Scottish Beekeepers' Association

Survey of Members 2008

Report on the survey results

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1. Introduction

Following the survey of Scottish Beekeepers' Association (SBA) members in 2006, a second survey was carried out in late spring of 2008 to monitor the ongoing effects of *Varroa*, observed rates of colony loss, and other factors which had been considered in that earlier survey. An additional range of questions explored both attitudes to and possible effects of a range of environmental factors which have been widely postulated as possible contributors to the widely publicised difficulties experienced by some beekeeping enterprises in recent years, both in the UK and elsewhere in the world, particularly the United States.

In contrast to the 2006 survey, this one had the advantage of being able to use the SBA's database of membership records to assist in selecting the sample for surveying. Using that as a sampling frame, after excluding the small number of members who had indicated to the SBA that they wished to be excluded from all such survey work, we had a population of size 1038 of which 986 were resident in Scotland, and so eligible to participate in the survey. They were distributed among the four main SBA areas and elsewhere as shown in Table 1.1.

Table 1.1: Distribution of SBA members willing to participate in surveys

Area	Number	Percentage within Scotland
Aberdeen	68	6.9
East	445	45.1
North	212	21.5
West	244	24.7
Outlying areas of Scotland	17	1.7
Total within Scotland	**986**	**100.0**
Outside Scotland	52	
Overall total	**1038**	

From this population a sample of size 110 was randomly chosen divided among the four main SBA areas, using optimal allocation based upon the variability of three separate quantities: the incidence of *Varroa* amongst areas as reported by respondents from those areas in 2006, mean enterprise size (average number of colonies kept in the two Octobers covered by the 2006 survey) and mean winter loss rate (average of the two winter loss rates, defined as number of colonies lost over each of the two winters covered by the 2006 survey divided by number of colonies kept in the preceding October). The results from these three separate allocations were averaged to give the resulting sample allocations to each area. These sample sizes within the main areas were divided proportionally to the membership within sub-regions of those areas determined by postcode, the North area being subdivided into the Far North, Inverness and surrounding sub-region, and the North-West; the East area being subdivided into the North-East sub-region, the Central sub-region and the South-East sub-region, and the West being subdivided into the West Central sub-region and the South-West sub-region. The Aberdeen area was not subdivided.

In addition a sample of size 9 (about a 50% sample) was randomly chosen from among members in those parts of Scotland which are not included within the main areas, namely the Inner and Outer Hebrides, Orkney and Shetland (labelled "Outlying areas of Scotland" above. Inner Hebrides included Mull and Islay, but not Skye, which was sampled as part of the Far North). This deliberate over-sampling of the outlying areas was done because it was felt important to have information from these island regions where conditions for beekeeping are very different from what holds in most of Scotland. In the summary tables which follow however, the information from these outlying areas has been included with that from the North area, since geographically these outlying regions are within that area.

Table 1.2: Sub-division of areas and LAs included in each sub-area for use in the 2008 survey

Area	Sub-division	Local Associations included
Aberdeen		Aberdeen & District
East	Central	Dunblane & Stirling; Dunfermline & West Fife; East Lothian; Edinburgh & Midlothian; Peebles-shire;West Linton & District
	North-east	East of Scotland; Fife; Fortingall; Freuchie; Kirriemuir; Perthshire
	South-east	Border; Caddonfoot
North	Far North	Dingwall; Easter Ross; Olrig; Skye & Lochalsh; Sutherland;
	Inverness and surrounding area	Inverness-shire; Moray; Nairn & District
	North-west Outlying areas	Lochaber; Oban; Mull; other Inner Hebrides*; Outer Hebrides*; Orkney*; Shetland*
West	South-west	Ayr & District; Kilbarchan & District; Kilmarnock & Irvine; Largs & District; South of Scotland; Western Galloway
	West-central	Cowal; Eastwood; Glasgow & District; Helensburgh & District; Kelvin Valley
* No local association		

Table 1.3: Membership numbers and numbers sampled from each area and sub-area

Area	Sub-region	No. of members	Total	No. sampled	Total Sampled
Aberdeen		68	**68**	6	**6**
East	Central	242		15	
	North-east	156		10	
	South-east	47	**445**	2	**27**
North	Far North	77		8	
	Inverness and surrounding area	98		10	
	North-west	37	**212**	4	**22**
North	Inner Hebrides	4		2	
	Outer Hebrides	6		3	
	Orkney and Shetland	7	**17**	4	**9**
West	South-west	139		31	
	West-central	105	**244**	24	**55**
Outside Scotland		52	**52**	0	**0**
Total		**1038**	**1038**	**119**	**119**

The use of Local Association Secretaries and Area Representatives for sample selection in the 2006 survey meant that though the sample was not randomly chosen, and so could not justifiably have a strong claim to be representative of the SBA membership, the personal contact was a probably important factor resulting in a very high response rate of 77%. Unfortunately the random and impersonal nature of the sample selection this time probably contributed to what was in the end a disappointingly low number of responses, namely 50 out of a total of 119 questionnaires, giving a response rate of 42%. The possibility of non-response bias with such a low response rate once more means that we cannot make any very strong claim to have here a representative sample of SBA members, despite our endeavours to ensure that the selection process was unbiased.

In order to comply with Data Protection law, the responses returned only allowed the identification of the respondent, in so far as the respondent revealed it, each questionnaire being identical, with no identifier on it as sent out by the Membership Secretary. Of the 50 respondents, 8 (16%) wished to remain anonymous and provided no contact details, and only limited geographical information. However, most respondents did give full contact details.

Table 1.4: Tally for Discrete Variables: Area

Area	Count	Percent
Anonymous/missing	2	4
Aberdeen	1	2
East	13	26
North	11	22
West	23	46
Total	50	

As table 1.4 shows, it was possible to establish the SBA area of all but 2 of the respondents from information provided, using the address or postcode (regarded as having a high degree of certainty) or own local association code (reasonable certainty). There were 23 (46%) respondents from the West area, 13 (26%) from the East, 11 (22%) from the North, and only 1 from the Aberdeen area.

2. All respondents

In selecting a random sample of SBA members to receive the survey questionnaire, it was expected that some respondents would not be active beekeepers themselves. Six of the respondents (12%) were not beekeepers at the time of the survey or in the two years previously, although one of these was interested in becoming a beekeeper. This section of this report analyses the responses from all those who returned the questionnaire, since the questions in it could be answered meaningfully whether or not the respondent was a beekeeper. Later questions which apply to beekeepers only are analysed in the next section.

2.1 Membership of Local Associations affiliated to the SBA

Table 2.1

Member of local Association	Count	Percent
No	16	32.65
Yes	33	67.35
Total	**49**	
[Failed to answer]	1	

Table 2.2 below shows that of the respondents 33 (67% of those answering the question) were members of one or more Local Beekeeping Associations (LAs) affiliated to the SBA, including 4 of the non-beekeepers. Surprisingly perhaps, 15 (34%) of the beekeepers were not LA members.

Table 2.2: Distribution of LA membership among beekeepers and non-beekeepers
Upright figures in parentheses are percentages of entries in rows.
Italic figures in parentheses are percentages of entries in columns.

Member of a LA	Non-beekeepers	Beekeepers	Over-all
No	1 (6.25) *(20.00)*	15 (93.75) *(34.09)*	16 (100) *(32.65)*
Yes	4 (12.12) *(80.00)*	29 (87.88) *(67.35)*	33 (100) *(67.35)*
Over-all	5 (10.20) *(100)*	44 (89.80) *(100)*	49 (100) *(100)*
[No response]	[1]	0	[1]

Over-all, 16 of the forty-eight respondents who answered the relevant question were not members of any Local Association, 28 were members of just one, and 4 of them were actually members of more than one Local Association (their home area LA plus one other).

About 90% of respondents live within the area of a Local Association. The 5 that did not do so live in outlying areas, specifically Islay, Lewis or Shetland. Only 2 other respondents did not provide details of their own LA. Amongst all the Local Associations, Largs and District, Helensburgh and District, and Edinburgh and Midlothian were most heavily represented in the survey, with 4 or 5 respondents each.

The representation of the different Local Associations among the respondents to this survey is summarised in Table 2.3 overleaf.

Table 2.3: Representation of Local Associations among respondents

Local Association	No of respondents	Percentage of LA members in sample
1. Aberdeen and District	1	2.3
2. Ayr	2	4.6
3. Border	0	0.0
4. Caddonfoot	0	0.0
5. Cowal	0	0.0
6. Dingwall	0	0.0
7. Dunblane & Stirling	2	4.6
8. Dunfermline & W. Fife	1	2.3
9. East Lothian	0	0.0
10. East of Scotland	0	0.0
11. Easter Ross	1	2.3
12. Eastwood	0	0.0
13. Edinburgh & Midlothian	4	9.3
14. Fife	3	7.0
15. Fortingal	0	0.0
16. Freuchie	0	0.0
17. Glasgow & District	2	4.6
18. Helensburgh & District	4	9.3
19. Inverness-shire	1	2.3
20. Kelvin Valley	1	2.3
21. Kilbarchan & District	1	2.3
22. Kilmarnock & District	0	0.0
23. Largs & District	5	11.6
24. Lochaber	1	2.3
25. Moray	2	4.6
26. Mull	0	0.0
27. Nairn & District	1	2.3
28. Oban	0	0.0
29. Olrig	2	4.6
30. Peebles-shire	2	4.6
31. Perthshire	0	0.0
32. Skye & Lochalsh	0	0.0
33. South of Scotland	3	7.0
34. Sutherland	1	2.3
35. West Linton & District	3	7.0
Total	**43**	**100**
[No LA membership or no response]	[7]	

Among the respondents 38% of those who were members attended meetings of their home area Local Association regularly, 32% attended occasionally, and 19% never attended. All of the non-beekeepers who were members of Local Associations attended occasionally, although 9 of the beekeepers (21%) never did.

2.2 Awareness of the "Mary Celeste" phenomenon and beliefs about its presence in Scotland

A problem of particular concern at present is the sudden unexplained loss of honeybee colonies, in which a colony seen previously to be apparently prospering is suddenly found to have collapsed, and the hive in which it was housed is found abandoned, with no bees, or very few, left, but with plenty of food left in the hive. In our 2006 survey this phenomenon was called the "Mary Celeste" phenomenon, but has been called "Colony Collapse Disorder" (CCD) in the USA and elsewhere. As no definite cause for this has been yet established however, it is by no means certain that it is the same phenomenon that is being observed everywhere. The next few questions sought to explore whether members of the SBA were aware of this phenomenon, and whether they believed it to be already present in Scotland.

Of all the respondents, 65% (32) were very aware of the Mary Celeste phenomenon (or CCD). A further 29% were quite aware of this, and only 3 respondents were not aware of it at all. About 95% of beekeepers were quite aware or very aware of this.

Despite this strong awareness, only 22 (44.9%) of 49 respondents making any entries in this section believed that MC/CCD was present in Scotland at the time of the survey in spring 2008. On the other hand, only one of those active beekeepers who had experienced such sudden colony loss believed that the phenomenon was not present in Scotland, and that beekeeper had only lost one colony. All those who had lost two or more colonies in this way - and there were 6 of them out of the 44 respondents who were active beekeepers – did believe the phenomenon was present in Scotland. Of the 31 beekeepers who had not experienced such losses, only 9 stated that they believed the phenomenon was present in Scotland, 20 stating that they did not, and 2 giving no opinion. One beekeeper gave no response to either the question of whether such losses had been experienced or what opinion was held about its presence in Scotland. These results are summarised in Table 2.4 below.

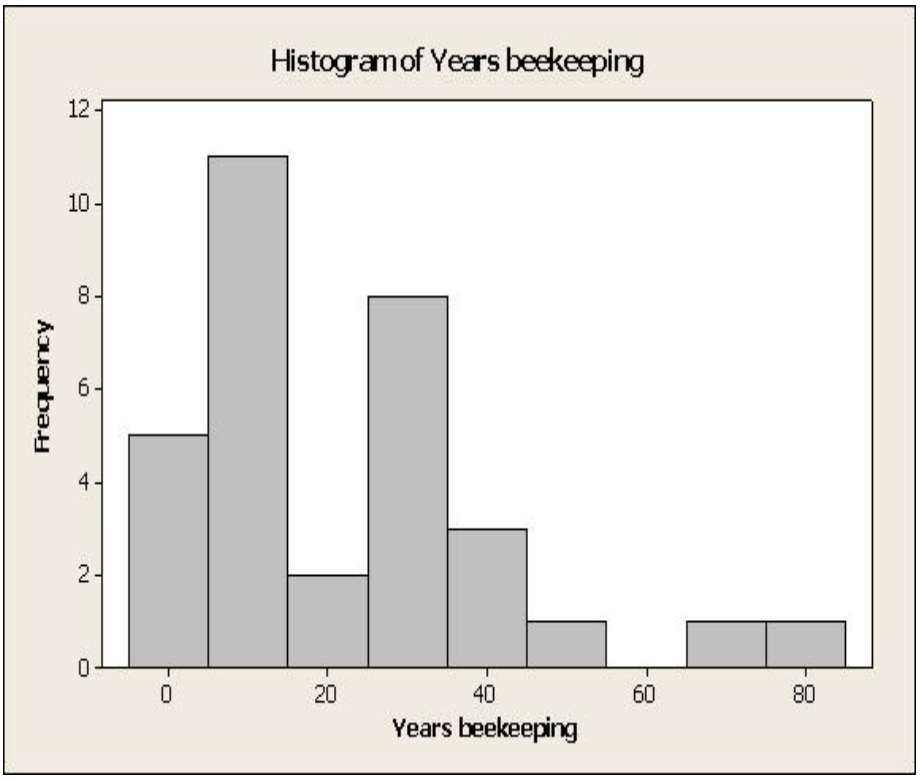
Table 2.4: Opinions about "MC" in Scotland against sudden colony losses experienced. Figures in parentheses are the percentages of entries in a row

Numbers of sudden colony losses experienced	No Opinion Expressed	Believe MC is not yet in Scotland	Believe MC is in Scotland	Total
0	2 (6.6)	20 (64.5)	9 (29.0)	31
1	0 (0.0)	1 (16.7)	5 (83.3)	6
2 or more	0 (0.0)	1 (14.3)	6 (85.7)	7
No information or irrelevant	2 (25.0)	1 (25.0)	2 (50.0)	4
Total	4 (8.2)	23 (46.9)	22 (44.9)	49

3. Beekeepers

The remainder of this report is concerned with responses made by those who were beekeepers, since the questions were ones to which only beekeepers could respond meaningfully. Of the 44 active beekeepers, 32 responded to the question asking about the year in which they started beekeeping. This indicated a spread of experience from 1 year to 78 years, as shown in the histogram in Figure 3.0.1.

Figure 3.0.1 Histogram of number of years of beekeeping



On the question of whether beekeepers kept all their bees in the home area of their Local Association, 31 of 43 respondents (72%) stated that they did so, however this question was not well phrased, making it more difficult to interpret the results.

3.1 Forage

As in the 2006 survey, beekeepers were asked what sources of forage their bees worked in the early season, in the mid season and in the late season. Results were in general not very different from those reported in 2006 and are briefly summarised below in Tables 3.1.1, 3.1.2 and 3.1.3.

Table 3.1.1: Reported frequency of use by respondents' bees of main early sources

Source	Aberdeen	East	North	West	Over-all
Autumn sown oil seed rape	0	4	2	1	7
Broom	0	5	8	9	22
Gorse	0	6	10	14	30
Horse Chestnut	0	7	5	11	23
Hawthorn	0	8	7	19	34
Sycamore	0	8	6	19	33
Willow	0	6	9	14	29
Apple/Pear	0	2	5	4	11

Table 3.1.2: Reported frequency of use by respondents' bees of main mid-season sources

Source	Aberdeen	East	North	West	Over-all
Bell heather	0	1	8	8	17
Bramble	0	5	7	16	28
Clover	0	7	10	15	32
Lime	0	6	4	12	22
Raspberry	0	2	5	6	13
Rosebay Willow Herb	0	7	6	17	30
Spring-sown Oil Seed Rape	0	5	1	0	6

Table 3.1.3: Reported frequency of use by respondents' bees of main late sources

Source	Aberdeen	East	North	West	Over-all
Himalayan Balsam	0	10	10	12	32
Ivy	0	4	5	13	22
Ling Heather	0	7	10	13	30

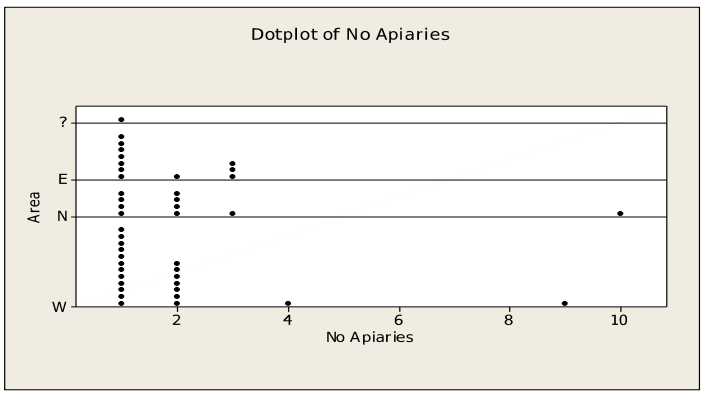
Some care is needed in interpreting these tables for two distinct reasons. First, all those beekeepers who reported the forage being used by their bees, reported several of the main sources in each season, so the total number of responses greatly exceeds the total number of respondents. Secondly, the numbers of respondents in each area was not the same, as stated earlier in this report. Hence comparing one area's return of usage with another directly will not give a realistic comparison. Over-all, however, it is clear that the most frequently reported early sources are gorse, sycamore and hawthorn: oil seed rape which was formerly a leading source has slipped from its high rating, probably because in some areas its cultivation has dropped out of favour with farmers. In the mid-season, clover is once again being reported as the main source, though for a time it was rarely available due to the lack of pasture where it was growing, with most grass-land being "improved" with nitrogenous fertilisers and little clover growing. Practices appear to be changing again, at least in some areas. The other most often cited mid-season sources are Rosebay Willow Herb and Bramble. Among late sources, Himalayan Balsam, a comparative newcomer, is now the most frequently reported, even outstripping the traditional ling heather. It is regarded by conservationists as a noxious weed, but is a valuable, though very late, plant for bees. We doubt if it yields a crop that can be harvested in many areas, but the conspicuous way that its pollen marks foragers working it, makes it very easy for beekeepers to spot, when it is being worked.

Once again, quite a few other sources were mentioned by respondents, those most frequently occurring being dandelion in the early season, and a wide mixture but with no clear favourites in both the middle and late parts of the season.

3.2 Sizes of Enterprises

The sizes of the beekeeping enterprises of our respondents were also investigated. First they were asked how many apiaries they were managing. The number varied from 1 (23 respondents) to 10 (just 1 respondent). Just 4 reported that they were managing 2 apiaries and only 4 altogether said they were managing more than 2 apiaries. Next they were asked how many stocks they were managing altogether at different times during the survey period. Here we shall only report that at the end of the survey period in April 2008 the median number of stocks being kept was 4, with the largest enterprise being one in the West area where 50 stocks were being managed. In 2006, that median number was as high as 8. This confirms our suspicion that our method of sample selection in 2006 tended to pick out the more committed and large-scale beekeepers, and we believe that the 2008 profile of the sizes of beekeeping enterprises is much more typical of the membership of the SBA. Figures 3.2.1 – 3.2.2 and Table 3.2.1 give a little more detail about this. First the responses about numbers of apiaries broken down by area are presented below in Figure 3.2.1.

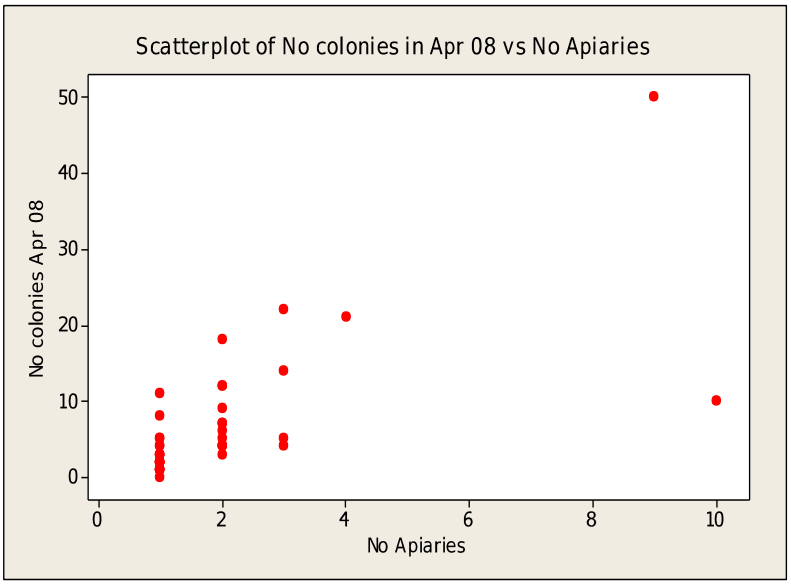
Figure 3.2.1: Dotplot of numbers of apiaries being managed by the respondents, by area



The majority manage only one apiary, with 19 beekeepers stating that they manage more than one. Only seven state that they manage more than two apiaries. The two managing the largest numbers of apiaries are two respondents in the North and West areas.

Respondents were also asked how many colonies they had at various time points of the survey period. The most recent point was April 2008, and the relationship between the two variables is shown in Figure 3.2.2 below for April 2008.

Figure 3.2.2: Scatterplot showing how the number of colonies being kept varies with the numbers of apiaries



Lastly Table 3.2.1 below also shows a summary of the distribution of the numbers of colonies being managed at all the four time points, the descriptive statistics presented being the Number of responses, the Mean number of colonies, the Standard Deviation (a measure of the variability of the responses), the Minimum, the Median and the Maximum. The Median, which is the number such that exactly half the respondents keep fewer (or the same) and exactly half keep more (or the same) is probably the most useful summary to keep in mind as typical of beekeepers in the Scottish Beekeepers' Association at these times. This number, like the mean, tends to rise over the summer, when beekeepers can make increase, and to fall over the winter, when some stocks die and cannot be replaced before the spring. The median in April 2008 is the lowest value, suggesting that the winter of 2007-08 was a particularly difficult one for wintering bees. This is borne out in our direct assessment of losses presented in the next section of this report.

One supposedly active beekeeper nevertheless reported that he or she had 0 stocks of bees, which explains why the minimum is where it is! Perhaps this was an assistant to another beekeeper who actually owned the stocks, but we have no way of knowing.

Table 3.2.1: Summary statistics on numbers of colonies being kept at different times

Date	Number of responses	Mean	Standard deviation	Minimum	Median	Maximum
April 06	44	8.3	10.1	0	5.5	60
September 06	44	9.1	12.6	0	6	80
April 07	44	7.7	8.7	0	6	50
September 07	44	8.3	10.1	0	6.5	62
April 08	44	6.7	8.5	0	4	50

3.3 Losses

Over-all losses

Colony losses were a major focus of the survey.

About 80% of respondents reported colony losses.

The total number of colonies lost during winter 2006-07 was 70 out of 399 being kept in September 2006, an average winter loss rate of about 17.5%, whereas in winter 2007-08 78 were lost out of 365 kept in September 2007, an average loss rate of about 21.4%. This compares to a 30.4% decline from end October 2007 to end March 2008 reported from a survey of losses in England.

Summer losses are more difficult to quantify, because of opportunities to create new colonies, as well as the risk of losing existing ones. However, during summer 2006 4.9% of colonies kept at the start of the season were lost, compared to 9.4% during summer 2007.

The over-all percentage losses observed within our sample for the different periods covered by this survey are shown in Table 3.3.1, both for the country as a whole and broken down by the main membership areas (Aberdeen, East, North and West). Unfortunately only one beekeeper from the Aberdeen area responded to our request for information, and that respondent's form was far from complete, so our information from that area on this topic is nil. Also we sampled a small number of people from some of the remote islands on this occasion – specifically the Outer Hebrides and Shetland – and in the analysis presented here, these responses have been included with those from the North area. A respondent from the Inner Hebrides was included in the West area. There were no participants from Orkney.

The table suggests that winter losses may be higher in the East and West areas, covering the parts of Scotland where *Varroa* has been established longest (4 (36%) of respondents from the East and 4 (19%) from the West have had the mite for 5 years or more), compared to the North. However these differences are not statistically significant (*p*-values for a chi-squared test of lost and surviving colonies versus area are respectively 0.791 and 0.530 for the two winter periods, so may well be due to chance fluctuations). As expected, winter loss rates are higher than summer ones.

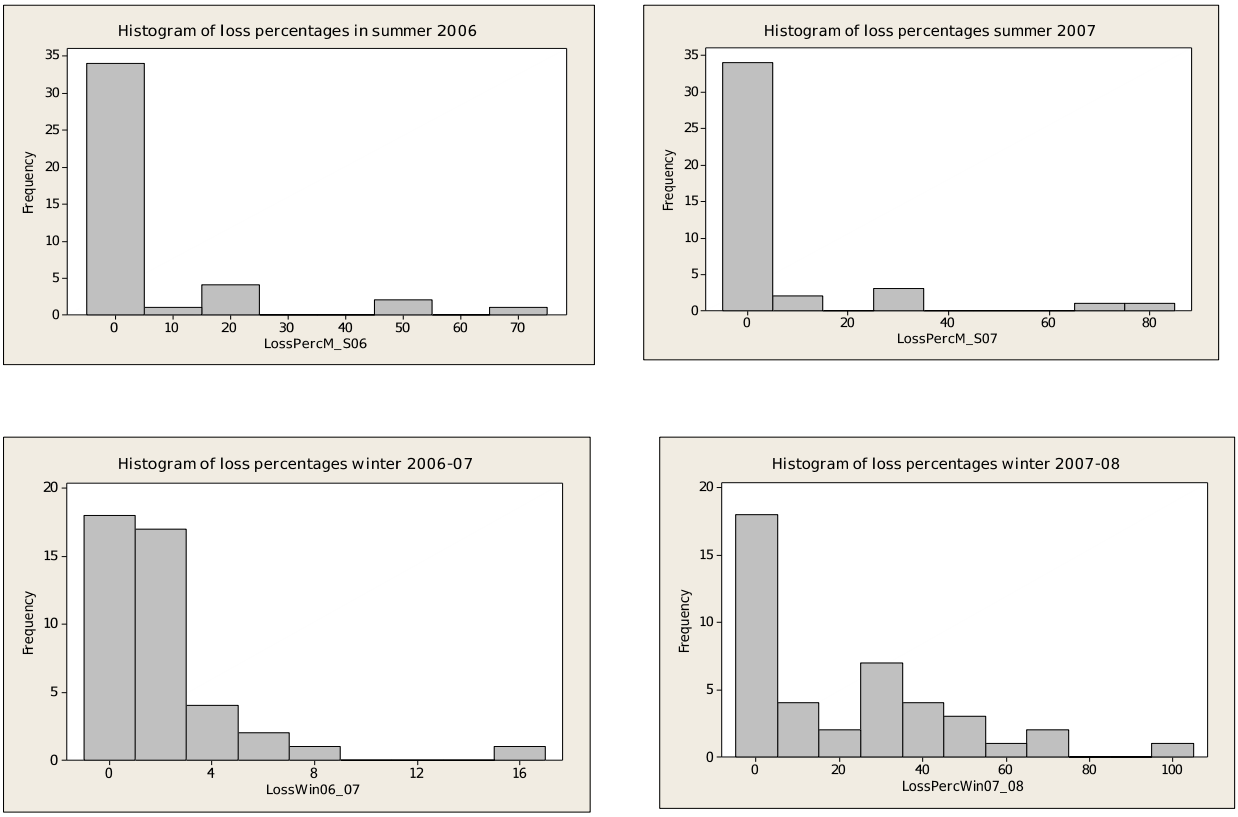
Table 3.3.1: Rates of loss per season, total losses (in round brackets) and number of colonies kept at the start of the season (in square brackets) respectively within each cell

Area	No. of respondents	Proportion (and no.) reporting losses	Summer 2006 (May 2006-Sept 2006)	Winter 2006-07 (Oct 2006-April 2007)	Summer 2007 (May 2007-Sept 2007)	Winter 2007-08 (Oct 2007-April 2008)
Over-all	44	79.6 (35)	4.9 (18) [365]	17.5 (70) [399]	9.4 (32) [340]	21.4 (78) [365]
Aberdeen	0	-	-	-	-	-
East	11	72.7* (8)	12.5* (7) [56]	19.7* (12) [61]	0.0 (0) [49]	25.9 (15) [58]
North	11	81.8 (9)	8.1 (7) [86]	15.5 (13) [84]	15.7 (14) [89]	16.9 (14) [83]
West	21	85.7 (18)	1.8 (4) [218]	18.1(45) [249]	9.1 (18) [197]	22.4 (49) [219]
Unspecified	1	0.0 (0)	0.0 (0) [5]	0.0 (0) [5]	0.0 (0) [5]	0.0 (0) [5]

*One respondent from the East area failed to give details for losses in summer 2006 and winter 2006-2007

Clearly the percentage losses experienced by individual beekeepers are much more variable than they are for whole areas. Details of how these are distributed are shown in the four histograms below as Figure 3.3.1 for all four periods.

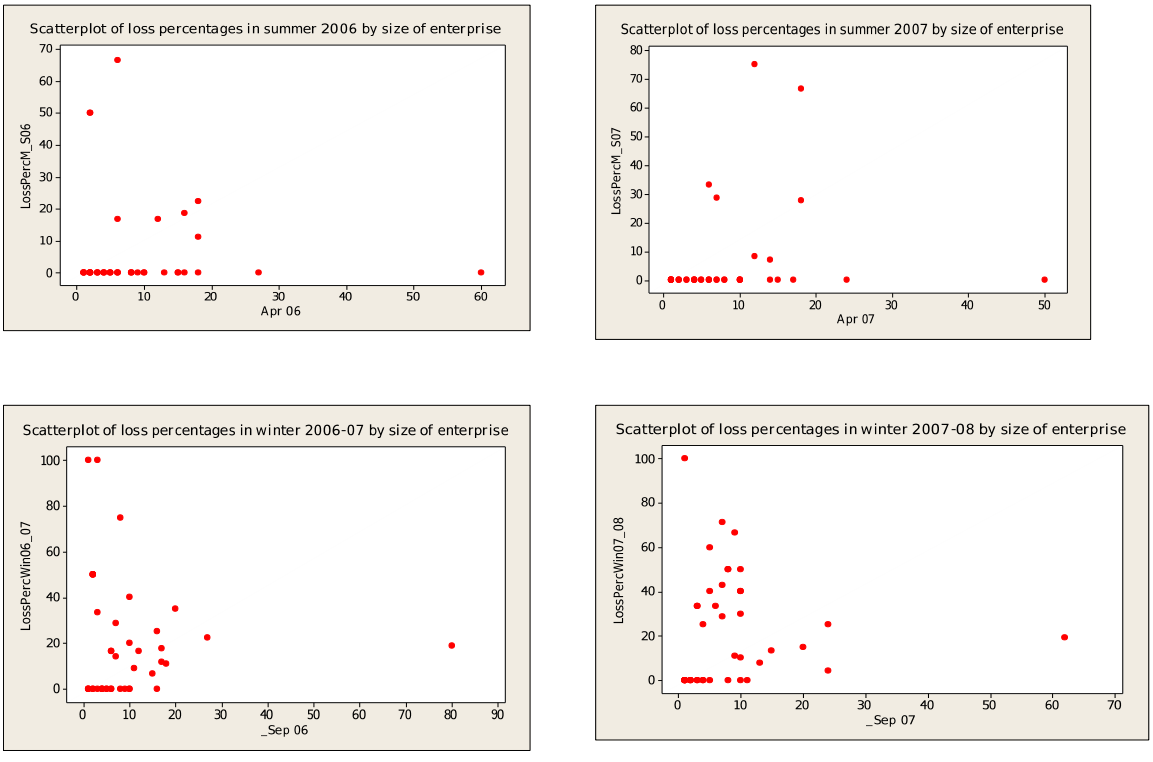
Figure 3.3.1: Histograms of distributions of percentage losses experienced by individual beekeepers



All four distributions show a strong positive skew, with most respondents only experiencing a low loss rate, but a few experiencing high and sometimes devastating losses. As is to be expected, loss rates experienced in winter are in general higher than those experienced in summer.

The sizes of the beekeeping enterprises reporting these are missing from these histograms. A beekeeper who owns only four stocks and loses three of them has experienced a 75% loss, but this can happen by misfortune without any very serious implication for other beekeepers. However a 75% loss by a beekeeper with 100 stocks might reasonably be taken as implying a serious problem. The scatter-plots below show how these percentage loss rates are distributed among enterprises of different sizes as judged by the number of colonies being kept at the beginning of the period under investigation.

Figure 3.3.2: Scatter-plots showing loss percentages against number of colonies kept



It is clear that the larger enterprises do not have either extremely low or extremely high loss percentages, but that these extremes are confined to smaller enterprises, and may be attributed to random fluctuations among small samples.

Losses due to particular causes

Respondents were asked to attribute causes for the losses they had experienced, as far as they were able to. In Table 3.3.2 below are some of the findings from those questions as percentages of losses (actual numbers in brackets) attributed to the possible specifically suggested causes, both over-all and broken down by Area.

Table 3.3.2: Total losses and % losses attributed to specific causes (actual losses in brackets)

Area	Total losses	Starvation	Queenlessness	Varroa	"Mary Celeste"	Diet change	Vandalism
Over-all	199	13.6 (27)	17.1 (34)	11.6 (23)	14.1 (28)	0.0	3.0 (6)
East	34	14.7 (5)	17.6 (6)	5.9 (2)	14.7 (5)	0.0	0.0
North	49	36.7 (18)	20.4 (10)	2.0 (1)	4.1 (2)	0.0	2.0 (1)
West	116	3.4 (4)	15.5 (18)	17.2 (20)	18.1 (21)	0.0	4.3 (5)

The leading assigned cause of loss over-all among our respondents is queenlessness, which has always been a risk to beekeepers. It is interesting however that the "Mary Celeste" type loss, which may be identified with Colony Collapse Disorder now ranks second, above starvation which again is a well-known risk, particularly in late spring if weather is inclement. In the North, the rather high percentage loss due to starvation is heavily influenced by the many colonies lost by one larger scale beekeeper in the bad summer of 2007. It is not completely clear on what grounds a respondent attributes a loss to *Varroa* unless because heavy infestation levels had been found before the loss took place. This too is now cited as an important cause of loss. However, change of diet, which had also been suggested as a possible problem, is not cited by any of the respondents to this survey as a cause of loss.

From the results above it is clear that about 40% of losses have not been assigned to any of the main headings above. In many cases respondents simply failed to attribute any specific cause to the loss of a colony. However there was an opportunity to suggest other possible causes, and the following (Table 3.3.3) were cited:-

Table 3.3.3: Other causes of colony loss

Specified other causes of loss	
Hives overturned by cattle	4 colonies, 1 respondent
"Internal collapse of hive"	1 colony, 1 respondent
Mismanagement	2 lost colonies by 1 respondent
Nosema disease	5 and 1 colonies by 2 different respondents
Theft	1 colony, 1 respondent
Weak colonies in poor weather	8 colonies among 6 respondents with a variety of details
Widespread collapse winter 06-07 – may be *Nosema* or *Varroa*	9 colonies, 1 respondent

In 2006, information was sought on unexplained losses and numbers of such losses of Mary Celeste type, whereas in 2008 it was thought more useful to ask about all losses, not just those thought to be unexplained. The overall proportions of unexplained losses reported in the 2006 survey were, for winter losses, 4.7% in 2004-05 and 7.3% in 2005-06, and in summer 2005 2.2%. The 2008 survey figures most nearly corresponding to these are, for all losses, 18% for winter 2006-07, 22% for winter 2007-08, 4.9% for summer 2006 and 9.4% for summer 2007. The overall proportions of unexplained losses reported as MC type in the 2006 survey were high (about 45% for the first winter, about 42% for the second winter, and about 58% for summer 2005), but these cannot be compared directly to the 2008 figures.

The association between "Mary Celeste" type loss and the length of time that *Varroa* has been known to be present in an apiary

One of the interesting results of the 2006 survey was that the data showed evidence of a strong association between the length of time that *Varroa* had been known to be present in an apiary and the risk of experiencing the "Mary Celeste" type of sudden colony loss. The variation between the percentage losses of this type experienced in the North area and other areas suggests that the same association might again be present. However, on carrying out the same test using Binary Logistic Regression as we did in 2006, the level of association found was not significant at the

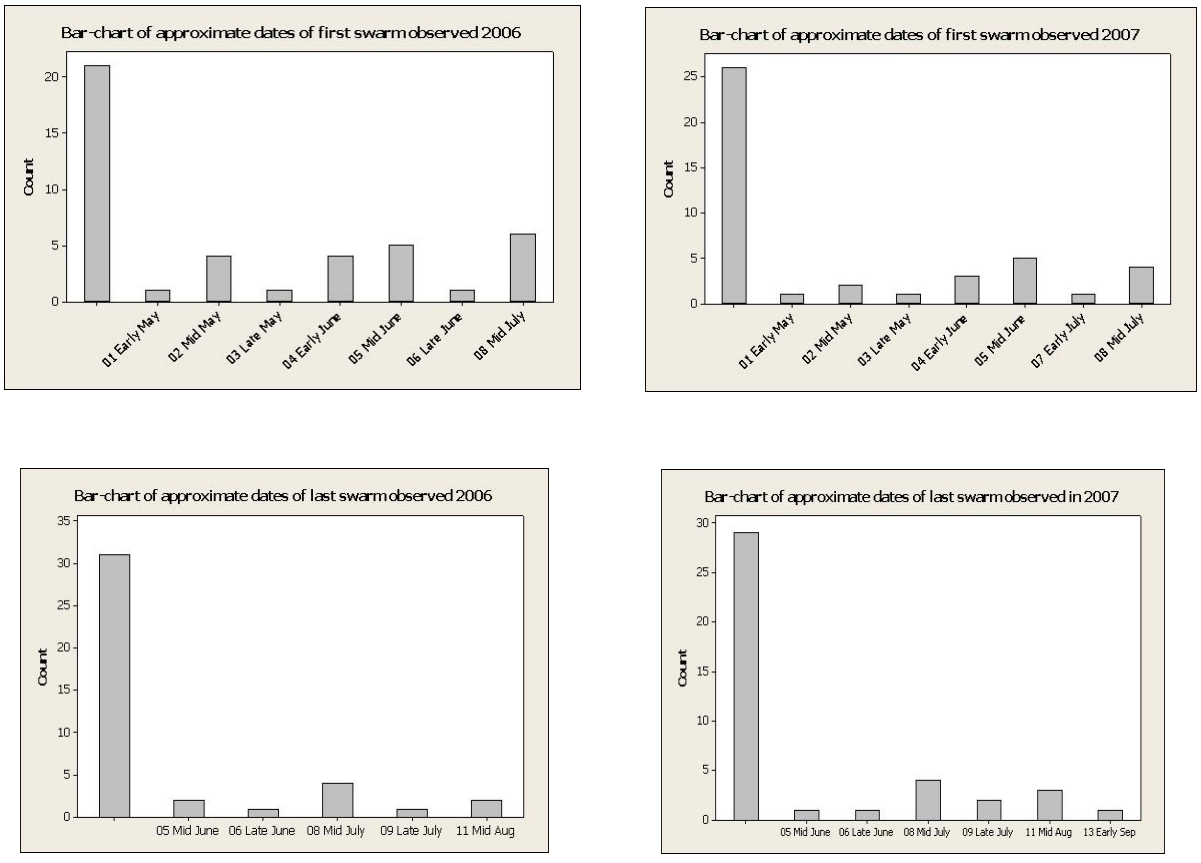
5% level (the *p*-value obtained was 0.086, which is above the usual significance cut-off value of 0.05). So there is no clear evidence of such an association from the present survey.

3.4 Swarms and swarming

Dates of swarming in 2006 and 2007

In the section on swarming, the first questions related to dates when the first and last swarms had been observed. Many respondents were clearly unsure about these dates, and made no return to these questions. In particular the dates of last swarms were poorly recollected. Throughout most of this section it was evident that the summer of 2006 had been more noticeable for swarms than the summer of 2007, with less early swarming reported in 2007, but some of the swarming which did occur that year being very late. More than 20 respondents out of 44 did not report observing any swarms in 2006 but in 2007 more than 25 reported none. These are shown in the left-hand bars of the upper graphs of Figure 3.4.1 Even more respondents in 2006 were unable to give a date for the last swarm observed, as shown in the first bars of the lower graphs in Figure 3.4.1. But the late continuation of swarming in 2007 allowed all but 29 to report an approximate date for the last swarm observed. One swarm was reported from as late as early September, which is most unusual for Scotland.

Figure 3.4.1: Dates of first and last swarms observed in 2006 and 2007

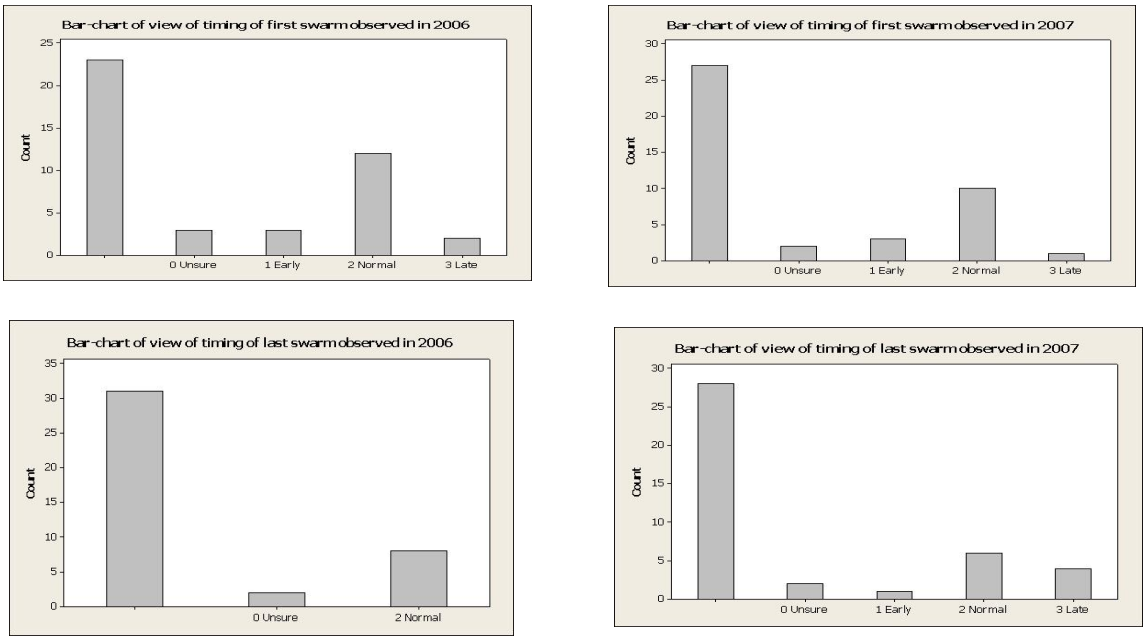


Respondents' opinions about these dates of first and last swarms (whether early, late, or normal), are mostly consistent with Figure 3.4.1. The scatter of opinions for each question and in each year is shown in Figure 3.4.2. Again fewer than half the respondents were prepared to give an opinion on this matter, but of those that did, there was a reasonable scatter of opinions about the "Normal" opinion for the date of the first swarm observed in 2006, and for all those venturing to express an opinion on the matter, the date of the last swarm was stated to be "Normal".

For the year 2007 the scatter of opinions about the date of the first swarm observed again shows a fairly symmetrical distribution around the "Normal" opinion, whereas the actual data (Figure 3.4.2) would suggest that first swarming tended to be late in 2007. The definite skew of opinions about the date of the last swarm towards suggesting it was late

is in accord with the reported dates of the last swarms observed that year.

Figure 3.4.2: opinions about dates of first and last swarming in 2006 and 2007



Numbers of swarms observed and taken in 2006 and 2007

Respondents were asked how many swarms they observed in each of the two summer seasons covered by the survey, and of these how many they captured. Finally they were asked whether these numbers were normal, or higher than usual or lower than usual. The results are shown in Figures 3.4.3 and 3.4.4. These give further confirmation about the more widespread occurrence of swarming in 2006 than in 2007. Again only a minority were prepared to express an opinion on this matter, but of those that did, in 2006 almost equal numbers believed the numbers of swarms observed that year were "Low", "Normal" and "High", whereas in 2007 slightly more responses indicated the "Low" opinion.

Figure 3.4.3: Numbers of swarms observed and captured in 2006 and 2007

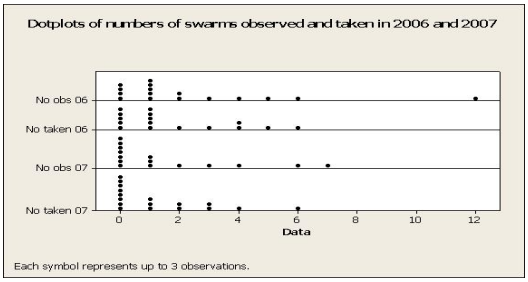
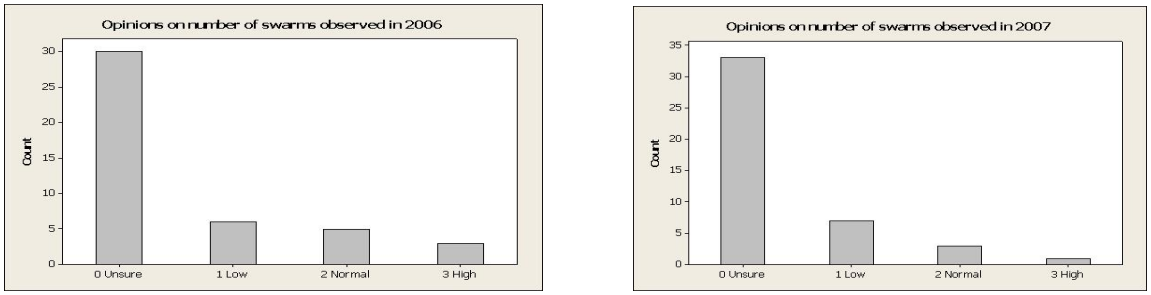


Figure 3.4.4: Opinions about the number of swarms in 2006 and 2007

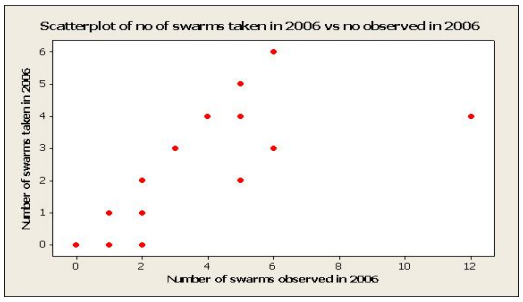


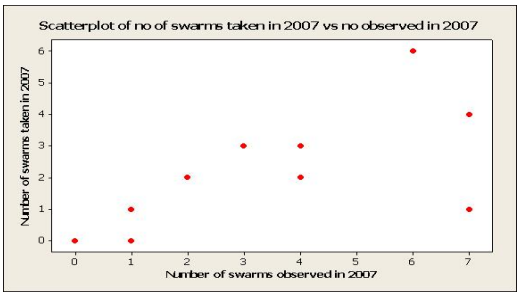
The numbers of swarms observed in the two seasons analysed were rather different, ranging from 0 to 12 in 2006 and from 0 to 7 in 2007. The distributions were also very skew as Figure 3.4.5 shows, so the median (typical number) of 1 in 2006 and of 0 in 2007 are more representative of common experience than the mean (average) numbers, which were 2.03 swarms in 2006 and 1.34 swarms in 2007.

The difference of opinion about the numbers of swarms between the two years is statistically significant at the 5% level. The value of chi-squared in a contingency table test is 13.3 with 6 degrees of freedom. However this result may be unreliable because of the small expected values in some cells of the table. The direction in which opinion has shifted is the expected one, namely that more people believed the observed numbers of swarms in 2007 was "Lower" than thought it was in 2006.

Comparing the numbers of swarms taken with those observed by those respondents who reported observing at least one swarm, the overall numbers of respondents observing and taking different numbers in the two seasons are shown below in Figure 3.4.5. In both years about half the respondents captured all the swarms they observed, and this remains true even for most of those who observed large numbers of swarms.

Figure 3.4.5: Comparison between number of swarms observed and number taken in 2006 and 2007





Tables 3.4.1 for 2006 and 3.4.2 for 2007 respectively display the data on swarms observed, but split by the SBA areas within Scotland (omitting Aberdeen, from which no responses were received). The numbers of respondents in each category is given first, followed (in brackets) by the percentage this is of the responses from each area. Although the East area has the lowest rate of observation of swarms in both years, none of the differences between areas are statistically significant for this variable, the *p*-values for the chi-squared test being about 0.5 for 2006 and about 0.2 for 2007.

Table 3.4.1 Numbers and column percentages of those reporting different numbers of swarms observed in 2006, by area

	Number (percentage) reporting this number of swarms			
No. observed	**East**	**North**	**West**	**All**
0	4 (44.44)	3 (27.27)	4 (21.05)	11 (28.21)
1	3 (33.33)	2 (18.18)	8 (42.11)	13 (33.33)
2	0 (0.00)	3 (27.27)	2 (10.53)	5 (12.82)
3	0 (0.00)	1 (9.09)	0 (0.00)	1 (2.56)
4	1 (11.11)	0 (0.00)	1 (5.26)	2 (5.13)
5	0 (0.00)	1 (9.09)	2 (10.53)	3 (7.69)
6	1 (11.11)	0 (0.00)	2 (10.53)	3 (7.69)
7	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
8	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
10	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
11	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
12	0 (0.00)	1 (9.09)	0 (0.00)	1 (2.56)
Total	9 (100)	11 (100)	19 (100)	39 (100)

Table 3.4.2 Numbers and column percentages of those reporting different numbers of swarms observed in 2007, by area

	Number (percentage) reporting this number of swarms			
No. observed	**East**	**North**	**West**	**All**
0	8 (72.73)	6 (54.55)	6 (33.33)	20 (50.00)
1	1 (9.09)	2 (18.18)	5 (27.78)	8 (20.00)
2	0 (0.00)	2 (18.18)	1 (5.56)	3 (7.50)
3	1 (9.09)	0 (0.00)	2 (11.11)	3 (7.50)
4	0 (0.00)	1 (9.09)	2 (11.11)	3 (7.50)
5	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
6	1 (9.09)	0 (0.00)	0 (0.00)	1 (2.50)
7	0 (0.00)	0 (0.00)	2 (11.11)	2 (5.00)
Total	11 (100)	11 (100)	18 (100)	40 (100)

Origin of swarms observed

Respondents were asked to give their best assessment of the origin of the swarms they observed, as to whether they were definitely from their own apiaries, definitely from another apiary, definitely a wild swarm from an unmanaged stock, or of uncertain origin. The results are given in Table 3.4.3 for the two seasons separately, and for the two seasons combined. The largest proportion (about 41% over-all) were believed to come from the respondent's own apiary. A fairly small proportion (about 9% in 2006 and about 18% in 2007 yielding an over-all proportion of about 12%) were believed to be of wild origin. The remainder (just under 50% over-all) were more or less evenly split between being attributed to another apiary or of uncertain origin. The differences between the two seasons were tested for statistical significance, but no difference was found, the *p*- value for a chi-squared test being as large as 0.4.

Table 3.4.3: Origin of swarms observed

Origin of swarms observed	**Own apiary**	**Another apiary**	**Wild swarm**	**Unsure**	**Total**
2006	36 (44.4%)	19 (23.5%)	7 (8.6%)	19 (23.5%)	**81 (100%)**
2007	20 (36.4%)	13 (23.6%)	10 (18.2%)	12 (21.8%)	**55 (100%)**
Combined	56 (41.2%)	32 (23.5%)	17 (12.5%)	31 (22.8%)	**136**

Use of bait hives

Many beekeepers put out one or more empty hives during the summer as an attraction for stray swarms. Respondents were asked whether they usually did this, and, if so, whether they had done so in 2006 or in 2007, and with what success. All the 44 respondents who were beekeepers answered this question. 30 of them (just over two-thirds) claimed to do this regularly.

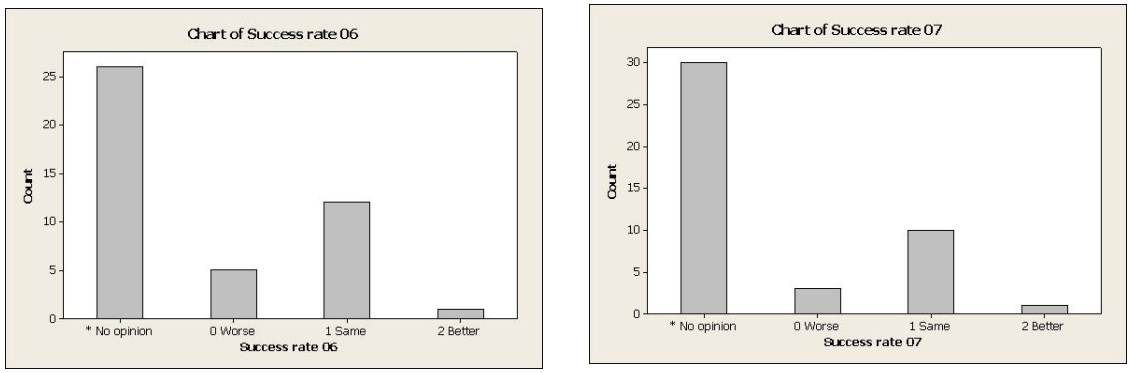
Next they were asked how many bait hives they had put out in the summer of 2006 and in the summer of 2007, and how many of these had actually attracted swarms. They were also asked what they could say about the origin of the swarms that colonised those that were colonised.

The results are summarised in the Table 3.4.4 below for 2006 and 2007. About 37% of bait hives were colonised in 2006 and about 30% in 2007 with about equal numbers of colonies from the beekeeper's own apiary and from elsewhere. The final question in this section was whether the respondent rated the particular year as worse, about the same, or better than usual in terms of the success rates with bait hives. Far fewer were willing to venture an opinion here, and as shown in Figure 3.4.6. There was a slight bias towards "worse" relating to both years.

Table 3.4.4: Numbers of bait hives put out and number colonised

Year	Number of bait hives put out	Number of bait hives colonised	Definitely from own apiary	Definitely from elsewhere	From uncertain origin
2006	47	18 (36.7%)	8 (44.4%)	7 (38.9%)	3 (16.7%)
2007	44	13 (29.5%)	5 (38.5%)	5 (38.5%)	3 (23.1%)

Figure 3.4.6 :Opinions on success rates of bait hives in 2006 and 2007



3.5 Migratory beekeeping

One of the new sections in the questionnaire for the 2008 survey asked questions about the practice of migratory beekeeping.

Surprisingly perhaps, most beekeepers did not move their bees to temporary locations in either 2006 or 2007 to take advantage of a seasonal honey flow. Only 23% of respondents moved their bees in either year. Although the pattern appears a little different amongst areas, with 19% of respondents in the West, 27% in the North/Aberdeen, and 10% in the East areas respectively moving their bees in 2006 and 14%, 36% and 9% respectively in 2007, the numbers

are too small to test for a significant difference amongst areas concerning this practice. Seven out of 10 of these beekeepers moved bees in both years. These moves were mostly to access heather or ling heather in mid to late summer (for 15 of 22 moves in total), with a minority for oilseed rape (in April). One exceptional respondent in a remote area moved twice, once to sycamore and a second time to garden flowers. The extensive heather moors of the north make this an attractive option for many beekeepers living there. Numbers of stocks moved varied from 1 to 25 or 30 in the first move, and to 15 or 16 in any second move, with a move of 5-7 stocks being typical.

Only a third of those moving bees did so twice in one year (typically a spring move in April to June/July followed by a late summer move in August to September/October). Single moves were all made in the summer. Interestingly those who moved bees twice moved the same distance in all but one instance. It seems unlikely however *a priori* that the bees were being moved twice to the same location, as usually the flora at a distant temporary site are dominated by a single flowering species with a single flowering period during the summer. Bees were moved distances of 4 to 36 miles, with 7 or 8 being a typical distance for these respondents in this survey to move their bees if they moved them at all. The temporary sites used were shared with at most one other beekeeper. One respondent reported concern about the movement of colonies as a source of spreading disease.

3.6 *Varroa*

The spread of *Varroa* across Scotland continues to be a matter of concern to all those connected with beekeeping. As in 2006, we asked respondents to state what was the year in which they were first aware of having that infestation, or alternatively whether they had not yet found the *Varroa* mite. Most of the respondents who were beekeepers (43) answered this question. From the East area only 1 respondent (9%) claimed not yet to have found the mite in their bees, whereas from the West and North respectively 5 (24%) and 4 (36%) had not yet found it. There may be some distortion here compared with the 2006 survey because our sample this time includes beekeepers from very remote northern locations, but it does appear that some of the remote parts of Scotland are still clear of this pest. Of the respondents from the East 4 (36%) and of those from the West 3 (14%) have had the mite for 5 years or more, so that both these areas now have many beekeepers with fairly long experience of managing *Varroa.* The details are presented in Table 3.6.1 below.

Table 3.6.1: Date of first finding of *Varroa* by area in Scotland
Numbers of respondents and (column percentages)

	Area in Scotland			
Year first found	**East**	**North**	**West**	**Over-all**
Before 2003	0 (0.00)	0 (0.00)	1 (4.76)	1 (2.33)
2003	4 (36.36)	0 (0.00)	3 (14.29)	7 16.28)
2004	1 (9.09)	0 (0.00)	1 (4.76)	2 (4.65)
2005	3 (27.27)	3 (27.27)	5 (23.81)	11 (25.58)
2006	1 (9.09)	2 (18.18)	3 (14.29)	6 (13.95)
2007	1 (9.09)	2 (18.18)	3 (14.29)	6 (13.95)
2008	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
2009	1 (9.09)	4 (36.36)	5 (23.81)	10 (23.26)
Total	11 (100)	11 (100)	21 (100)	43 (100)

In these days when there is concern about the possibility that some strains of the *Varroa* mite may be developing resistance to the pyrethroid strips used to treat for the infestation, beekeepers are being advised to vary the treatments they apply to keep this pest under control. Only three treatments were licensed veterinary medicines for such treatment at the time of this survey: the pyrethroid plastic strips for suspension between combs, impregnated with fluvalinate and sold under the name of Apistan; another plastic strip medication using a closely related chemical, flumethrin, and sold under the name of Bayvarol; and a completely unrelated treatment based on the use of thymol-impregnated gel sold under the name of Apiguard. However many beekeepers have been using a variety of unlicensed substances to try to keep the mite under control. Two organic acids, oxalic acid administered either by trickling a dilute solution directly on to the bees in winter, or by driving a fine dust of crystals into the hive by sublimating the solid crystals using a heat source, the vapour re-crystallising as a fine powder which immediately spreads throughout the hive on encountering the colder air there; and formic acid, usually applied as a vapour evaporating from a pad impregnated with a suitable dilute solution of the acid. Other individually prepared or pre-bought substances containing thymol are also used. In addition there are various bio-technical methods in use. Inducing the bees to create artificially large amounts of drone brood comb in the summer, as it is preferentially parasitized by the *Varroa* mites, and then to cut it out before the drones

emerge and to destroy it is one such technique. It can be lost without serious damage to the honey-producing capability of the colony, although some care must be taken that an apiary is not left short of drones to mate with emerging virgin queens. Another is the use of floors to hives with an open metal mesh, rather than a solid wooden board, through which *Varroa* mites dislodged by the bees can fall to their destruction rather than being able again to retrieve a position on another bee from the solid floor.

Questions were asked about which of the most commonly used of these methods the respondents were using at different seasons of the year. In retrospect some of the questions were injudiciously worded, as the removal of drone brood is only possible during the summer, when drones are being actively reared by the bees, and open mesh floors are generally in permanent use by those who use them, rather than being applied at any particular season. Respondents were also given the opportunity to state what other methods of treatment they were using. Figures 3.6.1 to 3.6.6 below show how numbers of respondents using different treatments vary between treatment types and seasons.

Table 3.6.2: Frequency of use of *Varroa* treatments across the seasons percentages (and numbers)

Treatment	Respondents answering	Spring 06	Autumn 06	Spring 07	Autumn 07	Spring 08
Apistan/Bayvarol	43	18.6 (8)	51.2 (22)	20.9 (9)	51.2 (22)	9.3 (4)
Apiguard	43	0.0 (0)	16.3 (7)	4.7 (2)	14.0 (6)	2.3 (1)
Oxalic acid (trickle method)	43	7.0 (3)	23.3 (10)	9.3 (4)	23.3 (10)	7.0 (3)
Oxalic acid (sublimation method)	43	0.0 (0)	7.0 (3)	2.3 (1)	7.0 (3)	7.0 (3)
Drone brood removal	43	11.6 (5)	18.6 (8)	20.9 (9)	23.3 (10)	9.3 (4)
Open mesh floors	43	30.2 (13)	44.2 (19)	46.5 (20)	55.8 (24)	44.2 (19)

The results are summarized in Table 3.6.2. Apistan or Bayvarol (which are very similar treatments and so have been united under one heading) has been used by about 50% of respondents every autumn. In spring only a small number have used it each year. Apiguard was used by fewer respondents than the strip medications, with very little use in the spring – none reported in the spring of 2006. Five respondents report using it in each of the two autumn seasons recorded. The pattern of use for oxalic acid by the trickle method is very similar to that for Apiguard, but it is less commonly used. There is an even lower reported level of use of oxalic acid by the sublimation method, no doubt because of the potential hazard of dealing with the vapour, and the need to use a protective mask to deal with this danger. Although most beekeepers appear to assent to the use of biotechnical methods as the best option when they are available, the reported use of drone brood removal is fairly low. Three factors probably contribute to this: (1) the choice of "Spring" or "Autumn" as the seasons when the use of this technique was to be reported is unfortunate, as it is best done in high summer when production of drones is at its peak and those respondents who do this probably did not report the use of the technique; (2) its use does involve extra manipulations of the bees and the use of dedicated frames in the hive, which some beekeepers no doubt find troublesome; (3) some beekeepers are understandably anxious about the possible effect on the success of queen mating which too great a reduction of drone populations can bring about. At each reporting season around half the respondents state that they use Open mesh floors. Many beekeepers in the UK have in fact switched all their beekeeping to the use of these as a permanent feature, and our survey would suggest that this was already at a level of about 50% at the time of this survey.

A question also asked respondents as to what other treatments for *Varroa* they were using. One beekeeper with around 10 stocks reported the permanent use of the "HappyBeekeeper" floor – a version of the open mesh floor. Another with about 15 stocks reported the use of a variety of different treatments at different times – sprinkling with icing sugar/ ground sugar, treatment with thymol crystals, replacement of brood combs by the "shook swarm" technique, and an intention to use formic acid at some time in the future. Another, also with about 15 stocks, reported "regular monitoring" for *Varroa*, although this can not really be regarded as a treatment, but only as a guide to when treatment has become advisable to keep infestation at an acceptable level. Two others reported the use of formic acid in spring 2008 for the first time, and another its use for fumigation then of a hive where bees had died. These cases would support the view that the use of formic acid is becoming more widespread as a treatment.

One feature of these responses which stands out is that it appears to be a small minority who are prepared to be adventurous in their choice of treatment for *Varroa.* Others are tending to stick to the well-tried methods of the seasonal use in autumn of the pyrethroid-impregnated strips – Apistan and Bayvarol. Such beekeepers will be well-advised to be vigilant for the spread of resistant mites into Scotland, which have now made these treatments ineffective in much of the south of the UK.

Tests for mites resistant to pyrethroids

Another question which was asked was whether the respondent was aware of any tests for mites resistant to pyrethroids being carried out. The result was clear-cut. Only one of the respondents was aware of any such tests being carried out, and even that one did not give the date of the test or whether the result showed the presence of resistant mites or not. Clearly this is something which the SBA would be well-advised to include in their future education programme.

3.7 Breeding problems as a possible consequence of *Varroa* infestation

The appearance of the *Varroa* mite in Scotland is believed to have had a severe effect on the number of surviving feral colonies of honeybees here. One of the feared consequences of this is that the pool of genetic diversity among the drones available to mate with queen bees on their mating flights may be much reduced, with a possibly great increase in the amount of in-breeding among the managed stocks of honey-bees, particularly in those large apiaries whose bees have all descended from an already in-bred line.

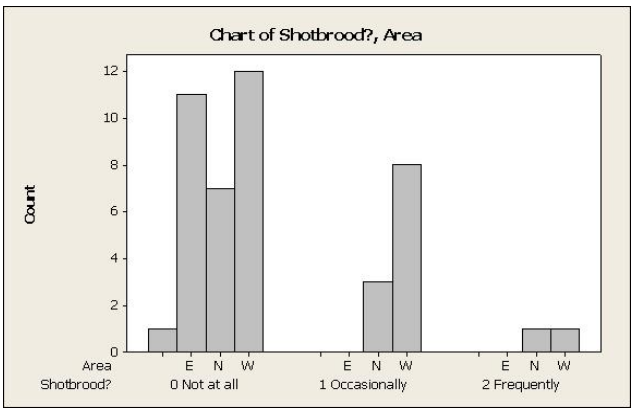
Because of the mechanism of sex determination among honey-bees [See for example Charlesworth, B *"Sex determination in the Honeybee"* **Cell, Vol 114; 4;** pp 397-8], close in-breeding which results in a high proportion of the drones which mate with each queen being closely related to her, has the consequence that such queens lay a much reduced proportion of viable worker brood. The resulting larvae, if allowed to develop, become infertile diploid drones. Workers however detect these and eat them, and the result is a brood pattern with many empty cells – a phenomenon known particularly in America as shot-brood, and in the UK sometimes as pepper-pot brood. A question in the survey asked beekeepers whether they had noticed this phenomenon recently among their bees. The result is displayed in Table 3.7.1 below. All 44 of the beekeepers who responded answered this question.

Table 3.7.1: Levels of shot-brood reported

Level of shot-brood observed	Number of respondents	Percentage of respondents
Not at all	31	70.45
Occasionally	11	25.00
Frequently	2	4.55

Figure 3.7.1 below shows a bar-chart of these results, broken down between the three main areas from which we received responses from beekeepers. Applying the chi-squared test, there is no significant area effect here, and over-all the proportion of respondents identifying this as a frequent problem is small at under 5%.

Figure 3.7.1: Dotplot of frequency of observation of shot-brood by area

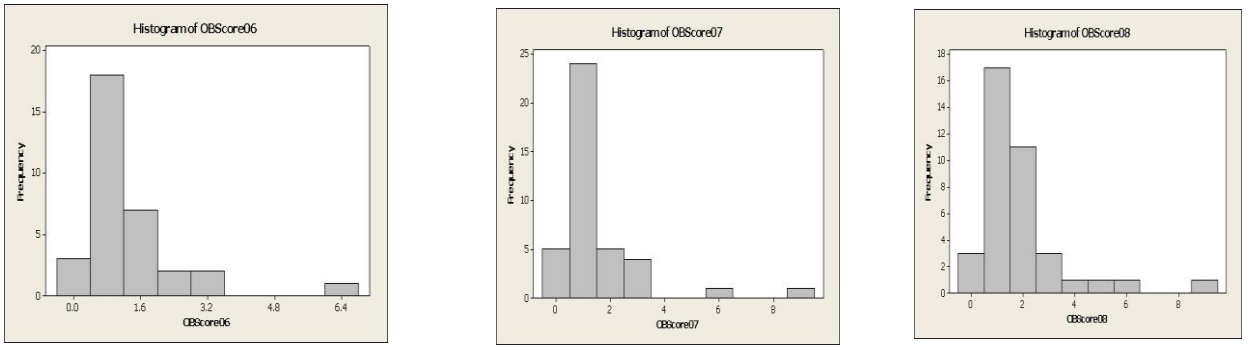


An attempt was also made, as in 2006, to try to assess the risk of too close in-breeding being run by respondents, by asking how many of the stocks in each single apiary were headed by queens which were close relatives, defined as being either sisters or mother and daughter. At the same time an attempt was made to estimate how many

managed stocks from other apiaries there were within 5 miles of each one – a distance reckoned to be about the maximum that drones could be expected to fly reasonably often. The greatest risk would clearly occur in an isolated apiary where most of the queens were closely related to each other.

On the basis of the information given, where possible, an "outbreeding score" was given to each apiary by using the factors above, so that the score was calculated as the number of family groups in each apiary – a family group being a group of stocks headed by queens which were all closely related – added to the number of other adjacent apiaries, divided by the total number of stocks in the apiary. Unfortunately, as in 2006, we found that the information needed for calculating the outbreeding score was something that many respondents found it very difficult to be certain about, so that the number of cases where this could be meaningfully calculated was fairly small. Of 75 apiaries which were available for report, only 33, 40 and 38 had enough information given to be able to calculate an outbreeding score for them in each of 2006, 2007 and 2008 respectively. The distributions of these scores are given below for each of the three years in Figure 3.7.2.

Figure 3.7.2: Outbreeding scores for apiaries reported on in 2006, 2007 and 2008



The distributions in the three years are all similar. For most apiaries the score is about 1 with a small number of very low scores, and a few apiaries having very high scores over 5. Such high scores are usually awarded to small apiaries with a variety of families in them, and in the vicinity of many other apiaries.

The next topic in this area is the success-rate achieved by the different respondents in their efforts at queen-rearing in 2006 and 2007. The success rates experienced by those respondents who were able to answer this question are summarised in Table 3.7.2 below.

Table 3.7.2: Percentage success rates in breeding queens in 2006 and 2007

Year	Number reporting (out of 44)	Mean success percentage	Minimum	Median	Maximum
2006	20	81.6	0.0	100.0	100.0
2007	19	64.2	0.0	75.0	100.0

The breeding success percentage was significantly greater in 2006 than in 2007: using the sign-test on the differences of the success rates reported in the two years yielded a *p*-value of 0.0026 that the median success rates were not equal, although the corresponding 95% confidence interval for that difference in medians was only between 0% and 1%.

Clearly it would also be interesting to know whether these varying success rates in queen breeding were significantly correlated with the outbreeding scores for the different apiary sites. Unfortunately we did not collect the success rates on a site by site basis, so we have to use the over-all success rates reported by each respondent, but when we do so we find nothing of worth for further analysis. Using only the information we have shows no evidence of a positive correlation between these variables at all. In fact the Spearman Rank Correlation coefficient between the breeding success percentage and the outbreeding score in each of 2006 and 2007 works out to be positive in 2006 (+0.276) and negative in 2007 (-0.196). Neither value is statistically significant at the 5% level.

Other observations connected with queen breeding

Three more questions sought information about further problems which can arise with breeding new queens.

The first was whether a higher than usual number of supersedures of queens by colonies had been observed during the period covered by the survey. Only 38 of the 44 beekeepers available had answered this question, and of these 34 (just over 89%) thought that levels of supersedures were no higher than usual.

The second was whether an unusually high number of deformities among queen bees had been observed during that period. All of the 44 beekeepers answered this question, and of these 41 (just over 93%) stated that they thought the level of such deformities was no higher than usual.

The third was whether any unusual behaviour of bees had been observed during 2006 or 2007, and if so to provide a description. Of the 44 beekeepers all but one answered this question, and 36 of them (just under 84%) had observed nothing unusual during this period. The 7 replies stating that unusual behaviour had been observed (and one further relevant reply from a beekeeper who had stated that no unusual behaviour had been observed!) instanced the following examples of such behaviour:

- Bayvarol appeared to kill two queens in 2006 and hives did not re-queen. In 2007 mainly weather related causes plus my bad management contributed to my losses this winter. There is no doubt varroa is making beekeeping more difficult.
- High incidence of queen balling: collapse of colony morale during wet summer: very weak attempts to recover or sort out the mess: NB many baby bees born without wings etc: high incidence of chalk brood: high incidence of chilled brood. Summer of 2006 constant and repeated swarming - even by current year queens in small colonies with plenty of space.
- Replaced new queens in two hives within a few weeks.
- Colony died out in winter 2006. A new colony now established since April 2007.
- One colony did not have Varroa despite all other colonies having heavy infestations - unfortunately they tried to supersede late in the season - no drones, colony died out! I really wanted them to continue and was looking after them to the best of my ability.
- Only the disappearance of an expanding colony in early spring 07. Expanding well early March: gone in mid-April.
- A strong hive was snelgroved in mid-May 2007. On 23 July it was found to be without brood or eggs; with just a few drone cells. There were also 1-2 sealed and 3-4 empty large queen cells.
- 2 unmarked queens found during swarm control manipulations wouild appear to be late 07 supersedures. These are in addition to the 11 noted above. (Not declared unusual in preceding question.)

3.8 Environmental concerns

The responses to new questions added to the questionnaire since 2006 indicated that there is considerable concern amongst beekeepers about environmental factors affecting their bees. Regarding pesticides and herbicides as a possible cause of losses of honeybees, nearly 80% (35 of 44) of beekeepers reported some level of concern about this. Thirty six per cent (16) were moderately concerned and 43% (19) were very concerned, although only 19% (8 of 43) of respondents were aware of the use of such chemicals on local fields and/or gardens within foraging distance of their own bees. All respondents in the North/Aberdeen areas were concerned about pesticides and herbicides. On the question of electromagnetic radiation (EMR) however, only 5% (2 out of 42) of respondents felt this was a serious threat, and a majority were of the opinion that if EMR had any effect on honeybees this would be slight and unimportant. Clearly pesticides and herbicides are a much greater cause of concern, although unfortunately it is much more difficult to establish the nature and presence of these than of sources of EMR (and hence to study any statistical effect). However, data were provided on the distances of various EMR sources from apiary sites, and further analysis below investigates whether there is any statistical relationship between any of these environmental factors and reported colony losses.

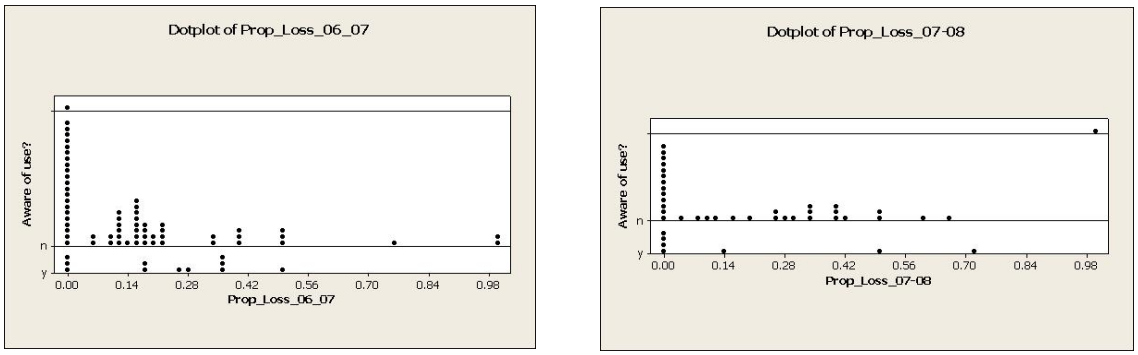
Regarding mobile phone masts, most commonly these were not known of within 1km of apiary sites, although 28% (12 of 43) of respondents knew of them between 500m and 1km away from their main apiary, and 2 respondents were aware of these within 100m and 500m of their other apiaries. Power lines were more commonly known of nearby, with 31 of 72 (43%) apiaries being closer than 500m to a power line, and 51 of 72 (71%) being within 1km of a power line. There were only 6 known instances out of 67 of microwave telecoms towers, and 9 known instances out of 72 cases of TV/radio masts, respectively within 1km of an apiary. The only other possible such hazard mentioned was an amateur radio mast between 500m and 1km distant from a main apiary.

To evaluate whether the data we have do show any effect of either pesticide use or the presence nearby of sources of Electromagnetic Radiation (EMR) the following variables were considered. The response variables are the proportional losses of colonies experienced by respondents during the winters of 2006-07 and 2007-08. The factors used for each analysis are: for pesticides, awareness of any use of pesticides in the vicinity of any apiaries; and for Electromagnetic Radiation, the recorded presence nearer than 1 km to any apiary site of any of the proposed sources of Electromagnetic Radiation, or in one case another type of source (an amateur radio mast).

Each analysis has weaknesses: that for pesticides of course can only deal with those cases where the use of pesticides nearby has become known to the beekeeper, and so it is very likely that many such uses have been missed. In addition, while some pesticides may in fact be fairly harmless to bees, we have no way from our data of distinguishing harmless from harmful ones. In addition no distinction is made between the pesticide use in one season against another. For EMR, the analysis has used the presence of a source for each apiary site individually, but the proportional loss figures used are for the whole of that respondent's beekeeping, which may be on several sites with different levels of EMR. We do not have a site by site breakdown of losses so no other possibility is open to us. Finally of course, we are, as for the whole of this survey, working only with the small number of responses we received, so that only a very strong effect will show up.

Below in Figure 3.8.1 are dotplots of proportional losses experienced by beekeepers, both those aware of pesticide uses near their apiary and those unaware of such use, for both winter seasons.

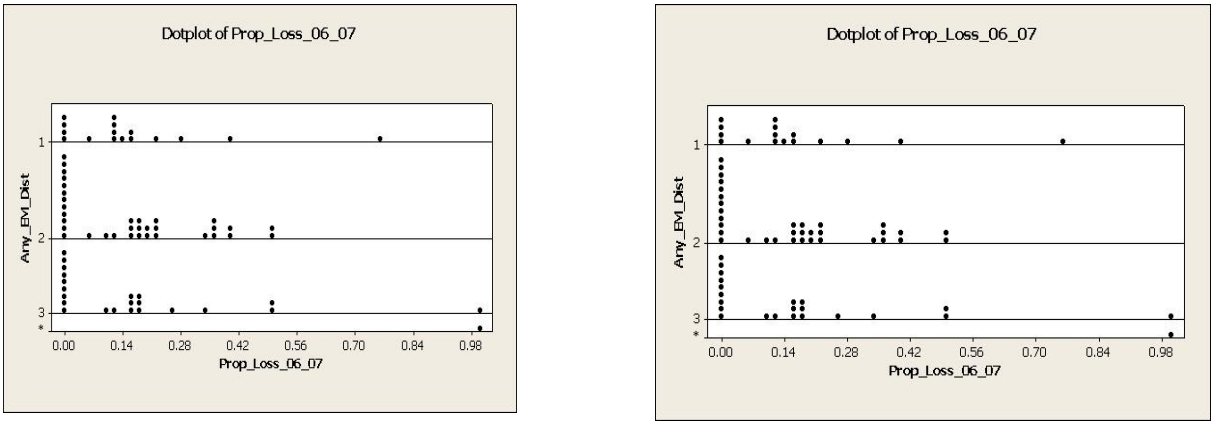
Figure 3.8.1: Dotplots of proportional losses in 2006-07 and 2007-08 for beekeepers aware and unaware of pesticide use nearby



Carrying out Mann-Whitney tests to compare the proportions of losses experienced by beekeepers aware of and not aware of pesticide use near particular apiaries does not yield a statistically significant result, the *p*-values being 0.16 (2006-07) and 0.80 (2007-08) both greater than 0.05.

Next in Figure 3.8.2 are similar dotplots for proportional losses experienced over-all by beekeepers managing sites with sources of EMR at various distance ("1" a source nearer than 50 m, "2" a source more than 50 m but less than 1 km away, and "3" no known source nearer than 1 km). Distances are on a site-by-site basis, but the proportional losses are for the beekeeper's over-all experience in each of the two winter seasons. These categories were obtained by amalgamating the responses of those aware of a source between 100 m and 500 m distant with those aware of a source between 500 m and 1 km, since keeping these two classes separate gave very low table frequencies.

Figure 3.8.2: Dotplots of proportional losses experienced over-all by beekeepers managing sites where distances from EMR sources are small, medium and large for 2006-07 and 2007-08



Carrying out a Kruskal Wallis Non-parametric Analysis of Variance on these data sets shows no significant effect of nearby sources of EMR, the *p*-values being 0.88 for 2006-07 and 0.72 for 2007-08.

Other concerns

Respondents were also asked about any other issues of concern to them regarding their beekeeping. The most commonly reported concerns were about adverse weather and changing climate patterns, mentioned by 9 respondents. There was no other concern common to many respondents. Two respondents mentioned GM crops. One respondent mentioned agricultural use of industrially produced artificial fertilisers as a concern. Other comments mentioned viral problems, inbreeding, queen rearing and queen mating difficulties, and the possible adverse effects of repeated treatment for *Varroa.*

4. Conclusions

The survey was conducted in May/June2008. It was a postal survey. A sample of 119 was chosen from the target population of 986 individual or family members of the Scottish Beekeepers' Association living in Scotland at that time. The SBA's membership list was used as the sampling frame, and selection was at random using stratification by sub-areas. Family members were treated as single units.

The response by only 50 (42%) was disappointingly low. Follow-up at that time was impossible because of legal restrictions imposed by the Data Protection Act.

Questions addressed to all respondents asked about

- Membership of local beekeeping associations;
- awareness of loss of bees due to the "Mary Celeste" phenomenon.

Questions addressed only to those respondents who were beekeepers (of whom there were 44) asked about

- Length of time as a beekeeper;
- foraging plants of importance;

- sizes of beekeeping enterprises;
- losses of stocks;
- swarming;
- migratory beekeeping;
- *Varroa;*
- breeding problems;
- environmental concerns.

Membership of local beekeeping associations (LBAs)

33 (67%) of respondents were members of at least one LBA. However 15 (34%) of the beekeepers responding were not LBA members so that membership rates were almost the same among beekeepers and non-beekeepers. Only 5 of the respondents did not live in an area covered by an LBA.

Awareness of the "Mary Celeste" phenomenon

Only 3 respondents (6%) were unaware of MC. However only 23 (46%) believed it was present in Scotland.

Length of time as a beekeeper

Respondents' length of beekeeping experience varied from 1 year to 78 years, in a fairly skew distribution.

Forage

The forage plants named were almost identical to those mentioned in a similar survey in 2006. Among early sources sycamore was most frequently named, closely followed by gorse and willow. In mid-season clover and rose-bay willow-herb occurred most frequently. The only surprise was in the late season, with Himalayan balsam being included by 32 respondents and ling heather only by 30.

Sizes of enterprises

Most respondents only managed stocks in a single apiary, though 1 respondent was managing 10 apiaries. The median number of stocks being kept varied a little over the survey period, rising from 5.5 in April 2006 to 6.5 in September 2007, but then falling back to 4 in April 2008.

Losses

Of the 44 beekeepers responding, 35 reported losses at some time between May 2006 and April 2008. The heaviest losses were over the two winter seasons. 70 stocks out of 399 (17.5%) were lost in winter 2006-07 and 78 out of 365 (21.4%) in winter 2007-08. Although rates of loss were highest in the East and West areas where *Varroa* has been longest established, the differences between areas were not statistically significant at the 5% level.

The most common cause cited for losses was queenlessness, followed by the "Mary Celeste" type (perhaps the same as Colony Collapse reported from America). These were both more common than winter starvation. Of the losses, 40% were not attributed to any known cause by the respondents.

Swarming

Significantly more swarms were observed in 2006 than in 2007. Of the swarms observed, 41% were believed to have come from the respondent's own apiary with about 12% of "wild" origin. The remainder were believed to be from another apiary or were of unknown origin.

Of the 44 beekeeper respondents, 30 claimed to use bait hives regularly. About 37% of the bait hives put out in 2006 were colonised, and about 30% in 2007.

Migratory beekeeping

Only 10 respondents out of 44 beekeepers (43%) moved their bees in either 2006 or 2007, with 7 moving hives in both years. Most were moves to ling heather in August, though a minority moved bees to Oil Seed Rape earlier in the year. Distances of moves ranged from 4 to 36 miles, with 7 or 8 miles being typical. Although most moves were to unshared sites, one respondent expressed concern about the risk of spreading disease by this practice.

Varroa

By the time of this survey most respondents had confirmed *Varroa* infestation in their bees. The exceptions were: in the East area 1 (9%), in the North area 4 (36%) and in the West area 5 (24%). This confirms that there were then still remote areas in the West and North where the mite had not yet penetrated. The most commonly used control measure was Apistan or Bayvarol every autumn (50% of beekeeper respondents). A variety of other treatments was also reported.

Despite recent anxieties about the possible emergence of mites resistant to Apistan and Bayvarol, not one of our respondents was aware of any testing for resistant mites carried out during the survey period. This would seem to be a matter deserving immediate attention by the Scottish Beekeepers' Association.

Breeding problems

"Shot brood" or "pepper-pot brood" is one possible consequence of too close in-breeding, and the fear that this may happen with the widespread loss of many feral colonies motivated questions in this area. Only 2 of the beekeeper respondents said that had found this frequently, and another 11 that they found it occasionally. Mean success rates in queen breeding were about 82% in 2006 and 64% in 2007.

Environmental concerns

Nearly 80% of respondents (35 out of 44 beekeepers) had some level of concern about pesticide use. However no clear evidence of any higher rates of loss associated with reported pesticide use was found.

On the possible harmful effects of Electro-Magnetic Radiation (EMR), only 2 respondents (about 5%) were seriously concerned, and the majority believed that if there were any effect it would be slight.

Again comparing loss rates experienced by beekeepers reporting possible sources of EMR near their apiaries, no significant effect could be found.

Note however that for both of these concerns, with such a small sample as this, the power to detect slight effects is very limited. Also no distinction could be made between different pesticides, and many uses of pesticides may have been missed. Also there may have been other sources of EMR which were missed by respondents.

Appendix – Questionnaire used for the survey

SBA 2008 Beekeeping survey

Dear SBA member,

Following the successful survey carried out in 2006 by the Scottish Beekeepers' Association, the Association has decided to repeat the exercise in 2008. The main purpose is to investigate further the topics studied two years ago so that we can learn how things are changing in Scotland as *Varroa* infestation spreads ever further through the country with all its attendant problems. We also wish to continue to monitor the similarities and differences in beekeeping practice throughout the country.

We are therefore approaching a subset of our members in order to gain a picture of how matters have unfolded during the last two years in Scotland. The selection of respondents for the survey has been made by random sampling from the list of members, while ensuring that each main area of the country is adequately represented. You are one of those selected from those SBA members who have consented to be approached by the SBA for this kind of exercise. We would stress that you may, if you wish, remain completely anonymous in responding. Currently, your name and address are only known to the Membership Convener who will mail out the forms, and you have not been identified to the survey organisers. Even if you choose to disclose to us your contact details, we will keep these confidential unless you later choose to give us permission to reveal them should we think any aspects of your responses are of wider interest.

In order that we can report on the results of this survey by the end of the summer, we would ask that you please return this form in the stamped addressed envelope provided

by Saturday 31st May 2008.

Finally, we wish to stress that any and all answers to the questions that you can provide will be valuable, no matter how few. If you cannot answer a question please indicate this as directed in the question, or with “Not known” or something equally applicable.

With many thanks in advance for giving your time.

The SBA Executive.

Contact details or anonymous response

Unless you indicate that you are willing to be contacted for possible follow-up, your responses will remain anonymous and we will not trouble you further after receiving your completed survey form. But if you would be willing to be contacted by the SBA to follow-up your answers, please give your contact details here:-

Name.....

Address.....

.....

Phone.....

email.....

OR

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

Questionnaire

Section 1: General Information

1. (a) Are you a member of any Local Beekeeping Association(s) affiliated to the SBA?
Yes / No

If 'Yes', please answer (b).

(b) There are currently 35 Local Beekeeping Associations affiliated to the SBA. A list of these is at the end of the questionnaire, each of which has been given a code number for you to insert here those for all you belong to.

SBA Local Association Code Number(s)…….

2. (a) Do you live within the area of a Local Association? Yes / No

(b) If 'Yes', please insert its Code Number below:

Home area SBA Local Association Code Number……..

(c) How often do you attend your home area Local Association meetings?

Regularly	□
Occasionally	□
Never	□
Not Applicable	□

3. How aware are you of the *Mary Celeste* phenomenon (also known as Colony Collapse Disorder) when a hive previously apparently thriving is one day unexpectedly found abandoned, but containing intact stores and sometimes also brood?

Very Aware	□
Quite Aware	□
Not sure what this means	□
Never heard of it	□

4. This phenomenon is increasingly being reported throughout the world. To the best of your knowledge, do you believe this to be present in Scotland yet?
Yes / No

5. Are you currently a practising beekeeper or have you been a practising beekeeper at any time over the past two years?
   (a) Yes / No

   (b) If 'No', are you interested in becoming a beekeeper? Yes / No
   (c) If 'Yes', in what year did you first start keeping bees?

   Year……

If you answered 'No' to Qu 5(a), this is the end of your questionnaire. Thank you for your participation. Please return the Questionnaire as instructed.

If you answered 'Yes' to Qu 5(a), please continue with the questionnaire.

SECTIONS FOR ACTIVE BEEKEEPERS
General information

6. Do you keep **all** your bees in the home area of your Local Association?

Yes / No

If 'No', please describe the location(s) of your apiaries as well as possible:

……

……

……

……

……

……

Section 2: Sources of Forage

7. Which of the following are the principal nectar/pollen sources available to your bees?
(*Please tick those that apply, and/or add others at the end. If you are unsure, just tick 'Not known'. Leave blank those that you don't believe are nectar sources for your bees.)*

Early

Autumn-sown oil-seed rape ☐
Broom ☐
Gorse ☐
Horse Chestnut ☐
Hawthorn ☐
Sycamore ☐
Willow ☐
Apple/Pear ☐
Other 1 (specify)……..
Other 2 (specify)……..
Not known ☐

Mid-season

Bell heather ☐
Bramble ☐
Clover ☐
Lime ☐
Raspberry ☐
Rosebay Willowherb ☐
Spring-sown oil-seed rape ☐
Other 1 (specify)……..
Other 2 (specify)……..
Not known ☐

Late

Balsam ☐
Ivy ☐
Ling heather ☐
Other 1 (specify)……..
Other 2 (specify)……..
Not known ☐

Section 3: Colonies and Losses

8. How many separate apiaries do you manage? ……..

9. In total how many colonies with mated laying queens had you in:

April 2006?	
September 2006?	
April 2007?	
September 2007?	
April 2008?	

10. How many colonies did you lose during the following periods?

	No of colonies lost
May 06 – Sep 06	
Oct 06 – Dec 06	
Jan 07 – Apr 07	
May 07 – Sep 07	
Oct 07 – Dec 07	
Jan 08 – Apr 08	

11. Please specify below the number of colonies lost due to each reason. If 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		
Went Queenless		
Varroa		
Mary Celeste		
Changes in Diet		
Vandalism		
Other 1		
Other 2		
Unknown		

Section 4: Swarms and Swarming

It is said that *Varroa* has wiped out many of the wild colonies of honey-bees. An indication of the state of the wild population is the number of swarms originating from wild colonies that come to the attention of beekeepers. In this section we ask questions on this topic. Please note that for this section "wild" means not in the care of a beekeeper at the time of swarming.

12. Roughly on what dates did you see the first and last swarms in 2006 and 2007? (dd/mm or just month). Were these earlier or later than you usually expect, or were the timings normal (or are you unsure)?

	First Swarm	Earlier / Later/ Normal / Unsure		Last Swarm	Earlier / Later/ Normal / Unsure
2006					
2007					

13. (a) How many swarms did you observe in 2006 and 2007?
(b) Of these, how many did you capture?
(c) Was the number higher or lower than you usually expect (or are you unsure whether this is higher or lower than usual)?

	(a) Observed	(b) Captured	(c) Higher / Lower / Unsure
Summer 2006			
Summer 2007			

14. How many of the swarms you observed were definitely from your own apiary? How many were from another managed apiary? How many were definitely of wild origin? For how many were you unsure of their origin? Please enter numbers in the table below.

	Definitely from own apiary	Definitely from another managed apiary	Definitely from a wild stock	Unsure
Summer 2006				
Summer 2007				

15. (a) Has it been your custom to put out an empty hive or hives as bait hives for swarm capture? If so, did you do so in 2006 or 2007? Yes / No

If 'No', please go straight to question 16.

(b) What can you say about the outcome of your use of bait hives?

			Origin of Swarms		
	No. of Bait hives put out	**No. Colonised**	**Swarms definitely from own apiary**	**Swarms definitely from elsewhere**	**Swarms of uncertain origin**
2006					
2007					

(c) How did these success rates compare with your previous experience?

	2006	**2007**
Higher		
About the same		
Lower		
Not sure		

Section 5: Migratory beekeeping

We should like to estimate how extensive is the practice of migratory beekeeping in Scotland.

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

	Yes	**No**
In 2006		
In 2007		

If you answered "No" for both years in Question 16, please go straight on to Question 18, otherwise please fill in the table below. You may provide an extended table if necessary.

17.

	No. of stocks moved	**From (date)**	**To (date)**	**Distance moved (miles)**	**Crop**	**No. of Beekeepers at site**
2006 move 1						
2006 move 2						
2007 move 1						
2007 move 2						

Section 6: Managing *Varroa*

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

Before 2003	□
2003	□
2004	□
2005	□
2006	□
2007	□
2008	□
Not yet known to be infested	□

19. What treatments or precautionary measures have you used against *Varroa* in the last two years? *(If you have not administered any treatment, then enter 'None' in the last column of the table.)*

	Apistan / Bayvarol	**Apiguard**	**Oxalic Acid Trickle Treatment**	**Oxalic Acid Sublimation Treatment**	**Drone Brood Removal**	**Open mesh floors**	**Other (specify)**
2006 Spring	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	
2006 Autumn	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	
2007 Spring	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	
2007 Autumn	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	
2008 Spring	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	

20. (a) Have you during 2006/07/08 been aware of any tests carried out in your local area for Varroa mites **resistant to** Apistan/Bayvarol?

Yes / No

If 'Yes', please answer (b).

(b) When were the tests carried out and what were the results?

Date(s) (dd/mm/yy)	**Resistant mites?**
	Yes / No / Inconclusive/Not known
	Yes / No / Inconclusive/Not known

Section 7: Dangers associated with Varroa Infestation

Inbreeding

(A) Possible signs of inbreeding

It is said that *Varroa* has wiped out many of the wild colonies of honey-bees. Wild bee colonies historically provided drones to mate with managed queens, which were possibly unrelated to them. So, potentially, nowadays there is an increasing tendency for managed bees to become inbred. The questions that follow are an attempt to gain information about this possible problem.

A sign of inbreeding which is sometimes observed is an unsatisfactory brood pattern with numerous clean empty brood cells, sometimes called Pepper-pot Brood or Shot Brood. Please note that a very light scattering of empty brood cells is normal. Here we are concerned with what you would consider to be excessive shot brood.

21. (a) Have you seen any evidence of this?

Frequently	□
Occasionally	□
Not at all	□

(b) If you have seen evidence of this, have you any explanation (other than possible inbreeding) for your observations?

……

We now need information about each apiary site which you manage **with only your own colonies on it**. Some of these questions may be hard for you to answer, but please do your best.

(B) Queens and Mating

Number of Laying Queens in an apiary and their relatedness

Any two queens in one apiary which are **mother-daughter** or are **sisters** are considered for the purposes of this survey to belong to the same family group. The maximum genetic diversity occurs when all the laying queens are unrelated. The greatest danger of inbreeding will occur if all queens in an apiary belong to a single family group. We should like you to assess this for apiaries you manage where all the stocks are your own.

22. (a) Are all your colonies of bees on a shared site or sites? Yes / No

If 'Yes', please go straight to Qu 25.

23. (b) For hives on site(s) which are all your own, we should like to know for each such apiary site how many **laying queens** came through the winters of 2005-6, 2006-7 and 2007-8, and

(c) What is the number of family groups of laying queens which this represents?

Please complete the following tables for as many sites as possible:

My first site:

	(b) Number of laying queens	(c) No. of Family Groups
April 2006		
April 2007		
April 2008		

My second site:

	(b) Number of laying queens	(c) No. of Family Groups
April 2006		
April 2007		
April 2008		

My third site:

	(b) Number of laying queens	(c) No. of Family Groups
April 2006		
April 2007		
April 2008		

My fourth site:

	(b) Number of laying queens	(c) No. of Family Groups
April 2006		
April 2007		
April 2008		

(If you have more than 4 apiaries stocked with only your own colonies, then please complete more tables like this on a separate piece of paper, and submit them stapled to your questionnaire. If you have fewer than 4, then just complete as many tables as you need.)

Distance between apiary sites

The danger of inbreeding will be reduced if drones from nearby apiaries can be expected to contribute to the mating of queens flying from your apiary, so we should like you to assess this.

24. How many other **apiary sites do you know of** within 5 miles as the drone flies of each of your sites?

My apiary sites	Number of other apiary sites within 5 miles
Number 1	
Number 2	
Number 3	
Number 4	

Queen breeding difficulties perhaps associated with *Varroa*

One of the problems reported by some beekeepers has been a high proportion of failures of new queens to go on to become successful laying queens. How have you fared in this regard?

25. For each of the seasons 2006 and 2007 how many of your colonies were permitted or forced to attempt to raise new queens, and of these attempts how many succeeded in producing a **queen that laid normally until the end of the season**? (*If you are not sure of the answer to any of these questions, simply insert "not sure" in the table.)*

	Initial No. of queenright colonies	No. of attempts to raise a queen	No. of successes	No. of failures
2006				
2007				

26. Have you observed higher than expected numbers of supersedures in 2006 and/or 2007?

Yes / No

Deformities of queens and/or abnormalities of behaviour

27. Have you observed a higher number than expected of queen deformities in 2006 and/or 2007?

Yes / No

28. (a) Have you observed any unusual behaviour in your bees in 2006-07?

Yes / No

If 'Yes', please answer (b).

(b) Describe the unusual behaviour below:

……

……

……

Section 8: Environmental Concerns

29. Some types of recently introduced and long-lasting pesticides and herbicides have been blamed as a possible cause of losses of honeybees.

(a) What is your view on this matter?

Very concerned □
Moderately concerned □
Not at all concerned □
Don't know anything about it □

(b) Are you aware of any possible use of such chemicals within foraging range of your bees?

Yes / No

If "Yes", please give details……..

……

30. Some people have expressed concerns regarding the effect of Electro-Magnetic Radiation (EMR) on the homing ability and well-being of bees. Possible sources are mobile phone masts, high voltage power lines, high power TV and radio masts, microwave towers for terrestrial communications links, etc.

(a)

I feel it is a serious threat. □
I feel it may perhaps have effects on bees. □
I feel any effect will be slight and unimportant. □
I do not believe this has any effect. □

(b)

For each of your apiary sites please indicate the approximate distance between your apiary and the nearest mobile phone mast that you are aware of.

Mobile phone masts	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

(c) For each of your apiary sites please indicate the approximate distance between your apiary and the nearest EMR source of the kinds indicated below that you are aware of.

Power lines	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

TV/Radio masts	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

Microwave telecoms towers	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

Please add others that may occur to you:

	Site 1	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

	Site 1	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

	Site 1	**Site 2**	**Site 3**	**Site 4**
Less than 100 m				
Between 100 and 500 m				
Between 500 m and 1 km				
None known within 1 km				

31. In this survey, we have investigated possible effects of *Varroa*, Mary Celeste, agricultural pesticides, and electro-magnetic radiation on honeybees. Are there any other issues that you believe may adversely affect honeybee colonies? New topics raised will be investigated in future surveys if they are of concern to a high proportion of respondents.

Please describe these concerns below:

……..

……..

……..

……..

……..

Thank you for your help.

We hope to report the results of this survey in a future issue of "The Scottish Beekeeper".

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

Local Beekeepers' Associations affiliated to the SBA

Association Name	Code No
Aberdeen & District	1
Ayr	2
Border	3
Caddonfoot	4
Cowal	5
Dingwall	6
Dunblane & Stirling	7
Dunfermline & W. Fife	8
East Lothian	9
East of Scotland	10
Easter Ross	11
Eastwood	12
Edinburgh & Midlothian	13
Fife	14
Fortingall	15
Freuchie	16
Glasgow & District	17
Helensburgh & District	18
Inverness-shire	19
Kelvin Valley	20
Kilbarchan & District	21
Kilmarnock & District	22
Largs & District	23
Lochaber	24
Moray	25
Mull	26
Nairn & District	27
Oban	28
Olrig	29
Peebles-Shire	30
Perthshire	31
Skye & Lochalsh	32
South of Scotland	33
Sutherland	34
West Linton & District	35