Broadstone Bees Case Study
April 2024

This is a case study in observation of bee colonies in a natural apiary over 13 years from 2011-2023. Colonies are free-living although their nest cavities are man-made. We monitored their activity, survival and swarming. The aim of the study was to determine whether a resilient population of honey bees could survive and thrive in an ordinary landscape in South Wales: the apiary site is not protected, isolated or particularly noted for bee forage.

Introduction - nature-based beekeeping

Bees for Development partners with beekeepers in many parts of the world to promote and support beekeeping for its benefits to people, bees and biodiversity. Since 1993 Bees for Development (BfD) has been working with beekeepers who have no problem with bee diseases. Where landscapes are diverse and unpolluted, indigenous bees can thrive and beekeepers can benefit from harvests of honey and beeswax. Bees are abundant and hives are easily populated when beekeeping is adopted as an accessible and low-input contribution to sustainable livelihoods, despite the presence of varroa and its associated pathogens.

Apis mellifera is an indigenous insect in Britain, present since the end of the last Ice Age. Local bees are adapted to local ecologies, microclimates and flowering patterns in their brood-rearing, provisioning and reproductive strategies. The arrival of varroa in Britain in the 1990s led to a rapid decline in managed and wild colonies. While national responses in Britain and Europe focused on eradication and control, many beekeepers realised that, following this steep decline in numbers, some wild colonies were surviving without treatment or beekeeper intervention. In countries where regulation, consensus or poverty denied beekeepers access to expensive chemical treatments, BfD's partners were reporting similar findings: a decline in numbers was followed by a steady increase in colonies able to survive and thrive in the presence of an endemic pest. Contemporary research corroborated reports of local tolerance and resistance.

Working with Bees for Development we established a 'natural apiary' in Monmouthshire where we could test whether a local population of honey bees could survive without intervention from beekeepers. We based our methodology on the sustainability principles developed by BfD in collaboration with partners all over the world. We described sustainability as the maintenance of a healthy and resilient population of locally-adapted honey bees living in the wild and in the apiaries of beekeepers.

This approach has come to be called nature-based beekeeping. It comprises three interdependent themes - environment, genetics and management. Each is important for the health and resilience of the local bee population: the colonies in a beekeeper's apiary are only a

small subset of the wider population and every colony interacts constantly with many others. Implementation of our project required attention to all three themes, considering the scientific research on each and the practicalities of establishing an apiary.

Environment

The apiary is in South Wales, sited on 4 hectares of land at an altitude of 250 metres between two river valleys. It was necessary to ensure a diverse, abundant and unpolluted site free from pesticides, herbicides and fungicides. The site itself comprises rough pasture gradually being restored to wildflower meadows, hedges, mature trees, copses, ponds, stream, vegetable patches, orchards and garden. No sprays or artificial fertilisers have been used. Management aims to diversify and maintain wildlife-friendly habitats with abundant and primarily native flowering plants.

The surrounding landscape is varied: deciduous woodland, conifer plantations, pasture, heathland, bog, scrub, small-scale arable farming and village gardens. Nevertheless, most local farmland and pasture is not organic and sprays are regularly used by farmers, growers and gardeners. If our bees fly only 5 km from their nests, they will cover around 80sq km in foraging, mating and exploring new nest sites. They will meet a range of conditions and potential hazards. Although mean temperatures range from 2'-20'C, extremes can reach -10'C and 30'C. Winters are often wet, windy and prolonged; springs can be cold, wet and windy; summers may be either hot and dry or cool and wet.

Genetics

Honey bees adapt to their microclimates and flowering patterns, optimising their foraging, winter stores, brood raising and reproductive strategies to fit the local ecosystem. The local climate is wet with prevailing south westerly winds. The apiary site is colder and windier than the valley below. Spring can be late, with few flying days and little forage before April.

We knew there were wild colonies living in the walls of old houses, barns and tree cavities in the local area: swarms from these wild colonies would be best adapted to our conditions. In 2011 there were no beekeepers managing colonies nearby (within 2km), but it is not an isolated site: there are several hobby beekeepers within 10km and four commercial bee farmers within 15km. To establish the apiary we collected swarms from the local area (within 7km), from places where there were no known beekeepers. Thereafter we only collected swarms from within our apiary. Swarms were hived into simple hives but not fed or combined: swarms that could not survive would die.

Management

Colonies were allowed to live their natural lives and to swarm freely. They were closely observed but not fed or treated for varroa; nests were not disturbed for inspections or control. Swarms, when found, were collected and hived. No combs or bees were moved between colonies. No splits were made and no colonies were united. Where more conventional hives were used these were expanded as the colony grew and contracted when occasional harvests of honey and wax were taken.

The apiary was set up as a 'natural apiary': colonies were dispersed around 4 hectares of land in a variety of hives and nest boxes, at different heights, with differing materials, sizes, aspects and exposure. Hives included Top Bar hives, Warre hives, frame hive (without foundation), Bee Houses, Log Hive and skeps. Each colony is at least 30 metres from any other.

Swarms were hived into skeps, Warre or Top Bar hives. From the fourth year of the project (2014) we put up a log hive and Bee Houses; thereafter swarms began occupying these autonomously. Some conventional hives were autonomously occupied by swarms. There were always empty hives ready for occupation.

Monitoring

Dates and locations of swarms were recorded. Colony progress was monitored with regular observation. Observation entailed walking the site, observing activity and listening. Some conventional hives had observation windows and a stethoscope could be used to determine where the colony was active in the nest. Observations were recorded in a notebook. Walks varied in timing and frequency. Winter activity was monitored carefully on flying days, though these may only occur every few weeks. Walks became more frequent in spring, monitoring activity and pollen collection. In summer swarm season we would try to walk the site daily looking and listening for swarms. Late summer and autumn walks decreased in frequency but noted changes in activity, robbing, wasps or continued existence of drones. Throughout the year, bee monitoring had to fit around work and other responsibilities.

Terminology

The project required some different terminology from conventional beekeeping. Colonies are left to live as they would in the wild. Some of our colonies have occupied their hives or nest boxes autonomously. Some have been collected as swarms and hived by us in various designs of hive. TD Seeley (Life-history traits of wild honey bee colonies 2017 Apidologie) refers to this distinction between "wild colonies" and "simulated wild colonies". Wild colonies are autonomously occupied nest sites. Simulated wild colonies are swarms collected and hived. We have

distinguished between “hived” swarms – ie collected and run into a hive – and “autonomous” swarms.

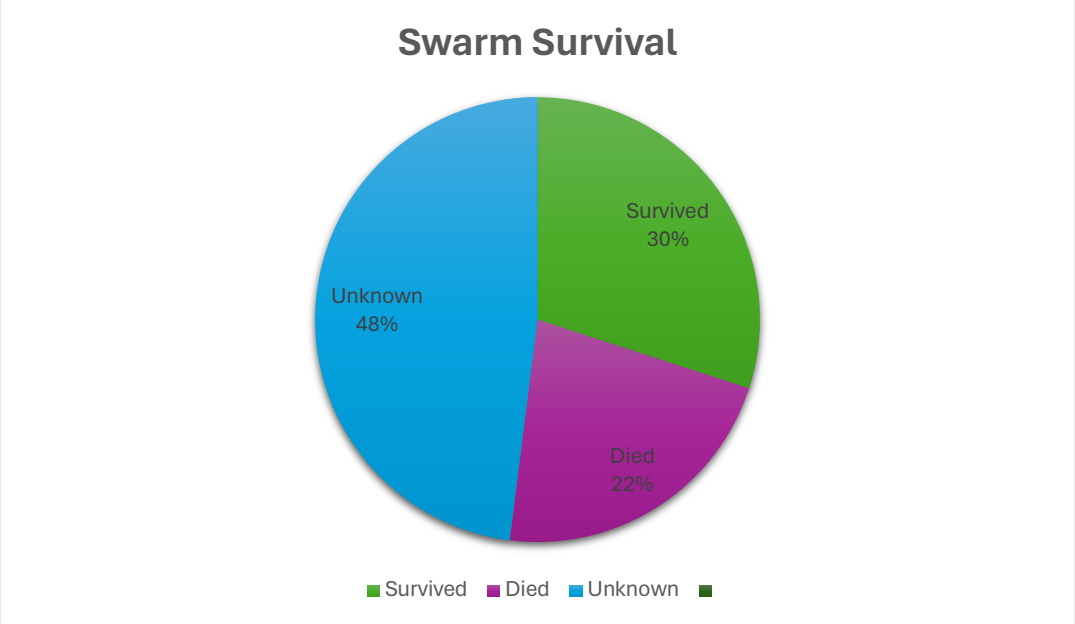
Seeley further distinguishes between ‘founder’ colonies and ‘established’ colonies. We have used the term “first year swarm” instead of founder colony. This describes the first 12 months of a swarm that has occupied a nest site and is monitored through the summer season and its first winter. Survivor colonies are from swarms which have survived at least one winter and been active in the following spring reproductive season. Thereafter these are termed “mature colonies” rather than established colonies.

Results

Swarms and survival

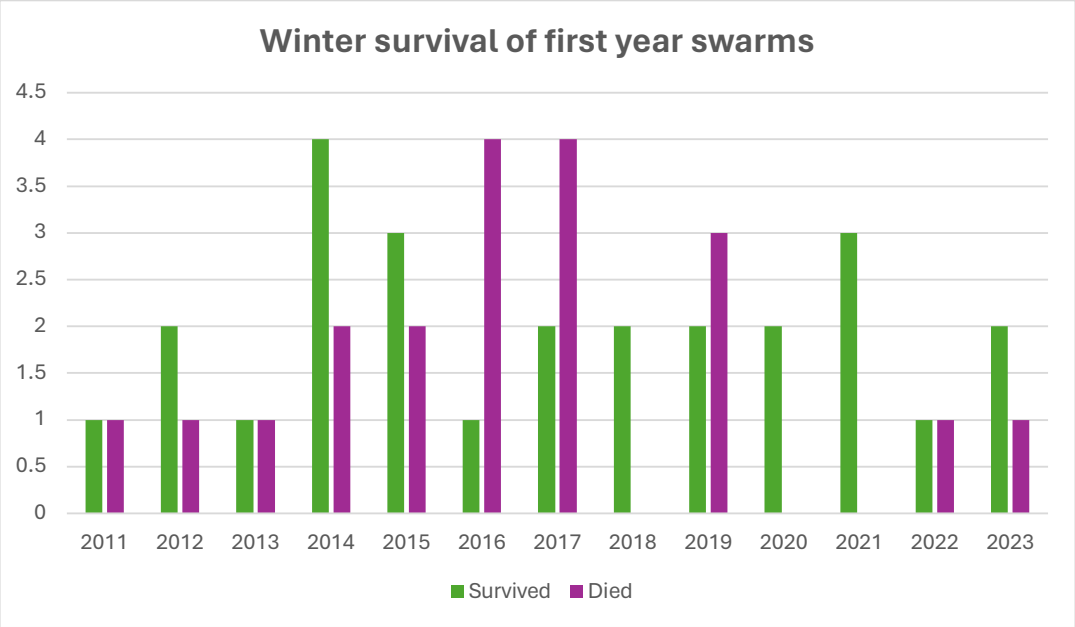
A total of 7 swarms were collected from the local area during the study. All other swarms were collected on site or occupied nest boxes and hives autonomously. Over 13 years of the project data were collected on 89 swarms. Many swarms were lost: either the cluster was inaccessible or it departed before or shortly after collection. The following chart shows the proportion of swarms which survived or died, or whose survival was unknown after they were lost or given away.

“Survival” indicates that the swarm survived summer and winter and was active again in the following reproductive season.

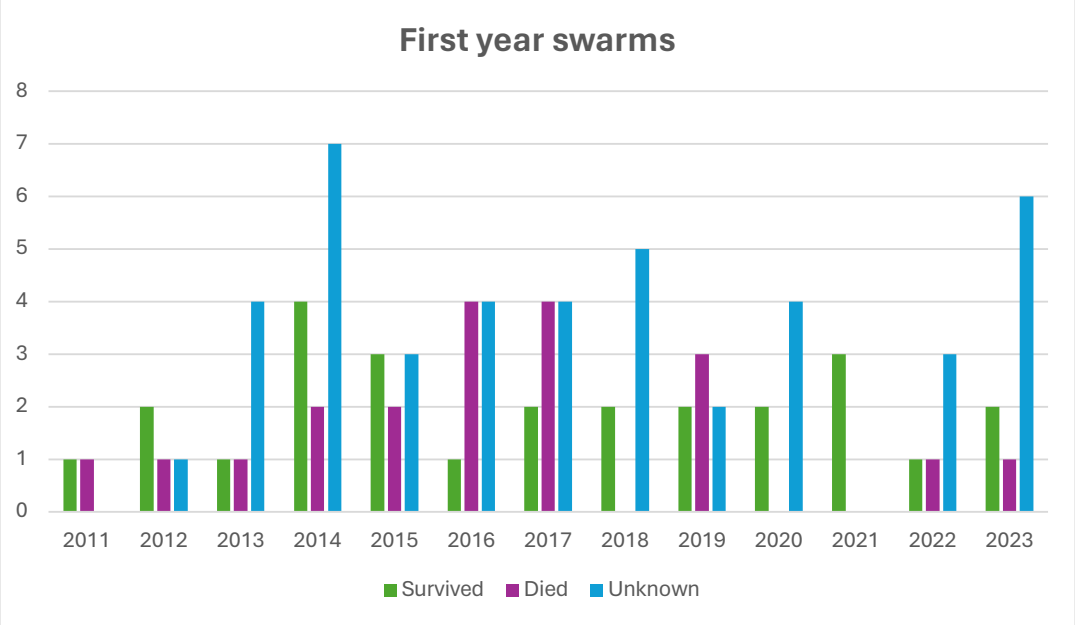


Winter survival of first year swarms

Some hived swarms never thrived: some never established or dwindled after a few weeks. The following chart compares the number of hived swarms which survived or died during their first year.



The following chart represents the fate of all swarms recorded during the project. Comparison is made between swarms in each year which survived their first year, died in their first year, or whose survival was unknown (lost or given away).



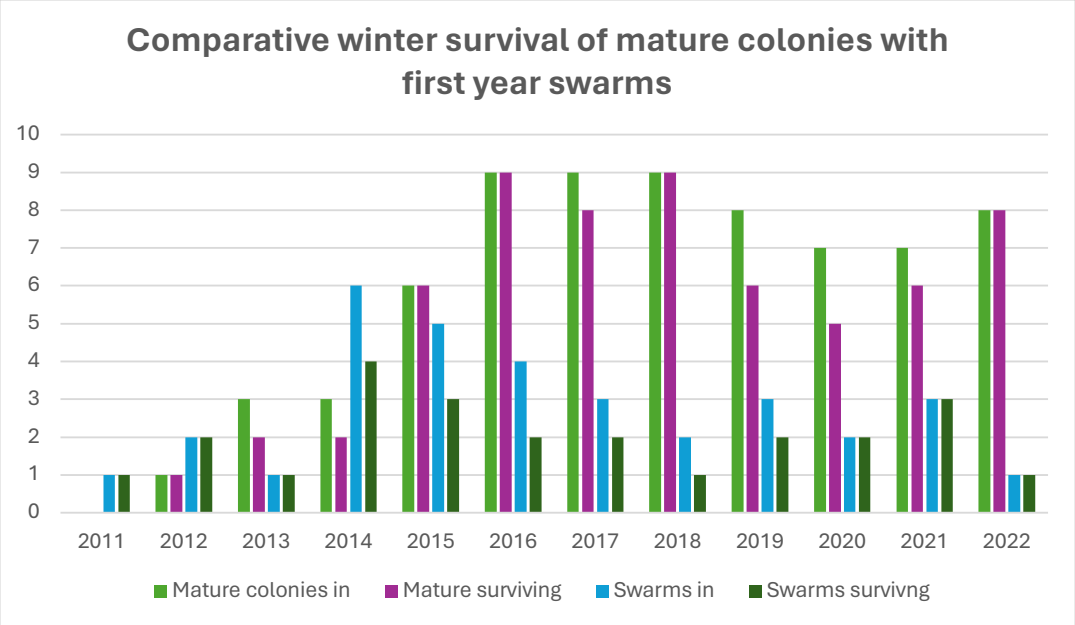
Winter survival of mature colonies

Beekeepers record data on colony losses in winter. Our methodology differs from standard Association beekeeping since no swarms are artificially increased or strengthened. Terminology also differs. Nevertheless some comparison can be made.

In this comparison swarms which have perished during their first year are excluded. Swarms are classified as first year swarms from collection until they have survived one winter and become active again in the following spring reproductive season. Colonies that have come through this reproductive season and go into their second winter or beyond are classified as mature colonies.

It should be noted that numbers are small. In the first year of the project (2011-2012) only one first year swarm was hived and went into winter. Numbers grew and varied in succeeding years. The number of mature colonies going into winter never exceeded nine. The number of swarms going into winter never exceeded six.

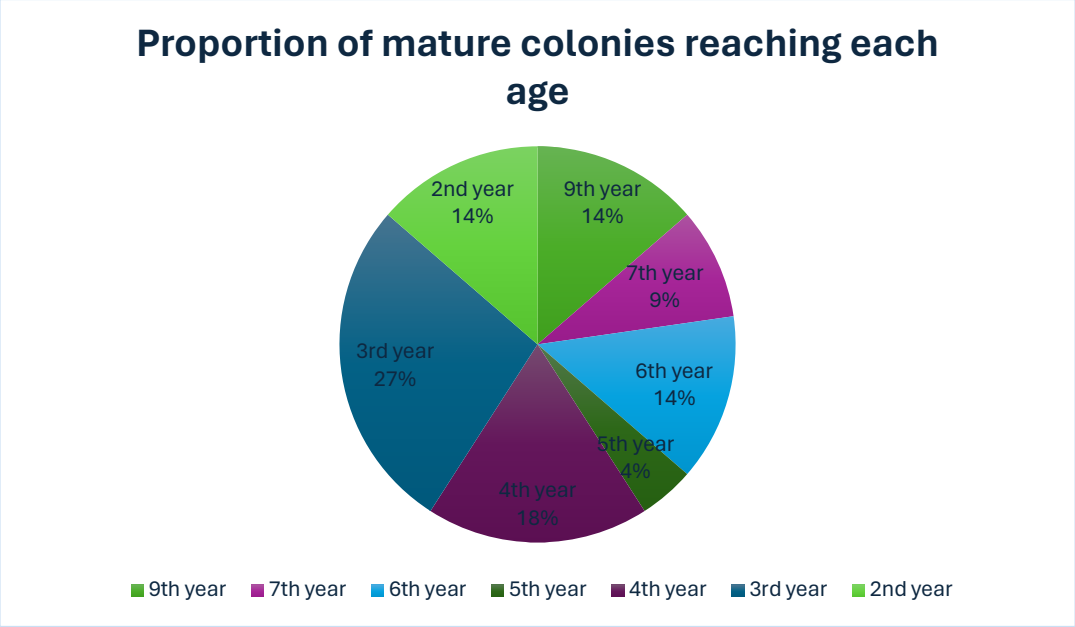
The following chart shows the number of mature colonies and first year swarms going into winter and surviving.



Longevity of mature colonies

After 12 years we can begin to assess how long mature colonies are surviving. The project is ongoing so these data will change in future years. All first year swarms are excluded.

The proportion of mature colonies surviving to each age is shown as follows:



Conclusion

Honey bee colonies are surviving and thriving without intervention in this location, in numbers sufficient to let them reproduce successfully, spread and maintain their population. Since observations began in 2011, 23 colonies have survived through their second winter or beyond.

What is the natural lifespan of a bee colony? This question is rarely asked: the natural annual replacement of queens implies that a colony can be eternal, and beekeeper interventions are often intended to prolong colony lifespan artificially. However, as Jamie Ellis points out (BBKA News May 2022):

Some of your colonies will die. I feel like this is necessary to include in my list of shared beekeeper experiences because of the common myth that bee colonies can live indefinitely as long as we manage them appropriately. To kill that myth, I need to remind you that honey bees and the colonies they form are living organisms and that all things that live eventually die. Honey bees are no exception.

In Autumn 2023 eight mature colonies went into winter. One is in its second winter, three are in their third winter, one is in its fourth winter, one is in its seventh winter, two are in their ninth winter. In 12 years of the project three colonies have survived to their ninth year. Two of these are still living. It remains to be seen how much longer each of these colonies will survive.

The project has confirmed that honey bees are surviving when the conditions are right. It raises many more questions which we cannot yet answer.

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April 2024