

REVIEW INTO OPTIONS FOR RESTOCKING HONEY BEE COLONIES IN SCOTLAND

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Contents

Summary

- 1. Issues relevant to restocking options**
 - 1.1 Policy, needs and sustainability
 - 1.2 Different communities of beekeeper and their interactions
 - 1.3 Quality of stock
 - 1.4 Bee health
 - 1.5 Queen production in an erratic climate
 - 1.6 Transparency, regulation and voluntary standards

- 2. Current position**
 - 2.1 Commercial sector description and needs
 - 2.2 Commercial sector preferences
 - 2.3 Commercial sector future restocking
 - 2.4 Amateur sector description and needs
 - 2.5 Amateur sector preferences
 - 2.6 Amateur sector future restocking

- 3. Issues arising and solutions**
 - 3.1 Lack of transparency in bee trade
 - 3.2 Preferences for type of bee and ideal bee traits
 - 3.3 Foulbrood and trade in bee stocks
 - 3.4 Importation and home production of stocks
 - 3.5 Queen and nucleus rearing in Scotland
 - 3.6 Additional resources

- 4. Options for future support for restocking**

Acknowledgements

Literature

- Appendix I Predictions of queen mating at six sites in Scotland using Met Office synoptic data sites.**
- Appendix II Surveys of commercial beekeepers and local associations**
- Appendix III Acronyms**

Summary

The needs, preferences and aspirations of the commercial and the amateur beekeeping communities in Scotland were reviewed using survey responses from a high proportion of local beekeeping associations and commercial beekeepers across Scotland.

The commercial beekeeper community in Scotland reports a wide range of winter loss figures but most have less than 40% and many less than 20% losses in difficult years. Half of the community aspire to increase their stock holdings by more than 25%. The most popular types of bee in this community are largely dark native hybrids, dark native honey bees and Carniolan honey bees. For future restocking this community would like an improved supply of home-grown stocks via trade, assistance with their own efforts and additional resources to help produce their own stocks. Only six of 19 respondents thought that importation of stocks should be encouraged although this is a route which some feel should remain open to ensure future resilience.

Local associations and their members provide around 80% of their local estimated demand for bees. The most popular types of bee in this community were dark native honey bees and their hybrids whereas very mixed hybrids were disfavoured. A minority of amateur beekeepers favour other kinds of honey bee. Most associations thought that assistance with their own effort was the highest priority for future restocking although there was also strong support for regional cooperation and supply. No local association selected importation as a means of improving the supply of bee stocks.

Using meteorological data and criteria from the literature for weather influences on the mating of honey bees, the frequency of opportunities for queen mating was modelled for six sites across Scotland. This suggests that even in poor summers honey bee queens can be mated at lowland sites with reasonable frequency. The criteria for mating have been determined from studies using internationally traded types especially Carniolan honey bees. The modelled data matches local experience in areas with very mixed honey bee stocks. However, from the experience of beekeepers in climatically less advantageous locations, this model appears to seriously underestimate mating opportunities. This gives support to the suggestion that there are locally adapted honey bees.

Taking into account the preferences expressed in the survey responses, the comments made by both communities and discussion on the feasibility of possible options with the Scottish Government, the following options are presented to improve the sustainability and the availability of stocks of honey bees in Scotland:

1. A certification scheme for trade in stocks of honey bees.
2. Training for increased production of stocks locally.
3. Further action to reduce winter losses and to spread good beekeeping practice.
4. Regional cooperation in queen and nucleus raising.
5. Resources for individual, regional and possibly national breeding efforts

1. Issues relevant to restocking options

1.1 Policy, needs and sustainability

In June 2010 the Scottish Government launched the Honey Bee Health Strategy, an initiative bringing together representatives from the amateur and commercial beekeeping sectors, Scotland's beekeeping advisor and key relevant individuals from the Scottish Government. The initiative came at a time of elevated concerns over honey bee health and the sustainability of stocks in Scotland. In the preceding year serious levels of bacterial disease had been uncovered in commercial colonies and the increased surveillance that summer also revealed significant problems in the amateur beekeeping community. Across the UK concerns had also been expressed at the high level of winter losses over a period of years and requests for action had been made by the beekeeping community. Since the initiation of the Honey Bee Health Strategy, remarkable improvements have been made in the health of honey bees in Scotland and in particular those of major bee farmers in Eastern Scotland. Improved cooperation across all organisations active in apiculture in Scotland is an additional output from the initiative.

The Honey Bee Health Strategy aims to use four pillars to ensure the sustainability of honey bee stocks in Scotland: education and training; communication; surveillance, diagnostics and biosecurity; and research. Two subgroups of the Strategy pursue these aims, bringing together the expertise and abilities of the Scottish Beekeepers Association (SBA), the Bee Farmers Association (BFA), Scotland's Rural College (SRUC) and the staff of SASA and RPID in the Scottish Government.

A major aim of the Strategy is to ensure the viability of the commercial operations that bring Scottish heather honey to the mass market. It therefore supports Scotland's Food and Drink strategy which aims to grow the industry's value to £16.5 billion by 2017. The health of the industry and the continuing elevation of hobby beekeepers to a commercial level indicates the success of the Strategy.

Since the low point of extensive disease and high winter losses in 2009, the Strategy has brought about a change in relationships and actions in beekeeping. There is now excellent cooperation between all kinds of beekeeper and the inspectorate in the Scottish Government, and indeed between all involved in the Strategy. European foulbrood in the apiaries of affected commercial beekeepers has been reduced to very low levels and only a small number of cases of American foulbrood are now detected in the bees of all types of beekeeper annually. Education of amateur beekeepers and commercial beekeepers has helped raise standards of beekeeping.

The sourcing of bee stocks to replace lost colonies or to grow numbers remains an issue requiring attention and is the focus of this report. There are several different routes to build numbers of stocks including importing packages (bees in a ventilated box without comb) and queens, rearing and trading nuclei from existing commercial apiaries and the apiaries of local groups of beekeepers, and reducing the need for

replacement stocks by further improving standards of husbandry. The importation of bee stocks is regarded as controversial by many beekeepers as it risks adding to the complement of bee diseases already in the country.

1.2 Different communities of beekeeper and their interactions

There are two organisations operating at the Scottish level which represent and support beekeepers, the Scottish Beekeepers Association and the Scottish Group of the Bee Farmers Association. The SBA has over 1500 individual members as well as 43 affiliated local associations and the BFA has 24 members in Scotland. Section 2 of this report will present more detail of the commercial beekeeper community and the local association network in Scotland. The combined membership of the SBA and the local associations is likely to be around 2,500 to 3,000 and a further group of beekeepers, perhaps 1,000 strong, are not members of any beekeeping organisation. There is a large turn-over of the membership of many local associations being swelled by beginners' classes by up to around 50% annually. The majority of aspiring beekeepers do not become established and leave the membership register after a year or two. The BFA membership in Scotland includes most beekeepers with 20 or more hives and operating at the commercial or semi-commercial level. The bee farming enterprises are often run as family businesses or have started as a long established hobby beekeeper turned professional. This leads to a relative stability of this community which turns over primarily due to retirement and a small number of new entrants.

Some members of the commercial beekeeping community are well connected with and engage well with the amateur beekeeping community. Some have membership of both national organisations and are active in both. Commercial beekeepers are often popular speakers at local or national beekeeping association events and some are active participants in public events mounted by the SBA. Some commercial beekeepers host visits by groups from the amateur community. In general there is now a trusting, friendly relationship between both communities in Scotland.

Many local associations generate their own stocks of bees for the beginners that come to them for advice or training. Others rely on commercial beekeepers who may produce some nucleus stocks (bees on about 5 frames) from their own bees or who may trade imported stocks, usually packages and queens although these are often presented to the buyer as established nuclei. Some beekeepers use mail order companies operating at a UK national level and again most of these stocks are derived from imported stocks.

Prior to the discovery of extensive infection with European foulbrood in the area of E Scotland used by major bee farmers in 2009, there was a significant trade from some of these bee farmers to the amateur sector. This trade effectively ceased from that point, although a voluntary protocol drawn up at the time (the European Foulbrood Control Plan) did permit local sales of nuclei.

1.3 Quality of stock

A wide range of types of honey bee are kept in Scotland. Most commonly, beekeepers use the hybridised stock available locally. The bees are often

derivatives of the dark native honey bee, *Apis mellifera mellifera* and various imported types such as Italians (*Apis mellifera ligustica*), Carniolans (*Apis mellifera carnica*), Buckfast (a man-made stabilised hybrid of complex origin originally created by Brother Adam), and a few other types. Different types of beekeeper prefer different types of bee for a variety of different reasons. Honey producers are usually interested in productivity above all else whereas others may require gentle stocks or may be keeping bees for reasons of conservation and biodiversity. Consequently there is often a mix of different types of bee in one area with extensive hybridisation generated by mating and the dispersal of swarms, both of which take place over many kilometres, and it remains difficult to maintain the purity of bees of a particular type in such mixed areas. Many beekeepers come to believe that their stocks show local adaptation of some kind and that the introduction of different types of honey bee into their area jeopardises this by introducing non-adapted types. The local native and near native stocks are likely to perform well below their potential given that there has been a lack of significant effort in bee improvement using this material for many decades. Despite this, a preference continues for native honey bees in many local associations and by some commercial beekeepers. This provides an opportunity for those committed to keeping and propagating native stock to improve their stock.

1.4 Bee health

Bee health is a major concern and is the primary focus of the Honey Bee Health Strategy. Two main issues are the incidence of endemic notifiable disease and the prevention of the introduction of new disease via imports. Although regulated trade includes the safeguards of the inspection of stocks prior to shipping, traceability and the exclusion of areas from trade that have been shown to carry risks of non-endemic pathogens, this still leaves the possibility of undetected or unrecognised pathogens moving with the international trade in honey bees. A further concern is the unregulated trade reputed to take place into the UK without any inspection of the health of the stock. However the spread of pathogens already in the country is also a major concern.

The European Foulbrood Control Plan, developed with the affected commercial beekeeper community by the Scottish Government, placed voluntary restraint on trade from the infected area to the uninfected area. Now that action to change practices and identify and deal with disease at an early stage has been effective, the level of infection has been reduced to levels similar to those in other devolved nations of the UK, from which stocks of bees can be freely traded. Self-regulation and cooperation between the commercial community and the inspection service is at a good level and it is timely to consider mechanisms to re-open this trade, reducing the need for the purchase of import-derived stocks. The Scottish Government already has a pilot scheme planned for 2016 which will permit a controlled release of nucleus stocks to the amateur community after the inspection of stocks. This scheme has the potential to be expanded to release restrictions on additional bee farmers and to improve other aspects of the trade in bees in Scotland, raising the confidence of potential purchasers of stock.

1.5 Queen production in an erratic climate

It is often said that queen rearing and mating in Scotland and indeed the rest of the UK is a risky endeavour. Southern parts of Europe can produce mated queens more reliably and a considerable level of trade has become established with over 10,000 queens and 2,500 packages or nuclei officially recorded as coming into the UK annually from the EU. Despite this, queen rearing can be performed in Scotland and one major commercial beekeeper has set up a unit to do this with an impressive target of 2,000 mated queens in 2016.

Instrumental insemination has been proposed as a means of ensuring the fertilisation of queens when unsuitable weather prevents it happening during free flight. Scotland has one individual who maintained his beekeeping on Shetland for many years with the help of instrumental insemination. There is also one member of the commercial beekeeper community with a special interest in instrumental insemination and who offers training at a purpose built small laboratory in SW Scotland. There is another instrumental insemination expert in England who has created a mobile laboratory to offer training or insemination services to beekeepers. Most queen breeders consider that the method is too time consuming for the routine production of queens but is a very useful technique to produce controlled crosses and maintain special lines used for open-air queen rearing in the next generation.

To address the question of the feasibility of reliable queen rearing in Scotland, the scientific and bee literature was explored to determine weather variables required for successful queen mating. These were used to compile a list of criteria that were used to interrogate a panel of synoptic weather data sets kindly supplied by the Met Office for sites across Scotland. Data sets with the full range of required hourly variables (air temperature, wind speed, sun hours and rain) were selected for Edinburgh (Gogarbank), Ayr (Prestwick), Auchterarder (Strathallan Airfield), Aberdeen (Dyce), Tiree and Orkney (Kirkwall). In Excel, time points were extracted that met the requirement for air temperature 18°C or over, wind speed 15 kph or less, no rain and at least some sun during the hourly periods ending 13:00 to 18:00. The requirement for 18°C was an arbitrary choice as the leading European experts, Gudrun and Nikolaus Koeniger, suggest that German carnica queens fly only at 20°C. Other research and observations from the bee literature suggested 18°C whereas observations with Scottish native *Apis mellifera mellifera* (Andrew Abrahams, personal communication) and Irish native *Apis mellifera mellifera* (Jon Getty, ditto) indicates that they will fly at 16°C. Five year spans of data were filtered using these criteria and plots of the six Scottish sites are presented in the Appendix I. An additional set of data was kindly supplied by Dr Roy Neilson and Alison Dobson of the James Hutton Institute (JHI) at Invergowrie, Tayside. These data were interrogated for potential mating weather windows using the same criteria with the exception of replacing no recorded rain with humidity below 85%. Plots from the JHI data were discussed with Murray McGregor who owns a queen rearing operation in the same area and it was agreed that they provided a reasonable correlation with actual successful mating in 2015 at his queen mating station. Variation in the detail, including better mating in June and poorer mating in August, could have been due to topographical differences affecting the microclimate at the two sites.

Points of interest arising from this exercise include that successful queen mating takes place at lowland Scotland sites even in particularly poor summers such as 2015. Given that virgin queens have an approximately 15 day period of receptivity,

all summers in lowland Scotland have relatively infrequent periods in which virgins cannot mate. In better sites in better summers almost all queens set out for mating during the main period of the summer should have the opportunity to mate. The plots also indicate the unreliable conditions at either end of the season, in May when natural swarming is just getting underway and in September when some colonies may be replacing queens through supersedure.

The exercise also appears to demonstrate that in the Hebrides and on Orkney periods when queens can mate successfully are rare and even absent in poorer years. This is in contrast with the experience of beekeepers in these places. Andrew Abrahams on Colonsay reports that queens get mated in all summers and this differs from predictions from Met Office data for Tiree, an island with very similar weather to Colonsay. Together this suggests that the bees in these places are showing local adaptation and have been selected for the ability to fly in cooler and windier conditions than the central and eastern continental subspecies. However this is, to a degree, speculation as there has been very little scientific work on the mating biology of native honey bees (*Apis mellifera mellifera*) in Scotland or indeed elsewhere. The study described here appears to be a novel use of meteorological data and will be prepared for publication by the contractor and SASA and RPID staff.

1.6 Transparency, regulation and voluntary standards

As was mentioned above, there is a significant level of international trade in packages, nuclei and mated queens. Although the more reputable suppliers cooperate well with the regulatory authorities, there are persistent stories of individuals in the trade who avoid the requirement to follow regulations relating to exporting and importing stock. There may also be direct trade between producers abroad and individual, small scale beekeepers in the UK. As far as can be determined, the great majority of the trade into Scotland is performed legally and ethically, although beekeepers in Scotland may individually and unknowingly source bees from traders elsewhere in the UK who are not following the requirements. As well as the means by which imported stocks reach beekeepers there are additional concerns over transparency and ethical trading. Some traders in Scotland use significant quantities of imported packages and queens yet do not appear to declare the origin of the stock to buyers. There is also some selling of stocks from *Varroa*-infested areas to currently *Varroa*-free ones. These are issues that were revealed in the surveys of beekeepers that form the main part of this work.

2. Current position

2.1 Commercial sector description and needs






The current membership of the Bee Farmers Association in Scotland was surveyed for details of their businesses, information on the stocks they hold, their current estimates of their own nucleus or package and queen production and their intentions for the future. The survey questions used for this study can be seen in Appendix II.






A total of 24 commercial beekeepers were approached and 19 responded. Of the remaining five approached, one was in the process of withdrawing from commercial

beekeeping, three are thought to be retired bee farmers and one is an existing trader in bees and equipment. Consequently all but one of the active commercial beekeepers in Scotland were included in this study.

Most commercial beekeepers have 50-500 colonies with only two operations larger than 500 colonies.




The need for restocking arises from a desire to replace losses, often suffered during the previous winter but in some cases previously and a desire to increase the total holdings of the beekeeper. Winter losses vary greatly from year to year and commercial beekeepers were asked for their level of exceptional losses, ie losses in particularly poor years. Almost 70% of bee farmers indicated that their worst losses were below 40%. In discussions with commercial beekeepers some have indicated that in poor years a proportion of their stocks may survive the winter but are too weak to be productive in the early part of the subsequent season, giving rise to an additional need to supplement stock.

| How many production stocks did you take into winter 2015-16? | | | | | |
|--|----------|---|--|------------------|----------------|
| | | | | Response Percent | Response Total |
| 1 | <50 |  | | 11% | 2 |
| 2 | 50-100 |  | | 42% | 8 |
| 3 | 101-500 |  | | 37% | 7 |
| 4 | 501-1000 |  | | 5% | 1 |
| 5 | >1000 |  | | 5% | 1 |
| | | | | answered | 19 |
| | | | | skipped | 0 |

| In exceptional years for winter losses, what proportion of hives need restocked? | | | | | |
|--|--------|---|--|------------------|----------------|
| | | | | Response Percent | Response Total |
| 1 | <20% |  | | 37% | 7 |
| 2 | 21-40% |  | | 32% | 6 |
| 3 | 41-60% |  | | 16% | 3 |
| 4 | 61-80% |  | | 11% | 2 |
| 5 | >80% |  | | 5% | 1 |
| | | | | answered | 19 |
| | | | | skipped | 0 |

Commercial beekeepers were also asked what their aspirations were in terms of change in the number of stocks they owned. This demonstrated a remarkable desire for building (or rebuilding) businesses with no respondents indicating a desire to reduce numbers and almost half wishing to increase their holdings by more than a quarter. It should be borne in mind that one individual, a recent recruit, was withdrawing from bee farming due to a change in direction apparently linked to the difficulty of running such a business with certain ethical constraints. The contractor is aware of six additional individuals (not surveyed) making plans to become commercial beekeepers at the scale that would qualify for BFA membership. Taken together, this indicates a healthy demand for additional stocks for the commercial sector.

Commercial beekeepers indicated that they raised about 1175 nuclei and packages from their own bees annually, predominantly nuclei. Approximately 3200 queens are raised by these beekeepers, more than half of these by one queen rearing unit. This queen rearing unit has grown substantially in the last few years and expects to produce at least 2,000 queens in 2016. In the difficult summer of 2015 and prior to additional scaling up for 2016, the unit produced 700 queens. The majority of the queens generated by this unit will be used within the business for production colonies and for increase both within the business and for sale. This unit also produces several hundred nuclei and the operators have mentioned that both the queen and nucleus production are scalable.

| Do you aspire to change your holding of stocks? | | | | |
|---|------------------------------|---|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | up more than 25% |  | 47% | 9 |
| 2 | up by up to 25% |  | 10% | 2 |
| 3 | maintain approximately as is |  | 42% | 8 |
| 4 | reduce by up to 25% | | 0% | 0 |
| 5 | reduce more than 25% | | 0% | 0 |
| | | | answered | 19 |
| | | | skipped | 0 |

After deducting the nuclei and queens used within operations, approximately 280 nuclei and 280 queens are available for trade. Seven of these beekeepers also use packages or nuclei (approximately 427) from elsewhere. Six of these beekeepers use queens from elsewhere in most years, either from the Scottish queen rearing unit, from elsewhere in the UK or imports. One beekeeper imports a large number of queens which, it is assumed, are largely sold on.

2.2 Commercial sector preferences

The commercial beekeepers were asked what types of bees they kept, and what types they would prefer to keep. Comments were also offered and the results are reported below.

The responses show that a diversity of types of bee is kept by the commercial beekeeping community in Scotland. Some explicitly indicate they have no preference for race or subspecies whereas others, in the comments here and elsewhere in the survey, show a liking for one type or another. Some indicate that locally adapted bees are important to them. The differences between the two charts above show that when asked for their preference, some beekeepers would wish to reduce holdings of very mixed hybrids, Italians and Buckfast.

| What kinds of bees do you keep? (tick all that apply) | | | | |
|---|---|--|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | very mixed hybrids | | 37% | 7 |
| 2 | largely dark native hybrids | | 37% | 7 |
| 3 | dark native honey bees | | 42% | 8 |
| 4 | Italians | | 16% | 3 |
| 5 | Buckfast | | 53% | 10 |
| 6 | Carniolan | | 47% | 9 |
| 7 | other ... | | 5% | 1 |
| | | | answered | 19 |
| | | | skipped | 0 |
| Comments: (5) | | | | |
| 1 | Up till 2014 I had all largely dark native hybrids. I then bought Italian Buckfast strain | | | |
| 2 | The Buckfast and Carniolans are less than 20% of the total but are relatively true to type still. | | | |
| 3 | We like good bees and consider race/breed to be of secondary importance. Our dominant types will be carnica and black bees, and all shades of mix in between. | | | |
| 4 | Having spent some 10 years improving my own strain I have to contend with Buckfast all around, they are too prolific for our area, most of the swarms I collect are usually Buckfast. | | | |
| 5 | Over the years I have purchased French blacks, Danish Carniolan, Danish Buckfast and Italians still see this blood line through the locally adapted hybrids. | | | |





| What kinds of bees would you prefer to keep? (tick all that apply) | | | | |
|--|--|--|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | very mixed hybrids | | 16% | 3 |
| 2 | largely dark native hybrids | | 42% | 8 |
| 3 | dark native honey bees | | 42% | 8 |
| 4 | Italians | | 5% | 1 |
| 5 | Buckfast | | 21% | 4 |
| 6 | Carniolan | | 47% | 9 |
| 7 | other | | 11% | 2 |
| | | | answered | 19 |
| | | | skipped | 0 |
| Comments: (5) | | | | |
| 1 | No preference for race, a well adapted local mongrel suits me fine. | | | |
| 2 | For an average crop I find a mix gives average results | | | |
| 3 | Low swarming and good returns over time. From experience bad traits can be bred out. | | | |
| 4 | No preference as long as they show the traits I look for as a beekeeper. | | | |
| 5 | Adapted to local conditions | | | |

These additional comments from elsewhere in the survey are also relevant, showing differing views on the desirability of importing stocks or breeding from selected, locally adapted ones.

| Comments: (13) | | |
|----------------|--|---|
| 1 | | (queens supplied) From [] |
| 2 | | I purchase queens through [] when/if i need as they are mated and laying within the week of making the new colonies off of my own hives. |
| 3 | | My first consignment of package bees was in 2014 I ordered 40 and in 2015 I ordered 12 |
| 4 | | My management is in flux. Historically I have bred replacements from colonies preparing to swarm then united at the end of the season. Any nucs or packages have been by way of an experiment to see how they compare. The arrival of the Payne's box and the possibility of buying good queens from [] will make me consider changing to improve my stock. I anticipate splitting some colonies to make perhaps 100 Payne's nucs and introducing a [] queen into each. I have a current order placed with [] for 50 packages as I am anticipating heavy winter losses due to the late heather, a mild winter so far and the likelihood of a lot of drone layers. |
| 5 | | Carnolian virgins from Wales |
| 6 | | Have purchased many queens and packages in the past but this is not financially sustainable and often the quality is poor. |

| | |
|----|--|
| 7 | Very varied.....I do a lot of the imports for others but use relatively few ourselves. As the queen breeding effort grows the number bought in will decline, and requeening will be more frequent. Hopefully we can get to a position where all we import or buy in will be selected breeder queens to keep the stock fresh. |
| 8 | I prefer to breed from bees of know performance. |
| 9 | Took the decision in 2009 to only breed from my best locally adapted hybrids, so do not buy in, not to say will not in the future if I experience high % losses, more than 50% say. |
| 10 | Isolated, self contained population! |
| 11 | I have previously bought packages but have now developed my business to be able to make my own up with my own queens |
| 12 | Have restocked most years since 2010. |
| 13 | After the disaster of the summer of 2012, we were forced for the first time in our history to use restock from overseas. These have been kept totally separate from our own stocks and have gradually been bred out. They were of a far lesser standard than my own. |

The commercial beekeepers were also asked for their views on the need to improve the stocks they held. There was some enthusiasm for improving the bee kept.

| Do you believe that the quality of bees you keep needs improving? | | | | | |
|---|-------------------|---|--|------------------|----------------|
| | | | | Response Percent | Response Total |
| 1 | Not at all |  | | 11% | 2 |
| 2 | A little |  | | 37% | 7 |
| 3 | To some extent |  | | 37% | 7 |
| 4 | To a large extent |  | | 16% | 3 |
| | | | | answered | 19 |
| | | | | skipped | 0 |

When asked to rank their preferred traits of bees, productivity was top of the list with good temper, low swarminess and frugality next in sequence.

| Please rank these traits according to your preference for your own business. 1 - highest preference; 6 or 7 - lowest preference | | |
|---|--------------------------|--------------|
| Item | Total Score ¹ | Overall Rank |
| Productivity | 123 | 1 |
| Good temper | 93 | 2 |
| Low swarminess | 85 | 3 |
| Frugality | 76 | 4 |
| Varroa tolerance | 63 | 5 |

Please rank these traits according to your preference for your own business. 1 - highest preference; 6 or 7 - lowest preference

| Item | Total Score ¹ | Overall Rank |
|--|--|--------------|
| Chalkbrood resistance | 61 | 6 |
| other | 31 | 7 |
| ¹ Score is a weighted calculation. Items ranked first are valued higher than the following ranks, the score is a sum of all weighted rank counts. | answered | 19 |
| | skipped | 0 |
| Comments: (4) | | |
| 1 | OTHER = ability to overwinter well | |
| 2 | The click boxes aren't working but my preference is: Productivity, Varroa tolerance, low swarminess, good temper, chalkbrood resistance then frugality. | |
| 3 | Other is general disease resistance. There is a marked correlation, also observed by others of this same correlation we noticed independently. Frugality is a rather nebulous factor, as it can be linked to low vigour and thus modest low input honey crops.....ie the 'Maud' bee..., or merely as the antithesis of overconsumption of stores in adverse conditions, as do many Italian type strains and hybrids. We do not see it as a factor per se that we would desire, but the very heavy and unregulated stores usage of Italians is a very strong negative that would push frugality far higher up the list. We do not keep such bees thus it drops down the list and stock of that nature is never selected by us. | |
| 4 | Other I call is nervousness, difficult to work bees successfully if they are nervous on the comb (running everywhere) as a lot of my management method require me to find queen. | |

2.3 Commercial sector future restocking

The commercial beekeepers were invited to comment on the possible means of improving the supply of honey bees in Scotland and were offered six choices. The responses show that there is widespread support for additional home production via trade nationally, through regional centres or through assistance with their own effort. Six of the 19 supported importation as a possible means of future restocking. There was a tendency for the larger-scale commercial beekeepers to be more supportive of importation than the smaller and medium-scale beekeepers.

Many of the additional comments were relevant to the question of the means of addressing the supply of honey bee stocks. Some expressed the view that queen rearing in Scotland is not viable whereas others wished encouragement for that and pointed out the bee health risks and the effect on the adaptation of bee stocks from importation of non-adapted stock. One pointed out that nuclei can be over-wintered successfully with their queens which were mated at the optimal time. This is an alternative to making increase by splitting colonies in late spring and using imported mated queens to quickly get the new colony established and growing.

What lines of supply of honey bee stocks do you think should be encouraged in the future for the commercial beekeeping sector? (tick all that apply)

| | | | Response Percent | Response Total |
|---|---|--|-------------------------|-----------------------|
| 1 | Importation (directly or via traders) | | 32% | 6 |
| 2 | Improved supply of home grown stocks via national traders | | 63% | 12 |
| 3 | More regional medium-scale suppliers | | 53% | 10 |
| 4 | Assistance with own effort | | 63% | 12 |
| 5 | National breeding centre | | 32% | 6 |
| 6 | Regional breeding centre | | 58% | 11 |
| 7 | other ... | | 0% | 0 |
| 8 | No requirement to improve supply | | 0% | 0 |
| | | | answered | 19 |
| | | | skipped | 0 |

Comments: (5)

| | |
|---|---|
| 1 | If stock could be purchased from breeders in UK at reasonable prices for large numbers I would be looking no further. The breeders would have to prove that there bees would be as good if not better than bees already being supplied from further afield. |
| 2 | Commercial beekeepers who buy bees need them early in the season so there is a chance of obtaining a crop from them. For that reason commercial beekeepers will still want/need to have access to imports to some extent. The answers for the hobby sector would be very different, much more local and self help focus. |
| 3 | Importation done properly is fine. Not seeking to greatly develop that but in favour of it continuing to be available as a responsibly carried out option. |
| 4 | Scottish queen producers must compete on quality and price with imports. Trials that compare performance under commercial conditions of best quality local queens vz imports would determine performance differences. How large is that performance gap, how great is the price difference of queens? |
| 5 | Having tried foreign imports, they are a very poor replacement for our own native stock. Having developed a strain of bee that has a direct link back to Willie Smith of Innerleithen, I would far rather get support to develop and restock my own colonies. |

Do you have any additional comments on the supply of bees and queens in Scotland?

| | | Response Percent | Response Total |
|---|---------------------|-------------------------|-----------------------|
| 1 | Open-Ended Question | 100% | 11 |
| | no | | |

Do you have any additional comments on the supply of bees and queens in Scotland?

| | Response Percent | Response Total |
|--|---------------------|-------------------|
| All imported stocks of queen should have more quality control to ensure an increase is quality of home breed queens. | | |
| I have bought nucs in the UK in the past and paid a lot of money for them and then find they were bad tempered and poor honey gatherers We would need to find a breeder who is skilled and dedicated enough to be able to breed and supply bees fit for the purpose and in the quantities needed. A tall order I think? | | |
| You have seen my thoughts in another document but I think the time spent by Graeme with the SSBKA is a good model to follow We were successful in trying a new technique (to us) and have gone from producing no nucs for our members to being able to meet the members demand. At a larger scale I think [] model is first class and if supported could grow. | | |
| Queen rearing in Scotland is highly dependent on the weather. Financial assistance should go into other aspects of beekeeping which would be a more efficient use on any monies/ support. | | |
| I have seen models in other countries where the best queens from beekeepers are sent to a centre of excellence where queens are reared on a commercial scale. Our climate does not allow enough time for this and I would advocate this idea being run in a country in Southern Europe so that queens and or nucs/packages are ready for the start of our season. If there is some initial funding to set this up then it should be self financing after a couple of years. | | |
| The precarious nature of our climate renders it an uncertain venture. Proper honey production in this country requires planning, including having new seasons queen ready and installed by certain critical dates to have decent colonies to exploit the available forage. This planning is very difficult, even impossible, with locally produced queens. The supply of overwintered nuclei is more of a runner, as these can be mated at any optimal time during the season and built up, being supplied out to the client only once of suitable quality. Instrumental insemination is a potential option, but is not really viable cost wise for ordinary production colonies. | | |
| Traders must make sure the end user the beekeeper, has the skills in place to manage the colony witnessed to many honey bees killers who are a source of repeat business. Also the quality of stock sold must be able to survive at times the harsh Scottish climate. Would be in favour of more localised queen rearing groups. | | |
| If the risk of spread of bee diseases through importation of bees and queens was fully understood and quantified by commercial bee farmers in Scotland, most would run self contained units. Think about commercial pig, poultry and salmon farms! Prior to 1990's most bee farmers reared their replacement queens and stock. It was commercially viable and still is. Think imports, think disease, that should become the mantra. | | |
| The shortage and price of domestic stock is a problem. | | |
| Most of the large scale, experienced, beekeepers on Scotland are more than capable of increasing their stock holding. Most of the bees have been bred over long periods of time to work in tandem with the area they forage. Financial support to allow beekeepers to increase their own stock is far preferable to bringing in foreign bees, often of unknown standard. | | |
| | answered | 11 |
| | skipped | 8 |

Finally, given that a proportion of commercial beekeepers may be interested in assistance with their own efforts, they were asked what that assistance may look like. The responses included help with equipment including nucleus boxes, training, finance for staff costs and collaborative working including breeding effort and the provision of drone production sites for mating.

| 13. If, in Q11, you indicated that you could benefit from assistance with your own effort, what form would that take? | | | |
|--|---------------------|------------------|----------------|
| | | Response Percent | Response Total |
| 1 | Open-Ended Question | 100% | 11 |
| <p>A collective of BFA Queen breeders with an aim of improvement of stocks. Whether they are imported or home grown or a mixture.</p> <hr/> <p>Assistance could be anything from help with buying equipment nuc boxes etc to the supply of good breeding stocks so we are not just mating queens with there own blood line. Opportunities for other beekeepers to bring mating nucs to areas that have known healthy stocks to mate with drones from different lines.</p> <hr/> <p>This answer is more a general one that one that refers to my beekeeping. There will be two things needed to expand production, training where it is needed to ensure that beekeepers have the necessary skills but just as important is access to the physical resources which will be needed. In most cases expanding capacity will require purchase of equipment and possibly breeding stock. The Restocking element of the EU Apiculture Programme provides the possibility of funding being available.</p> <hr/> <p>We need proper targeted grant funding for bees. If we are now agricultural then we should be entitled to some form of livestock funding. This could be in the form of subsidised bees from a central restocking unit controlled by Scottish beekeepers. NO bees NO honey NO pollination NO beekeepers!</p> <hr/> <p>Help to buy enough equipment, and to fund staff training, to enable us to take our project forward.</p> <hr/> <p>Need regular good breeder queens to improve stock and add new genes</p> <hr/> <p>A managed isolated quality drone mating facility</p> <hr/> <p>Queen breeding and mating with some degree of isolation, to improve in strain mating, along with field testing for desired characteristic.</p> <hr/> <p>Further training in queen rearing, grafting techniques</p> <hr/> <p>Find way of allowing safe trade/movement of shook swarms in face of EFB.</p> <hr/> <p>We would need extra staff and training.</p> <hr/> <p>The ideal scenario is for financial support to cover the additional staff, travel and equipment costs incurred by increase in stock numbers, It must also be remembered that the additional feed costs are extensive also.</p> | | | |
| | | answered | 11 |
| | | skipped | 8 |

2.4 Amateur sector description and needs

Forty one local beekeeping associations (also called Affiliated Beekeeping Associations by the Scottish Beekeepers Association) provided input into this study. Their combined membership is 2175 and the membership of the national beekeeping association, the Scottish Beekeepers Association, is over 1500. There is incomplete overlap in the memberships of these organisations and it is believed that there are around 4000 beekeepers in Scotland in total. Local associations provide the majority of training for beginner beekeepers in Scotland with 17 associations represented on the current list of formal classes offered. Most other associations help people into beekeeping more informally. A small number of beekeeping enterprises, occasionally local colleges and one social enterprise, now closed, have also offered training.

Responses were gathered by email requests and by telephone interviews. Only two relatively small beekeeping associations in the west of the country did not respond to email requests and could not be reached by telephone. Local association secretaries responded (41 associations, 95%) using their own knowledge of their association, after consulting senior members of their association or after consulting the wider membership. Two members' meetings were attended and the preferences of members sought by open debate to supplement and verify responses by their local secretaries. An additional meeting of a fringe group interested in environmental aspects of beekeeping was attended but those present with bees were few in number and belonged to local associations.

Six local associations reported a membership of greater than 100 with the largest reporting 230 members. Most associations have memberships in the range of 20-70 individuals. Only one had a membership smaller than 12 individuals.



Twenty one local associations (51%) reported that they raise their own bees to supply members. All but two of the 15 largest associations raised their own nuclei.

The numbers raised annually range from 2 to 100 with the majority (16 associations) raising 10 or fewer per year. Nine associations reported separately raising queens that were not integral to the raising of nucleus stocks. Two of them raised 20 and 25 respectively, the others raised small numbers. The total number of nuclei and similar starter stocks raised by associations across Scotland for their members was 202 and the number of additional queens produced was estimated to be 72.

Sixteen local associations provided additional comments on nucleus and queen rearing at their apiaries. Two indicated that they aspire to initiate an association apiary. Of those with association apiaries one uses their colonies only for tuition and not raising stock, others distribute queen cells to members when the opportunity arises, some produce stocks via swarming and by splitting colonies with queen cells, whereas others are building their skills with grafting and directed queen raising with the use of mini-nucs and other boxes to obtain mated queens. One pointed out that they cover an area which has pockets of *Varroa* infestation and pockets of freedom from *Varroa*. Others are known to be in the same position and all will attempt to direct available stocks to the appropriate type of area.

Associations were also asked whether there were individuals in their area supplying bees to members. This elicited a greater positive response with 37 (90%) reporting that members generate stocks for others. The total number of stocks said to be produced in this manner was approximately 345. Individuals in associations raising queens additional to those remaining in nuclei were found less frequently with 17 associations (41%) reporting this route to generate queens. A total of approximately 204 queens were reported to be raised by individuals.

In summary, the current total activity within local associations through their own efforts and those of their members in raising stocks for others produces about 547 stocks and about 274 additional queens annually.

Local association secretaries were also asked whether their members sourced bees from traders. Although associations with less well organised production of stocks frequently reported that members buy stocks from commercial sources, this occurred in other associations too. Twenty five associations (61%) reported that members bought a total of about 154 bee stocks from traders. Fourteen of them also reported that their members bought queens from traders, a total of about 85 queens.






The question was asked 'Are you able to say where these traders obtained their bees'? Of those association secretaries answering this question (which came, of course, from associations where members do buy from traders) relatively few thought that the traders were importing bees with the majority believing that the bees were raised in Scotland or were from the trader's own bees. This result was a little surprising as the traders in Scotland consist of two groups: a small number of individuals who do sustainably raise stocks for local sale from their own bees and form a relatively small part of the market; and three or four operators who make use of imported packages, colonies from imported packages and/or queens to generate nuclei for sale over a wide area. There are also a number of online retailers operating from England who trade in packaged bees converted to nuclei for onward sale to the amateur market.

This suggests that there is a lack of openness on the part of the traders. One local association responded to this question saying that the trader obtained his bees from his own bees and from purchases within Scotland. This secretary also volunteered the name of the trader, one known to use imported packages in his business. This view was also illustrated by comments from local associations (associations that discourage their trainees and members from buying from traders) as follows:

‘Ideally an "Approved supplier" registration would ensure buyers could obtain good quality disease-free bees; end all importations of bees; require beekeepers to record where bees were obtained.’

‘Our ABA members have been made aware of the benefits of buying locally produced and adapted bees. Some introduction of other Scottish stock to improve local mix. Very critical comments with an unscrupulous supplier telling customers that bees are 'Scottish' and who do not care if they spread Varroa to Varroa-free areas.’

‘We are against the importation of bees from Europe & their subsequent re badging as UK bred.’

| Are you able to say where these traders obtained their bees? | | | | |
|--|-------------------------------|---|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | Imports |  | 19% | 6 |
| 2 | Purchased in Scotland |  | 39% | 12 |
| 3 | Purchased elsewhere in UK |  | 32% | 10 |
| 4 | Raised from trader's own bees |  | 45% | 14 |
| 5 | Don't know |  | 26% | 8 |
| | | | answered | 31 |
| | | | skipped | 10 |

Local association secretaries were also asked to estimate the requirement for i) nuclei for beginners, ii) nuclei for replacement colonies, and iii) additional queens. The total estimated requirements were: i) 346, ii) 312, and iii) 267. Consequently the total requirement for replacement stocks (346+312=658) was estimated to be 20% higher than the capacity of the local associations or local individuals to generate the stocks required. Queen numbers required and produced were similar.

It should be recognised that these numbers are approximate estimates and that there is a high degree of uncertainty as to the gap. It should also be noted that the demand for bees also includes beekeepers who do not join local associations and may seek advice and the purchase of bees from traders themselves.

2.5 Amateur sector preferences

Any consideration of restocking needs to address the preferences of the beekeeping community for the different types of bee available and their suitability. Two questions were asked, one to gain an impression of the types of bee managed by local association members and one to gain an impression of the preferences of their members should it be possible to change the stocks kept.

As can be seen by inspecting the tables, the most abundant bee types amongst local association members are largely dark native hybrids and very mixed hybrids. The next most abundant types are dark native bees and Buckfast bees. Buckfast are most commonly kept by a minority of individuals in associations, sometimes earning the disapproval of other members in the association. There is one relatively small association where the majority of the members keep Buckfast bees. A small number of beekeepers keep Italian or Carniolan stock and one individual was singled out in the comments as having Iberian bees (*Apis mellifera iberiensis*). At two members meetings attended the view was expressed that their bees are mostly very mixed hybrids but also that was inevitable given that the territory was shared by, in one case, a high density of commercial apiaries of a very mixed type and, in the other, that they had beekeepers in their association who kept different types of bee.

The views of the local association secretary were also recorded on the preference of their membership for the type of bee to keep. The differences between the responses to the two questions are illuminating. There appears to be a wish to keep fewer of the very mixed hybrids and, in preference, increase the number of dark native honey bees instead. There is also a smaller shift to Buckfast bees when considering preferences. The combination of 'some', 'many' and 'all' of the memberships wishing to keep dark native bees rises from 26% of responses saying these bees are kept to 69% aspiring to keep them. The equivalent figures for Buckfast are 26% rising to 36%.

| What proportion of your members do you believe keep these kinds of bees? | | | | | | |
|--|-------------|-------------|------------|-------------|------------|----------------|
| | None | few | some | many | all | Response Total |
| very mixed hybrids | 15% (6) | 17% (7) | 20% (8) | 38% (15) | 7% (3) | 39 |
| largely dark native hybrids | 8% (3) | 13% (5) | 24% (9) | 43% (16) | 10% (4) | 37 |
| dark native honey bees | 37% (13) | 37% (13) | 20% (7) | 6% (2) | 0% (0) | 35 |
| Italians | 66% (21) | 28% (9) | 6% (2) | 0% (0) | 0% (0) | 32 |
| Buckfast | 37% (13) | 37% (13) | 17% (6) | 6% (2) | 3% (1) | 35 |
| Carniolan | 56% (19) | 27% (9) | 15% (5) | 0% (0) | 0% (0) | 33 |
| other ... | 96% (27) | 4% (1) | 0% (0) | 0% (0) | 0% (0) | 28 |
| | | | | | answered | 41 |
| | | | | | skipped | 0 |





| What kinds of bees do you believe your members prefer to keep? | | | | | | |
|--|--------------|------------|-------------|-------------|------------|----------------|
| | None | few | some | many | all | Response Total |
| very mixed hybrids | 28% (9) | 22% (7) | 25% (8) | 19% (6) | 6% (2) | 32 |
| largely dark native hybrids | 18% (6) | 9% (3) | 21% (7) | 41% (14) | 12% (4) | 34 |
| dark native honey bees | 22% (7) | 9% (3) | 34% (11) | 31% (10) | 3% (1) | 32 |
| Italians | 65% (19) | 21% (6) | 14% (4) | 0% (0) | 0% (0) | 29 |
| Buckfast | 42% (14) | 21% (7) | 21% (7) | 12% (4) | 3% (1) | 33 |
| Carniolan | 65% (19) | 14% (4) | 21% (6) | 0% (0) | 0% (0) | 29 |
| other | 100% (27) | 0% (0) | 0% (0) | 0% (0) | 0% (0) | 27 |
| | | | | | answered | 38 |
| | | | | | skipped | 3 |

The comments given in this part of the survey show that the preferences of the beekeeping community in Scotland are diverse. Two responses advised that members are unconcerned about the type of bee they keep. This is likely to be a widely held view. Several mention that their local bee is the type which is preferred due to the view that local adaptation is important. Several emphasise that they have members who would prefer to keep native honey bees if possible. Considering the categories of 'many' or 'all' members' preferences together, dark natives and dark native hybrids appeared in the most responses whereas all other five categories together were relatively infrequent. This shows the clear overall preference of the amateur community for a bee that is similar to the original native honey bee against a background of a range of other views. This preference is particularly strong in the north and west but is also expressed elsewhere.

Local associations were asked whether they thought that the bees kept locally needed improvement. The view was widespread that the local bees need some, a little or a lot of improvement.

The next question asked for views on the most important traits of bees for their members. Good temper was ranked most highly, and had been highlighted as an issue which can be associated with hybridisation between bee races or subspecies. There were differences between associations with some ranking productivity or other traits more highly. In comments on this question and others there was a repeated suggestion that members needed stocks that could thrive in short season, wet and

windy summers and long winters. Some suggested that hardiness was an ‘other’ trait that members valued. Of the 12 additional comments offered, five specifically mentioned hardiness and frugality as being appropriate to their location and their beekeeping and three mentioned temper as particularly important. One mentioned that considerations of temper in an urban environment were driving some people to buy Buckfast or Italian queens.

| Do you believe that the quality of bees locally needs improving? | | | | |
|--|-------------------|---|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | Not at all |  | 13% | 5 |
| 2 | A little |  | 21% | 8 |
| 3 | To some extent |  | 45% | 17 |
| 4 | To a large extent |  | 21% | 8 |
| | | | answered | 38 |
| | | | skipped | 3 |

| Please rank these traits according to your belief of your members' preferences. 1 - highest preference, 6 or 7 - lowest preference | | | |
|--|--------------------------|--------------|----|
| Item | Total Score ¹ | Overall Rank | |
| Good temper | 241 | 1 | |
| Productivity | 214 | 2 | |
| Low swarminess | 192 | 3 | |
| Varroa tolerance | 133 | 4 | |
| Frugality | 128 | 5 | |
| Chalkbrood resistance | 105 | 6 | |
| Other | 51 | 7 | |
| | | answered | 38 |
| | | skipped | 3 |

¹ Score is a weighted calculation. Items ranked first are valued higher than the following ranks, the score is a sum of all weighted rank counts.







2.6 Amateur sector future restocking

Local associations were asked about their aspirations to change their production of nuclei and queens. Around half of those responding to this question expressed an ambition to increase the production of nuclei (16 associations, 46%) and to increase

the production of queens (17 associations, 51%). None indicated that they wished to reduce any current effort.

When asked about potential methods to improve the local supply of honey bee stocks not one included importation, either directly or via traders, as a suitable option. This is a remarkable level of unanimity in the amateur beekeeping community and contrasts with the current business model of some of the businesses offering bees in Scotland. There were low levels of support for national traders supplying home-grown stock and for a national breeding centre. Around 50% of responding local associations suggested that regional suppliers and regional breeding centres were suitable means of improving local supply of bees. The greatest approval (61%) was shown for assistance with local association effort as a means of improving the supply of stocks.

| If it does already, does your local association aspire to change its production of .. | | | | | |
|---|-----------|------------|-------------|----------------|----------------|
| | reduce | stay same | increase | not applicable | Response Total |
| Nuclei | 0 (0) | 23% (8) | 46% (16) | 31% (11) | 35 |
| Queens | 0% (0) | 12% (4) | 51% (17) | 36% (12) | 33 |
| | | | | answered | 35 |
| | | | | skipped | 6 |

| How do you think the supply of honey bee stocks should be improved in your area? | | | | |
|--|---|---|------------------|----------------|
| | | | Response Percent | Response Total |
| 1 | Importation (directly or via traders) | | 0% | 0 |
| 2 | Improved supply of home grown stocks via national traders |  | 11% | 4 |
| 3 | More regional medium-scale suppliers |  | 47% | 17 |
| 4 | Assistance with local association effort |  | 61% | 22 |
| 5 | National breeding centre |  | 19% | 7 |
| 6 | Regional breeding centre |  | 53% | 19 |
| 7 | other ... |  | 6% | 2 |
| | | | answered | 36 |
| | | | skipped | 5 |

Sixteen comments were received on this question and given that this is central to the topic of the review they are all reproduced here.

We have been successful so far in providing sufficient stocks for most of our new beekeepers. 15 in 2014 and 23 have completed the Beginners Course in 2015 so we hope to supply these with nucs over the coming year. If we should experience a bad nuc year then access to a regional breeding centre may be useful.

I think we as an association would benefit from help establishing our own apiary and breeding effort. Importation of non native bees is a cheap and unsustainable option which brings numerous problems both for the beekeepers who import them and those around them. I think also Scotland as a whole would profit immensely from the establishment of a nationally organised network of regional breeding stations for native bees much like they have in some countries in mainland Europe. Native bees have had limited breeding attention given to them and our entire national honeybee stock could be improved beyond recognition if such attention was given to them.

We have tried over the years to encourage our members not to bring bees in from outwith the county.

Supplies of quality stocks of locally acclimatised, good tempered bees seen as a priority.

Queen rearing courses to improve stocks through individuals raising their own.

National centre but not if in foulbrood areas

LAs make a good effort but need help from specialised regional breeding centres

More focus and advice on improving local stocks. Aggression seems to be an increasing issue generally and this year in particular from discussions at the last LA secretaries meeting in Perth.

Regional breeding should help to provide hardy bees for our weather and environment and keep the genetic stock varied but not too vulnerable to conditions.

Linked with Ayr beekeepers and benefit from their greater experience.

Difficulties locally due to periods of poor weather.

The island is Varroa free and is very keen to avoid introducing Varroa and other diseases through the movement of stocks.

Believe that locally adapted bees are best, but happy with the quality of a supplier in the east of Scotland which is some distance away.

Proposing to try an online members-only exchange. [*This comes from an association covering a large under-populated area and has Varroa-infested and Varroa-free areas in its range*]

Bees should be supplied regionally, ie from Ardnamurchan northwards up the W coast would be one suitable area.

3. Issues arising and solutions

3.1 Lack of transparency in bee trade

A recurring theme has been a level of disquiet about the lack of transparency in the trade in bees. Many local associations promote local honey bees and try to encourage their members not to purchase imported stocks for reasons both of biosecurity and avoiding diluting the locally adapted genepool or remaining native stocks. In addition to frustration with the operation of the bee trade, the responses of some local associations suggests that some are unaware of the contribution of imported stocks to the colonies sold to their members by traders. In addition, there

is some disquiet about colonies being sold into *Varroa*-free area by commercial suppliers.

In addition to the direct receipt of imported queens, nuclei and packages by the trader, bees are often sold on within the UK by the first recipient of the stock. This makes transparency more difficult to achieve especially when the primary recipient may keep the imported stocks for some time prior to selling them on.

Potential solutions

- A realistic option is to incorporate 'ethical trading' as part of a certification scheme for those selling stock
- Such a certification scheme could be run by a partnership including the Scottish Government and be an extension of a planned pilot for disease accreditation for nucleus stocks sold to other beekeepers, although it would be expected to be a Scottish Government initiative in the beginning.
- To satisfy concerns, such a scheme would require traders to make open declarations of the use of imports and stock derived from them, perhaps for a period two years after importation, whether or not they were the primary purchaser of imported stocks. Such declarations would need to be accessible to beginner beekeepers and therefore should be made in adverts, websites and at point of sale. A further requirement would be screening out of sales to currently accepted *Varroa*-free areas.
- The scheme would need a public register showing compliance together with effective means of removing traders from the scheme after transgressions. It would be expected that the beekeeping organisations would promote the scheme through their normal dissemination routes and via local associations that provide training to beginners.

3.2 Preferences for type of bee and ideal bee traits

In general, amateur beekeepers prefer well-tempered and also frugal, hardy or locally adapted bees. There is a wide range of preference for type of bee in the community but the most common preference is for a local or a native-type honey bee that meets those criteria. In some areas there is a strong feeling that native and near-native locally adapted stock is preferred, whereas in others beekeepers are happy with the local bee of any type. A small number of associations have a preference for a non-native bee and in many associations there are individuals who hold a different view from the local majority. Catering for such diverse preferences is difficult but the focus should be on the majority view. Those with minority interests would still be able to continue to source queens as they do now.

The option of running a national centre to produce nuclei and queens was not popular amongst local associations. It is suspected that preferences for locally adapted bees and for reducing the risk of the spread of disease were behind this view.

Overall, the commercial beekeeping community ranks productivity as more important than gentleness in their bee stocks. As with the amateur community, there is a

diversity of views on the sourcing of bees and the ideal bee to keep. In some areas there is a consensus of preference between the two communities, giving the possibility of more cross-community cooperation. In other areas there are local associations with a preference for local-type bees and a commercial beekeeper with a different view, and whose colony numbers can dominate an area. There is even one area where a commercial beekeeper prefers his near-native stocks and is frustrated with the local amateur community who seem to prefer Buckfast bees.

Potential solutions

- The most effective means of encouraging the propagation of the kinds of bees local communities or commercial enterprises wish to keep is to do that propagation locally or within commercial enterprises themselves.
- There is also the possibility, suggested by some local associations and also by some commercial beekeepers, of cooperating at a regional level to propagate a bee that suits beekeepers in that region. This is particularly attractive to local associations that do not feel that they have sufficient resources to achieve queen and nucleus rearing themselves.
- There is some call for drone-rich mating sites to assist breeding efforts of beekeepers in a region. This model is found in Germany and works well where beekeepers can bring mating nuclei to mating sites for a small fee.
- Discussion is required on how to achieve these outcomes. A first step could be additional training to improve skills, building on that already offered by SRUC, SBA and local associations. Assistance on finding funding sources for the necessary capital investment to initiate queen and nucleus raising would also be helpful.
- It should also be recognised that the largest beekeeping enterprise in Scotland already has an established business selling imported packaged bees and queens across the UK but primarily in England. Their queen rearing unit has a 1,000 mating nuclei and a target of 2,000 mated queens in 2016, primarily for own use but also for trade. This, like their nucleus production, is scalable and could be built up further to meet the demand for the productive hybridised bee generated. The major market for these is likely to be in England but there are already some bee farmers in Scotland using their bees.

3.3 Foulbrood and trade in bee stocks

The European Foulbrood Control Plan has been successful at reducing infection rates to around 1% amongst Scottish bee farmers. During this time the historic trade from the commercial to the Scottish amateur sector outside the EFB area was halted. Re-starting this trade was requested by an affected trader and would be appreciated by at least one major and another minor commercial beekeeper if possible and if well controlled. Additional sales from commercial beekeepers outside the EFB infected area could also benefit from a certification scheme which would give the purchaser the assurance of knowing that the bees were inspected prior to sale and produced using agreed methods to reduce the risk of disease. The Lead Bee Inspector believes that EFB-affected beekeepers are cooperative and honest in

their reporting under the existing European Foulbrood Control Plan, allowing the segregation of very low risk (i.e. no cases in two years) and higher risk apiaries as sources of bees for this scheme.

Possible solutions

A certification scheme for nucleus and self-produced package sales might include:

- Requirement for verified demonstration of foulbrood-free apiaries for two calendar years prior to use for production of stocks for sale
- Requirement to demonstrate high levels of apiary biosecurity including segregation or sterilisation of tools and gloves and segregation of all wood ware including supers at apiary level
- Paid pre-sale inspection service within two weeks of point of sale for each batch of bees on comb yielding a health certificate for each stock
- Incorporation of the points made above on openness on the sourcing of stock and the avoidance of sales into *Varroa*-free areas

There may be some local opposition to such sales from EFB areas but such local associations are free to produce their own stocks and market them locally. Such a scheme goes far beyond the requirements for sale from EFB areas in the rest of the UK where trade is allowed soon after clearing an apiary of foulbrood.

3.4 Importation and home production of stocks

Free trade rules within the EU are likely to continue to permit trade in honey bees within the EU except when specific pests have been discovered within 100 km. However the consensus in local associations in Scotland, and a view held by a proportion of bee farmers, appears to be that importation is undesirable. A few bee farmers expressed a wish to retain right to use imported stocks and one may use EU rules to engage in out of season propagation in another EU country. One Scottish bee farmer has a good business importing and trading packages and queens, mostly into England. However the requirement for imported stocks is low in Scotland in most years and evidence above indicates demand is low if local options are available. It is likely that better practices could reduce this further, particularly encouragement to raise nuclei and queens within businesses and also by improving standards of husbandry so that winter losses are reduced.

Possible solutions

- Importation will continue, but increases in sustainability will flow from encouragement and help to raise more stocks in local associations, groupings of associations and in the operations of commercial beekeepers.
- Regular exchange of bees between Scotland and S Europe would bring its own issues and risks. Mechanisms to reduce risk would have to be considered separately. Such a scheme is likely only to benefit a small number of bee farmers.

3.5 Queen and nucleus rearing in Scotland

Queens:

One unit has been built up to produce 700 queens in the difficult year of 2015 and aspires to produce 2000+ annually from now on. Other efforts are scattered, some bee farmers, some local associations and some groups of native bee enthusiasts. Modelling weather data suggests that although queen rearing has challenges, even in poor years many queens will be successfully mated. Some local associations and bee farmers expressed a desire for more training and assistance for them to improve or start their own queen rearing.

Nuclei:

There has been a revolution in beekeeping methods thanks to the ready availability of polystyrene nucleus boxes. Stocks are readily overwintered in them, providing units for sale or for filling empty production boxes in the same operation. Some beekeepers use these extensively, whereas others do not as yet despite requiring packages for increase. It was noted that more beekeepers have been incorporating their use into their swarm control and stock increase. Further adoption of them and of the methods required to use them to multiply stock with minimal effort would be of benefit for the reduction of the risks from imports and for the profitability of enterprises.

Potential solutions

- Provision of training in queen rearing: SRUC, SBA and local association expertise is available
- Provision of advice via the Guide associated with this report on techniques and limitations
- Lessons should be drawn from previous initiatives (SBA and local association), particularly to learn lessons to ease widespread application of methods taught. Those successfully implementing queen and nucleus rearing already could be part of an effort to train and support but the expertise in SRUC here would be an important part of any initiative.
- Training for bee farmers and local associations in efficient means of using polystyrene nuclei to raise additional stocks to provide a buffer to replace losses and to generate stocks for sale. The integration of nucleus raising in production systems will also be covered in the Guide produced as part of this project.
- Probably the single most effective contribution to the sustainability of beekeeping and beekeeping enterprises would be to facilitate access to polystyrene nucleus boxes especially given the ease of their use in stock multiplication

3.6 Additional services

Local associations have called for regional effort, including breeding centres, to service climatically similar areas. Some bee farmers also mentioned the desirability of the supply of tested, high quality stock either as queens or as drone mating areas on the German model and indicated that the BFA may contribute effort. There was a relatively low level of support for a national breeding centre amongst local associations with their expressed preference mostly for regional-scale effort.

Potential solutions

- A network of queen breeding stations relevant to local needs. Countries with a big commitment to beekeeping such as Germany subsidise such efforts for the beekeeping community but it is not clear how such initiatives would be funded in Scotland
- New initiatives in appropriate areas for regional-scale self-help possibly with input from all involved in apiculture

4. Options for future support for restocking

Measures to improve further the sustainability and restocking potential of honey bees in Scotland should come from a partnership between all with an interest and input into apiculture in Scotland. The partners already active, the BFA, SBA, local associations, SRUC, Scottish Government Bee Improvement team (BHIT) (AFRC Animal Health & Welfare; RPID and SASA), all have contributions to make to improve the restocking possibilities in Scotland. Discussion within and between the broader community in the local associations and directly with the bee farmers themselves could improve the prospects of real change.

Existing routes for restocking are likely to remain. These include the possibility of importing stocks, effective restocking within commercial operations and within local associations and the generation and sale of stocks by independent beekeepers of all scales. Options have been identified to ensure that Scotland's stock of honey bees is more sustainable and that there is an improved supply of stocks generated within the country. These Options were developed from the responses and comments received from the surveys of the two communities supplemented by discussions with key stakeholders. In particular, Option 1, the Certification Scheme, was developed with knowledge gained of activities amongst traders from informal discussion and following discussions with the Lead Bee Inspector on his current plans and the feasibility of accessing accurate records to verify stock history. Option 3, further reducing the risk of high winter losses amongst beekeepers at risk of suffering them and further spreading of good practice, arises from knowledge of the commercial community which was further strengthened during this study. The guidance document to be published as part of this work will develop best practice relevant to this issue. The five Options are presented below.

1. Certification Scheme for trade in stocks of honey bees.

Such a scheme should address concerns over the spread of disease and transparency in the sourcing of stocks sold on, and give purchasers confidence in

locally produced stocks. Vendors who are in the area in the east of Scotland with European foulbrood or in areas with American foulbrood have reduced levels of disease to that comparable with that in other parts of the UK. Accordingly, a scheme that ensures a two-year exclusion of apiaries with disease from nucleus production and that includes inspection of records plus pre-sale inspection of stocks will provide a safer route for the purchase of healthy honey bee stocks than trade from elsewhere. The scheme should also ensure that the sale of stocks from *Varroa*-infested to *Varroa*-free regions does not take place. A third requirement should be full openness on the sourcing of stocks within the business including the origin of stocks purchased from others in the UK who may be trading stocks derived from imports themselves. Again a two year period for the declaration of origin of stocks would be appropriate.

2. Training for increased production of stocks locally.

Although training has been offered in recent years by SRUC and the SBA, there remains an enthusiasm amongst local associations and some commercial beekeepers for training and other help to improve or start their own queen and nucleus raising activities. Currently 50% of local associations generate their own stocks and a further 25% expressed a desire to do. Amongst those who do generate stocks the level of expertise varies widely. Additional training effort through workshops, teaching material and help in other ways would assist both local associations and bee farmers meet their own aspirations.

3. Further action to reduce winter losses and to spread good practice.

The need for restocking could be reduced by improving winter survival of colonies. The wide range of winter losses in poor years reported by commercial beekeepers indicates that there is a need for advice and better husbandry to improve the standards of those who experience relatively high losses. Changes in feeding regimes, treatment regimes for *Varroa* and ensuring that apiary sites used are appropriate for the season could greatly reduce the need for restocking. An additional aspect of good practice is how beekeepers integrate swarm control with stock multiplication. There are opportunities to change procedures to ensure that commercial beekeepers are more self-sufficient and can cover their own winter losses as well as generate stocks for sale.

4. Regional cooperation in queen and nucleus raising.

Several local associations indicated that they did not consider that they had sufficient resources to embark on queen and nucleus rearing themselves, that they preferred a locally adapted bee and that they preferred regional cooperation across climatically similar areas for the production of stock. In some cases the preferences of commercial beekeepers coincided with the preferences of local associations in their area. It is recommended that discussion between local associations and commercial beekeepers is established to explore these possibilities.

5. Resources for individual, regional and possibly national breeding efforts

Some commercial beekeepers were explicit about their needs if they were to become involved in more queen and nucleus rearing. These included requests for funding for nucleus boxes, staff, provision of mating stations on the German model where virgin queens can be taken in mating boxes and provision of good quality queens for breeding for production. Some local associations were enthusiastic about regional breeding centres but few wanted to support a national one. It is recommended that a discussion is held with relevant parties to clarify what support and self-help is feasible in these areas.

Acknowledgements

The study was supported by the Scottish Government's Contract Research Fund (TBH/001/15). The Scottish Government Lead Bee Inspector, Stephen Sunderland, initiated the call for funding and acted as Project Officer for the study. The project was supported by a Working Group comprising Dr Nick Ambrose (Branch Head, AFRC Animal Health & Welfare), Dr Nia Ball (AFRC AH&W Science Adviser); Fiona Highet (SASA); Graeme Sharpe (SRUC Consulting); Margaret Ginman (BFA); John Mellis (BFA); and Alan Riach (SBA). Local association secretaries, bee farmers and other people in the beekeeping community contributed their time and expertise in their responses to surveys and in additional discussions. Access to meteorological data was kindly provided by the Met Office with the help of Jill Tivey, SASA librarian. Dr Roy Neilson and Alison Dobson at the James Hutton Institute, Invergowrie, provided additional meteorological data.

I am grateful to all for their advice, assistance and willingness to contribute their time and effort to help the project.

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Appendix I

Predictions of queen mating at six sites in Scotland using Met Office synoptic data sites.

1. Gogarbank, Edinburgh
2. Prestwick, Ayr
3. Strathallan, Auchterarder
4. Dyce, Aberdeen
5. Tiree
6. Kirkwall, Orkney

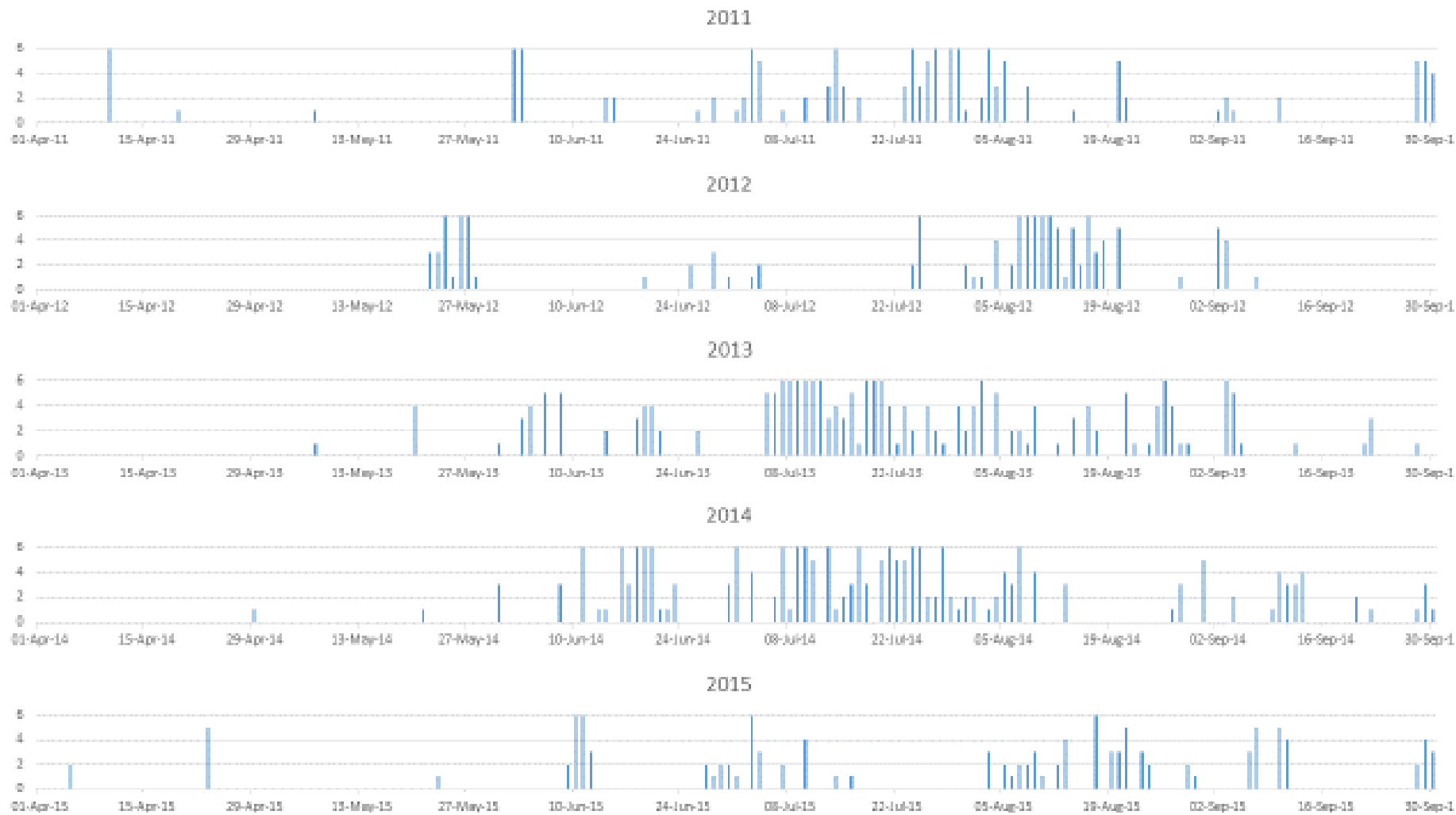
Synoptic data was sifted to discover periods that met the following criteria:

- Within the period of hourly records from 13:00 to 18:00 (a few queens will fly outside these times, most flights should be mid-afternoon)
- Air temperature 18°C or more
- Wind 15kph or less
- At least some sunshine
- No rain

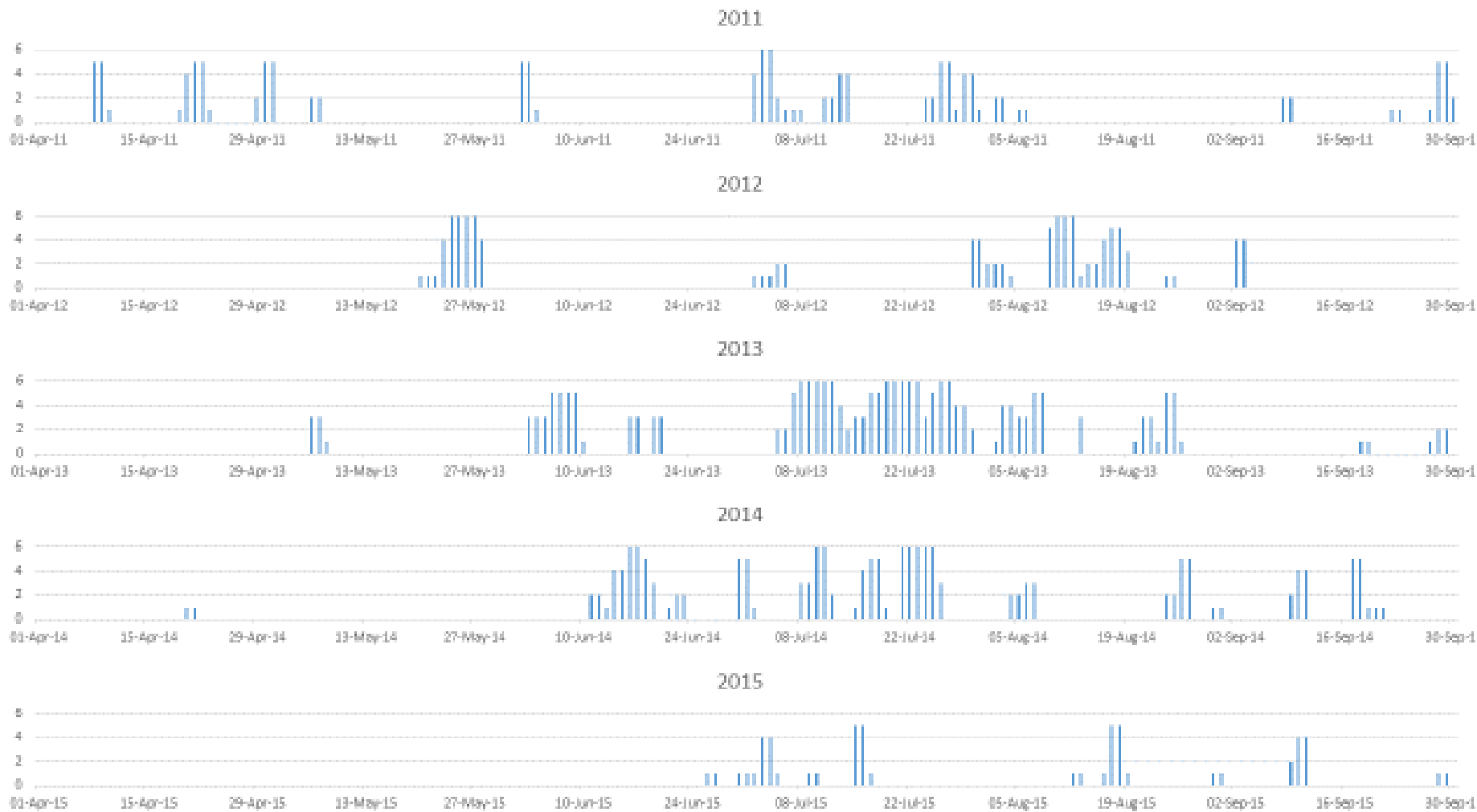
The criterion of air temperature at 18°C or more reflects the experience of some queen breeders and researchers internationally. The European experts in the field of honey bee mating biology, Gudrun and Nikolaus Koeniger, working with German *carnica* honey bees, report that queens mate at 20°C or above. Experience with Irish or Scottish native *Apis mellifera mellifera* (Jon Getty and Andrew Abrahams respectively, personal communication) suggests that honey bee queens of this type will mate at 16°C. No allowance has been made for virgin orientation flights as they can take place in cooler conditions, ie from 8°C (Jon Getty, personal communication). We are not aware of other work predicting queen mating weather windows from meteorological data. A paper for a refereed journal is planned which will explore these issues and describe this aspect of the project.

These plots can be used to estimate the likelihood of virgin queens missing a mating period during the time that they are receptive. Queens are regarded as being receptive between the ages of 6 days and 21 days old, ie a period of 15 days. Like other aspects of mating biology, these details have been researched in races originating from S and E Europe, especially *Apis mellifera carnica* but not in *Apis mellifera mellifera*. It may be expected that honey bees adapted to environments with unreliable mating opportunities, such as *Apis mellifera mellifera* and its locally adapted hybrid derivatives, could be adapted to cooler flying temperatures and windier conditions, and be capable of mating over a longer period. As *Apis mellifera mellifera* has contributed to the gene pools traded as German *carnica* (including the derivatives kept in New Zealand) and Buckfast honey bees, local breeding and selection in an environment challenging for queen mating could also drive change in derivatives of these types of honey bee.

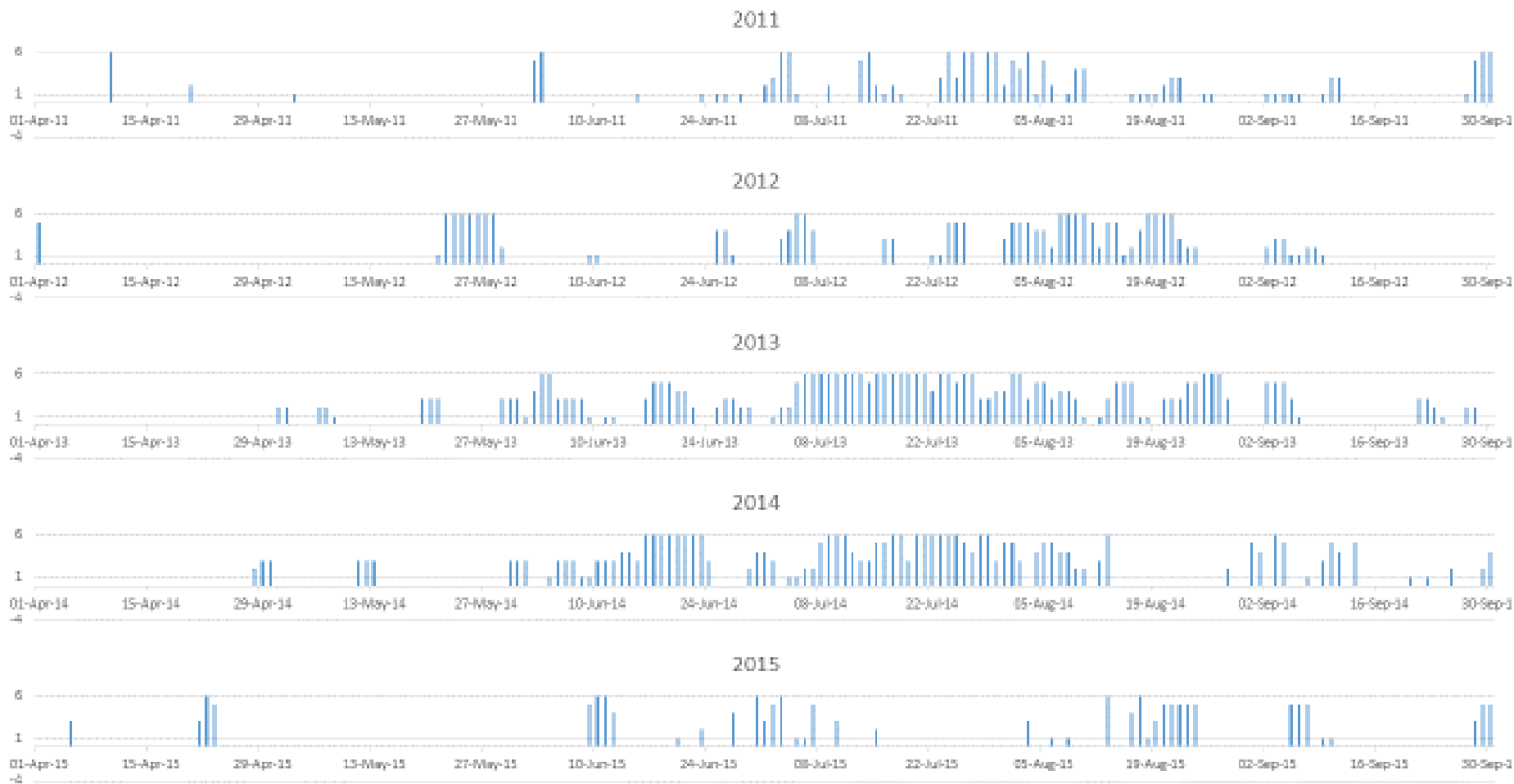
Gogarbank, Edinburgh



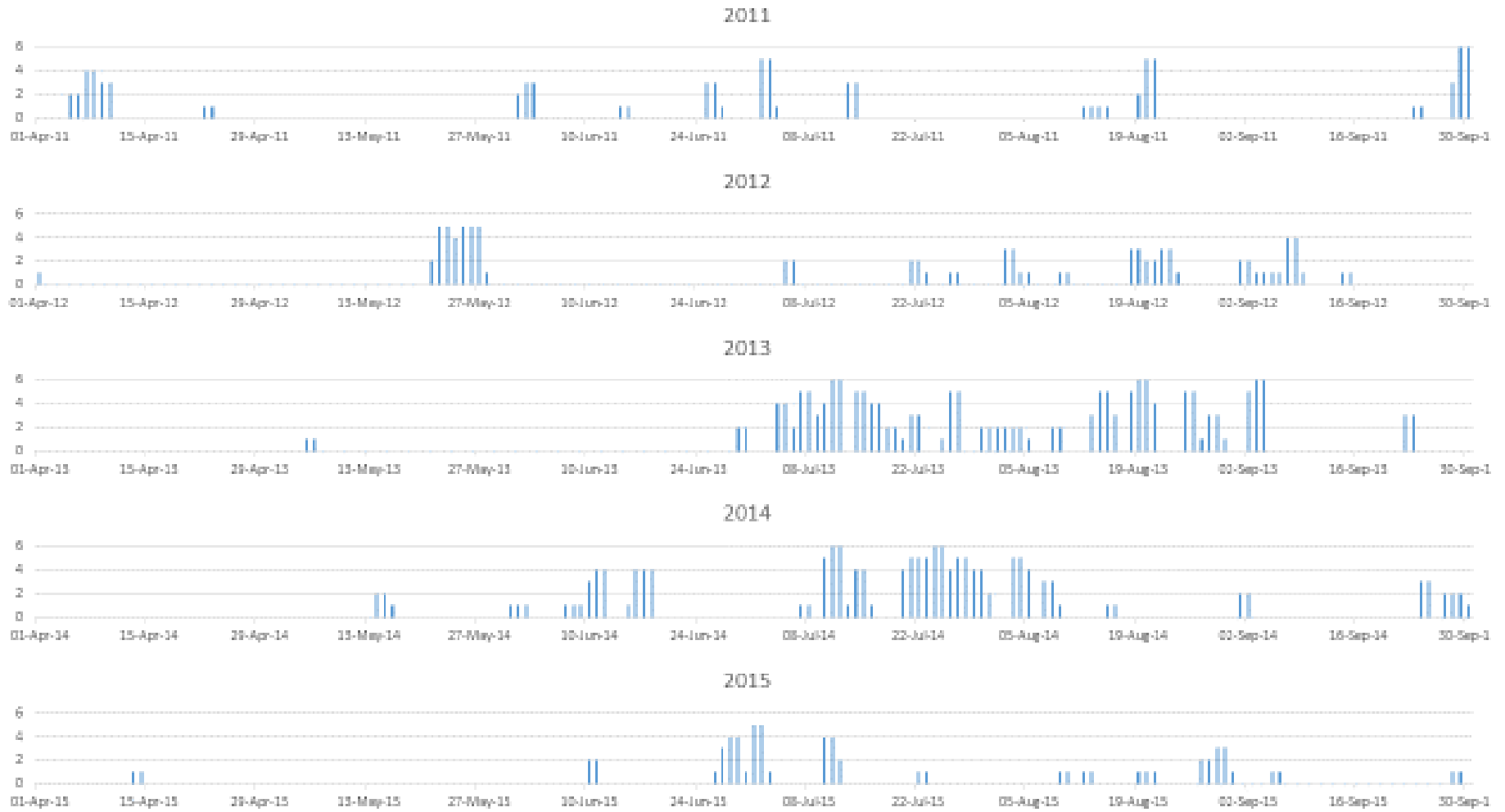
Prestwick, Ayr



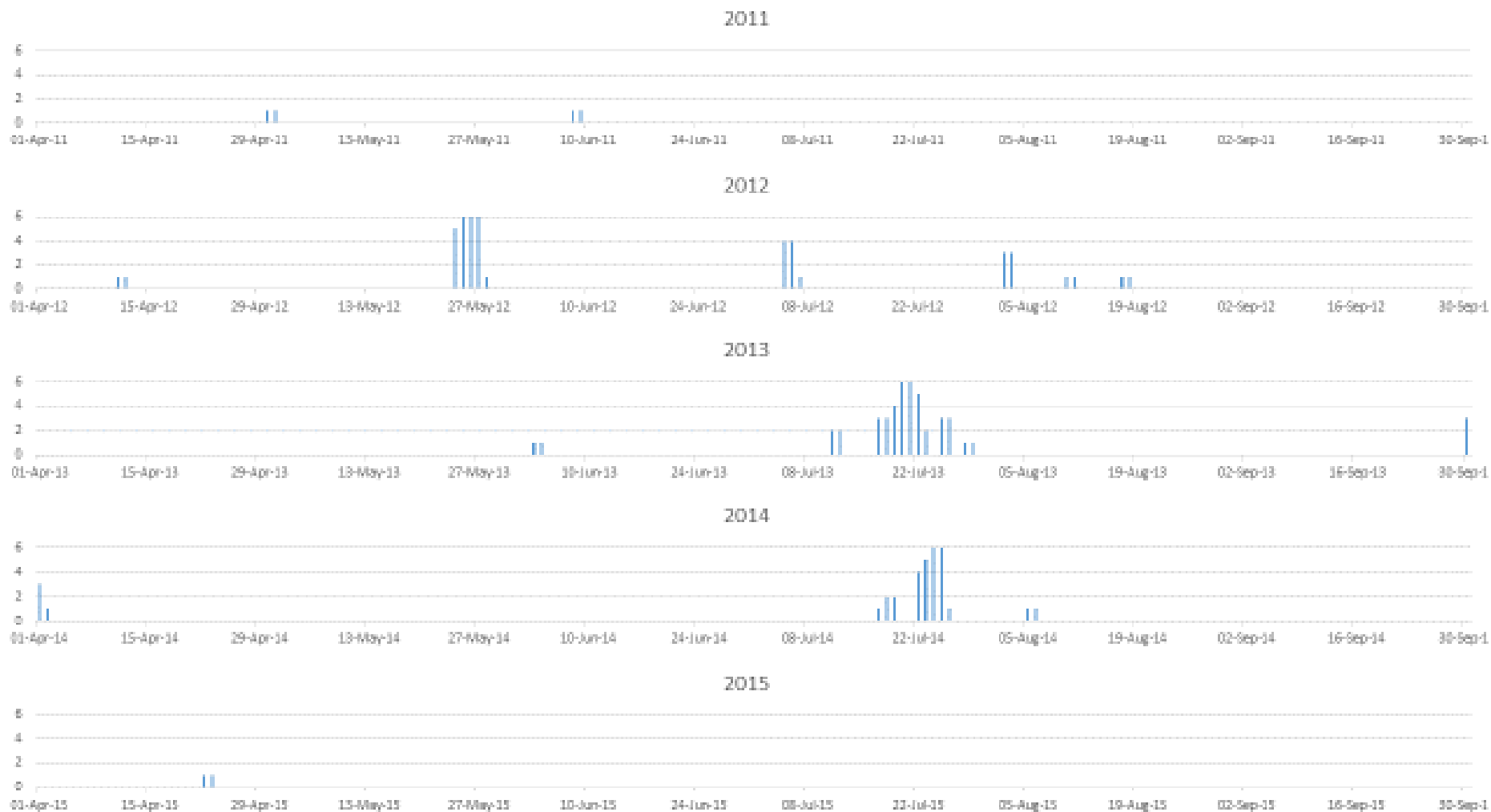
Strathallan, Auchterarder



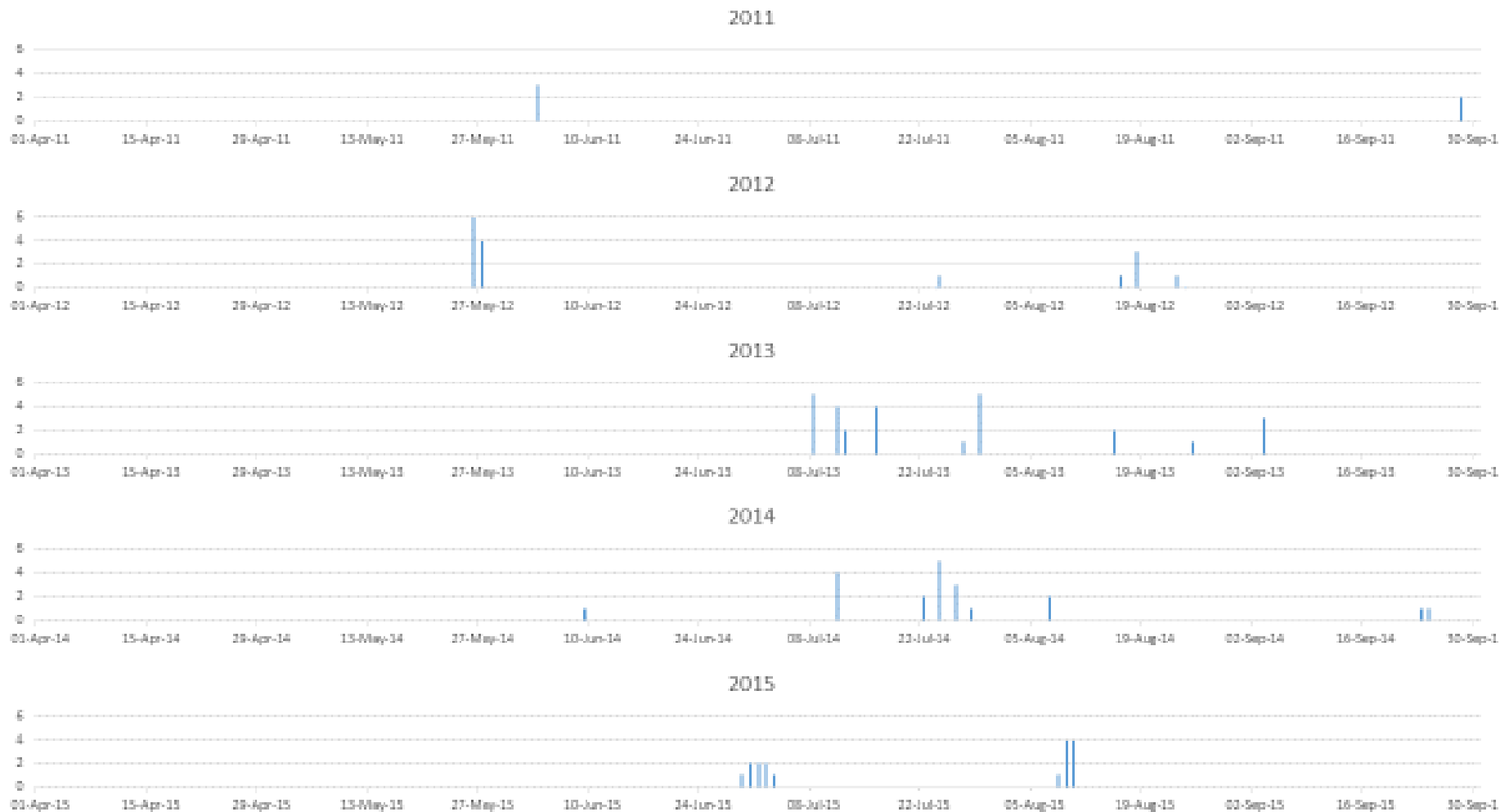
Dyce, Aberdeen



Tiree



Kirkwall, Orkney



Survey of Commercial Beekeepers in Scotland

Introduction

This survey seeks to collect data for the Review of Options for Restocking Honey Bees in Scotland, a project funded by the Scottish Government and carried out by Tay Bees and Honey. Your information together with other evidence will be used to build a picture of the needs, capacities and preferences across Scotland. The outcome will guide future Scottish Government action to improve the supply and sustainability of honey bee stocks in Scotland. Answers from specific respondents will not be divulged and data will be used to generate overall national and regional pictures in a manner that does not breach confidentiality without explicit permission. Please reply by 31 December. Many thanks!

1. Do you generate nuclei, packages and/or queens from your own stocks? If so, approximately how many annually?

Nuclei and packages:

Queens:

2. What percentages are used in your own business?

Nuclei and packages:

Queens:

3. In most years, approximately how many stocks and queens do you obtain from elsewhere?

Nuclei/packages/full stocks:

Queens:

Comments:

4. How many production stocks did you take into winter 2015-16?

- <50
- 50-100
- 101-500
- 501-1000
- >1000

5. In exceptional years for winter losses, what proportion of hives need restocked?

- <20%
- 21-40%
- 41-60%
- 61-80%
- >80%

6. What kinds of bees do you keep? (tick all that apply)

- very mixed hybrids
- largely dark native hybrids
- dark native honey bees
- Italians
- Buckfast
- Carniolan
- other ...

Comments:

7. What kinds of bees would you prefer to keep? (tick all that apply)

- very mixed hybrids
- largely dark native hybrids
- dark native honey bees
- Italians
- Buckfast
- Carniolan
- other

Comments:

8. Do you believe that the quality of bees you keep needs improving?

- Not at all
- A little
- To some extent
- To a large extent

9. Please rank these traits according to your preference for your own business. 1 - highest preference; 6 or 7 - lowest preference

- Productivity
- • Good temper
- • Low swarminess
- • Frugality
- • Chalkbrood resistance
- • Varroa tolerance

- • other

Comments:

10. Do you aspire to change your holding of stocks?

- up more than 25%
- up by up to 25%
- maintain approximately as is
- reduce by up to 25%
- reduce more than 25%

11. What lines of supply of honey bee stocks do you think should be encouraged in the future for the commercial beekeeping sector? (tick all that apply)

- Importation (directly or via traders)
- Improved supply of home grown stocks via national traders
- More regional medium-scale suppliers
- Assistance with own effort
- National breeding centre
- Regional breeding centre

- other ...
- No requirement to improve supply

Comments:

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12. Do you have any additional comments on the supply of bees and queens in Scotland?

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13. If, in Q11, you indicated that you could benefit from assistance with your own effort, what form would that take?

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Survey of Local Associations

1. Introduction

This survey is part of a study funded by the Scottish Government to collect data for the Review into Options for Restocking Honey Bee Colonies in Scotland. Your information will be used to build a picture of the needs, capacities and preferences for obtaining bee stocks across Scotland. The outcome will guide future Scottish Government action to improve the supply and sustainability of honey bee stocks. Answers from specific respondents will not be divulged and data will be used to generate overall national and regional pictures in a manner that does not breach confidentiality without explicit permission. We realise that answers are likely to be informed guesses in many cases and that is fine for the purposes of this study. Please respond asap as this project has short timescales. Many thanks!

1. Association details

name of association:

*

approximate number of members:

*

2. Does your local association generate nuclei and/or queens from its own stocks? If so, approximately how many annually?

If you would like to comment on the methods in use please use the box below.

Nuclei:

Queens:

Comments:

3. Do individuals in your association or in your area generate nuclei and/or queens for others locally? If so, approximately how many?

Nuclei:

Queens:

4. Do people in your association obtain bees from traders? If so, roughly how many annually?

Nuclei:

Queens:

5. Are you able to say where these traders obtained their bees?

- Imports

- Purchased in Scotland
- Purchased elsewhere in UK
- Raised from trader's own bees
- Don't know

6. What is the approximate annual requirement locally for numbers of

Nuclei for beginners

Nuclei for replacement colonies

Queens

7. What proportion of your members do you believe keep these kinds of bees?

| | none | few | some | many | all |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| very mixed hybrids | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| largely dark native hybrids | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| dark native honey bees | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Italians | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Buckfast | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Carniolan | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| other ... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Comments:

8. What kinds of bees do you believe your members prefer to keep?

| | none | few | some | many | all |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| very mixed hybrids | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| largely dark native hybrids | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| dark native honey bees | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Italians | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Buckfast | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Carniolan | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| other | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Comments:

9. Do you believe that the quality of bees locally needs improving?

- Not at all
- A little
- To some extent
- To a large extent

10. Please rank these traits according to your belief of your members' preferences. 1 - highest preference, 6 or 7 - lowest preference

- Productivity
- • Good temper
- • Low swarminess
- • Frugality
- • Chalkbrood resistance
- • Varroa tolerance

- • other

Comments:

11. If it doesn't already, does your local association aspire to start the production of stocks?

- Yes
- No
- not applicable

12. If it does already, does your local association aspire to change its production of ..

| | reduce | stay same | increase | not applicable |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Nuclei | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Queens | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

13. How do you think the supply of honey bee stocks should be improved in your area?

- Importation (directly or via traders)
- Improved supply of home grown stocks via national traders
- More regional medium-scale suppliers
- Assistance with local association effort
- National breeding centre
- Regional breeding centre
- other ...


Comments:

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14. Do you have any additional comments on the supply of bees and queens in Scotland?

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15. If you think that your association could benefit from additional help, what form would that take?

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Appendix III

Acronyms

| | |
|------|--|
| AFRC | Directorate for Agriculture Food and Rural Communities |
| AHW | Animal Health and Welfare |
| SRUC | Scotland's Rural College |
| SASA | Science and Advice for Scottish Agriculture |
| SBA | Scottish Beekeepers Association |
| BFA | Bee Farmers Association |
| CRF | Contract Research Fund |

REVIEW INTO OPTIONS FOR RESTOCKING HONEY BEE COLONIES IN
SCOTLAND March 2016

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