The introduced Honeybee *Apis mellifera* and the Precautionary Principle: reducing the conflict

Graham H. Pyke
Australian Museum, 6 College Street, Sydney, New South Wales 2000

ABSTRACT

For more than 20 years there has been conflict arising from different points of view concerning the role of the introduced honeybee. There is a strong *prima facie* argument, and some supporting evidence, that introduced honeybees are likely to adversely affect the environment. Some land management agencies have consequently adopted a policy of removal of hive honeybees from areas devoted primarily to conservation. On the other hand, some argue that the scientific evidence on the issue remains poor, point out the economic benefits that arise from the honeybee industry and suggest that removal of apiaries from such areas is unjustified. It is suggested in this paper that adoption of the Precautionary Principle could significantly reduce this conflict. Instead of the focus being on obtaining definitive "proof" concerning possible impacts of honeybees, it could shift to finding ways to reduce the density of feral honeybees, and hence their impacts on both the natural environment and honeybees in hives. The focus could also shift to finding sites where reduction in honeybee density is feasible and the likely conservation gains arising from such a reduction are relatively high. In this way both the honeybee industry and the natural environment could benefit.

Key words: *Apis mellifera*, Precautionary, Honeybee, Australia, Feral, Competitor, Pollinator.

INTRODUCTION

The Honeybee *Apis mellifera* was successfully introduced to Australia in the 1820s to provide honey and pollination of certain agricultural crops (Doull 1973; Pyke and Balzer 1985; Pyke 1990; Paton 1996; Manning 1997; New 1997). It quickly escaped into the wild and became established as a feral species (Paton 1996; New 1997; Oldroyd 1998).

Both hive and feral honeybee colonies are now widespread in Australia and occur in almost every habitat (Hamilton 1917; Pyke and Balzer 1985; Pyke 1990; Paton 1996). The only areas where the honeybee is apparently rare or absent are in places where there is significant snow in the winter and it is presumably too cold for colonies to overwinter (Seeley and Visscher 1985; Pyke 1990; Paton 1996), and places where honeybees are presumably unable to obtain sufficient water because the climate is very dry and there are no artificial water sources (Pyke 1990; Paton 1996; New 1997).

Management of honeybees in the Australian environment is a controversial issue (Pyke 1990; Paton 1996; New 1997). Some authors suggest or claim that honeybees have or have had a negative impact on native flora and/or fauna (e.g., Wilson 1970; Matthews 1976; Douglas 1977; Bond and Brown 1979; Donovan 1980; Hawkeswood 1981; Pyke and Balzer 1985; Pyke 1990). Others dispute this (e.g., State Forests of NSW 1995; Manning 1997; Gibbs and Muirhead 1998). Some suggest that human-managed hives of honeybees (i.e., apiaries) should not be permitted in areas of natural vegetation, such as reserves dedicated largely for conservation and State Forests (Pyke and Balzer 1985). Others see no justification for such an approach and often point to the adverse economic consequences that this might have on the honeybee-based industry (Stace 1993; Manning 1997; Gibbs and Muirhead 1998).

This controversy has been raging, off and on, for about the last 20–25 years (Paton 1996; New 1997). Discussion of the issue began in the 1970s (Wilson 1970; Matthews 1976; Douglas 1977; Bond and Brown 1979), but at that stage there was little evidence one way or the other. The first study of possible impacts of honeybees on the Australian environment was carried out by Pyke and Balzer in 1982 and published in 1985 (Pyke and Balzer 1985; Manning 1997; Schwartz and Hurst 1997). A number of studies (e.g., Sugden and Pyke 1991; Paton 1993) and much discussion has followed. Quite recently an entire issue of the Victorian Naturalist was devoted to the issue (see Victorian Naturalist Vol. 114, 1997), and the Australian Nature Conservation Agency (now Environment Australia) recently commissioned a review of the subject (Paton 1996). There is little sign that this controversy will be resolved soon, if ever (Pyke 1990; Paton 1996; Butz Huryn 1997; Gibbs and Muirhead 1998).

The purposes of this paper are to (i) consider possible reasons for the continuation of this controversy, (ii) present a proposed strategy for dealing with the issue of honeybees and the Australian environment, and (iii) develop a management approach to honeybees that could result from such a strategy. Adoption of the Precautionary Principle is an important component of my approach (see Deville and Harding 1997).

ONGOING NATURE OF HONEYBEE CONTROVERSY

It is tempting to attribute the ongoing controversy to a lack of suitable information (e.g., Paton 1996; Manning 1997; Oldroyd 1998). Indeed many authors have called for further research concerning the honeybee in the Australian environment (Pyke 1990; Paton 1993, 1996; New 1997; Schwartz and Hurst 1997; Oldroyd 1998).

In my view, however, this is not the fundamental reason for the conflict and further information may do little to reduce it. If a lack of information was really the basic reason for the ongoing conflict then it seems likely that much research on the issue would have been carried out and that a significant proportion of this research would have been funded and otherwise supported by the honeybee-based industry. Instead, the number of published studies of the impacts of honeybees on the Australian environment remains relatively small, and these research programmes have generally been supported by government rather than the honeybee industry (e.g., Pyke and Balzer 1985; Taylor and Whelan 1988; Sugden and Pyke 1991; Vaughton 1992; Paton 1993, 1996; Oldroyd *et al.* 1994; Gross and Mackay 1997).

I suggest that the real reason for the ongoing conflict is the general legalistic approach that has so far been taken to the issue with honeybees being judged as in a court of law and being considered "innocent-until-proven-guilty". Indeed some authors have used courtroom jargon to refer to the issue. Manning (1997), for example, indicated that, in his view, "the jury is still out" on the issue. Such a legalistic approach would be expected to foster conflict where scientists are called upon to give evidence in support of one view or the other, each side disputes the quality and extent of the opposing evidence, and further research is not encouraged by the honeybee industry because it might produce evidence that is perceived to be damaging to its cause. This, it seems to me, is exactly what has been occurring for quite a long time.

A preferable approach would, I think, be one which results in collaboration rather than conflict among all parties concerned, especially scientists, conservationists and members of the honeybee industry (Pyke 1990; Paton 1996; Sugden *et al.* 1996). In the following section I describe such an approach based on adoption of the Precautionary Principle.

RELEVANCE OF THE PRECAUTIONARY PRINCIPLE TO THE ISSUE OF HONEYBEES IN THE AUSTRALIAN ENVIRONMENT

The Precautionary Principle has been stated slightly differently in a variety of documents (see Deville and Harding 1997). In the present paper, I adopt the following version as stated in Deville and Harding (1997):

- Where there are *threats* of serious or *irreversible* environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The Precautionary Principle, as stated in this form, could easily apply to the honeybee issue. Firstly, there is, as I argue below, a strong *"prima facie"* case (to continue the legal analogy) that honeybees continue to have an adverse impact on the Australian environment. This case indicates that there are indeed threats of serious or irreversible damage from honeybees to the Australian environment.

This case is based on the following:

1. Honeybees overlap in resource use with a large number of Australian native animals (Pyke 1990; Wills *et al.* 1990; Park 1993; Paton 1993, 1996; Schwartz and Hurst 1997);

   Floral pollen and nectar provide food not only to honeybees but also to many other insects including native bees, wasps, butterflies, moths, flies and beetles, as well as birds such as honeyeaters and lorikeets and mammals such as fruit bats, possums and gliders. There are thousands of such species (Pyke 1990; Paton 1993, 1996; Schwartz and Hurst 1997).

   Feral honeybees generally nest in tree hollows which are also sought as nesting and/or roosting sites by birds such as parrots, cockatoos and owls and mammals such as insectivorous bats (Microchiroptera), possums and gliders (Pyke 1990; Bird Observers Club of Australia Conservation Committee 1993; McDonald 1994; Trainor 1995; Paton 1996; New 1997).

2. Honeybees are often extremely abundant at flowers and often remove or utilize high proportions of their available nectar and/or pollen (Pyke and Balzer 1985; Paton 1993, 1996; Williams 1993).
3. It is likely that the abundances of some native animal species will be limited by the availablity of nectar, pollen or tree hollows and that those species that share these resources to a significant degree with honeybees will therefore be reduced in abundance through competition with the honeybees (Roubik 1978, 1980, 1982, 1983; Schaffer *et al.* 1983; Roubik *et al.* 1986; Pyke and Balzer 1985; Pyke 1990; Bird Observers Club of Australia Conservation Committee 1993; Park 1993; Paton 1993, 1996; Trainor 1995; Sugden *et al.* 1996).
4. Honeybees visit a high proportion of Australian native plants in search of floral rewards (Pyke and Balzer 1985; Wills *et al.* 1990; Paton 1993, 1996).
5. The behaviour of honeybees while foraging for nectar and pollen suggests that they will often be less effective as pollinators than native pollinators (Pyke and Balzer 1985; Ramsey 1988; Taylor and Whelan 1988; Pyke 1990; Vaughton 1992; Paton 1996. 1997; Gross and Mackay 1997), will sometimes reduce the effectiveness of native pollinators through pollen removal (Pyke 1990; Paton 1993, 1996, 1997; Gross and Mackay 1997), and will sometimes alter the patterns of genetic interchange amongst plants (Pyke 1990; Paton 1996, 1997). In some cases they may also enhance pollination above natural levels (Pyke 1990; Paton 1996, 1997).
6. It is likely that some plant species that are visited by honeybees will experience pollination that differs in nature and/or degree from natural pollination and that this will result in changes to the relative abundances of different plant species and possibly changes in the genetic characteristics of some plant species (Pyke 1990; Paton 1996).

In other words, the presence of honeybees in the Australian environment is likely to bring about changes in the abundances of many native plants and animals. In so far as the abundances of native plants and animals and the various interactions among them have coevolved, such recent changes brought about by an introduced animal species can be regarded as deleterious.

There is also a lack of "conclusive scientific evidence" concerning the issue (see also Paton 1996; Sugden *et al.* 1996; Butz Huryn 1997). This situation seems likely to continue indefinitely. No scientific study is perfect and it will always be possible for opposing sides to criticize any research programme (Sugden *et al.* 1996). Given the enormous number of species, habitats and geographic locations that could, and arguably should, be investigated, it will also be possible to insist that the results of any single study represent a "special case" and that the *general* situation is different.

The Precautionary Principle is relevant to the issue of honeybees in the Australian environment. It is not clear, however, what the consequences of applying it might be. I shall discuss this in the next section.

APPLICATION OF PRECAUTIONARY PRINCIPLE TO ISSUE OF HONEYBEES IN THE AUSTRALIAN ENVIRONMENT

Virtually all the conflict concerning honeybees in the Australian environment has concerned the extent to which beekeepers have access to areas of natural vegetation, especially areas managed as Conservation Reserves (New 1997). In this context, it might be easy to conclude, after adopting the Precautionary Principle, that all licences for beekeepers to place hives in such areas be revoked. However, I argue that such an extreme "guilty-until-proven-innocent" approach would be facile and inappropriate. It would also be very different from current policy of land management agencies towards apiary honeybees. Present policy of NSW National Parks and Wildlife Service is, for example, to allow present licences for apiary sites in National Parks, Nature Reserves etc. to continue while not permitting them to be transfered or sold (NSW National Parks and Wildlife Service 1988)

Application of the Precautionary Principle to the issue of honeybees in the Australian environment should embrace the following realities:

1. Honeybees continue to make valuable contributions to our lives through provision of honey, crop-pollination and other products (Martin 1975; Pyke 1993; Moncur and Kleinschmidt 1993; Park 1993; New 1997).
2. Alterations in the extent of access to areas of natural vegetation for beekeepers could have significant economic consequences, especially for the individuals involved (Pyke 1990).
3. From the point of view of management, there are two kinds of honeybees in the

Australian environment — bees in managed hives (apiary honeybees) and bees that have colonies established in the wild (feral honeybees) (Pyke 1990; Paton 1996; New 1997; Oldroyd 1998).

4. It is likely that feral and apiary honeybees compete with each other for floral resources with the net result that hive productivity for the apiary honeybees is reduced by the presence of feral honeybees.

   (Since feral honeybees are generally abundant in areas that are beyond the normal foraging range of apiary honeybees, their background density appears to be generally high. They apparently utilize the same floral resources as apiary honeybees and must therefore reduce the levels of these resources that are available to the apiary honeybees. This should result in decreases in rates at which individual apiary foragers can harvest nectar and pollen and hence in decreases in the productivities of the apiary hives compared with levels in the absence of the feral honeybees.)

5. It is possible that feral honeybees carry parasites or diseases that could be detrimental to hive bees.

6. It is also possible that the presence of apiary honeybees in an area will lead to enhanced abundance of feral honeybees through the escape of swarms from apiary hives (Pyke 1990).

With these realities in mind, application of the Precautionary Principle to the issue of honeybees in the Australian environment could lead to the following approach:

- Where feasible and practicable, attempts will be made to reduce or eliminate the feral honeybee population (Paton 1996, 1997; Oldroyd 1998);
- Hive honeybees will be removed from some areas where this is likely to significantly reduce the overall honeybee density (in concert with control of feral honeybees) and where the resultant conservation gains are likely to be relatively high (see also Paton 1997);
- In some areas the productivity of apiary honeybees may be increased through either replacement of feral honeybees with apiary honeybees or increased productivity of apiary honeybees after reduction in the abundance of feral honeybees.

This approach seems likely to result in rather different research and different levels of collaboration among interested parties than presently occurs. I discuss these in the next section.

CONSEQUENCES OF APPROACH BASED ON PRECAUTIONARY PRINCIPLE FOR FUTURE RESEARCH AND COLLABORATION

Adoption of the above approach seems likely to result in the following:

1. Pursuit and encouragement by all parties of research concerning the impacts of feral honeybees on both apiary honeybees and native wildlife;

   (This would lead to estimates of the potential benefits, in terms of both conservation and the honeybee industry, of any reductions in feral honeybee populations.)

2. Similar enhancement of research concerning possible methods for controlling feral honeybee populations and their associated costs (e.g., Oldroyd 1998);

   (This would lead to estimates of the feasibility and likely effectiveness of various alternative control methods in different situations.)

3. Collaborative search for areas where the likely conservation gains from honeybee reduction are relatively high and the likely economic losses from reduction in apiary honeybees are relatively low;

4. Similar collaborative search for areas where the productivity of apiary honeybees can be enhanced without significant likely adverse impacts on conservation values.

In this way a mutually beneficial situation may be achieved where conservation gains are obtained alongside economic gains to the honeybee industry.

CONCLUSION

I have argued that it is not necessary for the conflict concerning the honeybee in the Australian environment to continue (see also Paton 1996; Sugden *et al.* 1996). To achieve this result, however, it will be necessary for all concerned to change their attitudes and approaches. Everyone must, in particular, cease to focus on the question of whether or not honeybees have adverse impacts on the natural environment. This question, though interesting, is never likely to be satisfactorily answered in the context of the honeybee conflict. The focus should instead shift to a determination and pursuit of common goals. Only then can conservation and economic gains be pursued simultaneously.

I have also proposed the following as starting points for resolution of the conflict concerning honeybees:

1. The *prima facie* case that there are threats of serious or irreversible damage resulting

from the presence of honeybees in the Australian environment is accepted.

2. Reductions in the densities of feral honeybees are likely to benefit both the honeybee industry and native plants and animals.
3. There are probably situations where reductions in the densities of hive bees (perhaps in concert with reductions in feral honeybees) are likely to be beneficial to native plants and animals.
4. Conversely, there are probably situations where reductions in the densities of hive bees are likely to have little or no beneficial impacts on native plants and animals.
5. In addition, there are probably situations where increases in hive bees are likely to have little or no adverse impacts on native plants and animals.

Adoption of these premises could, I believe, lead to a collaborative approach with a focus on finding and implementing practical ways to reduce the densities of feral honeybees, reducing hive bees in situations where this is likely to result in significant conservation benefits in terms of native plants and animals, and maintaining or enhancing hive bees where this is unlikely to have significant negative impacts on native biodiversity.

ACKNOWLEDGEMENTS

I acknowledge and appreciate the support I have received from the Australian Museum throughout my involvement in honeybee-related research and the controversy that surrounds the honeybee issue. I also appreciate comments concerning earlier versions of this paper that I have received from Caroline Gross, Richard Major, David Paton and Rob Whelan.

REFERENCES

Bird Observers Club of Australia Conservation Committee, 1993. Glossy Black-Cockatoos in South Australia. *Bird Obser. No.* **735:** 4–5.

Bond, H. W. and Brown, W. L., 1979. The exploitation of floral nectar in *Eucalyptus incrassata* by honeyeaters and honeybees. *Oecologia* **44:** 105–11.

Butz Huryn, V. M., 1997. Ecological impacts of introduced honey bees. *Quart. Rev. Biol.* **72:** 275–97.

Deville, A. and Harding, R., 1997. Applying the Precautionary Principle. Federation Press: Sydney.

Donovan, B. J., 1980. Interactions between native and introduced bees in New Zealand. *NZ J. Ecol.* **3:** 104–16.

Douglas, A. M., 1977. Some inimical effects of the domestic bee on the native fauna and flora. *West. Aust. Nat.* **14**(1): 1–2.

Doull, K., 1973. Bees and their role in pollination. *Aust. Plants* **7:** 223, 230–31, 234–36.

Gibbs, D. M. H. and Muirhead, I. F., 1998. The economic value and environmental impact of the Australian beekeeping industry. Report prepared for the Australian Beekeeping Industry

Gross, C. L. and Mackay, D., 1997. Honeybees reduce fitness in the pioneer shrub *Melastoma affine. Cons. Biol.* In press.

Hamilton, A. G., 1917. Presidential address to the Linnaen Society of NSW. *Proc. Linn. Soc. NSW* **42:** 15.

Hawkeswood, T. J., 1981. Notes on the pollination of *Nuytsia floribunda* (Labill.) R.Br. (Loranthaceae) and some literature reviewed. *West. Aust. Nat.* **15:** 17–21.

Manning, R., 1997. The honey bee debate: a critique of scientific studies of honey bees *Apis mellifera* and their alleged impact on Australian wildlife. *Vic. Nat.* **114:** 13–22.

Martin, E. C., 1975. The use of bees for crop pollination. Pp. 579–614 in *The hive and the honeybee* ed by Dadant and Sons. Dadant and Sons: Hamilton, Illinois.

McDonald, D., 1994. Birds, hollows and honeybees. *Bird Obser. No.* **743:** 6–7.

Matthews, E. G., 1976. Insect Ecology. Univ. of Queensland Press: Brisbane.

Moncur, M. W. and Kleinschmidt, G. J., 1993. A role for honey bees (*Apis mellifera*) in eucalypt plantations. *NSW Agricul. Fish. Bee Briefs* **9:** 1–5.

New, T. R., 1997. Significance of honey bees in the Australian environment: Setting the scene. *Vic. Nat.* **114:** 4–7

NSW National Parks and Wildlife Service, 1988. Field Management Policies. NSW NPWS: Sydney.

Oldroyd, B. P., 1998. Controlling feral honey bee, *Apis mellifera* L. (Hymenoptera: Apidae), populations in Australia: Methodologies and costs. *Aust. J. Entomol.* **37:** 97–100.

Oldroyd, B. P., Lawler, S. H. and Crozier, R. H., 1994. Do feral honey bees (*Apis mellifera*) and regent parrots (*Polytelis anthopeplus*) compete for nest sites? *Aust. J. Ecol.* **19:** 444–50.

Park, A., 1993. Chasing the honeyflow. *Aust.Geogr.* **July-September:** 32–49.

Paton, D. C., 1993. Honeybees in the Australian environment. *Bioscience* **43:** 95–103.

Paton, D. C., 1996. Overview of the impacts of feral and managed honeybees in Australia: Distribution, abundance, extent of interactions with native biota, evidence of impacts and future research. Final report for Australian Nature Conservation Agency Invasive Species Program — Project 50.

Paton, D. C., 1997. Honey bees *Apis mellifera* and the disruption of plant-pollinator systems in Australia. *Vic. Nat.* **114:** 23–29.

Pyke, G. H., 1990. Apiarists versus scientists: A bittersweet case. *Aust. Nat. Hist.* **23:** 386–92.

Pyke, G. H. and Balzer, L., 1985. The effects of the introduced honeybee (*Apis mellifera*) on Australian native bees. NSW National Parks and Wildlife Service Occasional Paper Number 7.

Ramsey, M. W., 1988. Floret opening in *Banksia menziesii* R.Br.; the importance of nectarivorous birds. *Aust. J. Bot.* **36:** 225–32.

Roubik, D. W., 1978. Competitive interactions between neotropical pollinators and Africanised honey bees. *Science* **201:** 1030–032.

Roubik, D. W., 1980: Foraging behaviour of competing Africanized honeybees and stingless bees. *Ecology* **61:** 836–45.

Roubik, D. W., 1982. Ecological impact of Africanized honeybees on native neotropical pollinators. In *Social Insects in the Tropics* ed by P. Jaisson. Presses de l'Universite Paris XIII.: Paris, France.

Roubik, D. W., 1983. Experimental community studies: time-series tests of competition between African and neotropical bees. *Ecology* **64:** 971–78.

Roubik, D. W., Moreno, J. E., Vergara, C. and Wittmann, D., 1986. Sporadic food competition with the African honeybee: projected impact on neotropical social bees. *J. Trop. Ecol.* **2:** 97–11.

Schaffer, W. M., Zeh, D. W., Buchmann, S. L., Kleinhans, S. and Schaffer, M. V., 1983. Competition for nectar between introduced honey bees and native North American bees and ants. *Ecology* **64:** 564–77.

Schwarz, M. P. and Hurst, P. S., 1997. Effects of introduced honey bees on Australia's native bee fauna. *Vic. Nat.* **114:** 7–12.

Seeley, F. D. and Visscher, P. K., 1985. Survival of honeybees in cold climates; the critical timing of colony growth and reproduction. *Ecol. Ent.* **10:** 81–88.

Stace, P., 1993. Australian honey industry takes lead in developing a quality assurance manual. *NSW Agricul. Fish. Bee Briefs* **9:** 12–16.

State Forests of NSW, 1995. Proposed forestry operations in the Gloucester and Chichester Management Areas. Environmental Impact Statement. Volume A. Main Report. Published by State Forests of NSW: Sydney.

Sugden, E. A. and Pyke, G. H., 1991. Effects of honey bees on colonies of *Exoneura asimillima*, an Australian native bee. *Aust. J. Ecol.* **16:** 171–81.

Sugden, E. A., Thorp, R. W. and Buchmann, S. L., 1996. Honey bee-native bee competition: focal point for environmental change and apicultural response in Australia. *Bee World* **77:** 26–44.

Taylor, G. and Whelan, R. J., 1988. Can honeybees pollinate *Grevillea*? *Aust. Zool.* **24:** 193–96.

Trainor, R., 1995. Sweet danger. How feral bees compete with hollow-using birds and mammals. *Bird Obser.* No. **751:** 7–9.

Vaughton, G., 1992. Effectiveness of nectarivorous birds and honeybees as pollinators of *Banksia spinulosa* (Proteaceae). *Aust. J. Ecol.* **17:** 43–50.

Williams, G., 1993. Hidden Rainforests. Subtropical rainforests and their invertebrate biodiversity. NSW University Press: Sydney. 188 pages.

Wills, R. T., Lyons, M. N. and Bell, D. T., 1990. The European honey bee in Western Australian kwongan: foraging preferences and some implications for management. *Proc. Ecol. Soc. Aust.* **16:** 167–76.

Wilson, P. G., 1970. A taxonomic revision of the genera *Crowea*, *Eriostemon* and *Phebalium* (Rutaceae). *Nuytsia* **1**(1): 65.