Draft Flora and Fauna Guarantee Action Statement

Threats to native flora and fauna arising from the use by the feral honeybee *Apis mellifera* of nesting hollows and floral resources

Description

Apis mellifera, commonly known as the European honeybee or Western honeybee, is a species of introduced honeybee. Honeybees are a subset of bees that produce and store honey and construct perennial, colonial nests out of wax. A *Honeybee* colony can consist of anywhere from 10,000 to 80,000 bees, including a single queen, up to a few thousand males (drones) and semi-sterile female workers. The workers perform the majority of tasks within the colony, including cleaning cells, feeding larvae, processing and storing food, secreting wax and constructing comb, guarding the hive and foraging for food. The queen is the only fertile female and lays all eggs. The drone bees are the male bees of the colony. Their primary purpose is to fertilise a new queen.

Colonies reproduce through a process of colony budding, commonly referred to as swarming. As colonies grow to swarming size, which in feral colonies is believed to be about 20,000 workers, new queens are reared. The old queen generally leaves the nest with a group of bees to initiate a new nest and leaves the daughter queen with the existing nest and any remaining adults. In temperate climates swarming usually takes place in spring, where as in tropical and sub-tropical areas swarming can happen throughout the year.

Honeybees construct their nests in natural cavities, often tree hollows. There have been no measurements of the sizes of cavities used by feral honeybees in Australia or the size of feral colonies (Paton 1996). However, in North America feral colonies range in size from 10,000 – 30,000 and occupy nest cavities of 15-80 L in volume (Seely 1985).

Use as a pollinator of commercial crops

Honeybees provide an essential service in Australia through crop pollination services. Since European settlement our food chain has been almost entirely exotic, with 65% of the food crops introduced requiring honeybee pollination (Jones 1995). The value of unpaid pollination services in Victoria is estimated to be $251 million (Gibbs and Muirhead 1998). This includes both incidental pollination from managed hives and pollination from feral honeybees. Some crops, like almonds, are almost entirely dependant on insect pollination. Others, such as citrus, require pollination by bees to achieve maximum fruit quality. Some producers ensure pollination of their crops by paying beekeepers to place their hives in close proximity to crops at the appropriate times. However, many crops are dependant on feral honeybees. If feral honeybees are removed from the Victorian landscape it could have significant impacts on the agricultural industry. When feral bee populations in the USA were decimated by the Varroa (*Varroa destructor)* and Tracheal (*Acarapis woodi*) mites, this resulted in a pollination crisis amongst lucerne seed and hay producers (Gibbs and Muirhead 1998). The removal of feral honeybees could have a similar impact in Victoria. Consequently, any reduction in feral bee populations needs to be carefully considered.

Occurrence

Feral and managed colonies of *Honeybees* have been present in Australia for about 160 years, but their distribution and abundance has increased dramatically over the last 60 years (Paton 1996). They were introduced to Australia from Europe in 1822 for the production of honey and quickly naturalised throughout Australia, although they are patchily distributed. Feral populations are controlled by natural factors including access to water, temperature, fire, floral resources, availability of suitable hollows and bee diseases. Areas of highest density in Victoria include north-west mallee regions and riparian habitats in north-eastern Victoria, particularly redgum/black box habitats and drier woodlands in the south-west (Paton 1996). Oldroyd *et al.* (1995) found that feral nests may be aggregated rather than evenly distributed.

Nature of threat

Taxa and/or communities of flora and fauna affected

There are many native fauna species that utilize hollows in Victoria. Those species that use similar-sized hollows to feral honeybees are at risk of displacement by feral bee colonies. Some typical threatened species which are likely to be affected include the Brush-tailed Phascogale *Phascogale tapoatafa;* Squirrel Glider *Petaurus norfolcensis*; Yellow-bellied Glider *Petaurus australis;* Major Mitchell's Cockatoo *Cacatua leadbeateri*; Glossy Black Cockatoo *Calyptorhynchus lathami*; Australian Owlet-nightjar *Aegotheses cristatus*; Superb Parrot *Polytelis swainsonii*, Red Rumped Parrot *Psephotus haematonotus* and Regent Parrot *Polytelis anthopeplus* (Oldroyd *et al.* 1994, Paton 1996,

Trainor 1995). Honeybees have also been implicated in the decline of some native invertebrates (particularly native bees) via competition for food resources (Paton 1996).

Eucalypts are commonly visited by honeybees and can remove a significant amount of floral resources, which can discourage visitation by other native pollinators, who are often more effective. This may reduce pollination and seed set of many eucalypts. Listed eucalypts likely to be affected are *Eucalyptus aggregata, E. cadens, E. crenulata, E. froggattii* and *E. leucoxylon* ssp. *bellarinensis*. *Grevillea barklyana* is a listed taxon in this category as well.

Examples of listed communities that may be affected by feral honeybees are: Coastal Moonah *Melaleuca lanceolata* ssp. *lanceolata* and Grey Box-Buloke Grassy Woodland Community. There is also potential for honeybees to alter pollination patterns from outbreeding to inbreeding and thus the genetic quality and absolute quantity of Mountain Swamp Gum *E. camphora* ssp. *humeana* (Paton 1993, Horskins and Turner 1999).

Conversely, there are those that believe that after over 160 years of *Feral honeybee* establishment in Australia, an equilibrium has been reached and there is no significant effect on native species (Manning 1997). Gibbs and Muirhead (1998) suggest that no adverse effects of any kind have been demonstrated in studies where the resource is not limiting. However, until further research clarifies the effects that feral honeybees are having on native flora and fauna, a precautionary approach should be taken.

Impact of threat

Competition for hollows with native species

It has been demonstrated that there is overlap in hollow use between feral honeybees and native fauna (Paton 1996, Lawler *et al*. 1995). Colonies of honeybees can occupy hollows in trees for 20-50 years, thereby making them unavailable to native species for that period. In Victoria, there are 14 bird and eight mammal species listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act) that use tree hollows and are potentially threatened by feral honeybees via competition for hollows (SAC 2002). However, there is limited data as to the effects of this competition for hollows on these species. Trainor (1995) found that invasion of nest sites by feral honeybees has the greatest impacts on spring nesting tree-hollow using birds the most. This is because the swarming period for honeybees is between October and February. In some cases birds were incubating eggs or brooding chicks when hollows were invaded and the young birds did not survive when their parents were displaced by the invading swarm. Lawler *et. al* (1995) observed several translocations where parrots took up residence in former bee hollows and vice versa. Despite these examples, evidence to date has suggested that when hollows are numerous, honeybees use a small proportion of available hollows and have little impact on native species (Paton 1996, Oldroyd *et al*. 1994, Lawler *et al*. 1995). Few studies have adequately assessed competition between honeybees and native vertebrates when hollows are rare (Paton 1996).

Competition for floral resources

Honeybees compete for floral resources with nectarivorous birds, specialised parrots, some native mammals and endemic bees. The Regent Honeyeater (Critically Endangered), Helmeted Honeyeater (Endangered), Black-eared Miner (Endangered), Swift Parrot (Endangered), and Squirrel Glider (Endangered) are FFG-listed species which are likely to be affected by honeybee foraging through competition for nectar or pollen.

Honeybees often remove 80% or more of floral resources produced (Paton 1996, 2000). An average colony can collect 18kg of nectar during the year and up to 30kg of pollen (Sugden *et al.* 1996). Honeybees also begin foraging earlier than native bees (Goulson 2003) and so can deplete the nectar stores before native bees begin to forage. Honeybee*s* have another advantage over most Australian native bees as they have the ability to communicate with each other. This means feral honeybees are able to collectively locate new resources and exploit them more quickly. Although honeybees certainly compete for the same resources as native bees, it is unclear whether this competition is having any impact on native bee populations. However, this may be due to the difficulty in studying small bees and the large number of native bee species rather than a lack of real impact.

Honeybees also compete with nectarivorous birds for floral resources. Paton (1993) showed that honeyeaters changed their foraging habits significantly in response to higher numbers of bees. They visited flowers fewer times, avoided the preferred flowers of honeybees and increased their individual territories. However, he also noted that competitive interaction between honeyeaters and honeybees has existed for approximately 100 years in the relevant study area and the bird species have persisted. The same can be said for native bees. Donovan (1980) found that in New Zealand, despite 140 years of contact, native bees still outnumber introduced bees on many flowers. This shows that, in New Zealand at least, they are competing successfully with feral honeybees.

Impacts from interactions between honey bees and plants

There are two ways in which honeybees impact on plants; by reducing seed set of some native plants through nectar competition with their specialised pollinators (eg. rare eucalypts and grevilleas) (Goulson 2003), and by increasing seed set in introduced plants. Visits to flowers by honeybees often outnumber those by birds and so by the time a bird probes the flower, little pollen remains. As birds are much better cross pollinators, this can reduce pollination and seed set and possibly threaten the long term survival of the plant. Seed set and pollination is most affected by honeybees when nectar resource is limiting (Gibbs and Muirhead 1998).

Australian plants and their pollinators have evolved largely in the absence of social bees, and so honeybees are less effective than many native pollinators. However, many of our weed species are from Europe. Honeybees have co-evolved with these species and are therefore more efficient pollinators of many weeds than our native species. This means that honeybee visitation to exotic plants may lead to an increase in the distribution and abundance of weed species (Goulson 2003). Hanley and Goulson (2003) found clear evidence for a positive link between the spread of weeds and the presence of introduced bees in New Zealand where many introduced plants are visited exclusively or predominantly by introduced bees including the honeybee (Hanley and Goulson 2003). Simpson et al. (2005) found a strong link between pollination of Scotch Broom (*Cytisus scoparius*) and honeybee visitation. These findings point to increased seed set in introduced plants as a result of honeybee visitation.

Circumstances in which threat operates

Evidence indicates that honeybees are only a threat when resources, including hollows and floral resources, are limited (Paton 1999, Manning 1997, Gibbs and Muirhead 1998, Schwarz and Hurst 1997).

If honeybee populations need to be controlled, there are some potential problems. These are outlined below.

Current control methods are technically difficult, unsafe, require large investment of resources and/or are only short-term

Current control options include chemical control, physical removal of colonies and limiting access to watering points (Schwarz and Hurst 1997). All of these methods are problematic in some way. Chemical methods have the potential to impact managed honey bees or the quality of the honey produced. Most other types of control involves locating nests and individually treating them or removing the colonies, which is very time consuming. Also, any control method can only ever produce short-term results as long as there are managed populations of honeybees providing opportunities for re-infestation. Further research is required to develop cost-effective control methods that are practical, successful and safe for non-target species.

Prioritising feral honeybee management

Due to the lack of strong, unequivocal evidence regarding the impacts of feral honey bees on native flora and fauna, and the lack of practical and effective control methods, it may be difficult for land managers to justify investing in feral honeybee control. Land managers generally have many issues to deal with simultaneously and need quality information in order to prioritise them. There is evidence that there are competitive interactions between native fauna and honeybees, however more evidence is needed as to what effect, if any, these interactions actually have at the population level. Research is needed into identifying key areas or situations where control would be most beneficial.

The presence of managed colonies of honeybees provides a further disincentive for control of feral colonies. The benefits of control would be significantly reduced if managed bees still have access to the areas where feral bee control has been carried out. This is due to the direct effect of bees foraging in the area and also the increased risk of reinvasion by swarming commercial bees.

Feral honeybee control may not be supported by all sections of the community because removal of feral honeybees will mean reduced pollination of horticultural crops. Without as many feral honeybees, horticulturalists may have to buy pollination services from commercial beekeepers which will increase their costs and consequently the price of some foods. Additionally, Paton (1993) believes that some native plants have lost their endemic pollinators and so now depend on feral honeybees for pollination. Further research is needed to determine the pollination services that honeybees offer to these plants.

Status of threat

Victorian conservation status

"Threats to native flora and fauna arising from the use by the feral honeybee *Apis mellifera* of nesting hollows and floral resources" has been listed as a "potentially threatening process" under the *Flora and Fauna Guarantee Act 1988*.

Past management actions

Action	*Result explanation*
Control introduced animals	Honeybees have been controlled in Wyperfeld National Park when high numbers of bees affect visitor amenity and reduce visitor safety. They are controlled with pesticide strips when the need arises.

Conservation objectives

Long term objective

To minimise the negative impacts of feral honeybees on Victoria's native flora and fauna.

Objectives of this Action Statement

- To increase knowledge of management requirements
- To reduce the extent and impact of the threatening process

Intended management actions

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

Standard objective	*Targets*	
To increase knowledge of management requirements.	• Risk assessment method developed and comprehensively applied. • Demonstrable increase in knowledge of impacts and control measures.	
Action	*Details*	*Responsible agents*
Assess threats.	Assess which species are most at threat from competition with feral honeybees in order to determine priority areas for control.	DSE Biodiversity and Ecosystem Services
Identify research priorities and facilitate their implementation.	Undertake research into the impact of feral honeybees on threatened species. Specifically, determine: • The extent to which fauna populations are impacted by competition for floral resources • The extent to which fauna are impacted by competition for hollows • The extent to which flora (native and exotic) are affected by honeybee interactions.	DSE Biodiversity and Ecosystem Services
Undertake research into management requirements.	Undertake research into practical and successful methods of control. Any control method need to consider potential impacts on the honey industry. Determine the most appropriate strategies to minimise impact of feral honeybees, i.e. focus control on areas where control will benefit threatened species. Any management plan needs to take into account the value of feral honeybees to horticulture and potential impacts of feral honeybee control on commercial hives.	DSE Biodiversity and Ecosystem Services

Standard objective	*Targets*	
To reduce the extent and impact of threatening process.	• Control measures applied to highest priority infestations, as determined by comprehensive risk assessment.	
Action	*Details*	*Responsible agents*
Develop, provide input to or implement park, reserve or land management plan.	Include actions to control honeybees in relevant Action Statements or land management plans if research shows that they have a significant impact on particular assets.	DSE Statewide Services – all areas Parks Victoria CMAs
Control introduced animals.	Control honeybees in Wyperfeld National Park when high numbers of bees affect visitor amenity and/or reduce visitor safety.	Parks Victoria

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