

Scottish Beekeepers' Association Survey 2010 Report

Magnus Peterson, Alison Gray, Calum Ruddock and Graeme Kerr

Department of Mathematics and Statistics,
University of Strathclyde,
Livingstone Tower, 26 Richmond Street, Glasgow G1 1XH

August 2012

1 Introduction

The two questionnaires for this survey are reproduced in the Appendices to this report. The report is organised around the structure of those questionnaires, so that successive topics are addressed as they appear there. There are also several investigations which use answers from more than one question, and these have been inserted at appropriate points in the report. The data from this survey were submitted to COLOSS (www.coloss.org), in an anonymised form, as part of their 2010 monitoring survey exercise and form part of a wider report covering multiple countries in Europe and beyond (www.ibra.org.uk/downloads/20120130_11/download) participating in the COLOSS project.

1.1 Design of the survey and response rate

A stratified random sample was taken, split proportionally between the four main SBA areas according to the SBA membership in each area, and then further sub-divided geographically. For the purposes of sampling, it was decided in this case to include the Outer Hebrides, Orkney and Shetland in the North Far-North sub-region, and the Inner Hebrides in the North North-West sub-region. A sample size of 200 was used, or 18% of the 1111 SBA members available for sampling after exclusion of bee farmers and those resident outside of Scotland, based on membership figures available in early June 2010.

Area	No. Members	No. sampled	Sub-region	No. sampled	Respondents	Response rate
Aberdeen	71	13		13	7	53.8%
East	562	101	East-Central North-East South-East	56 34 11	71	70.3%
North	246	44	Far-North Inverness & surrounding area North-West	17 17 10	32	72.7%
West	232	42	South-West West-Central	24 18	27	64.3%
Total	1111	200		200	137	68.5%
Bee farmers	16	16	-	-	-	-
Non-resident in in Scotland	45	-	-	-	-	-

Table 1: Membership and sample details

Of the 200 questionnaires sent out to the selected SBA members, 137 were returned, giving a high 68.5% response rate, broken down by area as above. The response rate for the Aberdeen area has been lower than in other areas in all three SBA surveys so far.

The high response rate over-all may be partially due to the use of a shorter and simpler questionnaire than in previous years, as well as the opportunity to take part in a prize draw for survey participants returning their questionnaire by the specified deadline, as Thorne's of Wragby and Newburgh had kindly provided a gift voucher as a prize. It was also possible this time to issue reminders to those not having responded to the survey, through the SBA membership secretary, who could be notified of the missing questionnaire numbers, could identify those concerned and hence issue a reminder.

Additionally 9 returns were received from bee farmers, keeping at least 40 colonies of bees, of whom 26 were sent a slightly shorter questionnaire (i.e. all those known as bee farmers from the SBA data base and all others identified as bee farmers in Scotland with the help of the Bee Farmers' Association). Of these 9 responses, one

respondent failed to answer any questions, leaving only 8 useable returns. The 8 bee farmers kept an average of 17.6 apiaries and an average of 467.1 colonies going into winter 2009/2010. The over-all winter loss rate they experienced in the winter of 2009–10 was 26.8% as compared with an over-all winter loss rate experienced by the beekeeping SBA respondents of 30.9%

Detailed winter loss analyses for SBA members and bee farmers are presented below in section 2.2.2.

2 SBA members only

2.1 Preliminary questions

- **Anonymous response**

Respondents were asked to disclose their contact details for the use of those conducting the survey, or, if they were not prepared to do so, to declare that they wished to remain anonymous. Of the 137 members of the SBA who responded, only 20 (15%) chose to with-hold their contact details.

- **Beekeepers and non-beekeepers**

Not all members of the SBA are active beekeepers, even when institutions such as libraries etc. have been excluded. Of the 137 respondents to the questionnaire, 21 (just over 15%) were not keeping bees in September 2009, so 116 respondents were beekeepers and answered further questions on their beekeeping experience and practices.

- **Interest in becoming a beekeeper**

There has been much informal reporting within Scotland in recent years of an upsurge of interest in beekeeping, with many beginners' classes being over-subscribed. For this reason it was decided to ask those respondents who were not beekeepers in September 2009 whether they were interested in becoming beekeepers. The result is shown in Figure 1.

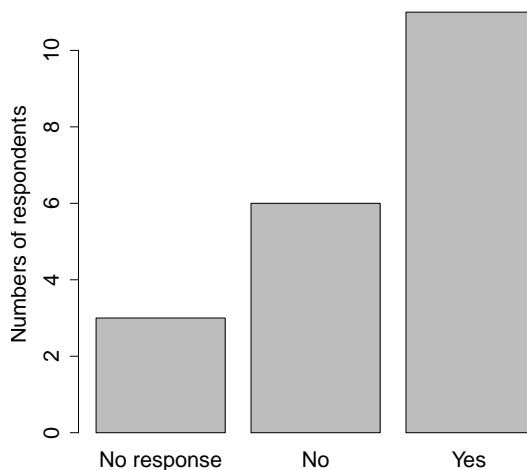


Figure 1: Distribution of interest in beekeeping among non-beekeeping respondents

Of the 21 non-beekeepers, 3 gave no answer to this question, 6 said they were not interested, but the remaining 11 — more than half the non-beekeepers in the sample — all said that they were interested in becoming beekeepers.

- **Former beekeepers**

The other main category of non-beekeepers who might well be members of the SBA are former beekeepers who for various reasons have given up beekeeping. Hence we also asked how many of the non-beekeepers

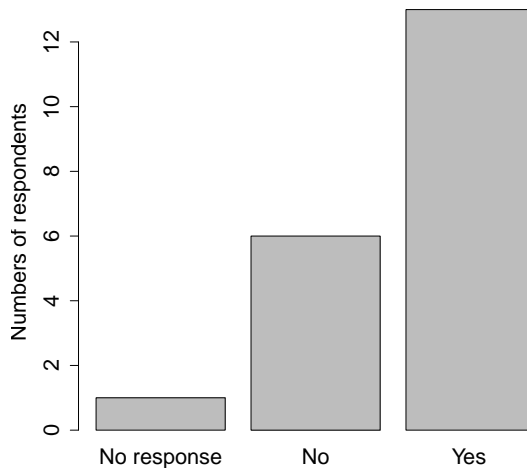


Figure 2: Numbers of those not keeping bees in Sep 2009 who had previously been beekeepers

had previously been beekeepers. The result is shown in Figure 2. Only 1 qualified respondent failed to answer this question, and 14 out of the 21 (67%) stated that they had formerly been beekeepers.

One obvious point emerges: since more than half the non-beekeepers are interested in becoming beekeepers, and two-thirds of them had formerly been beekeepers, it is clear that at least some of the former beekeepers are interested in taking up the activity again. From further response to other questions it is clear that these are mainly beekeepers who had lost all their stocks over the hard winter of 2008–09, and had not succeeded in re-stocking over the summer. This emphasises yet another point which is widely reported anecdotally, namely that getting new bees these days is quite difficult.

The distribution of the numbers of those wanting to start beekeeping again after losing their bees is shown, along with other information, in Table 2.

		Interested in beekeeping?			Totals
		NA	No	Yes	
Previous beekeeper?	NA	0	0	1	1
	No	0	1	5	6
	Yes	4	5	5	14
Totals		4	6	11	21

Table 2: Cross-tabulation of non-beekeepers who are interested in becoming beekeepers against those who have previously been beekeepers

Of the 11 respondents not keeping bees in September 2009 who are interested in becoming beekeepers, 5 had previously been beekeepers, and so presumably had failed to re-stock in summer 2009 from a total winter loss in 2008–09.

- **Length of time as a beekeeper**

Those respondents who were keeping bees were asked for how many years they had done so. Not all responded but the distribution of years of experience among those who did respond is shown in the histogram in Figure 3. This shape of distribution is “positively skewed”, and is perhaps not what would intuitively be expected in an activity often seen as one for which many of those still doing it are elderly and have been keeping bees for many years. Undoubtedly the new upsurge in interest in beekeeping has resulted in many new beekeepers appearing in recent years.

The mean number of years of experience is 17.3, but a better idea of a typical beekeeper’s years of experience

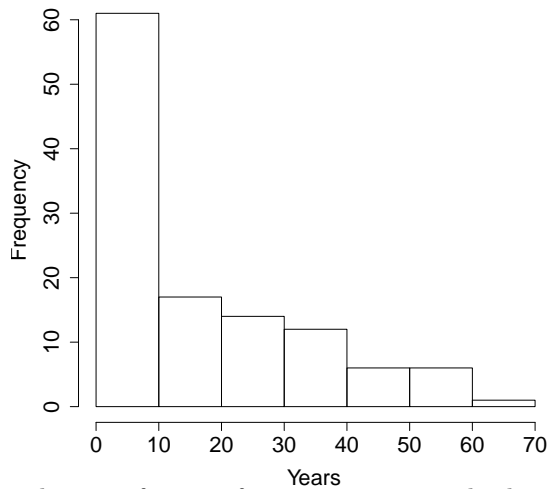


Figure 3: Distribution of years of experience among beekeeping respondents

for such skewed data is given by the median value which is just 10 years. Half the beekeepers have less experience than this, and half have more.

2.2 Questions posed only to active beekeepers

The main part of the questionnaire was aimed at those respondents who were actively keeping bees, and sought information about various aspects of their beekeeping activities and experience during 2009 and 2010.

As noted above, of the 137 SBA members responding to the survey, just 116 said they were actively keeping bees in September 2009. The analyses in the following section all relate to the responses made by these 116 people.

2.2.1 Location, scale and details of beekeeping activities

Dealing first with the SBA respondents, the following is the picture that emerges.

- **Where do you keep your bees? — SBA respondents**

Respondents were asked whether they kept all their bees “in their Home Area”, and if they said “No” they were asked to explain in more detail where they kept their bees. The responses to the first question are summarised in Table 3.

Yes	No	No Response
90 (77%)	23 (20%)	3 (3%)

Table 3: Do you keep all your bees in your Home Area?

The term “Home Area” was interpreted with varying degrees of strictness by different respondents. Of the 23 who said they did not keep all their bees in their Home Area, most managed one or two out-apiaries as well as a home apiary. Some did not have an apiary very near home, and so travelled away, but not usually more than 5 miles, to undertake their beekeeping activities.

- **What can you tell us of the race(s) of bees you mainly keep? — SBA respondents**

Respondents were asked to select, from a list, the race of bees which they mainly kept. The following were the listed races:

- Apis mellifera mellifera* (the native Northern European dark honey-bee);
- A. mellifera carnica* (the Carniolan honey-bee);

A. mellifera ligustica (the Italian honey-bee);
 the “Buckfast” strain;
 any other known and named race;
 local hybrids;
 non-local British bees of unknown race;
 imported bees of unknown race.

Interestingly many respondents claimed to be keeping more than one race, as shown in Figure 4.

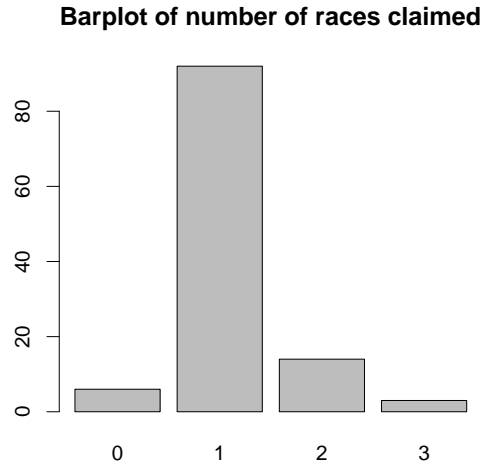


Figure 4: Distribution of numbers of distinct races of bees being kept

Given the propensity of the different races to inter-breed when queens are mating in free flight, as well as the high probability that queens will mate with drones from a completely different source than the beekeeper’s own apiary, it must surely be a matter of some doubt as to whether any beekeeper in Scotland practising the usual kind of small-scale beekeeping undertaken by most SBA members (see the next item below), can sensibly claim to be maintaining any pure racial strain without inter-breeding with other races.

The history of beekeeping in the UK in the early twentieth century included the time when beekeeping was devastated by the “Isle of Wight Disease”, and many beekeepers during the 1920s and 1930s re-stocked with bees imported from various parts of Europe: both Italian and French bees were then widely distributed across Scotland. Without detailed study, claims of pure racial strains being kept must therefore surely be worth investigating before they are accepted at face value.

The question of the present-day distribution of *Apis mellifera mellifera* in Scotland is in particular of great interest to the Bee Improvement and Bee Breeders’ Association (BIBBA). It has already been suggested that some members of that Association in Scotland may think it worthwhile for us to seek permission from those respondents who claim to be keeping bees of that race and who have given us their contact details, to allow us to pass those details on for possible contact and detailed study of the racial characteristics of their bees, either by wing morphometry, or by more sophisticated DNA analysis.

Table 4 shows the numbers of respondents who claimed to be keeping the different races of *A. mellifera* listed above.

Race claimed							
<i>mellifera</i>	<i>carnica</i>	<i>ligustica</i>	Buckfast	Other known race	Local hybrids	Non-local British	Imported
61	3	3	4	1	52	2	3

Table 4: Numbers of respondents claiming to keep the different races of bees specified above

More respondents claim to be keeping *A. mellifera mellifera* than any other race at all.

A few other points of interest are that the one respondent claiming another known race stated that his bees were of the Macedonian race (3 hives of this race), that the three imported stocks of bees came from Russia, from New Zealand, and from an unknown country. Of the three respondents who stated that their bees were of non-local British origin, two did not make any claim for the race of their bees, and the third claimed they were *A. mellifera mellifera* — this is the respondent who said he was also keeping Macedonian bees.

- **Scale of beekeeping enterprises of SBA respondents: numbers of apiaries and numbers of stocks of bees**

Respondents were asked how many apiaries they managed. The distribution of these numbers is shown in Figure 5.

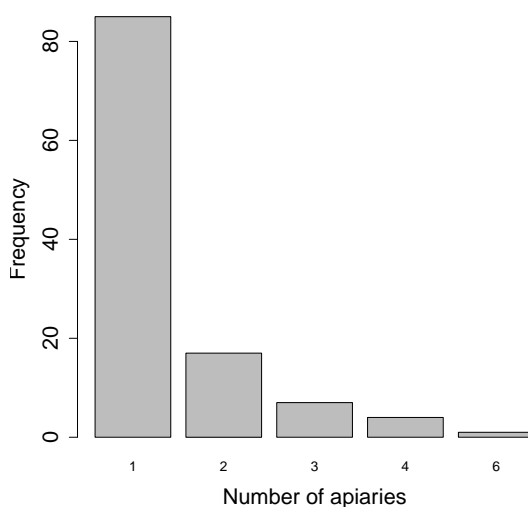


Figure 5: Numbers of apiaries being managed by respondents

Clearly most beekeeping respondents manage just one apiary. The number is 85 out of 114 who answered this question, or about 75%. Just 17 respondents manage 2 apiaries and only 11 manage more than 2. The largest number is 6 apiaries managed by just one respondent.

Respondents were also asked how many production colonies they had (i.e., colonies bigger than just a nucleus) at 3 different dates — in 2009 May 1st and October 1st and in 2010 May 1st.

Here we shall take as the baseline for the number of production colonies, the numbers reported on October 1st, since on May 1st beekeepers may well have reduced colony numbers due to winter losses in the preceding season, whereas in the autumn they will have presumably made use in most cases of the opportunities offered by the summer to increase their stocks.

The distribution of the numbers reported is shown in Figure 6.

Again the distribution is positively skewed. The mean number is just below 5 colonies, but as with all such skewed data, a better idea of the number of colonies typically being kept is given by the median, which is just 3 colonies. The largest number being kept by any of our respondents is 35, confirming that, at least for SBA members, most beekeeping enterprises are on a fairly small scale, assuming that our sample can be regarded as representative of the membership as a whole.

A related question of interest is whether those beekeepers managing more apiaries are also managing more colonies.

The scatter-plot in Figure 7 shows the relationship between these two variables. In fact there is no very clear relation between them. For example, the respondent managing the largest number of colonies (35) was then running only 3 apiaries, whereas the respondent managing 6 apiaries was on 2009 October 1 keeping only 3 production colonies! Presumably some of the apiaries were at that time unstocked, or else were being used simply for the raising of nucleus colonies. One beekeeper reports managing 24 colonies in a single apiary.

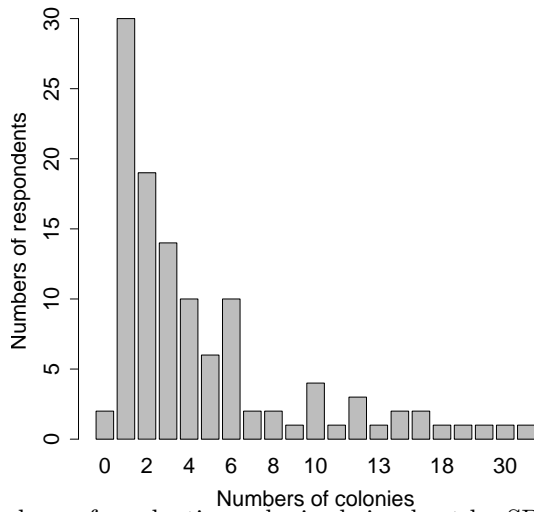


Figure 6: Distribution of numbers of production colonies being kept by SBA respondents at 2009 October 1

Unless that is a very productive area of bee forage, the fear for such an enterprise is that the colonies would compete strongly for the limited forage available, thus limiting the harvest they gave.

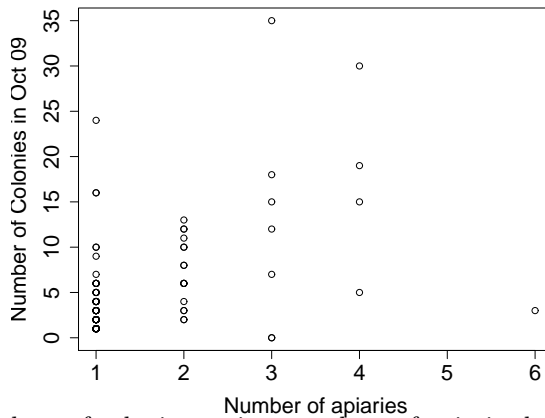


Figure 7: Scatter-plot of numbers of colonies against numbers of apiaries being managed (SBA respondents)

• **Types of hive being used by SBA members**

Respondents were asked which types of hives they used, the types suggested being Single Walled Wooden hives, Insulated Wooden hives (i.e., double walled or with some other form of insulation), Top Bar hives, Polystyrene hives or some other type. It was hoped that some light might be shed on which hive type allowed bees to thrive best in present-day conditions. Of course not many respondents could be expected to use more than one hive type, and undoubtedly some hive types — such as Top Bar hives — were likely to occur rarely.

Figure 8 and Table 5 show how frequently each hive type was mentioned by any respondent, and also how many different types were stated to be in use by individual respondents.

From Figure 8 it is clear that the overwhelming majority of beekeeper respondents use Single Walled Wooden hives, so that it is unlikely that this sample will reveal any significant difference between the results to be obtained with this and any other hive type. No beekeeping respondent claimed to be using any hive type other than one of those specified in the questionnaire. This is not surprising since types which many

beekeepers would regard as “different” — such as the Dartington Long Hive, for example — are Single Walled Wooden hives, though of an unusual design.

Only 16 of our beekeeper respondents were using the next most frequently reported type, namely the Insulated Wooden type, compared with 104 using Single Walled Wooden hives. To make comparison even more difficult, Table 5 showing the numbers of hive types being used by those beekeeping respondents stating that they used Insulated Wooden hives (the second most frequently claimed hive type) indicates that of these 16 respondents, only 6 use this type alone, all the others using them in conjunction with at least one other hive type. Thus very few beekeeping respondents used a hive type different from a Single Walled Wooden Hive as their sole hive type, so any comparisons that are made need to take account of differential performance within a respondent’s enterprise, rather than simply comparing the different performances of enterprises using the different hive types.

Finally Table 5 makes it clear that at least 4 of the beekeeping respondents did not answer this question adequately, since they did not identify any hive type that they were using.

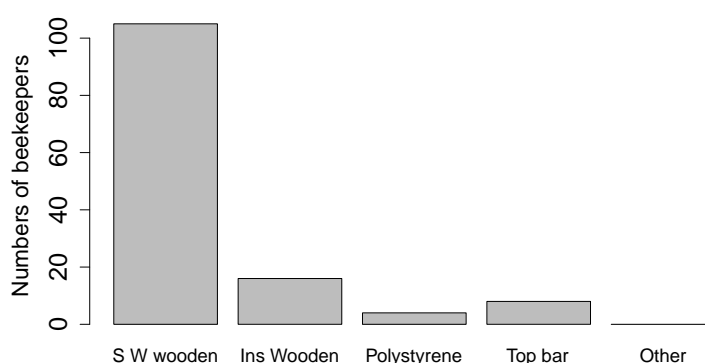


Figure 8: Bar-chart of numbers of beekeepers claiming to use different hive types

Numbers of hive types used	0	1	2	3
Frequency	4	92	19	1

Table 5: Numbers of beekeeping respondents claiming to use different numbers of hive types

The use of Insulated Wooden Hives (principally the WBC type) has been falling out of favour in recent years because it is a costly option and also not very easy to move. Table 6 shows that just 6 beekeepers responding to this question were using this as their only hive type.

Types used	Number using Insulated Wooden hives
1	6
2	9
3	1

Table 6: Numbers using Insulated Wooden hives against numbers of hive types used

Turning next to the bee farmers who responded, a very different picture emerges.

- **Where do you keep your bees? — bee farmers**

Only one of the bee farmers who responded was keeping bees in a single “home area”. The one exception is an enterprise confined to a single Scottish island. All others had apiaries distributed through an area at least the size of a county in Scotland.

Number of apiaries	4	8	9	10	12	18	20	60
Number of colonies in Oct '09	103	61	66	400	45	952	360	1750

Table 7: Sizes of the 8 bee farmers' enterprises — apiaries and colonies

- **What can you tell us of the race(s) of bees you mainly keep? — bee farmers**

As to the races of bees being kept, two bee farmers, one of whom is a specialised queen breeder, claim to be keeping *Apis mellifera mellifera* only. Almost all the others state that at least some of their bees are “Local Hybrids”, although one claims to keep only *A. mellifera mellifera* and *A. mellifera carnica*. Among those who state that some of their bees are local hybrids, one claims also to have *A. mellifera mellifera* and another to have both *A. mellifera mellifera* and an unnamed strain imported from New Zealand.

- **Scale of beekeeping enterprises of bee farmer respondents: numbers of apiaries and numbers of stocks of bees**

All the bee farmers who responded manage multiple apiaries, from 4 apiaries to 60, as compared to the SBA members who manage a maximum of 6 apiaries. The numbers of colonies being kept are also, for almost all the bee farmers, greater than any reported by the SBA members (who manage at most 35 colonies). The details are in Table 7:–

- **Types of hive being used by bee farmers**

Five of the eight bee farmers who responded use only Single Walled Wooden hives. The remaining three all use polystyrene hives, one of the respondents using this type exclusively, and the other two combining these with Single Walled Wooden hives. One of those using both types adds that 90% of the hives are polystyrene and 10% are wooden.

2.2.2 Colony Losses

- **Summer Losses**

Respondents were asked how many colonies they had lost during the summer of 2009. These summer losses were at a very low level, being fewer than 5% for the SBA members (23 colonies lost out of 502), and no reported losses at all for the bee farmers. There was felt to be little point in analysing these further.

- **Winter Losses**

Figure 9 plots the winter loss percentages experienced by the SBA members who responded, against the size of their operations, as measured by the numbers of production colonies they were managing in October 2009. Not unexpectedly, the small operations with very few hives had highly variable loss percentages.

A few adjustments have been made to the plot for clarity. Two reported inaccurately, one claiming to have gone into winter with 1 stock, but to have lost 2, another claiming to have gone into winter with 6 stocks but to have lost 7. Both these results have been suppressed along with the reports from two who went into winter with no colonies. The points have been plotted with some horizontal “jitter” so that the multiplicity of small-scale operators experiencing either 100% or 0% losses is more clearly shown. Finally the number of colonies has been plotted on a logarithmic scale, so that the bunching of results on the left is less extreme than it would be otherwise.

With two exceptions, the larger-scale operators all had loss rates below 50%.

Figure 10 shows the same thing for those bee farmers who responded.

With one exception (the business of the smallest size that responded) all the loss rates were below 50% in this group, and half the businesses had loss rates below 20%. The one exceptional business lost over 90% of the stocks over the winter, which was clearly a disaster.

Although in many respects the operations of the bee farmers and of the SBA members are not comparable, and although the questions asked of the bee farmers were more restricted than those asked of the SBA members, in the matter of winter loss rates it is legitimate to consider all the responses together.

The scatter-plot in Figure 11 does that. Again a logarithmic scale is used for colony numbers to avoid compressing the data for the small-scale beekeepers too much.

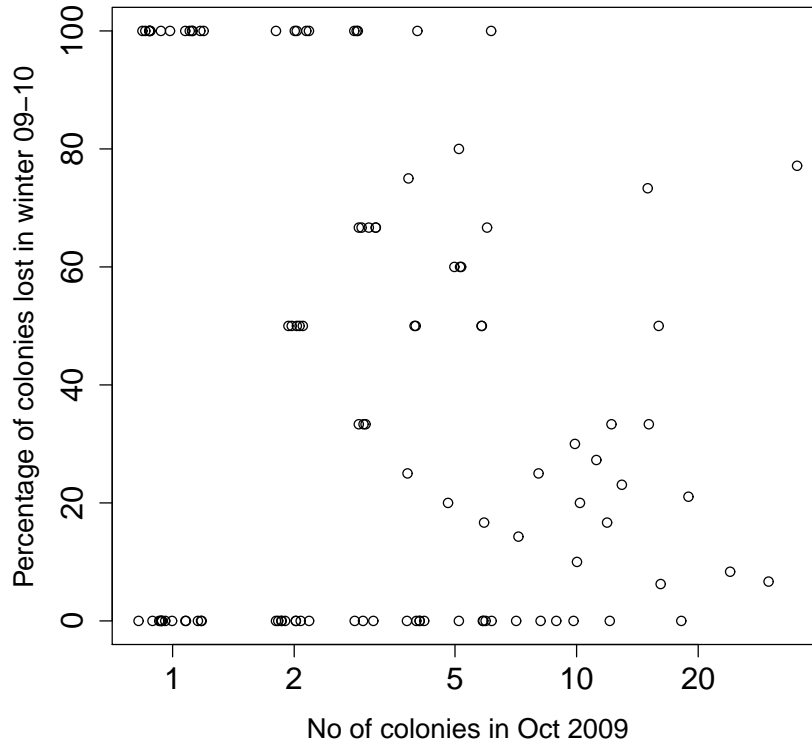


Figure 9: Scatter-plot of Winter Loss Rates for SBA members *v* Colony nos in October

From Figure 11 the winter loss rates experienced by the bee farmers appear lower than those experienced by the SBA members. Table 8 gives the actual figures for these over-all loss rates in the two separate groups and combined.

Group	Winter Loss Rate
SBA members	30.9%
Bee farmers	26.8%
Over-all	27.3%

Table 8: Winter loss rates in 2009–10 reported by the different groups of respondents

Testing for statistical significance of the difference between the over-all winter loss rate reported by the SBA members and that reported by the bee farmers, using Fisher’s Exact Test, showed that this difference is significant. The associated *p*-value is approximately 0.005, well below even the stringent cut-off level of 0.01. There is therefore strong statistical evidence that at least in this winter the bee farmers managed their bees more successfully than the SBA members.

When we bear in mind that the SBA members responding do include a small number of fairly large-scale operations, and that one of the bee farmers who reported had experienced a disastrously high level of winter loss, it must be the case that the difference between large-scale operations over-all and small-scale operations over-all is even more striking.

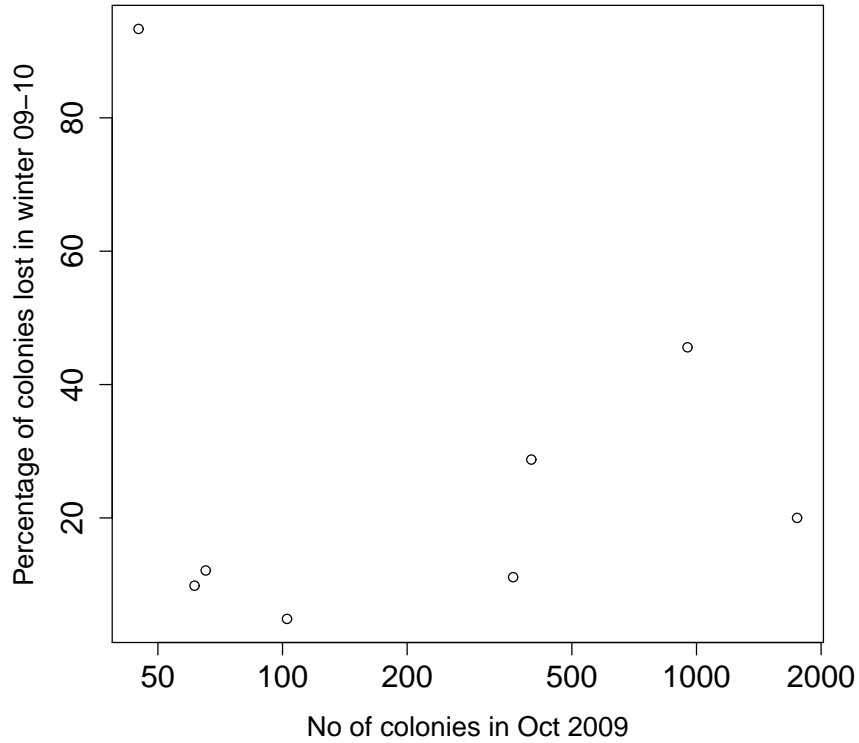


Figure 10: Scatter-plot of winter loss rates for bee farmers *v* colony numbers in October

- **Causes of loss**

Both SBA members and bee farmers were asked to assess how many of their losses over-all (during both summer and winter) were attributable to a number of different causes. The results are summarised in Table 9.

Cause	SBA members	Bee farmers	Total
Starvation	68 (36%)	22 (3%)	90 (8%)
Queenlessness	30 (16%)	326 (37%)	356 (33%)
Varroa	9 (5%)	474 (54%)	483 (45%)
“Mary Celeste” ¹	23 (12%)	7 (<1%)	30 (3%)
Nosema	7 (4%)	20 (2%)	27 (3%)
Acarine	1 (<1%)	0 (0%)	1 (<1%)
Other	28 (15%)	33 (4%)	61 (6%)
Unknown	25 (13%)	3 (<1%)	28 (3%)
Total	191	885	1076

¹ The “Mary Celeste” pattern of loss is the finding of a well-provisioned hive completely abandoned by bees.

Table 9: Numbers (and percentages) of over-all losses attributed to different causes

It is worth noting the very different patterns of loss found by the SBA members and the bee farmers. The SBA members are less good at ensuring their bees do not starve, but in general manage to keep on top of *Varroa*. The bee farmers on the other hand find *Varroa* an intractable problem. Both groups this year experienced a large proportion of losses due to queenlessness.

- **Differences in loss rates between apiaries**

Table 10 summarises how many of the respondents detected a difference in loss rates between the different

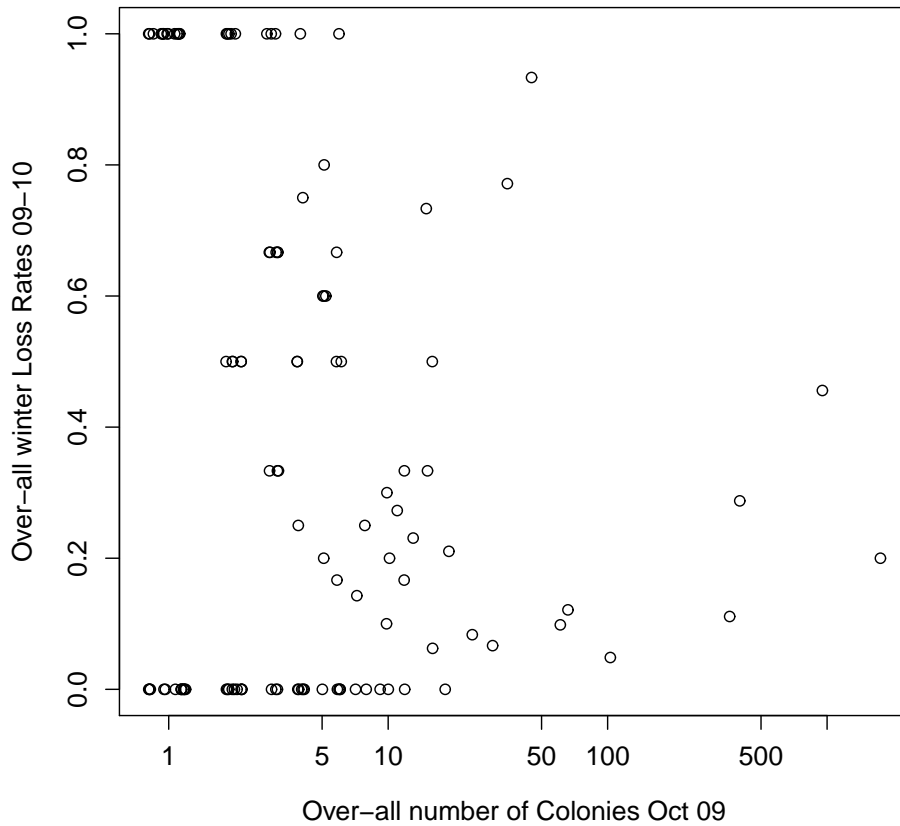


Figure 11: Scatter-plot of winter loss rates for all respondents v colony numbers in October

apiaries they were managing. The SBA members in most cases only manage a single apiary, so of course this question was not applicable to them.

Here again there is a notable difference between the SBA members and the bee farmers: 75% of the latter had observed differences in loss rates between apiaries, whereas only 25% of the SBA members to whom the question was meaningful had noticed such a difference. Bee farmers' apiaries are in general on a larger scale, and so the detection of such differences is easier for them.

- **Factors influencing winter loss rates**

Apart from the causes of loss indicated by respondents, there are various factors for which information was supplied by respondents which might possibly be associated with differences in winter loss rates. Those considered here will be:-

- Geographical position in Scotland.
- Likely presence or absence of *Varroa* in an area.

Situation reported	SBA members	Bee farmers
No response	27	1
Not applicable	82	0
No difference	21	2
Difference observed	7	6

Table 10: Numbers of respondents who detected different loss rates in different apiaries

Area	SBA members	Bee farmers
North	30% (49 out of 162)	46% (434 out of 952)
Centre	39% (108 out of 275)	28% (168 out of 609)
South	21% (27 out of 130)	18% (398 out of 2176)

Table 11: Different winter loss rates experienced in the North, the Centre and the South

Area	SBA members	Bee farmers
East	35% (140 out of 399)	28% (954 out of 3316)
West	26% (44 out of 168)	11% (46 out of 421)

Table 12: Different winter loss rates experienced in the East and the West of Scotland

– Geographical position in Scotland

The first approach to this is the breakdown of Scotland into three main areas according to latitude, namely the North, the Centre, and the South. For this approximate classification, those keeping bees north of Perth are regarded as being in the North, and those south of the Forth and the Clyde as being in the South, those in between being in the Centre.

Dealing with the SBA members and bee farmers separately, the different winter loss rates experienced in these areas are shown in Table 11.

The differences in loss rates observed are in both cases statistically significant, the p -value for Fisher’s Exact Test being less than 0.001 for the SBA members and being far smaller than this for the bee farmers. Clearly slightly different factors are at work in the two groups since the highest loss rates are not in the same areas, but the disastrous winter experienced by one bee farmer in the north probably accounts for this difference.

The second geographical approach was to split the country into East and West, with the SBA’s own administrative division being used for the part of the country south of Inverness, and a straightforward split for the north of the country according to whether the respondent was on the east or west coast. Respondents from Orkney and Shetland were excluded from these calculations, as being neither clearly in the east or the west. The results are shown in Table 12, indicating clear differences between the west and east of Scotland, with loss rates in the east being much higher.

What the causal mechanism for these differences is must remain speculative, but certainly the more intensive agriculture of the east of Scotland, as compared with the west, may lead one to conclude that the suspected harmful effects of neonicotinoid pesticides may be leading to higher winter losses of honey-bee colonies in the east of the country.

Once again the differences in these loss rates are statistically significant, the p -values being 0.04 for the SBA members and far less than 0.001 for the bee farmers.

2.2.3 Migratory Beekeeping

Most commercial beekeepers migrate their bees regularly to take advantage of seasonal honey flows from different sources (such as oil seed rape or heather), and sometimes also to fulfil pollination contracts. In the previous SBA survey in 2008, it was found that rather few members of the SBA do this. Most beekeeping members of the SBA are small-scale hobbyist beekeepers, and this is reflected in the sample we obtained in 2010 (see 2.2.1 above).

The only question asked on this topic in the present survey was:-

Did you move any hives of bees to a temporary location to take advantage of a seasonal honey flow in 2009?

Table 13 shows the responses given by beekeepers in this sample.

Migration		
No response	No	Yes
5	97	14

Table 13: Numbers of beekeeping respondents practising migratory beekeeping

Only 14 (12%) of the beekeeping respondents stated that they practised migratory beekeeping at all. Most of them (97, or 83%) did not. The remaining 5 respondents did not answer this question.

2.2.4 *Varroa* and its management

A major preoccupation of almost all beekeepers in Scotland these days is the management of *Varroa*, since most managed stocks succumb to this if they are not treated within a very few years. There are a few remote areas of Scotland where *Varroa* has not yet been found, and the first question on this topic attempted to find out what proportion of beekeeping members of the SBA had not yet encountered it, or had only recently met it.

The remaining questions on this all dealt with methods of management.

- **In which year did you first find any of your colonies infested with *Varroa*?**

The responses are summarised in Table 14. Unfortunately it became apparent on inspecting some of the more puzzling data from SBA respondents who claimed that their stocks were “Not yet known to be infested” that these were beginning beekeepers in areas where *Varroa* has been endemic for a number of years, but who interpreted the question literally, and were merely saying that they had not yet personally verified that their stocks had the infestation, although they almost certainly did have it. For this reason the frequency of this last response is certainly not measuring the quantity which was really of interest, namely what proportion of Scottish beekeepers still live in *Varroa*-free areas of the country. No such difficulties arise with the bee farmers, of whom only one claimed to be *Varroa*-free. His base is an isolated Scottish island, so his claim is almost certainly well founded.

	No Response	Before 2009	In 2009	In 2010	Not yet known to be infested
SBA members	28	75	10	2	22
Bee farmers	1	7	0	0	1

Table 14: Numbers of beekeeping respondents claiming different times of arrival of *Varroa*

Discounting the SBA responses in the last category as unreliable, it is apparent that the majority of respondents do live in areas where the mite is endemic, and for most it has been a problem for more than 2 years.

- **What treatments or precautionary measures have you used against *Varroa* in the last year?**

There is much information contained in the responses to this question. Table 15 and Figure 12 summarise the number of treatments used across the 3 seasons (Autumn 2009, Winter 2009–10 and Spring 2010) which the survey covered.

Only 6 SBA respondents (5%) were taking no precautions against *Varroa*. The majority (94 [81%]) were using between 1 and 6 treatments in all across the three seasonal periods covered by the survey.

No of Treatments used	0	1	2	3	4	5	6	7	8	9
No of SBA beekeeping respondents	6	12	21	15	10	17	19	8	6	2

Table 15: Numbers of SBA beekeeping respondents using different numbers of treatments

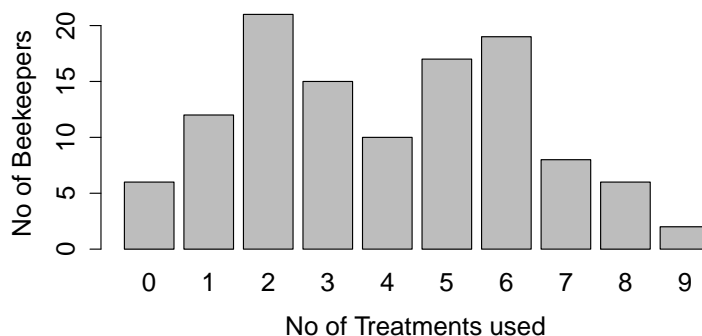


Figure 12: Bar-chart of numbers of beekeepers using different numbers of treatments

Table 16 shows which treatments were most frequently used at the different seasons, which treatments were most frequently used over-all, and in which seasons most treatments for *Varroa* were carried out.

Treatment	Season			Totals
	Autumn09	Winter09–10	Spring10	
Apistan/Bayvarol	60	9	12	81 (18%)
Apiguard	14	4	5	23 (5%)
Other Commercial preparation	2	1	1	4 (1%)
Oxalic acid trickle method	10	37	7	54 (12%)
Oxalic acid sublimation method	9	12	7	28 (6%)
Formic acid	3	0	4	7 (2%)
Thymol	4	1	2	7 (2%)
Other chemical preparation	0	0	0	0 (0%)
Drone Brood Removal	11	3	16	30 (7%)
Dusting with icing sugar	12	2	17	31 (7%)
Open mesh floor	71	60	64	195 (42%)
Totals	196	129	135	460

Table 16: Frequency of use by SBA members of the different treatments suggested at the three different seasons covered

Clearly the most commonly used measure of all is the fitting of open mesh floors instead of solid ones to hives. Experience has shown that in general bees do well over these floors, and they involve no application of potentially dangerous chemicals to the honey production process. It is fairly well established that they do tend to reduce levels of infestation to some degree. Clearly also when they are in use they are a permanent alteration of management technique, rather than an occasional treatment.

Apart from that, the most commonly used treatment was the use of the two licensed pyrethroid based strips Apistan and Bayvarol. There is now considerable apprehension that mites in Scotland are becoming resistant to this medication, but they were at this date still the main method in use. They are being used most frequently in autumn, as is recommended practice.

Interestingly the second most commonly used treatment was oxalic acid, by the trickle method. If the use of both methods of application of oxalic acid are combined, then this was in fact outstripping Apistan and

Bayvarol combined. As these treatments rely upon there being little brood present in the colony, again, as recommended, most treatments were being applied in winter, with some exceptions.

Apiguard, the other licensed veterinary medicine, was less popular than any of the treatments mentioned above, but was more used than any other chemical treatment.

The other biotechnical methods (apart from the use of open mesh floors) — i.e., drone brood removal and dusting with icing sugar — were also quite widely used. Clearly drone brood removal can only be practised when drone brood is present, so it is a puzzle why 3 respondents claimed to be using this technique in winter, but it is probable that this is more widely practised than this survey suggests, as the main time for carrying it out will be mid-summer, a season not covered by the survey.

- **Reason for initiating *Varroa* treatment**

Respondents were asked whether they initiated *Varroa* treatment (a) always after finding excessive levels on monitoring, (b) always as a seasonal routine or (c) sometimes for the first of these reasons and sometimes for the second. The results are summarised in Table 17.

	SBA members	Bee farmers
No response	37	1
Not applicable	4	1
Always due to monitoring result	4	0
Always as a seasonal routine	65	4
Not always the same reason	27	3

Table 17: Reason for initiating *Varroa* treatment

It is notable that very few always treat as a result of findings on monitoring levels. Clearly this is one of the fundamentals of Integrated Pest Management which is poorly observed both by the SBA members and the bee farmers.

2.2.5 Supplementary feeding

One question was asked on this topic:–

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

Respondents were offered the choice of 6 different types of feed:–

- Sugar syrup;
- Ambrosia (a proprietary liquid syrup feed for bees, containing invert sugar);
- Candy/fondant;
- Pollen patty feed product;
- Feed supplement (specify);
- Honey;
- Other (specify).

They were also asked to select from the following list of seasons, those ones in which any particular feed had been used. The list was:–

- Summer 2009;
- Autumn 2009;
- Winter 2009–10;
- Spring 2010.

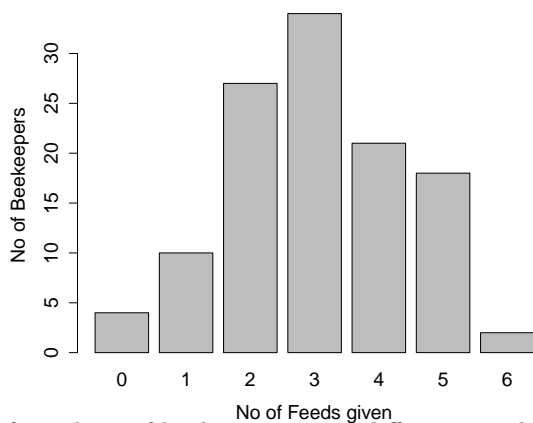


Figure 13: Bar-chart of numbers of beekeepers using different numbers of feeding opportunities

The responses are summarised in Figure 13 and Table 18.

Only 5 beekeeping respondents had not fed their bees at all during the period covered by the survey. Most had fed between 2 and 4 times, with the most common being to feed on 3 occasions during these seasons, although 2 beekeepers had fed their bees as many as 8 times.

Feed type	Season				Totals
	Summer 09	Autumn 09	Winter 09–10	Spring 10	
Sugar Syrup	24	75	20	48	167
Ambrosia	6	20	10	10	46
Candy/fondant	2	5	48	10	65
Pollen patty	1	0	2	14	17
Other Supplement	0	1	0	2	3
Honey	6	12	12	11	41
Other Feed	2	2	6	3	13
Totals	41	115	98	98	352

Table 18: Frequency of use of the different feed types at the different seasons

The most commonly used feed type was *sugar syrup*, and that was used most frequently during the autumn. The next most common was to feed *candy or fondant* during the winter. Both of these are long-established and orthodox feeding regimes.

The use of the proprietary feed *Ambrosia* — for most a more expensive option than sugar syrup — was confined to 46 uses over-all, with again most uses in autumn.

Almost all use of *pollen patties* for feeding was confined to the spring (14 instances) with only 3 others in all, 1 in summer and 2 in the winter.

Only 3 respondents recorded using any *other supplement*.

Honey had been fed on 41 occasions, which is surprisingly high considering that it is not a recommended food substance because honey brought in from outside the enterprise carries the risk of bringing in disease, and also because it causes such excitement that instances of serious inter-colony robbing are often attributed to its use. However comments added by respondents showed that in many cases this “feeding” amounted to restoring to the bees some of the shallow boxes in which they had stored their own honey, so that it could more appropriately be described as sacrificing some of the possible crop for the welfare of the stock.

2.3 “Other concerns”

The final sections of the questionnaires used for this survey invited respondents to detail any “other concerns” they had about beekeeping. Many used this opportunity, so much so that it is impracticable to quote them all here. However there were certain themes that cropped up repeatedly, and a few comments under each of these headings are reproduced below. Unless it is indicated that the comment is anonymous, the respondent has supplied contact details, but these are not reproduced here.

- **General concerns about disease**

“...Also hygiene in the apiary e.g., preventative measures e.g., disinfectant mat, wearing clean overalls, clean tools etc can all help to eliminate diseases, but do beekeepers practise this?”

“Insufficient bee inspectors, therefore the only disease monitoring open to beekeepers is self-assessment, with the result that outbreaks of AFB and EFB, chalk-brood, sac-brood and Nosema remain undiscovered due to lack of recognition by the inexperienced. The ring of silence due to British privacy laws should be abolished so that serious outbreaks can be reported far and wide — you shouldn’t have to be in an Association to discover details as to when and WHERE an outbreak has occurred, this information should be made widely available. ALL beekeepers should be registered as per the English system, then everyone could be inspected as a matter of routine and disease outbreaks kept in check not remain undiscovered as per the current serious problems for the past 2 or 3 years.”

“In view of the level of disease now in Scotland I would welcome mandatory examination of all hives by experts and action taken to control all aspects of disease with support where necessary.”

“Hygiene — keep all equipment as clean as possible. Regularly remove old frames. Rehouse old boxes.”

- **In particular concerns about the treatment of *Varroa***

“I have found beekeepers locally who have treated with a pyrethroid based product have suffered with large infestations of *Varroa*, probably due to resistance.”

“I am of the view that Apistan is less effective than previously.”

“Failure to control *Varroa* effectively rendered the bees susceptible to viruses and other diseases. Resistance to Apistan and Bayvarol is probably widespread, Apiguard is unsuitable for treating heather bees, yet access to Apivar is complex and expensive. I assume my losses are relatively normal because Apivar has provided effective control.” [A bee farmer]

- **Environmental concerns, and concerns about pesticide use**

“Bees have lived on earth for millions of years and have no doubt experienced many challenges to their survival. People who advocate destruction of feral colonies should consider, the bees’ natural ability to survive in the wild, and the fact that they could be a source of healthy bees in the future.”

“... Is there a way of monitoring the possible effects of farm pest and weed controls on bees? Also, the effects of fewer farm crops being grown — i.e., loss of bio-diversity?”

“I am worried about pesticides and the implications this may have on colonies. It should be investigated further ...”

- **Breeding local bees versus importing bees (and the role of the native black bee)**

“Breeding from *Varroa*-resistant feral colonies: native black bee breeding — Colonsay.”

“The threat from commercial operators importing bees, potentially affecting the native bee due to cross-breeding and disease. Many commercial hives can be close to small apiaries.” [Anonymous]

“Do your best to get the black bee into Scotland.”

“I’ve been an ‘overseas’ member of the SBA for some years. On return to Scotland I’ve found it impossible to source ‘local’ bees, and am not prepared to buy from England.”

“All beekeepers should be encouraged to increase the number of colonies and also produce quality queens in order to secure the survival of the honeybee.”

3 Concluding comments

3.1 Principal findings of interest

3.1.1 Non-beekeeping members of the SBA and the distribution of experience among beekeepers

Among ordinary SBA members resident in Scotland it appears that around 15% were not active beekeepers in 2009–10, but more than half of these were interested in becoming beekeepers.

About two-thirds of the non-beekeepers had been beekeepers formerly, and a fairly high proportion of these wished to take it up again. Interest in beekeeping appears to be growing strongly, but it is not easy nowadays to procure bees if either one has lost them or one has never had them before.

In support of this picture, the median length of experience of SBA respondents was 10 years, so that half of the beekeeping respondents had 10 years or less of experience.

3.1.2 Races of bees being kept

Of the 116 beekeeping SBA respondents, 61 (about 53%) claimed to be keeping the race *Apis mellifera mellifera* (the native Northern European Dark Bee). Only 45% claimed they were keeping a local strain of mixed race. It is in our view extremely unlikely that all claims of keeping a pure race are well-founded, particularly as some claim to be keeping several distinct races, but not in isolated apiaries. However checking such claims would not be easy.

3.1.3 Colony Losses

Summer losses, as expected, were at a very low level.

However winter losses revealed many interesting features. The over-all rate of winter loss reported was 27.3%, but this was significantly higher at 30.9% among the SBA members than among the bee farmers, who lost only 26.8%. This is a higher rate of winter loss than that reported for either the winter of 2006–07 (16.2%) or 2007–08 (21.2%) in our previous survey of 2008. Unfortunately we have no data for the winter of 2008–09. But there does appear to be a worrying trend to higher rates of loss in winter. This is even more worrying when it is realised that the appropriate figure to use in comparing like with like is the 30.9% loss rate reported by the SBA members, since the bee farmers were not included in the earlier survey.

The most frequently reported causes of winter loss among the SBA members were starvation (36% of losses), and queenlessness (16%), but the categories of “Other” and “Unknown” combined accounted for 28% of reported winter losses. Among the bee farmers, the leading cause of loss cited was *Varroa* (45%), followed by queenlessness (33%), all other cited causes being at much lower levels.

The “Mary Celeste” pattern of loss — the analogue of “Colony Collapse Disorder” reported as a serious problem in the USA, where a well-provisioned hive is found completely abandoned with no dead bees — was only reported in 12% of losses by SBA members, and in fewer than 1% of cases by the bee farmers. It does occur in Scotland, but was not a major problem here in the winter of 2009–10.

Apart from the significantly lower loss rate reported by the bee farmers, the data show significant regional variations in winter loss rates.

Splitting Scotland into a North, a Central and a Southern region, the highest winter loss rate reported by the SBA members was in the Central region (39%) and the lowest in the Southern region (21%) with the Northern region reporting 30% losses. Among the bee farmers the highest winter loss rate was 46% in the Northern region, with 28% in the Central region and 18% in the Southern region. It is suggested that this last result may have been unduly influenced by one bee farmer in the north, who had a major disaster over winter.

Splitting the country between East and West also showed significantly different rates of winter loss, with East loss rates being much higher than for West for both the SBA members and the bee farmers. Perhaps this may be related to the more widespread use of agricultural pesticides by the more intensively managed farms in the east of the country.

Appendix 1: the SBA Questionnaire

Questionnaire

Contact details or anonymous response

Unless you indicate you are willing to be contacted by the SBA for possible follow-up of your answers, your responses will remain anonymous. If you are willing to be contacted, **please give your contact details here:-**

Name.....

Address.....

.....

Phone.....

email.....

OR

I wish my response to this questionnaire to remain anonymous. (Tick Box)

Section 1: Preliminary questions

1. Were you keeping bees at 1st September 2009?

Yes/No (Please ring one.)

2. If you answered 'No' to question 1,

(a) are you interested in becoming a beekeeper? Yes/No (Please ring one.)

(b) have you previously been a beekeeper? Yes/No (Please ring one.)

3. If you answered 'Yes' to question 1, for how many years (approximately) have you been keeping bees?

No. of years..... (Please insert number.)

If you answered 'No' to Question 1, this is the end of your questionnaire. Thank you for your participation. Please return the Questionnaire as instructed.

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

SECTIONS FOR PRACTISING BEEKEEPERS

Section 2: Location, scale and details of your beekeeping activities

4. Do you keep **all** your bees in your own home area?

Yes / No (Please ring one.)

If 'No', please describe the approximate location(s) of your apiaries:

.....

.....

.....

5. Various races of the Western Honeybee (*Apis mellifera*) are kept by beekeepers in Britain. What can you tell us of the race(s) of bees you mainly keep?

Please tick the relevant box(es)

- A. mellifera mellifera* (the native British bee)
- A. mellifera carnica* (the Carniolan honeybee)
- A. mellifera ligustica* (the Italian honeybee)
- The "Buckfast" strain
- Any other known and named race (*specify*)
- Local bees, probably hybrid, of unknown race
- Non-local British bees of unknown race
- Imported bees of unknown race
- (*Specify country of origin if known*).....

6. How many separate apiaries do you manage?

7. If you have more than one apiary, were any winter losses noticeably different between apiaries?

Yes / No (Please ring one.)

8. 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:

Please insert numbers in the table below

1 May 2009?	
1 October 2009?	
1 May 2010?	

9. Please indicate which of the following hive types you use in your beekeeping.

Tick all that apply.

Single-walled wooden	
Insulated wooden (double-walled or other insulated)	
Top-bar hives	
Polystyrene hives	
Other (Specify).....	

Section 3: Recent losses of colonies

10. How many colonies did you lose (i.e., unplanned colony deaths) during the following periods?

Insert numbers in table below where possible. An overall total only is still useful.

Period	Number lost
1 May 2009 – 30 Sep 2009	
1 Oct 2009 - 31 Dec 2009	
1 Jan 2010 - 28 Feb 2010	
1 Mar 2010 - 30 Apr 2010	
Total winter 2009-10	

11. Please specify below the number of colonies you believe were lost due to each reason given below.

If the reason is unknown, include this in the "Unknown" row. Space is available to include any extra information which you feel may be of use to us.

Reasons	Number Lost	Additional comment you may wish to make (such as additional stress on colony due to moving bees or some other cause)
Starvation*		
Queenless or poor queen		
Varroa		
"Mary Celeste"***		
Nosema		
Acarine		
Other		
Unknown		

* Including isolation starvation where cold has kept the cluster from reaching stores.

**The "Mary Celeste" type of loss occurs when the hive is found abandoned with no dead bees present, in the hive or round it in the apiary, with plenty of stores in the hive.

12. If you use more than one type of hive, did winter losses differ in the different types of hive? Please add your comments below:

.....

.....

.....

Section 4: Migratory beekeeping

13. Did you move any hives of bees to a temporary location to take advantage of a seasonal honey-flow in 2009?

Yes / No (Please ring one.)

Section 5: Varroa and its management

14. In which year did you first find any of your colonies of bees infested with *Varroa*?

Please tick the relevant box.

- Before 2009
- In 2009
- In 2010
- Not yet known to be infested

15. What treatments or precautionary measures have you used against *Varroa* in the last year?

Please tick the relevant boxes in the table below.

	Autumn 2009	Winter 2009-10	Spring 2010
Apistan/Bayvarol			
Apiguard			
Other commercial preparation Specify.....			
Oxalic acid (trickle)			
Oxalic acid (sublimation)			
Formic acid			
Thymol			
Any other remedy prepared by the beekeeper using a chemical ingredient. Specify.....			
Drone brood removal			
Dusting with icing or powdered sugar, or ground rice			
Open mesh floors			

None			
-------------	--	--	--

16. Were the measures you used against *Varroa* (apart from the use of open mesh floors) undertaken as a result of monitoring the level of infestation in the hives, or purely as a seasonal routine?

Please ring (a), (b) or (c) below:

- (a) all after finding excessive levels on monitoring.
- (b) all as a seasonal routine.
- (c) some as a routine seasonal measure, and some as a result of monitoring.

Section 6: Supplementary feeding

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

Type of feed	Summer 2009	Autumn 2009	Winter 2009-10	Spring 2010
Sugar syrup				
Ambrosia				
Candy/fondant				
Pollen/ patty feed product				
Feed supplement. (Specify)				
Honey				
Other. (Specify)				

Section 7: In conclusion

18. In this survey, we have investigated the scale and details of beekeeping activities, losses of colonies and their possible causes, migratory beekeeping, the management of *Varroa* and the feeding of colonies. If there are other matters which you think are of importance to beekeepers in Scotland, about which you would like to comment, then please add your comments below:

.....

.....

.....

.....

.....

.....

.....

Thank you for your help.

We hope to report the results of this survey in a future issue of “The Scottish Beekeeper”. Your data will also be contributed in an anonymous way to the international COLOSS survey.

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

Appendix 2: the Bee Farmers' Questionnaire

QUESTIONNAIRE

Section 1: Location, size and details of your beekeeping enterprise

1. Please describe the approximate location(s) of your apiaries:

.....

.....

.....

2. Various races of the Western Honeybee (*Apis mellifera*) are kept by beekeepers in Britain. What can you tell us of the race(s) of bees you mainly keep?

Please tick the relevant box(es)

- A. mellifera mellifera* (the native British bee)
- A. mellifera carnica* (the Carniolan honeybee)
- A. mellifera ligustica* (the Italian honeybee)
- The "Buckfast" strain
- Any other known and named race (*specify*)
- Local bees, probably hybrid, of unknown race
- Non-local British bees of unknown race
- Imported bees of unknown race
- (Specify country of origin if known)*.....

3. How many separate apiaries do you manage?.....

4. Were winter losses noticeably different between different apiaries you manage?
 Yes / No (*Please ring one.*)

5. 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:

Please insert numbers in the table below

1 May 2009?	
1 October 2009?	
1 May 2010?	

6. Please indicate which of the following hive types you use in your beekeeping.

Tick all that apply.

Single-walled wooden	
Insulated wooden (double walled or other insulated)	
Top-bar hives	
Polystyrene hives	
Other (Specify).....	

Section 2: Recent losses of colonies

7. Approximately how many colonies did you lose (ie unplanned colony deaths rather than by sale or destruction) during the following periods?

Insert numbers in table below where possible. An overall total only is still useful

Period	Number lost
1 May 2009 – 30 Sep 2009	
1 Oct 2009 - 31 Dec 2009	
1 Jan 2010 - 28 Feb 2010	
1 Mar 2010 - 30 Apr 2010	
Total winter 2009-10	

8. Please specify below the approximate number of colonies you believe were lost due to each reason given below.

If the reason is unknown, include this in the "Unknown" row. Space is available to include any extra information which you feel may be of use to us.

Reasons	Number Lost	Additional comment you may wish to make (such as additional stress on colony due to moving bees or some other cause)
Starvation*		
Queenless or poor queen		
Varroa		
"Mary Celeste"***		
Nosema		
Acarine		
Other		
Unknown		

* Including isolation starvation where cold has kept the cluster from reaching stores.

**The "Mary Celeste" type of loss occurs when the hive is found abandoned with no dead bees present, in the hive or round it in the apiary, with plenty of stores in the hive.

9. If you use more than one type of hive, did winter losses differ in the different types of hive? Please add your comments below:

.....

.....

.....

Section 3: Migratory beekeeping

10. On average, how many moves did your hives make in 2009 for a seasonal honey-flow?

(Please insert number.)

Section 4: *Varroa* and its management

11. In which year did you first find any of your colonies of bees infested with *Varroa*?

Please tick the relevant box.

- | | |
|------------------------------|--------------------------|
| Before 2009 | <input type="checkbox"/> |
| In 2009 | <input type="checkbox"/> |
| In 2010 | <input type="checkbox"/> |
| Not yet known to be infested | <input type="checkbox"/> |

12. Were the measures you used against *Varroa* (apart from the use of open mesh floors) undertaken as a result of monitoring the level of infestation in the hives, or purely as a seasonal routine?

Please ring (a), (b) or (c) below:

- (a) All after finding excessive levels on monitoring.
- (b) All as a seasonal routine.
- (c) Some as a routine seasonal measure, and some as a result of monitoring.

Section 5: Supplementary feeding

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

Type of feed	Summer 2009	Autumn 2009	Winter 2009-10	Spring 2010
Sugar syrup				
Ambrosia				
Candy/fondant				
Pollen/ patty feed product				
Feed supplement. (Specify)				
Honey				
Other. (Specify)				

Section 6: In conclusion

14. In this survey, we have investigated sizes and details of beekeeping enterprises, losses of colonies and their possible causes, migratory beekeeping, the management of *Varroa* and the feeding of colonies. If there are other matters which you think are of importance to beekeepers in Scotland, about which you would like to comment, then please add your comments below:

.....

.....

.....

.....

.....

Thank you for your help.

We hope to report the results of this survey in a future issue of “The Scottish Beekeeper”. Your data will also be contributed in an anonymous way to the international COLOSS survey.

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