Minimising Honey Bee Impacts on Nesting Boxes and Hollows

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Introduction: Swarming Honey Bees and Nesting Boxes and Hollows

European honey bees swarm as a natural reproductive process. They also swarm if their hive is overcrowded, as often happens when the onset of warmer spring weather from August until mid December leads to the numbers in each hive growing dramatically. Occasionally, bees will "swarm" to find a new home if they are suffering from poor conditions where they are, and to stop disease.

When honey bees swarm, they initially gather on a tree, post or anything near their origin hive while scouts search out options for a new home. This search process can take as little as half an hour (and some believe occurs well ahead of swarming), or a day or two. Once a new home is found, the swarm moves to it, whether it be a compost bin, wall cavity, under rocks, hollow trees, couches, chimneys, sheds and, of concern here, hand-built nest boxes or tree hollows with the boxes having been installed for native birds and animals as part of protection and regeneration projects.

Beekeepers use a mix of management practices to reduce or eliminate the process and, in case swarming does occur, by putting up "swarm traps" or by trapping a swarm as it awaits the findings of its scouts. Swarm traps are usually small hive boxes (or "nucleus hives") with honey, pollen, comb foundation and attractive scents in them which attract swarms and thereby allow them to be captured. Bees Easy is one such pheromone spray. For details on swarm traps, see http://www.thepracticalbeekeeper.com.au/wp-content/uploads/2016/09/Beehive-bait-hive-instructions.pdf

It is generally agreed that honey bee, introduced wasps and feral bird infestation of nest boxes and tree hollows, can be a significant problem. Field evidence indicates that introduced bees often out-compete native bees for food while the homes swarms seek out are often the animal and bird boxes attached to trees by conservationists and landcare organisations. It seems unlikely that honey bees specifically target birds or animals in these boxes, but there is clear documented evidence that they can kill both, especially if the birds or animals struggle and either do not or cannot evacuate in time. Cohabitation can rarely occur and it is known that previously-thriving possums and birds have been found dead at the bottom of nest boxes, underneath bee swarms.

So what can conservationists do to counter this threat? This paper reports on some findings on the issue.

Opinions on Managing Honey Bees in Natural Settings

In seeking answers on how to deal with honey bee occupation of bird and animal boxes, we posted questions on a number of beekeeper and conservation-focused web sites to collect member views. Thanks to the members of Australian Backyard Beekeepers, Field Naturalists and Nestboxtales who responded.

Not surprisingly, there were differences of opinion on the part of beekeepers and conservationists, but it was not possible to identify an agreed strategy to combat the problem on the part of either group. Most conservationists saw feral honey bee swarms as a significant problem and agreeed that they should be removed and/or eradicated. They also argued that the source hives of swarms is commercial or hobby bee hives, these should be better managed by the beekeepers to prevent swarming. While this may be so, it needs to be recognised that tracking swarms back to a local beekeeper and proving the beekeeper as the source can be extremely difficult, while swarms can also come from unknown or known feral hives.

Several respondents argued that animal/bird box infestation appears to have become more common over recent years due to a substantial increase in the numbers of hobby beekeepers, many of who know less about how to stop swarms than do professionals. This is possibly true, but is largely unsubstantiated, and swarming occurs for a number of other reasons. It could equally be that more bird/animal boxes are being installed, that more people are moving to rural areas and that climate change is impacting on hive

swarming rates. Some respondents felt it was too late to take action and although this pessimism is understandable, it will not achieve a positive outcome or even reduce impacts.

Interestingly, the widespread (but disputed) view that "we have to save the bees because they will save the earth", led some conservationists to argue that feral bees were an acceptable part of the ecosystem and should either be left alone or at most, moved out of animal/bird boxes. Those who were willing to accept honey bees suggested that catching swarms and selling them on was a useful way to generate income. These views were largely rejected by other conservationists and beekeepers, the counter arguments being that feral bees are no different to foxes, brumbies and carp and should be exterminated, at least in national parks and special conservation reserves. It was argued that collecting swarms for sale would not stop them invading bird/animal boxes.

Significantly, the Victorian Trust for Nature has a clause in its conservation covenant agreements with property owners which excludes the keeping of honey bees. The Trust has even contacted properties adjoining covenant-protected properties to seek their cooperation in keeping honey bees away by explaining the threat they pose to native wildlife.

Arguments against leaving honey bees in the wild include the fact that they compete with native species, cannot be inspected for disease, are often more aggressive and that they are likely to swarm more often as the natural hive opportunities available to them are frequently less suitable than those provided by beekeepers. There is also evidence that European bees can interfere with the successful pollination of many unique and specialised native plants. For example, 'Native Fuchsias' in the genus Correa often have their flowers mutilated by bees as they chew through the tubular flowers to access the nectar at the base, thereby avoiding the pollen and stigma in the mouth of the tube, resulting in the failure of the plant to produce seed, (while also depriving honey-eating birds of a vital food source).

It was suggested that more honey bees are taking over built structures such as nest boxes as there are fewer hollow trees due to land clearing, bushfires and tree ageing, with the latter two being "pushed" by climate change. This then leads to feral honey bees interfering with natural and managed breeding programs for native species.

Several people provided details on published research papers. These are listed at the end of this paper but have not been reviewed in detail at this point. In general the papers indicate that honey bees can generally out-compete native animals and birds in occupying built boxes and tree hollows. Of particular concern is the fact that the research suggests that while many bird and animal species can have quite specific nest/hollow requirements, this is far less so for bees which, consequently, have an advantage over many other species. This is exacerbated by the fact that in Australia over 17% of native bird species, 28% of reptiles and 42% of mammals are entirely dependent on tree hollows or artificial nest boxes for their survival and reproduction.

A Framework for Action to Minimise Honey Bee Impacts on Nesting Boxes & Hollows

The actions proposed by respondents to deal with honey bees/wasps in bird/animal boxes and hollows have been refined and added to and categorised into six steps. These are (1) improving management practices, education and policing of beekeepers, (2) strengthening beekeeper liaison, (3) removing feral hives, (4) deterring swarms from infesting nesting boxes, (5) removing swarms in nesting boxes, and (6) recording, reporting and promoting action outcomes. These are detailed in the following chart.

Strategies	Comments
1. Improve beekeeper management practices, education and policing	
1.1 Strengthen federal, state and local government biosecurity and beekeeping rules and regulations to improve hive and swarming management	Both beekeeper and conservationist respondents felt that there was inadequate training or supervision of beekeepers and their hives
1.2 Establish mandatory beekeeper training programs in keeping with 1.1	

1.3 Support additional research into swarm control and swarm management	
2. Strengthen liaison with beekeepers 2.1 Liaise with local/regional/itinerant beekeepers and bee clubs/groups regarding the need to optimise management practices and minimise swarming 2.2 Offer the opportunity for beekeepers to install swarm traps and collect any swarms that are found	This approach helps to develop a positive relationship between beekeepers and conservationists and through this, improved swarm management
3. Remove feral hives 3.1 Keep an eye out for honey bees in the locality. If there are none, no action may be needed. If bees are seen, attempt to track down what might be described as "source" hives eg: apiaries, hobby beekeepers with hives and wild hives. The difficulty here is that these hives could be many kilometres away (bees have been tracked travelling 8 km. in Victoria to feed on canola crops while apiary officers have traced them travelling 13 km. in Tasmania) 3.2 When honey bees/introduced wasps are seen in a bushland/conservation setting, attempt to identify their source in order to go back to step 1 or find any feral hives. Where feral hives are found, it may be possible to have a beekeeper remove them. Otherwise it may be necessary to exterminate them. Depending on the circumstances, the use of drowning, burial, fire, boiling water, entombing, commercial insecticides or argon and nitrogen gases to asphyxiate them should be evaluated.	There is a need to research the effectiveness and safety of the techniques available for exterminating feral hives. A process for recording and reporting research findings also needs to be developed
4. Deter swarms from infesting bird/animal nest boxes 4.1 Chemical methods suggested to deter bees from inhabiting animal/bird boxes were: • Put domestic animal flea collars, cattle ear tags or moth balls on top of the boxes as the chemicals deter bees • Use a range of aromatic oils sprayed on/around the boxes eg: eucalyptus as a base with added lemon myrtle for extra scent (See https://pestpointers.com "Use these 10 essential oils to keep bees away (humanely)". Several respondents highlighted the effectiveness of using orange, other citrus fruit oils, cinnamon, peppermint, lavender and almond oils to spray boxes so as to leave a residue to discourage bees (both before and after occupation). It was argued that there is a need to spray every few weeks, particularly during the swarming season. • Use Honey-B-Gone. This is a spray that smells a lot like almond oil. It is used to move bees within hives and out of areas that cannot be reached • Use the repellent Kilz which also seals boxes each time a swarm is removed or "Coopex". The latter is a residual insecticide and should be carefully considered before use 4.2 Physical methods suggested to deter bees from inhabiting animal/bird boxes were: • Install shag pile wool carpet, bathmats, astroturf, artificial grass, carpet underlay, waves of loose shade cloth, rough leather, foam or silicone baking mats in the box roof and for 5-10 cm down the sides as bees have trouble attaching comb to these • Use cat flaps on box entrances • put a 1 cm slot/vents around the top of the box to make it unattractive for bees	Some respondents noted individual successes in deterring bees with these strategies but they warrant wider trials. This is because some chemicals may kill bees and other native wildlife, some aromatics (such as lemongrass) are used to *attract* bees, and others, such as peppermint and spearmint, are used in bee food supplements. Others can deter animals and birds or impact detrimentally on both humans and wildlife well after bees have been removed. For instance, Youtube features on Honey-B-Gone warn against skin contact and inhalation. Finally, the comparative effectiveness of each approach also needs to be assessed. It was argued strongly that if chemical methods are used, they need to be refreshed regularly. Many of the physical strategies appeared to be anecdotal rather than based on research and while they may work in some instances, they do not seem to be consistently reliable. Loop pile carpet can catch the claws of both bees and native birds/ animals and kill them. Carpet, astroturf and artificial grass drop microscopic particles into the environment. Slots near the top of boxes may work in some instances but, depending on the climate and bird/animal species the boxes are provided for,

• burn the insides and roof of boxes to make it difficult for bees to attach their comb to it • install multiple boxes in close proximity to each other so that birds/animals using boxes become familiar with them and, at least in some circumstances, have a refuge. The method of installing boxes needs to be considered so as to facilitate easy removal. The height of boxes and hollows is an issue for some native birds and animals and it may be that in some instances, pulley systems will be needed to allow infested boxes to be removed • Consider using PVC materials for nest boxes rather than wooden boxes in the light of Kangaroo Island research into feral bees infesting Glossy Black Cockatoo nests. This showed that over an 11 year period, 5% of nest boxes made of PVC were infested vs 24% of wooden boxes and 14% of hollows in Eucalyptus trees (See Berris and Barth in bibliography) • use the "push-pull" approach advocated by Efstathion in South American and African research (see bibliography). This uses pairing nest boxes treated with permethrin insecticide to "push" scout bees away and swarm traps treated with pheromones to "pull" bees 4.4 Have spare nest boxes ready to replace infested boxes during the spring swarming season (Aug -Dec depending on region), inspect nest boxes as frequently as possible eg every 2-3 days	may be seriously detrimental to bird and animal needs. See https://nestboxtales.com/bushfire-zone-nest-box-design-and-species-list-booklets/ and https://nestboxtales.com/nest-box-materials/
5. Remove swarms in nesting boxes/hollows 5.1 Once swarms have been found to have infested a nesting box, a swarm trap or a hollow log, they should be removed as soon as possible 5.2 Beekeepers who have installed swarm traps or who want to collect swarms should be notified and will most probably be needed if it is possible to extract swarms from hollow logs. Property owners can remove swarm traps and boxes by sealing their entrances after dark and transporting them away, preferably immediately, and in a hessian bag or pillow slip/sheet for safety. Safety netting and heavy gloves should be worn as a precaution. Swarms should not be left sealed for more than 12 hours or they are likely to die from smothering 5.3 If no beekeepers are available, swarms may need to be exterminated. The safest ways to do this is to put the sealed nest box into a freezer or a large tank of water. Swarms that cannot be removed from hollow logs can be exterminated by the use of sprays or powder, through smothering by entombing or with argon or nitrogen gas 5.4 Removed boxes should be replaced with a new or cleaned box 3-4 days after their removal. This time lag ensures that none of the bees remain as they can survive for several days in warm weather	Several people argued that once a swarm is eradicated, bird/animal boxes must be well-cleaned, as fresh swarms are likely to be attracted back by pheromones and the aromas of wax and honey. This was disagreed with by others and as such, clearly needs further testing
6. Recording, reporting and promoting findings 6.1 To be effective, it is essential that the outcomes of all actions taken on 1. to 5. above are recorded and distributed to wider conservationist and beekeeper communities. The location, dates and circumstances of the action and the target of bird/animal boxes or hollows should be provided with any descriptions.	Unless the findings of action on dealing with bee/wasp infestations of bird/animal boxes and hollow logs are recorded and disseminated, there is little point in taking the action. This is because while some things may work for some people, they *may not always do so* and they may not work for others. This appears to be the case with some of the actions suggested by respondents to this paper.

Conservationists may wish to join "Nestboxtales" where there has been a lot of discussion about feral bee invasion of nest boxes: https://www.facebook.com/groups/2568804883151887 See also: https://m.facebook.com/groups/nestboxtales/permalink/5148085085223841/?m_entstream_source=group&anchor_composer=false Beekeepers might join Australian Backyard Beekeepers or more focused state-based groups. Alternately, a new joint-user group might be usefully established Facebook and other web site administrators are encouraged to appoint co-administrators to collate and disseminate findings	

Conclusion

Despite the views of some, honey bees (and European wasps) can have a negative impact on natural ecosystems. This includes the loss of pollen and nectar needed by other native species and the destruction of flowers. However the impact is particularly bad when swarms invade nesting boxes established by conservationists as part of population breeding programs or to offset the loss of nesting opportunities due to forest clearing, bushfires and climate change. Invasions can lead to the death of native birds and animals as well as the loss of nesting opportunities.

A range of strategies is available to both beekeepers and conservationists to reduce the impact of swarms. Beekeepers have a responsibility to manage their hives more intensively to reduce swarms and action is needed to improve their skills and accountability. Biosecurity regulations and policing need to be strengthened as part of this. That said, "sourcing" a swarm can be difficult and preventing swarming totally is impractical as it occurs for a number of natural reasons amongst bee hives.

A variety of tools can be used by conservationists to minimise honey bee invasions. These extend from the removal or extermination of all feral hives through to an enhanced process of liaison and coordination with beekeepers so that swarms that are found can be collected and removed. Similarly, a range of actions can be taken by conservationists: invasions can be reduced by improvements to the design and management of nesting boxes, a mix of chemical and physical strategies to deter honey bees can be applied, alternate boxes for both bees and native species can be provided, and a rapid process of collection, removal and/or extermination can be used. Critical to any action are three things: consistency and diligence in applying the action; the recording of what is done, monitoring the outcomes and reporting on these, and finally, cooperation between beekeepers and conservationists. Mechanisms need to be developed for recording and reporting because without them, little benefit will be gained from starting.

The information collected for this paper with regard to deterring honey bee invasion of nesting boxes in suggests that there is a dire shortage of "cold hard facts" and that there is limited research into which tools that are most effective. Some of the suggested strategies are highly unlikely to work or work uniformly across Australia while others are almost certainly detrimental to both bees and some of the very animals and birds they are intended to protect. The paper proposes a six step strategy for addressing the issue of honey bees (and others) in native bird and animal nesting boxes. Research into the efficacy of the six steps and the specifics within each is urgently needed and anyone using any of them is encouraged to post their actions and the outcomes through a reputable web site.

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