting Scotland into North, Central and South areas, the North reported a loss rate of 31.5%, the Centre a loss rate of 43.0% and the South a loss rate of 16.8%. These differences are statistically significant, whereas no significant differences between these regions were reported in earlier years.

  Splitting Scotland between East and West revealed no statistically significant difference:– in the East a 30.5% loss rate and in the West 34.1%. In earlier years the East has had a significantly higher loss rate than the West.

  Those colonies which were reported as foraging on Oil Seed Rape showed a loss rate of 18.1% and those not foraging on that crop a loss rate of 41.4% — a statistically significant difference, but in the *opposite* direction to the significant differences reported in some earlier years.

1.2.6 Bee races being kept

Only 33 of the 117 respondents to the question on the race of bees being kept claimed to be keeping a particular race of the Western honey-bee (28.2%). Among these the most frequently claimed race was the Northern European Dark Bee (*Apis mellifera mellifera*) which was claimed by 22 respondents.

But of the 33 respondents claiming to be keeping a named race, only 5 claimed to base that claim on a wing morphometry test, the remainder relying either on the general appearance of the bees, or on what they had been told by the supplier of the bees.

1.2.7 *Varroa*

- **Awareness**

  Of 118 beekeepers responding to this question, 15 (12.7%) did not believe that *Varroa* was present in most stocks in their area. Using published data on the incidence of *Varroa* in Scotland, it seems likely that only one of these is on fairly sure ground for this belief, and rather worryingly, 5 of these 15 were taking no steps to detect infestation by the mite.

  Of the 103 beekeepers who did believe *Varroa* was present in most stocks in their area, 19 (18.4%) were taking no steps to monitor infestation levels.

- **Control**

  Of the 130 beekeepers, 95 (81.9%) of the 116 respondents to this question said they used Open Mesh Floors on most of their colonies as a control measure against *Varroa.*

  Also 56 of the beekeepers (43.0%) used at least one biotechnical method to control *Varroa.* The most frequently reported biotechnical method of control was dusting with icing sugar (42 beekeepers — 32%).

  Only 116 beekeepers responded to the question of whether they used any chemical method to control *Varroa.* Of these 100 (86.2%) said that they did. Most of the non-use of such methods is linked to a belief that *Varroa* is not present.

  The peak times for the use of chemical control measures are late summer and mid-winter.

  The most frequently applied chemical control reported was oxalic acid, either by the trickle method or by sublimation. The use of the synthetic pyrethroids (Apistan and Bayvarol) is now in second place. Many other chemical control measures were also reported.

1.3 Design of the survey

One major innovation in this survey was the use of an electronic questionnaire designed with the package LimeSurvey and administered using email addresses of SBA members when these were available. This has the advantage of providing much quicker and easier data entry both for those administering the survey and also for those responding to it. It is also much cheaper to run — an important consideration in these days of ever rising postal costs. However in order to allow those members of the SBA who do not make use of email to participate, a limited number of SBA members with no email addresses were also approached by post, the results of the two sets of responses being combined for the analysis below. One major benefit of the electronic method of surveying is that the sending out of reminders is both cheap and easy, and we were in this way able to raise the response rate quite considerably.

A Neyman allocation scheme (using the winter 2011–2012 overall loss rates per area) was used to divide the chosen sample size of 300 between the main SBA administrative areas, namely Aberdeen and the North combined, the East and the West. These samples were then subdivided in proportion to the SBA membership in the smaller geographical sub-areas that were also used in the previous recent surveys. Orkney, Shetland and the Outer Hebrides were included in the North Far-North sub-area, and the Inner Hebrides were included in the North North-West. The details are in Table 1.

Area	No. of members	No. sampled	Sub-region	Size	No. sampled
Aberdeen	81	23		81	23
East	546	147			
			East-Central	378	102
			North-East	113	30
			South-East	55	15
North	207	60			
			Far-North	71	21
			Inverness & surrounding area	79	23
			North-West	57	16
West	260	70			
			South-West	163	44
			West-Central	97	26
Total	1094	300			300

Table 1: Details of the survey design

Once more we offered a prize to be competed for by those responding (as in the last few surveys, kindly provided by Thornes of Wragby and Newburgh. We are grateful to Thornes for their ongoing support of these surveys).

2 The Questionnaire used

This was changed quite considerably this year for several reasons:–

- The format was adapted to suit the format of the on-line package LimeSurvey.
- Even closer adaptation to the standardised COLOSS format was attempted this time.
- Some further simplification was attempted.

The postal version of the full final questionnaire used is included as an appendix to this report. The on-line version matches this as closely as is feasible, and is available for anyone interested to see it.

LimeSurvey encourages the grouping of questions as we have already done. The groups used this time were:–

- A Preliminary questions.

- B Beekeeping activities introduction.
- C Beekeeping activities — spring colonies.
- D Beekeeping activities — summer losses.
- E Beekeeping activities — summer increases and decreases.
- F Autumn 2012 colonies.
- G Winter 2012–13 losses.
- H Winter increases/decreases.
- I Spring 2013 colonies.
- J Bee races being kept.
- K Queens and their replacement.
- L Varroa awareness.
- M Varroa control.
- N Migratory beekeeping and pollination contracts.
- O Forage crops.
- P Management issues.
- Q Final (for free format comments).
- R Optional contact details.

As last year, the main body of the report will be arranged in sections following this arrangement for the most part, though with some deviations where these are appropriate.

3 Going through the questionnaire

3.1 Preliminary Questions

3.1.1 The response rate

The total numbers of electronic and postal questionnaires issued and returned along with the response rates are summarised in Table 2.

	Electronic	Postal	Total
Sent out	206*	94*	300
Completed	142	32	174
Not returned	64	62	126
Response rate	68.9%	34.0%	58.0%

Table 2: Responses to the survey

* Note that the original intention was for 218 electronic and 82 postal, but some email addresses failed.

The response rate to the electronic questionnaires of 68.9% is very satisfactory. As in previous years, the response to the postal questionnaires was lower, though this year it was not followed up as rigorously as in previous years.

	Electronic	Postal	Total
Beekeepers	108	22	130
Non-beekeepers	23	11	44
No Response	11	0	11
Percentage keeping bees**	78.6%	48.9%	74.7%

Table 3: Beekeepers and non-beekeepers

** The dates applied were between April 1st 2012 and May 1st 2013.

3.1.2 Beekeepers and non-beekeepers

As in previous years not all those approached were active beekeepers during the period being surveyed. It is not currently possible to identify active beekeepers before selecting the SBA members to invite to participate in the survey. The results are summarised in Table 3. Of the 174 respondents to the survey, 130 (74.7%) were active beekeepers.

A striking feature of this table is that the proportion of non-beekeepers among the postal respondents is much higher than among those responding electronically. Perhaps this reflects a tendency among those not using electronic communication to be elderly, and possibly at an age when they may be giving up keeping bees.

3.1.3 The non-beekeepers

A little further questioning of the non-beekeepers was undertaken. They were asked

(a) whether they were interested in becoming beekeepers, and

(b) whether they had been beekeepers.

The results are summarised in Table 4.

	Electronic	Postal	Total
Total numbers	23	11	34
Interested in becoming a beekeeper	19 (82.6%)	2 (18.2%)	21 (61.8%%)
Previously a beekeeper	13 (56.5%)	10 (90.9%)	23 (67.6%)

Table 4: Characteristics of the non-beekeepers

The percentages here bear out the suggestion that more of the postal respondents may be older people who have given up beekeeping permanently, whereas the majority of the electronically responding non-beekeepers are keen to start beekeeping, some certainly because they have lost their bees.

3.1.4 Ages and sexes of respondents

All beekeeping respondents were asked to give their age group and their sex (F (Female) or M (Male)). Ages were in 7 groups. Respondents could choose not to respond to these questions. The results are summarised in Table 5.

It is clear that in our sample the great majority of beekeepers are aged over 40 and more than half of them are over 50. Although in recent years many more people have taken up beekeeping, this is not reflected in a reduction in the age of those we find in our sample. Most (81) of the 130 beekeepers in our sample are male, 47 are female and 2 did not answer this question.

This is further supported by Figure 1 where the approximate ages of respondents are plotted against their stated years of experience of beekeeping. Many even of the older beekeepers have limited experience and so are relative newcomers to beekeeping.

3.1.5 Further support for beekeepers

Respondents who were beekeepers were asked if they felt further educational support from the Scottish Beekeepers' Association of any particular kind was needed. Of the 130 beekeepers who responded, 14 (11.5%) said they would

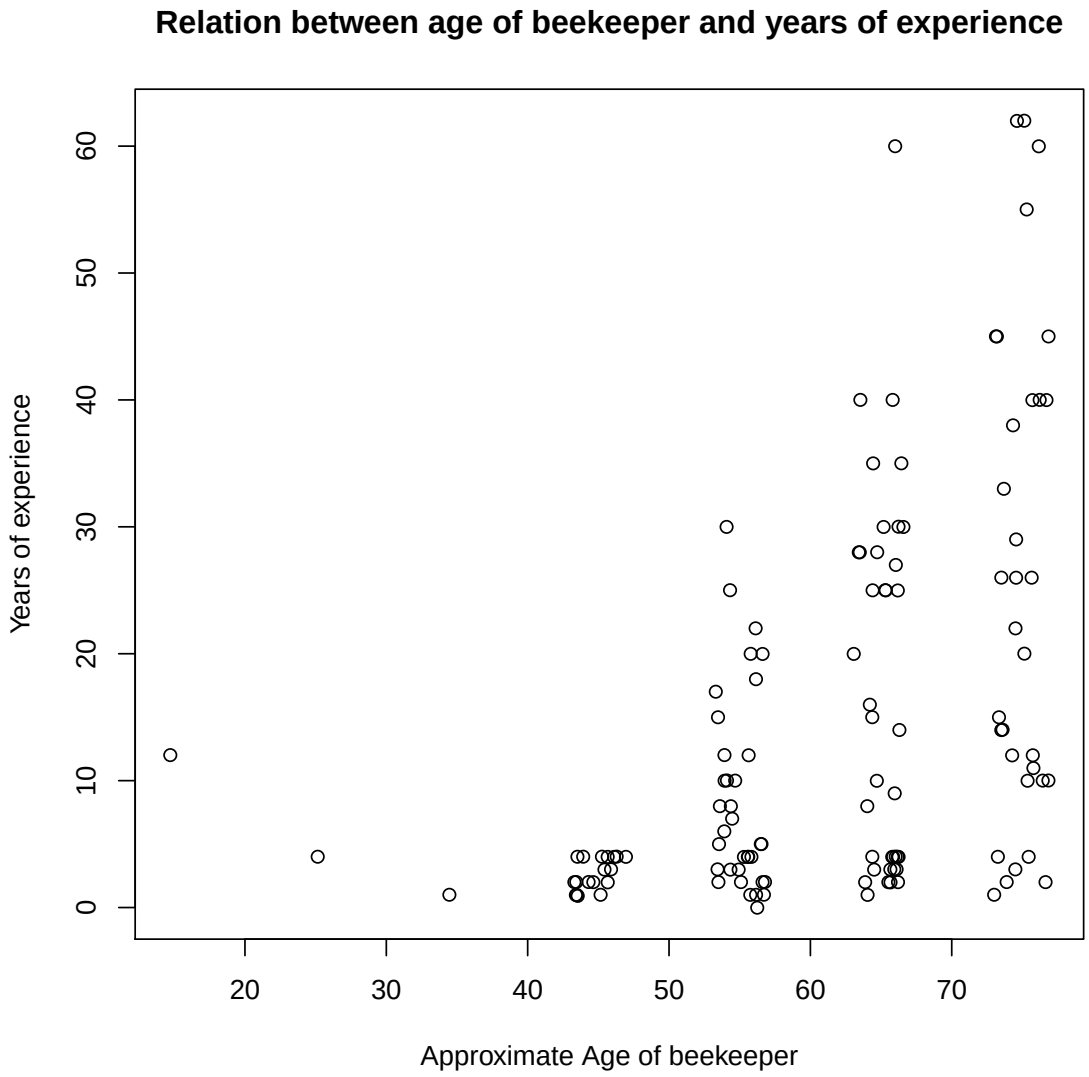

Figure 1: Relation between ages of beekeepers and years of experience

Age group	No sex given	F	M	Total
Undeclared	0	0	2	2
Under 20	0	0	1	1
20–29	0	0	1	1
30–39	0	0	1	1
40–49	1	9	8	18
50–59	0	20	15	35
60–69	1	13	24	38
70 or over	0	5	29	34
Total	2	47	81	130

Table 5: Distribution of age group and sex of beekeepers

welcome such further support. Some responses were difficult to interpret or classify, but most topics mentioned are listed in Table 6. The most frequently mentioned topics are placed earlier.

Topic	**Number of mentions**
Preparation courses for advanced SBA examinations	5
Information about the effects of agricultural chemicals on bees	2
Practical tips and practical opportunities	2
Travelling lectures or use of skype for those in remote areas	2
Advice on processing honey and beeswax	1
Regular clear updates in "The Scottish Beekeeper" on disease treatments	1
"Unexpected events"	1

Table 6: Educational topics for further support requested

3.2 Beekeeping Activities — Introduction

3.2.1 Size and location of beekeeping enterprises

Beekeepers were asked the number of apiaries for which they had primary responsibility. The distribution of answers is shown in Table 7.

Number of apiaries	No response	0	1	2	3	4	5	6	Total
Frequency	2	2	97	18	6	1	3	1	130
Percentage	1.5	1.5	74.6	13.8	4.6	0.8	2.3	0.8	100.0

Table 7: Number of apiaries the beekeeper looks after

Two beekeepers failed to answer the question, and two stated that they had no main apiary of their own. The most frequent response was to claim a single apiary, and only 11% stated that they had more than 2 apiaries.

It is therefore no surprise that only 10 of the beekeepers responding stated that they did not keep all their hives within 10 miles of where they live, and that 119 (91.5%) did keep them within that distance (one respondent failed to answer the question).

Beekeepers were asked to give an indication of the location of their principal apiary. Only two of the 130 beekeeper respondents failed to give an adequate indication. These locations have all been converted to short postcodes, and from these the geographical spread of the apiaries of the respondents can be assessed in various ways. Table 8 below shows the frequencies with which different regions feature in three different ways of breaking down the geography of Scotland.

The first way uses the SBA's administrative areas of the North Region, Aberdeen and Moray Region, East Region and West Region. The second way divides Scotland arbitrarily into Northern, Central and Southern, using as division lines approximately a line from the Firth of Tay to Oban to separate Northern from Central,

SBA Areas				
Aberdeen and Moray Area	East Area	North Area	West Area	**Total**
12	49	27	40	128
Northern, Central and Southern				
	Northern	Central	Southern	**Total**
	40	64	24	128
Eastern and Western				
	Eastern	Western	Unclassified	**Total**
	76	51	1	128

Table 8: Locations of apiaries (a) by SBA area, (b) by Northern, Central, Southern, (c) by East and West

and another approximately from the Firth of Forth to the Firth of Clyde to separate Central from Southern. The third way separates Scotland into Eastern and Western, using the SBA's East or West regions where possible to classify the southern part of the country, and a line roughly from Fort Augustus to Tongue to divide the northern part of the country into East and West. Orkney and Shetland apiaries are omitted from this division, since they cannot sensibly be classified as either East or West.

As some final idea of the sizes of the beekeeping enterprises being analysed, the beekeepers were asked to state how many colonies they were managing at 3 distinct time-points, namely 2012 April 1st, 2012 October 1st and 2013 April 1st. Table 9 summarises that information for the first of those three time-points. (Table 13 shows this for 2012 October 1st and Table 20 for 2013 April 1st).

Colonies 2012 April 1	**Beekeepers keeping this number**
0	11
1	33
2	31
3	13
4	12
5	4
6	8
7	7
8	2
9	1
10	4
16	1
22	1
90	1
Total	129

Table 9: Numbers of colonies being managed on 2012 April 1st

One of the 130 beekeepers failed to answer this question. Only 29 of those who responded were keeping more than 4 colonies at this time, and more than half of those responding were keeping no more than 2 colonies, so that the median number of stocks being kept at this date was 2. It is clear that, if this sample is representative, the great majority of beekeeping SBA members are beekeeping on a very small scale. This has also been found to be the case in the samples in our previous surveys.

It is also noteworthy that 11 of those claiming to be beekeepers had no bees at all in April 2012. Either these were beekeepers who had lost all their stocks before this date, or were newcomers just starting. By the end of the summer of 2012, the number of beekeepers in this position had come down to 9.

3.3 Beekeeping Activities: Spring and Summer 2012

3.3.1 Changes of colony numbers over the summer of 2012

Beekeepers were asked about losses of colonies and other changes of colony numbers over the summer of 2012. Though for many beekeepers, summer losses were reasonably low, for the large proportion of respondents who keep very small numbers of stocks, even the loss of just one or two colonies represents a very high percentage loss. In this section we report results for beekeepers with "valid" loss data, using the following criteria. There were 109 such beekeepers out of the 130 beekeepers responding to the survey. These are beekeepers with a stated number of colonies in April 2012 that was at least 1, and a stated total number of summer losses that was no larger than the number of colonies kept in April. This is not entirely satisfactory for calculating summer losses when there is potential for expansion in numbers of colonies, but is used here for consistency with the calculations used for winter losses. Also, anyone not providing a total number of summer losses was omitted from this part of the analysis.

The overall reported percentage of loss over that summer is in fact higher than might have been expected, at 12.4% (58 colonies lost out of a total of 466 colonies kept in April 2012). This is in part influenced by the outcome for the largest-scale beekeeper reporting in this survey who was managing 90 stocks in April that year, and who reported losing 22 of them due to Nosema over the summer — a high loss rate of almost 25%. But even if that case is omitted from the data, the overall reported loss rate over the summer is still 9.6%. The comparable loss rate for our survey conducted in 2012 was only 7.4%. The proportion of beekeepers experiencing colony losses over summer 2012 was 23.8% (26 of 109 beekeepers).

The different reported causes of loss over the summer are summarised in Table 10.

Reported cause	**Number of lost colonies**
Starvation	5
Isolation starvation	5
Colony depopulation syndrome	3
Queen problems	28
Loss due to *Varroa*	14
Losses due to other known causes	23
Losses due to unknown causes	4
Total summer losses	**58**

Table 10: Reported causes of loss of colonies during summer 2012

The "Losses due to other known causes" are summarised in Table 11.

Reported cause	**Number of colonies lost**	**Number of beekeepers involved**
Small cast not fed, absconded	1	1
Nosema	22	1

Table 11: Other known causes of loss during summer

Note that the numbers of losses due to the different causes shown in Table 10 exceeds the total number of reported losses. This is because several beekeepers reported losses due to multiple causes, rather than just one cause.

Queen problems accounted for the largest proportion of summer losses stated to be due to a specified cause.

3.3.2 Planned changes in colony numbers during summer 2012

Summer is the season during which beekeepers can make increases in their number of colonies, by splitting existing colonies, by promoting small nucleus stocks to production status, by taking swarms, or by buying or otherwise acquiring from others new colonies. In total 205 new colonies were acquired in one or other of those ways by the 120 beekeepers who responded to the question of how many new colonies they had acquired.

The distribution of the numbers of newly acquired colonies among the different sizes of the beekeeping enterprises in April 2012 are shown in Table 12.

	Number of colonies being managed in April 2012														
Number of new colonies	0	1	2	3	4	5	6	7	8	9	10	16	22	90	**Total**
0	3	17	17	2	5	0	1	1	0	0	0	0	0	0	46
1	5	9	6	5	1	1	0	3	0	0	1	0	0	0	31
2	2	2	6	2	3	0	1	1	1	0	0	0	0	1	19
3	1	1	1	0	1	1	1	0	0	0	0	0	0	0	6
4	0	1	0	0	1	0	1	0	0	0	0	1	0	0	4
5	0	1	0	1	0	1	1	2	0	0	0	0	0	0	6
6	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
7	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
16	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Total	11	31	30	11	11	3	7	7	2	0	4	1	1	1	120

Table 12: Distribution of the numbers of new colonies among different sizes of enterprise

Colony numbers can also be reduced during summer, by sale or giving away of colonies, or by the uniting of colonies. The total number of colonies reported as lost in this way over the summer was 66, for all the beekeeper respondents.

3.4 Colonies in autumn 2012, and changes of colony numbers over the winter of 2012–13

3.4.1 The number of colonies being kept in October 2012

In order to determine the rate of loss experienced over the winter season by those responding to the survey, beekeepers were asked how many colonies each was managing in October 2012. The total number of reported colonies was 507. The distribution of those numbers among the different sizes of operations is summarised in Table 13. Note that only 119 of the beekeeper respondents gave information on this, and 9 of these in fact had no bees at 1st October 2012. Most beekeepers had just 1 or 2 colonies and more than 3 was not common.

Colonies 2012 October 1	**Beekeepers keeping this number**
0	9
1	26
2	31
3	17
4	8
5	2
6	3
7	1
9	1
10	1
11	1
13	1
17	1
29	1
42	1
70	1
Total	119

Table 13: Numbers of colonies being kept in October 2012

3.4.2 Colony losses during the winter of 2012–13

Perhaps the main point of interest addressed by this survey is the reported rate of winter losses during the winter of 2012–13.

There were 108 beekeeper respondents to the survey with "valid" winter loss data. These are beekeepers with a stated number of colonies in Ocober that was at least 1, and a stated total number of winter losses that was no larger than the number of colonies kept going into winter. Also, anyone not providing a total number of losses was omitted from this part of the analysis.

The overall loss rate for these beekeepers was 31.6% of colonies wintered (158 colonies reported as lost from 500 colonies in total being managed in October 2012), and 61 of the 108 beekeepers (56.5%) experienced winter colony losses. This is extremely high compared to the previous winter when 40% of beekeepers reported losses and the overall loss rate was 15.9%. This winter loss rate for 2012–13 is the worst winter loss rate reported in our whole series of surveys so far, the next worst being 30.9% for the winter of 2009–10.

The different reported causes of loss over that winter are summarised in Table 14. As was the case for losses during the summer, the sum of the total numbers reported for each cause exceeds the total reported number of lost colonies (158), and, as for the summer losses, the reason is that some beekeepers reported losses due to multiple causes.

Reported cause	**Number of lost colonies**
Starvation	15
Isolation starvation	62
Colony depopulation syndrome	8
Queen problems	39
Loss due to *Varroa*	6
Losses due to other known causes	31
Losses due to unknown causes	8
Total winter losses	**158**

Table 14: Reported causes of loss of colonies during winter 2012–13

The most commonly reported cause of winter loss was isolation starvation, and no doubt this is largely due to the very late spring experienced in 2013, which will have caused the death of colonies which had already been stressed by the extremely poor summer weather of 2012 in much of Scotland. The high rate of queen problems has also been attributed by many beekeepers to poor mating conditions for queens during the summer of 2012, so that many of that summer's queens were not adequately mated, and became drone-layers over the winter.

The "Losses due to other known causes" are summarised in Table 15.

Reported cause	**No. of colonies lost**	**No. of beekeepers involved**
Poorly mated queens	7	1
Vandalism	5	1
"Wasted away"	5	1
Dysentery, possibly nosema	4	3
Acarine	3	2
Frozen	2	1
Chalkbrood	1	1
Late supersedure so non-viable colony	1	1
Weak colonies unable to survive cold spring	2	1
Deformed Wing Virus	1	1
Nosema	3	3
Poor management using oxalic acid	1	1
Queen loss	1	1

Table 15: Other known causes of loss during winter 2012–13

The loss of a queen might well have been classified under "Queen problems". It is clear that many of these are cases of colonies going into winter too weak to survive, in line with earlier observations on the late cold spring

of 2013.

Differential winter loss rates by area of Scotland and by forage plants

In the last few surveys we have also analysed the differences in reported loss rates from different areas of Scotland and also between those colonies reported as foraging on Oil Seed Rape, from those not foraging on that crop. Below are the results of those investigations, which this year are surprisingly different from those reported in the last three years.

- **Differences in winter loss rates between the North, Centre and South of Scotland**

  The different loss rates reported over the winter for beekeepers in the North,Centre and South of Scotland are summarised in Table 16.

Area	North	Central	South
Colonies Oct 2012	197	172	131
Winter losses reported	62	74	22
Loss rates	31.5%	43.0%	16.8%

Table 16: North, Centre, South winter loss rates 2012–13

  The reported differences here are highly significant (p-value for Fisher's Exact Test $< 10^{-5}$). This is in marked contrast to the last three years where no significant difference was found between loss rates from these areas.

- **Differences in winter loss rates between the East and West of Scotland**

  The different loss rates reported over the winter for beekeepers in the East and West of Scotland are summarised in Table 17.

Area	East	West
Colonies Oct 2012	282	211
Winter losses reported	86	72
Loss rates	30.5%	34.1%

Table 17: East and West winter loss rates 2012–13

  The reported difference here is not significant (p-value for Fisher's Exact Test 0.43 which is greater than 0.05). Again this contrasts with other recent years, for which significantly higher loss rates were reported from the East than from the West.

- **Differences in winter loss rates between colonies foraging and not foraging on Oil Seed Rape**

  The different loss rates reported over the winter for beekeepers whose bees had foraged on Oil Seed Rape, as contrasted with those not foraging on this source, are summarised in Table 18.

Area	OSR	No OSR
Colonies Oct 2012	210	290
Winter losses reported	38	120
Loss rates	18.1%	41.4%

Table 18: OSR vs No OSR winter loss rates for winter 2012–13

  The reported difference here is highly significant (p-value for Fisher's Exact Test $< 10^{-7}$). Again this contrasts with other recent years, where a significant difference has been repeatedly reported, but always until now in the opposite direction.

Planned changes in colony numbers during the winter

A question was also asked about the increases or decreases of numbers of stocks deliberately made by beekeepers over the winter. These, as expected, were at a much lower level than was reported for the summer, as shown in Table 19. These results are for all the beekeeper respondents.

Nature of change	Number of colonies
Increase by acquiring or splitting	20
Decrease by selling or giving away	5
Decrease by uniting colonies	12

Table 19: Planned increases and decreases during winter 2012–13

Colony numbers in April 2013

Finally to round off this section, beekeepers were asked how many stocks they were managing on April 1st in 2013. The total number reported for all beekeepers was 365, the sharp decline reflecting mainly the high rate of winter losses reported above. The distribution of these numbers is detailed in Table 20. Note that many beekeepers reported losing all their bees over the winter of 2012–13, and that the number of beekeepers stating that they had no bees in April 2013 had risen to 24 out of 118 who answered this question, giving a percentage of 20.3% of those responding having no bees in the spring of 2013.

Colonies 2013 April 1	Beekeepers keeping this number
0	24
1	32
2	26
3	12
4	8
5	5
6	2
7	2
8	1
10	2
13	1
17	1
39	1
65	1
Total	118

Table 20: Numbers of colonies being kept in April 2013

3.4.3 Comparing loss rates of postal and online respondents

In this section we compare the profile and the loss rates experienced by respondents using the online questionnaire and those submitting a postal questionnaire.

There were 174 responses in total, 32 responses from the postal questionnaires and 142 responses from the online survey. Of these 130 respondents (74.7%) were beekeepers, 22 of whom were postal participants and 108 were online participants.

Of the 108 beekeeper respondents with "valid" winter loss data, 86 (80%) responded online and 22 (20%) by post. All of the postal respondents provided valid winter loss data, having no more stated winter losses than colonies going into winter at the start of October.

Table 21 shows the number of colonies lost over winter and the number surviving for the online and postal respondents and overall.

The overall winter loss rate was 31.6% and 56.5% of the beekeepers experienced winter losses. The winter loss rate for the postal respondents was 19.3% (and 11 (50%) of 22 with valid loss data experienced colony losses) and

	Online	Postal	Total
Losses	130	28	158
Survivals	225	117	342
Total	355	145	500

Table 21: Winter losses for online and postal respondents

for the online respondents it was a much higher 36.6% (50 (58.1%) of 86 with valid loss data experienced losses). These are strikingly different loss rates, and the difference in the loss rates is highly significant (using a Fisher's exact test gave a very low p-value of 0.0001297), although the proportions of beekeepers experiencing colony loss are not significantly different (p= 0.6306).

Repeating this analysis for the summer loss data, of the 109 beekeeper respondents with "valid" summer loss data, 89 (81.7 %) responded online and 20 (18.3 %) responded by post.

Table 22 shows the number of colonies lost over summer and the number surviving for the online and postal respondents and overall.

	Online	Postal	Total
Losses	31	27	58
Survivals	276	132	408
Total	307	159	466

Table 22: Summer losses for online and postal respondents

The overall summer loss rate was 12.4% and 23.8% of beekeepers experienced losses. For the online respondents the loss rate was 10.1% (31 colonies lost of 307 colonies kept in April 2012) and 22 of 89 beekeepers (24.7%) experienced losses. For the postal respondents the loss rate was higher at 17.0 % (27 colonies lost from 159 colonies) and 4 out of 20 beekeepers (20%) had losses. Again a Fisher's exact test of the difference in the summer loss rates is significant (p-value = 0.03837), but the difference in the proportion experiencing losses at all was not significant (p=0.7774).

These differences may well be due to different beekeeper profiles in the two groups, as it was suspected that the postal respondents might well be older beekeepers on the whole, with more experience of beekeeping. It might be expected that such beekeepers would have lower winter losses. It might also be the case that older more experienced beekeepers might expand their beekeeping more in the summer, with greater risk of loss.

This was therefore examined, with the following results. The data used is the data for the 108 beekeepers with valid winter loss data. There are only a few differences between the individuals contained in this data and those in the data for beekeepers with valid summer loss data.

Statistic	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Online	1.00	3.25	5.50	13.22	23.75	60.00
Postal	1.00	4.00	22.00	24.57	40.00	62.00

Table 23: Distribution of years of experience; one postal respondent did not provide this information.

Table 23 shows a summary of the years of experience of the beekeepers, including the minimum, maximum, lower quartile (1st Qu.) and upper quartile (3rd Qu.) as well as the median and mean number of years. Although for both online and postal respondents these range from 1 year to 60 or more years, the typical online respondent has about 5 or 6 years experience, compared to about 22 years for the postal respondents.

There was little difference in the number of apiaries managed (Tables 24 and 25). One postal respondent stated that they did not have any apiaries. Possibly their bees were kept in someone else's apiary, as only beekeepers with colonies in October were included here.

Four of the online respondents have 3 or more apiaries compared to only 1 of the postal respondents. The number of colonies kept was typically slightly larger for the postal respondents. Table 26 shows the number of colonies in October 2012 going into winter. One postal respondent kept 70 colonies, and the mean (average) number of colonies was higher (at 6.6), than the mean number for the online respondents (4.1), but the median

Statistic	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Online	1.000	1.000	1.000	1.372	1.000	5.000
Postal	0.000	1.000	1.000	1.238	1.000	6.000

Table 24: Distribution of the number of apiaries; one postal respondent did not reply

No. of apiaries	0	1	2	3	4	5	6
Online	0	65	14	5	-	2	-
Proportion	-	0.756	0.163	0.058	-	0.023	-
Postal	1	18	1	0	0	0	1
Proportion	0.048	0.857	0.048	-	-	-	0.048

Table 25: Frequency distribution of number of apiaries

(typical number) is not distorted by the very large number of colonies for that one beekeeper and it is a little higher at 3, than for the online beekeepers with a median number of 2 colonies. However this is a small difference, and it is also the case that one online respondent kept 42 colonies, which is also a large number of colonies to manage compared to what is typical.

Statistic	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Online	1.000	1.000	2.000	4.128	4.000	42.000
Postal	1.000	2.000	3.000	6.591	5.500	70.000

Table 26: Number of colonies in October 2012

There are proportionally more females in the online respondents, who also tended to be younger than the postal respondents (Tables 27, 28 and 29).

	online		postal		
	F	M	F	M	Declined to answer
Frequency	32	54	6	15	1
%	37.2	62.8	27.3	68.2	0.5 (rounded)

Table 27: Gender distribution for postal and online respondents

Most of the postal respondents were 50 or over, with 50% of then being at least 70 years old (Table 27).

Age group	40-49	50-59	60-69	70 or over
Frequency	2	5	4	11
Relative Frequency	0.091	0.227	0.182	0.500

Table 28: Frequency distribution of the age group of the 22 postal respondents

Age group	Under 20	20-29	30-39	40-49	50-59	60-69	70 or over	Missing
Frequency	1	1	1	12	23	32	14	2
Relative Frequency	0.012	0.012	0.012	0.140	0.267	0.372	0.163	0.023

Table 29: Frequency distribution of the age group of the 86 online respondents

3.5 Bee Races being kept

Beekeepers were asked which, if any, particular race of bee they were keeping, and also asked, if they did claim to be keeping a named race, on what evidence they based that claim.

The answers to the first question are summarised in Table 30. Note that 13 beekeepers failed to answer this question. Most claimed to be keeping a local strain of bee (51 respondents) or not to know what race they were keeping (33 respondents). The next most commonly claimed was *Apis mellifera mellifera* (the Northern European black bee) claimed by 22. Only 6 beekeepers claimed to keep the Buckfast bee.

Race reported	**Number claiming this**	**%**
Local strain of no named type	51	43.59
Apis mellifera mellifera (N. European black bee)	22	18.80
Apis mellifera carnica (the Carniolan race)	4	3.42
Apis mellifera ligustica (the Italian race)	0	0.00
The "Buckfast" strain	6	5.13
Any other named race	1	0.86
Don't know	33	28.21
Number responding	117	100.01

Table 30: The races of honey-bees the beekeepers believe they are keeping

The one beekeeper claiming to be keeping "another named race" stated that it was a cross between *A. mellifera mellifera* and *A. mellifera ligustica*.

Those who were claiming to keep a named race of bees were asked upon what grounds they based this claim, with the options shown in Table 31 below.

Basis of claim	**Number claiming this**	**%**
General appearance of the bees	13	43.3
What I was told by the supplier	12	40.0
A wing morphometry test	5	16.7
A genetic analysis of the DNA of the bees	0	0
Number responding	30	100

Table 31: The grounds on which beekeepers claimed to be keeping a particular race

Only 30 beekeepers answered this question. Most of them responded that they relied on the appearance of their bees or on what they had been told by the supplier of their bees. It is therefore quite possible that many of the stated black bee colonies, for example, are in fact hybridised. It would be interesting to investigate this further.

3.6 Queens and their Replacement

Two questions were asked about this topic. The first was the beekeeper's source of the majority of replacement queens. The results are summarised in Table 32.

Seventeen of the beekeepers failed to answer this question. Over half who responded stated that they used a queen from the colony being re-queened, with no effort therefore at selective breeding. Of those acquiring queens from outside their own enterprise, most were using a queen breeder within Scotland. None reported sourcing queens from overseas. The 10 who reported using an "other" source reported are shown in Table 33.

Beekeepers were asked how many queens they had replaced during the summer of 2012 because of (a) a policy of regular replacement of queens, (b) queen problems, (c) dealing with swarming preparations. The distributions of the percentages of all queen replacements made by a beekeeper for each of these reasons are summarised in Table 34.

It is clear that most replacements are made to deal with swarming problems. Averaging across all beekeepers, 61.2% of replacements are for this reason, a typical (median) percentage of replacements is almost 71% over all beekeepers in our sample. Typically beekeepers in Scotland are not replacing queens as part of a regular

Main source of queens	Number claiming this	%age of responses
The colony being re-queened	66	58.4
The beekeeper's selected queen	15	13.3
A queen breeder in Scotland	19	16.8
A queen breeder from elsewhere in the UK	3	2.7
Outside the UK	0	0.0
Other	10	8.8
Number responding	113	100.0

Table 32: The source of the majority of the beekeeper's replacement queens

Main source of queens	Number claiming this
No replacement queens	4
Local association	2
Local swarms	1
Scottish queen breeder (indirectly)	1
"Swarming"	1
Unspecified	1
Total	10

Table 33: Other sources of replacement queens

Reason	Regular replacement policy	Queen problems	Dealing with swarming
Minimum	0	0	0
Median	0	0	70.8
Mean	15.7	23.0	61.2
Maximum	100.0	100.0	100.0
Standard Deviation	31.8	37.6	42.3

Table 34: Distributions of Queen replacements

replacement policy. Note however that the proportion of replacements for any particular reason is very variable, as shown by the large standard deviations. Naturally these proportions will vary widely when the scale of most beekeeping enterprises is small.

The overall results are further summarised in Table 35, where the total numbers of queens reported as replaced are given, and also these numbers as a percentage of the numbers of colonies being managed in October 2012.

Reason	Total number	As a percentage of colonies
Regular replacement policy	37	7.3
Queen problems	29	5.7
Dealing with swarming	154	30.3
Totals	220	43.4

Table 35: Queen replacements summary

3.7 *Varroa*

3.7.1 *Varroa* awareness

Beekeepers were asked whether they believed that the *Varroa* mite is present in most bee stocks in their area. Of the 118 respondents to this question, 103 (87.3%) believed that the *Varroa* mite was present and 15 did not. For those who did not believe it was present, Table 36 shows the measures taken to detect any infestation.

Steps taken	Number doing this
Sent floor scrapings to SASA	5
Personally examined floor scrapings	6
Other	5
None	5

Table 36: Approaches used to detect *Varroa*

Unfortunately 5 of the 15 beekeepers were taking no measures to detect any *Varroa*. A few beekeepers used more than one approach. For those stating that they used another method, four checked/uncapped drone brood and one "Opened hive and inspected bees and cells for mites".

An indication of the areas where these 15 respondents' main apiaries are located is given in Table 37, from which it is clear that some of these are certainly in areas where *Varroa* is rife.

Area
AB51 (Aberdeenshire)
PA23 (Argyll and Bute)
EH51, Pencaitland
G46 (Greater Glasgow), Milngavie
IV3, IV4, IV32, IV36 (all Inverness area), Black Isle, PH31 (Highland)
KY11, KY12 (Fife)
TD6 (Scottish Borders)

Table 37: Approximate location of main apiary for beekeepers unaware of *Varroa* in their area

Of the 103 beekeepers who did believe that *Varroa* was in their area, rather worryingly 19 (18.4%) of them did not monitor the levels of *Varroa* infestation in their own bees. This is unfortunate as monitoring is necessary for timely use of Varroa control measures. For those who did monitor, most calculated daily natural mite drop (Table 38).

Monitoring method	Number of beekeepers
Calculating daily natural mite drop	66
Uncapping sealed drone brood	32
Other	17

Table 38: Method for monitoring level of *Varroa* infestation

Respondents commonly used more than one approach. Twenty four of the 103 monitored mite drop and uncapped drone brood. Five monitored mite drop and used another method. Four uncapped drone brood and also used another method. Two did all three. The other methods mentioned are listed in Table 39.

Table 40 shows the year when *Varroa* was first found in beekeepers' colonies, verifying that this was before 2012 for most. In addition one beekeeper who did not believe *Varroa* to be in most bee stocks in their area nonetheless stated that they had found *Varroa* in their own bees before 2012.

3.7.2 *Varroa* Control

Five questions were asked about *Varroa* control:–

Other Monitoring method	Number of beekeepers
Visual assessment of weekly drop, due to time constraints; *Varroa* floors in place	1
Check mite drop approx. every 10 days	1
Intermittent examination of mite drop through *Varroa* floor	1
Intermittent monitor of drop pre-/post-treatment	1
Observation of honeybees to check for *Varroa*-linked viruses, e.g. deformed wing	1
Personally examine floor scrapings	6
Personally examine floor scrapings and send to SASA	1
Scraping sent to SASA for analysis	1
Sacrificial drone brood	1
Visual observation	2
Observation of debris tray	1

Table 39: Other methods used for monitoring level of *Varroa* infestation

Year when *Varroa* first found	Number of beekeepers
Before 2012	80
In 2012	18
In 2013	1
Varroa not yet detected	4

Table 40: Year when *Varroa* was first found in colonies

25. Do you use open mesh floors on most of your hives as a control measure against *Varroa*?
26. Which, if any, of the biotechnical methods of *Varroa* control listed below do you apply to your bees?
27. Do you apply any chemical method of *Varroa* control to your bees?
28. If you do, do you apply the same chemical *Varroa* control treatment starting at the same time to all stocks in any one apiary?
29. In which of the months listed did you begin treatment with any of the chemical *Varroa* treatment agents listed below or with other chemical agents?

The use of Open Mesh Floors among respondents is summarised in Table 41.

Use of Open mesh floors	Number claiming this	% responses	Overall %
Use them	95	81.9%	73.1%
Do not use them	21	18.1%	16.2%
No response	14		10.8%
Total	130		100%

Table 41: Use of open mesh floors for most stocks

Fourteen beekeepers (10.8%) did not answer this question. Of the 116 who did answer, 95 (81.9%) said they used open mesh floors and the remaining 21 (18.1%) said they did not. Open mesh floors continue to be the favoured practice by most beekeepers.

Biotechnical methods for the control of *Varroa* are recommended as a useful supplement to chemical agents applied to kill them. The three proposed biotechnical methods suggested as possibilities in this survey were:–

- Dusting with icing sugar or other inert powder during hive inspections;
- Destruction of sealed drone brood cut from special trap combs;
- Queen trapping on brood frames with subsequent destruction of sealed brood from those trap frames.

Method	Number using this	% of beekeepers
Dust with icing sugar	42	32.3%
Destroy drone brood	25	19.2%
Trap queen & destroy brood	1	< 1%

Table 42: Use of biotechnical methods to control *Varroa*

A first analysis of the responses to this question are summarised in Table 42.

Some beekeepers clearly use none of these methods, but others use more than one. The details reported in the survey are in Table 43.

Number of methods used	Number using this	% of beekeepers
0	74	56.9%
1	44	33.8%
2	12	9.2%
3	0	0.0%
Totals	130	100%

Table 43: Use of multiple biotechnical methods to control *Varroa*

About 43% of the beekeepers responding reported using at least one biotechnical method of *Varroa* control.

However the principal means for controlling *Varroa* used by most beekeepers are the application of chemicals which can kill the mites. The responses to the question of whether they used such methods of *Varroa* control are summarised in Table 44.

Reponse	Number	% of beekeepers	% of responses
No	16	12.3	13.8
Yes	100	76.9	86.2
No response	14	10.8	

Table 44: Use of chemical methods to control *Varroa*

However snce some of the beekeepers claim to be living in areas where *Varroa* has not been detected, it would be reasonable for them to refrain from the use of chemical control measures. Adding this in as a further factor in the table yields Table 45.

Belief	Using chemicals	Number	% of use/non-use with this belief
Varroa	No	10	71.4
believed absent	Yes	4	28.6
Varroa	No	6	5.9
believed present	Yes	96	94.1
	No response	14	

Table 45: Use of chemical methods to control *Varroa*, believing *Varroa* is present or not

These responses show that most of the non-use of chemical controls is linked to belief that *Varroa* is not present in the area.

It is generally agreed that chemical methods work best if applied to all the stocks in an apiary simultaneously. Practice reported in this regard was that of the 130 beekeepers responding, 100 (76.9%) stated that this was their practice, and 16 (12.3%) said it was not. Fourteen beekeepers (10.8%) did not answer the question.

In 2013 there was quite a variety of such chemical methods of control available. The ones offered as routine answers to respondents to this survey were:–

A1 Apistan or Bayvarol strips, licensed veterinary medicines which use two different synthetic pyrethroids (tau-fluvalinate and flumethrin respectively);

A2 Apiguard, a licensed veterinary medicine based on thymol;

A3 A thymol-soaked pad made up by the beekeeper;

A4 Thymovar, another licensed veterinary medicine based on thymol;

A5 Oxalic acid, a simple organic acid, administered by the trickle method;

A6 Oxalic acid administered by the sublimation method;

A7 Formic acid, another organic acid, administered by any method;

A8 Apilife Var, a combination of the organic compounds thymol, eucalyptus oil, menthol and camphor.

Beekeepers were asked in which months, between November 2011 and Feburary 2013, they had applied any of these chemical treatments, or any others, which they were invited to name. The results for the named chemical substances month by month during the months specified were as shown in Table 46.

	Treatments									
Month	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**Totals**	**%**
Nov 11	6	5			4			1	16	8.8
Dec 11	1	1			9	3			14	7.7
Jan 12		1			5	6			12	6.6
Feb 12		1	1		3	1			6	3.3
Mar 12	2	1	2	1			1	1	8	4.4
Apr 12	1	2		1			3		7	3.8
May 12		1						1	2	1.1
Jun 12	1						1		2	1.1
Jul 12	1	1						1	3	1.6
Aug 12	6	7		2			3	3	21	11.5
Sep 12	13	5		1	1			3	23	12.6
Oct 12	3	3		1	4	1		1	13	7.1
Nov 12	1	2			3	1			7	3.8
Dec 12	1	1			19	4			25	13.7
Jan 13	1				10	5			16	8.8
Feb 13	1				1				2	1.1
Mar 13	1	1				1	2		5	2.7
Totals	39	32	3	6	59	22	10	11	182	100.0
%	21.4	17.6	1.6	3.3	32.4	12.1	5.5	6.0	100.0	

Table 46: Frequency of use of specified chemicals to control *Varroa*

As expected, the peak times for applying chemical control measures are the late summer and mid-winter. Now that there is evidence that many strains of *Varroa* in Scotland are becoming resistant to the synthetic pyrethroids, although the use of these was still widely reported, they were being passed in frequency of reporting by the two different modes of applying oxalic acid.

However it should be noted that all the measures under A2, A3 and A4 are based upon the use of thymol, and if these three columns are combined they account for almost 25% of the reported chemical control measures. If the use of the combined chemical treatment Apilife Var is added to the other uses of Thymol, then the use of that accounts for nearly one-third of all treatments.

Formic acid was not being widely used, no doubt because handling it is hazardous, though it is widely used elsewhere in Europe. Its use may become more common in Scotland in future now that safer preparations of it are available.

Beekeepers were also asked to report on any other chemical control measures they had applied. It is not so easy to tabulate their reports concisely. The other chemicals mentioned are:–

B1 “Apiary” (though what this means is not clear);

B2 Apistan/Bayvarol (which should have been included in the first set of responses);

B3 Apivar, an acaricide based on the pesticide Amitraz;

B4 Bee Vital Hive Clean, a proprietary product stated to contain propolis, oxalic acid and essential oils;

B5 Bienenwohl, a proprietary compound containing oxalic acid, citric acid, alcohol, propolis and essential oils;

B6 Hive Alive, a proprietary supplement to sugar syrup, said to be derived from grass and to protect against Nosema, Chalkbrood, Viruses and *Varroa*;

B7 Oxalic acid (which should have been included in the first set of responses);

B8 "Unspecified"!

B9 Varroa Guard, described as "a biodegradable beehive sanitising powder".

Their use is summarised as well as we can manage in Table 47.

	Treatments										
Month	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**Totals**	**%**
Oct 11		2	1	1						4	9.8
Nov 11										0	0.0
Dec 11										0	0.0
Jan 12							1			1	2.4
Feb 12										0	0.0
Mar 12									1	1	2.4
Apr 12	1		2						1	4	9.8
May 12									2	2	4.9
Jun 12									1	1	2.4
Jul 12									1	1	2.4
Aug 12		1	1						2	4	9.8
Sep 12			7	2	1	1		1	1	13	31.7
Oct 12			4		1	1		1		7	17.1
Nov 12										0	0.0
Dec 12										0	0.0
Jan 13										0	0.0
Feb 13										0	0.0
Mar 13						1				1	2.4
Apr 13			1			1				2	4.9
Totals	1	3	16	3	2	4	1	2	9	41	100.0
%	2.4	7.3	39.0	7.3	4.9	9.8	2.4	4.9	22.0	100.0	

Table 47: Frequency of use of other chemicals to control *Varroa*

The most frequently reported "other" chemical control measure is the use of Apivar, based upon the pesticide Amitraz, with Varroa Guard also frequently cited. The main seasons for the use of these "other"chemicals are spring and autumn, with little use of them in mid-winter or mid-summer.

3.8 Migratory Beekeeping and Pollination Contracts

Of the 130 beekeepers responding to the questionnaire, 17 did not answer the question concerning whether or not any of their colonies were contracted commercially for pollination services during 2012, and all the other 117 did not engage in such pollination contracts at all. Whilst commercial pollination is a feature of beekeeping in some other countries such as the USA, few or no beekeepers in Scotland appear to practise this based on our survey results so far. However this survey deliberately avoided approaching bee farmers, and for them the picture is almost certainly different.

Beekeepers were also asked whether any of their colonies were moved during 2012 for honey production. Of the 113 responding to this question, only 15 (13.3%) stated that they did move their colonies. These beekeepers moved from 1 to 64 colonies. Twelve out of 15 (80%) moved their bees only once, one moved them twice and two moved them three times. Most moves involved a round trip of 30 miles or less, though four beekeepers moved their bees between 50 and 70 miles.

3.9 Forage Crops

Beekeepers were asked to state on which of a number of different possible crops they believed their bees had foraged during 2013. The results are summarised in Table 48.

	Foraged		**Not foraged**		**No response**	
Crop	Number	%	Number	%	Number	%
Willow	79	60.8	7	5.4	44	33.8
Dandelion	81	62.3	9	6.9	40	30.8
Oil seed rape (early)	29	22.3	18	13.8	83	63.8
Top fruit (apples, pears, plums)	69	53.1	10	7.7	51	39.2
Raspberry	57	43.8	11	8.5	62	47.7
Oil seed rape (late)	10	7.7	21	16.2	99	76.2
Maize	1	0.8	22	16.9	107	82.3
Sunflower	8	6.2	21	16.2	101	77.7
Field bean	5	3.8	20	15.4	105	80.8
Clover	63	48.5	15	11.5	52	40.0
Bell heather	38	29.2	11	8.5	81	62.3
Lime (*Tilia*)	51	39.2	10	7.7	69	53.1
Rosebay Willow Herb	73	56.2	9	6.9	48	36.9
Ling heather	43	33.1	9	6.9	78	60.0
Himalayan balsam	33	25.4	17	13.1	80	61.5
Ivy	50	38.5	13	10.0	67	51.5

Table 48: Forage crops used by bees

The ones most frequently reported are the two early sources Dandelion and Willow, followed by Rosebay Willow Herb, Top Fruit, Clover and Raspberry. Both Lime and Ivy appear ahead of the traditional Scottish crop plant of Ling Heather, which is of course confined to moor and hill country.

Very few of those responding are prepared to commit themselves about Sunflower, Maize or Field Bean. Both Sunflower and Maize are rarely grown in Scotland, so ignorance about these is not surprising. However Field Bean is grown in many parts of the country, and is an important source to many Scottish beekeepers. There are also many who are unaware whether Late Oil Seed Rape is available to them. Possibly many beekeepers are unaware that autumn sowing flowers in April/May whereas spring sowings flower in mid to late June, so confuse these two sources.

Beekeepers were also asked to say if there were other sources of forage their bees had used. Of the 130 beekeepers responding, 47 did state that there were such plants available to them. They were then asked to state what these were.

A very wide range indeed of such "other" plants was mentioned. Those mentioned more than once are shown in Table 49, where they are listed in descending frequency of the number of times they were mentioned.

Crop	**Number of mentions**
Sycamore/Plane tree	17
Gorse	12
Cotoneaster	5
Hawthorn	4
Bramble	3
Horse chestnut	3
Hazel	2
Holly	2
Snowdrop	2
Thistle	2

Table 49: Other forage crops frequently named as being used by bees

Those mentioned only once are shown in the list below:–

Borage, Broom, Buddleia, Buttercup, Ceanothus, Chionodoxa, Cornflower, Crocosmia, Crocus, Currants, Daisy, Elder, Escallonia, Foxglove, Forget-me-not, Honeysuckle, Lavender, Lupin, Palm tree, Pea/sweet pea, Phacelia, Poached egg plant (*Limnanthes douglasii*), Poppy, Ragwort, Rhododendron, Rosa rugosa, Rowan, Runner bean, Salvia, Thyme, Wild fuchsia, Wild scabious.

Whether all these plants are really visited by honey-bees appears somewhat doubtful to us. For example Buddleia is generally said to have flowers too deep for honey-bees to be able to forage usefully on them.

Omitted from this report are many general observations about "garden flowers", "wild flowers" etc.

3.10 Management Issues

The first management question asked beekeepers approximately what proportion of brood combs they replace in production colonies each year. It is generally said that replacing old combs will reduce the burden of many pathogens within the hive, though drawing new comb is of course a burden on the colony.

This question was answered by 109 of the 130 beekeepers responding to the questionnaire. The results are displayed in Figure 2.

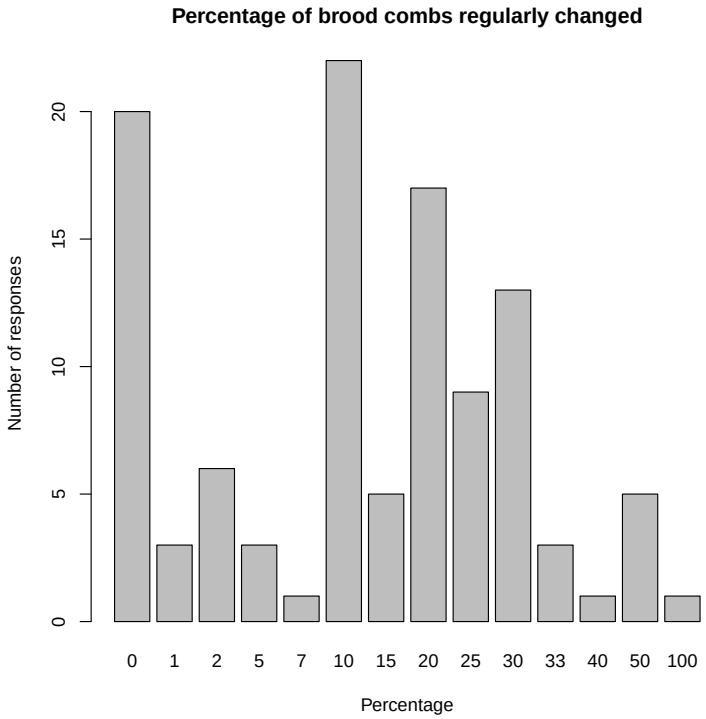

Figure 2: Percentage of brood combs regularly replaced

This bar-chart shows that there is widely varying practice among the beekeepers responding, so that there appears to be no guiding philosophy behind what most beekeepers are doing at present. The mean percentage reported as being replaced is a little over 16%, but as the standard deviation of these percentages is around 15% this is not really a good guide as to what is going on in practice.

It is worth noting however that 20 of those who responded, or 18.4% of them, stated that they replaced no brood comb. The most commonly reported percentages being replaced were between 10% and 30%.

The other management issue addressed was what feeding was being supplied to stocks by beekeepers. The responses are summarised in Table 50.

The "other" feeds mentioned were Ambrosia (which is a bee feeding syrup and could have been included elsewhere in the table) and also Nektapoll (which is a pollen substitute, and again could have been mentioned elsewhere), and "sugar bags" (a way of feeding solid sugar in winter, mimicking candy or fondant).

Type of feed	Season			
	Summer 2012	**Autumn 2012**	**Winter 2012–13**	**Spring 2013**
Sugar syrup	44 (33.8%)	66 (50.8%)	14 (10.8%)	36 (27.7%)
Bee feeding syrup	6 (4.6%)	27 (20.8%)	8 (6.2%)	13 (10.0%)
Candy/fondant	2 (1.5%)	9 (6.9%)	70 (53.8%)	29 (22.3 %)
Honey (not the colony's own)	2 (1.5%)	2 (1.5%)	0 (0.0%)	1 (0.8%)
Pollen substitute	2 (1.5%)	0 (0.0%)	1 (0.8%)	14 (10.8%)
Other	0 (0.0%)	3 (2.3%)	1 (0.8%)	5 (3.8%)

Table 50: Numbers and percentages of beekeepers stating they provide different feeds at different seasons

The table shows that most beekeepers are following text-book recommendations and feeding sugar syrup or bee feeding syrup in summer as needed, and in autumn almost universally to ensure stocks have ample reserves, feeding some form of solid sugar (candy or fondant) in the winter and early spring, and then returning to liquid feed in the later spring. Pollen substitute, if used, is usually only applied during the spring build-up.

3.11 Final Comments

A final question near the end invited all beekeepers to name any additional matters of concern to them which had not been covered elsewhere in the questionnaire.

Many topics were raised, but many of them could be grouped under a fairly small number of headings, which are summarised below in Table 51. Some respondents raised several concerns, and many raised none, so it is not possible to express these numbers as percentages in a meaningful way.

Topic	Number of mentions
Adverse effects of pesticides (especially neonicotinoids) on honey-bees	13
The adverse effects of the very bad spring of 2013	8
Habitat loss	4
Poor regulation of bee imports and movements	4
Introduction of *Varroa* by the malicious or ignorant to *Varroa*-free areas	2
Diseases with no adequate remedy at present (e.g. chalk-brood, nosema)	1
Genetically modified crops	1
Inadequate education for beekeepers	1
Lack of genetic diversity of honey-bees in areas with few stocks	1
Lack of information about agricultural sprays in use	1
Lack of supply of stocks of bees for new beekeepers	1
Lack of routine visits by bee inspectors	1
General concern that colonies seem to be less vigorous than they were	1

Table 51: Other concerns

3.12 Proportion supplying contact details

Of the 174 complete or partial responses received to the survey, only 58 had supplied no contact information and opted to remain completely anonymous. This means that one-third of all respondents had opted to remain completely anonymous. However if we restrict attention only to the 130 beekeepers who responded, 38 of them chose to remain anonymous, a proportion of 29.2% which is a little lower.

Of the 32 postal responses, 9 opted to remain anonymous, a rate of 28.1%. Among the online respondents, 47 out of 142 (33.1%) had supplied no contact details, which is higher. Of the online responses which were fully completed, there were 27 anonymous ones out of a total of 142, giving a proportion of 18.9% anonymous responses.

This is the first occasion on which the bulk of our responses were submitted online.

Probably the most influential factor which resulted in a higher rate of anonymous responses this year (for example in 2012 only 16% chose to remain anonymous), is that this year for the first time the invitation to

submit contact details was placed at the end of the questionnaire rather than at the beginning, so that only those respondents with sufficient perseverance to continue to the end of the questionnaire ever reached the question inviting the submission of contact details.

It remains true that the majority of respondents are willing to provide contact details.

4 Discussion

The major innovation in this survey was the use of an electronic survey package to approach potential respondents by email. Although there were a few teething problems, this was extremely successful and enabled us to carry out the survey at greatly reduced cost, and also to obtain a much higher response rate.

A shrinking but still fairly large number of SBA members still make no use of email, so a small number of postal questionnaires was also sent out. Some interesting differences were found between those responding electronically and those responding by post. These have been detailed above.

In future we expect to rely ever more heavily on electronic communication for such surveys.

There is no doubt that 2012–13 was a very difficult year for Scottish beekeeping. The summer of 2012 was very wet in much of the country, and the spring of 2013 did not really begin until well into May. Greatly increased loss rates of colonies were reported both in the summer of 2012 and also in the winter of 2012–13. There can be little doubt that the weather was an important factor in this.

What is intriguing however is that differential loss rates both between different regions of Scotland and also between colonies foraging and not foraging on Oil Seed Rape appeared in a completely different pattern this year, with the Centre suffering much worse than either the North or the South, and with foraging on Oil Seed Rape being associated with a greatly reduced rate of winter loss. Certainly in this year there is no evidence at all of any adverse effect on winter colony survival due to the use of neonicotinoid seed dressings on Oil Seed Rape.

The awareness of the extent of the spread of *Varroa* infestation is still patchier than might be expected, given the publicity it has received. There is evidently still a need to improve education about this.

On the other hand, many beekeepers are responding to reports of developing resistance in *Varroa* mites to synthetic pyrethroids by switching to newer chemical methods of control. This is an encouraging sign.

Appendix: questionnaire used

SBA Survey 2013
Questionnaire (Postal version)
A1 Preliminary questions

1. Were you keeping bees at any time between April 1st 2012 and May 1st 2013?

[A1.Beekeeper]

Yes/No

Please ring one.

2. If you answered 'No' to question 1:–

   (a) are you interested in becoming a beekeeper?

[A2.Interested]

Yes/No

Please ring one.

   (b) have you previously been a beekeeper?

[A3.Previously]

Yes/No

Please ring one.

If you answered 'No' to Question 1, this is almost the end of your questionnaire. Please turn now to Section R on the last page.

But if you answered 'Yes' to Question 1, please continue with the questionnaire.

Questions for practising beekeepers

A2 Beekeeper profile

3. For how many years have you been keeping bees?

Please insert number.

[A4.Experience]

4. In which age group are you?

[A5.Age.Group]

Please tick one box.

Under 20		20–29		30–39		40–49	
50–59		60–69		70 or over		I do not wish to answer	

5. Are you male or female?

[A6.Gender]

Please tick one box.

Male		Female		I do not wish to answer	

6. The SBA offers educational resources and support for beekeepers. Do you feel any need for education on any topic not currently offered by the SBA or not offered locally to the beekeeper?

[A7.SBA.Support]

Yes/No

Please ring one.

If 'Yes', please provide details below:

[A7aSBA.SupportDetail]

. . . . . .
. . . . . .
. . . . . .

B Beekeeping Activities Intro

7. For how many separate permanent apiaries do you have primary responsibility?

[B1.Apiaries]

Please insert number in the box above.

8. Do you keep all your bees within 10 miles of where you live?

[B2.ApiaryLocation1]

Yes/No

Please ring one.

9. For your main apiary, please give some indication of its approximate location (e.g., an abbreviated postcode, or a nearby town or village).

[B3.Apiary_Location2]

C Beekeeping Activities — Spring 2012 Colonies

Where numbers of colonies lost are asked for in the following questions, please consider a colony as lost if it is dead, or reduced to a few hundred bees, or alive but with unsolvable queen problems.

10. In total how many production colonies (i.e., queen-right colonies strong enough to yield a honey harvest or to provide a pollination service in season) did you have on April 1st 2012?

[C1.ColoniesApr12]

Please insert the number.

D Beekeeping Activities — Summer Losses

11. During the summer of 2012 (from April 1st till October 1st) what pattern of production colony losses did you have? Production colonies are colonies strong enough to give a honey harvest or provide a pollination service in season.

    Please give the total number lost in each way described below, and the overall total of losses.

    (Later questions will ask about losses in winter 2012–13 (October 1st 2012 to April 1st 2013).)

Pattern/cause of loss	**Number**	
Dead workers in cells and no food present in colony (starvation)		[D1.SummerStarvation]
Dead workers in cells and food present in colony (isolation starvation)		[D2.Summer_Isolation]
Death in a well-provisioned hive without dead bees in the hive or apiary		[D3.Summer_CDS]
Queen problems (queenlessness or drone-laying queen)		[D4.Summer_Queen]
Effects of *Varroa* infestation		[D5.Summer_Varroa]
Other (specify):		[D6.OtherKnownSLoss]
Specify other cause:		[D6a]
Unknown but different from any of the above		[D7.UnknownCauseSLoss]
Over-all total losses		[D8.Total.Loss]

12. Do the total summer losses you report agree with the total for all the different causes of loss? If the totals do not agree, can you please explain why?

    [D9.Loss.Tally]

    . . . . . .
    . . . . . .
    . . . . . .

E Beekeeping Activities — summer increase/decrease

13. Did you buy, sell, unite, split or promote (from nucleus to production status) colonies during the summer of 2012, or take swarms to keep (from April 1st to October 1st)?

    Yes/No

    Please ring one.

    If 'Yes' what changes in numbers of production colonies did you have

by buying colonies, making splits, taking swarms or promoting nuclei to production colonies?	+	[E1.SumBuySpltPrmtTk]
by selling or giving colonies away?	−	[E2.SumSellGive]
by uniting or merging colonies?	−	[E3.SumUnite]

F Beekeeping Activities — Colonies in October 2012

14. In total how many production colonies (i.e., queen-right colonies strong enough to yield a honey harvest or to provide a pollination service in season) did you have on October 1st 2012?

[F1.ColoniesOct12]

Please insert the number.

G Winter 12–13 Losses

15. During the winter of 2012–13 (from October 1st 2012 till April 1st 2013) what pattern of production colony losses did you have?

    Please give the total number lost in each way described below, and the overall total of losses.

Pattern/cause of loss	**Number**	
Dead workers in cells and no food present in colony (starvation)		[G1.WinterStarvation]
Dead workers in cells and food present in colony (isolation starvation)		[G2.Winter_Isolation]
Death in a well-provisioned hive without dead bees in the hive or apiary		[G3.Winter_CDS]
Queen problems (queenlessness or drone-laying queen)		[G4.Winter_QueenP]
Effects of *Varroa* infestation		[G5.Winter_Varroa]
Other (specify):		[G6.OtherKnownWLoss]
Specify other cause:		[G6a]
Unknown but different from any of the above		[G7.UnknownWLossC]
Over-all total losses		[G8TotalWinterLoss]

16. Do the total winter losses you report agree with the total for all the different causes of loss? If the totals do not agree, can you please explain why?

[G9.Winterloss.Tally]

. . . . . .
. . . . . .
. . . . . .

H Winter Increase/Decrease

17. By what number did you increase your number of production colonies between October 1st 2012 and April 1st 2013 by buying colonies or making splits of colonies?

by buying colonies or making splits?	+	[H1.Winter.Buy.Split]
by selling or giving colonies away?	−	[H2.WinterSellGive]
by uniting or merging colonies?	−	[H3.WinterUnite]

I Spring 2013 Colonies

18. How many production colonies did you have on April 1st 2013?

[I1.April13cols]

Please insert the number.

J Bee Races

Various races of the Western Honeybee (Apis mellifera) are kept by beekeepers in Britain. Some beekeepers specialise in specific races, though many accept the local strains of bees prevalent in their own areas, without any particular effort to maintain a pure race. It is believed that some races may be more resistant than others to the threats to bees which are appearing nowadays.

19. Which specific race (if any) of bees do you know with some confidence that you are keeping?
Please tick **only one** *relevant box.*

[J1.BeeRaceKept]

Local strain of no named type	
A. mellifera mellifera (the Northern European dark bee)	
A. mellifera carnica (the Carniolan bee)	
A. mellifera ligustica (the Italian bee)	
The "Buckfast" strain	
Any other named race (Specify below)	
Don't know	

20. If you chose "Any other named race": Please specify:

[J1a.SpecifyRace]

If you chose any named race please answer:–

21. On what evidence do you base this claim?

General appearance of bees	
What the seller told me I was buying	
Wing morphometry test	
Genetic test of the bees	

K Queens and their replacement

22. What is the origin of the majority of your replacement queens?

[K1.NewQueenOrigin]

Please tick one only and also add any required particulars.

The colony being re-queened			
One of your own selected queens			
A queen breeder in Scotland			
A queen breeder elsewhere in the UK			
Outside the UK		Country:	[K1a.OverseasQSource]
Other		Specify:	[K1b.OtherQSource]

23. For how many of your production colonies did you provide new queens between 1st April 2012 and 1st September 2012

[K2.QRepNos]

(a) because of a policy of regular replacement of old queens?

Please insert number.

(b) because of queen problems?

Please insert number.

(c) to deal with swarming preparations?

Please insert number.

L Varroa awareness

24. (a) Do you believe the *Varroa* mite is present in most bee stocks in your area?

[L1.VarroaInArea]

Yes/No

Please ring one.

Only if you answered "No" to question (a) please answer question (b).

(b) What steps (if any) did you take during the past year to detect any infestation of your bees with *Varroa*?

[L2.VarroaDetection]

Steps taken	**Please tick or leave blank**
Sent floor scrapings to SASA	
Personally examined floor scrapings	
Other (specify)	
None	

Only if you answered "Yes" to question (a) please answer questions (c)–(d).

(c) Do you monitor the levels of *Varroa* infestation in your bees?

[L3.MonitorVarroa]

Yes/No

Please ring one.

If 'Yes', please tick all the methods used:–

[L3a.VMonitoringMeths]

Calculating daily natural mite drop ☐

Uncapping sealed drone brood ☐

Other (specify) ..... [L3b. Other mon] ☐

(d) In which year did you first find any of your colonies of bees infested with *Varroa*?

[L4. Varroa Year]

Please tick the relevant box.

Before 2012	
In 2012	
In 2013	
Varroa not yet detected	

M Varroa control

25. Do you use open mesh floors on most of your hives as a measure against *Varroa*?

[M1.OpenMeshFloors]

Yes/No

Please ring one.

26. Which, if any, of the biotechnical methods of Varroa control listed below do you apply to your bees?

[M2.BiotechVControl]

Please tick all that apply.

Dusting with icing sugar or other inert powder during regular hive inspections.	
Destruction of sealed drone brood cut from special trap combs.	
Queen trapping on brood frames with subsequent destruction of sealed brood from those trap frames.	

27. Do you apply any chemical method of *Varroa* control to your bees?

[M3.ChemicalVTrtmnt]

Yes/No

Please ring one.

If you answered "Yes" to the last question please answer the next two questions.

28. Do you apply the same chemical *Varroa* control treatment starting at the same time to all stocks in any one apiary?

[M4.SimultaneousVCtrl]

Yes/No

Please ring one.

29. In which of the months listed did you begin treatment with any of the chemical Varroa control agents listed below or with other chemical agents?

[M5.WhichChemWhen]
[M6.OthChemVControl]

Possible treatments which have been used include: (1) Pyrethroid strips (Apistan/Bayvarol) (licensed veterinary medicines); (2) Apiguard (licensed veterinary medicine); (3) Thymol-soaked pad; (4) Thymovar; (5) Oxalic acid trickle method; (6) Oxalic acid sublimation method; (7) Formic acid; (8) Apilife Var. **You should add others if you have used them**.

Year	Month	Treatment(s) started
2011	November	
	December	
2012	January	
	February	
	March	
	April	
	May	
	June	
	July	
	August	
	September	
	October	
	November	
	December	
2013	January	
	February	
	March	

N Migratory Beekeeping and Pollination Contracts

30. (a) Were any of your colonies contracted commercially for payment for pollination services during 2012?

[N1.PollContrct]

Yes/No

Please ring one.

Only if you answered "Yes" to question (a) please answer qustions (b) and (c) below.

(b) How many times during 2012 were any of your bees contracted commercially for pollination services?

[N2.NoPollContrcts]

Please insert number of times.

(c) In total how many of your colonies were contracted for payment to provide pollination services during 2012?

[N3.NoPoll.Cols]

Please insert total number of colonies.

31. Were any of your colonies moved for honey production during 2012?

[N4.MigratYN]

Yes/No

Please ring one.

If you answered "Yes" to the last question, please answer the following three questions

32. How many of your colonies were moved for honey production during 2012?

[N4a.MigratCols]

Please insert number.

In the next question you are asked about the number of movements of your colonies. Please count moving to the honey flow and returning as one move.

33. How many times in 2012 were any of your colonies moved for honey production?

[N5.Migrt.Occasions]

Please insert number.

34. Approximately how many miles in total there and back were your bees moved on each double journey?

[N6.1.MigrtDists],[N6.2MigratDists2], [N6.3MigratDists3]

Occasion	**Distance there and back — miles**
First move	
Second move	
Third move	

O Forage crops

35. Have your colonies foraged during 2012 on:–

[O1.ForagePlants]
[O2]

Willow		
Dandelion		
Oil Seed Rape(early)		
Top fruit (apple, pear, cherry or plum trees)		
Raspberry		
Oil Seed Rape (late)		
Sweetcorn/maize		
Sunflower		
Field bean (Faba)		
Bell heather (Erica)		
Lime (Tilia)		
Rosebay willowherb (fireweed)		
Ling heather (Calluna)		
Himalayan balsam		
Ivy		
Other (first)		Specify
Other (second		Specify

P Management issues

36. Approximately what percentage of brood combs do you replace in your production colonies each year?

[P1.CombRep]

Please insert approximate percentage.

37. What feeding of your bees did you undertake in the past year?

[P2.Feeding]
[P3.OthFeed]

Please tick any box when a particular feed was used (or specify another feed).

Type of feed	**Season**			
	Summer 2012	**Autumn 2012**	**Winter 2012–13**	**Spring 2013**
	Used	Used	Used	Used
Sugar syrup				
Bee feeding syrup				
Candy/fondant				
Honey (not the colony's own)				
Pollen substitute				
Other: specify				

Q Final

Most of the questions in this survey address issues which are being investigated by the international COLOSS network, which monitors loss rates and factors implicated in colony losses in many countries, mainly in Europe. This is the fourth year we are making a contribution from Scotland to the COLOSS data collection.

This survey has dealt with those matters we believe are of primary concern to beekeepers in Scotland at present. But if there are other matters you are concerned about please tell us about them here.

[Q1.OtherConcerns]

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

R Contact details or anonymous response

If you are willing to do so, please give us your contact details so that the survey organisers can follow up with you any interesting points raised by your answers. Note however that you do not need to supply these, and if you do not, your response will remain anonymous. **If you supply your email address, we shall send you the key findings as soon as they become available, before the main report is published.**

Please give your contact details here:–

Name ..... [R1.Name]

Phone ..... [R2.PhoneNo]

email ..... [R3.email]

Postal Address ..... [R4.Address]

.....

.....

OR

I wish my response to this questionnaire to remain anonymous.

☐

Tick box if anonymous return desired.

Thank you for your help. We plan to publish the main findings of the survey in brief in "The Scottish Beekeeper" in late summer/autumn of 2013, and to make the full report available on the SBA web-site when it is finished.

Be assured that your identity will not be revealed in any report of this survey.