NSW GOVERNMENT
Department of Primary Industries

# NSW apiculture industry overview 2015

INTENSIVE LIVESTOCK PRODUCTION

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*NSW Apiculture Industry Overview 2015*

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# Contents

## Honey bee essentials

- The keeping and husbandry of honey bees (*Apis mellifera*) can be traced back thousands of years.
- Modern beekeeping can be said to have arrived with the advent of removable frame hives over 100 years ago.
- Beekeeping started in Australia soon after European settlement. The earliest known record is the arrival of beehives in 1810.
- The beekeeping industry these days is a modern and industrialised business, but it still requires high-level husbandry skills.
- The beekeeping industry can be divided into two groups – recreational and commercial. The recreational group is large in beekeeper numbers but small in hive numbers.
- Both groups have issues in common, but also their own distinct issues.
- Biosecurity is a common concern for all groups.
- Income from beekeeping is primarily obtained by honey production or the provision of paid pollination services.
- There is an increased interest in using honey for medicinal purposes. This is being supported by several academic institutions carrying out various research projects.

A colony of bees serves a single fertile female: the queen. She mates several times when she first emerges from her pupal development stage. The bulk of the population are worker bees. These are sterile female bees and carry out all the functions of a colony.

Drone bees are male and have only one significant task: to mate with virgin queen bees. Once a queen is mated she will no longer need any drones.

A colony of bees will vary its population depending on a range of factors, including:

- the capacity of a queen to lay eggs and of the worker population to tend and care for the developing larvae
- the nutritional inputs in the form of nectar and pollen
- environmental constraints; very hot or cold conditions will seriously reduce brood rearing
- pest and disease pressure: various pests and diseases can harm the overall wellbeing of a colony and may restrict population growth; in extreme circumstances a colony may be killed.

The larger the population of worker bees is, the better is the capacity of the colony to forage and collect a surplus honey crop or to pollinate a flowering crop.

The skills of a beekeeper are required to be at a high level to maintain and build populations for specific periods in the year when this will be the most advantageous. This is essentially the difference between active and passive managers of beehives.

For further information, go to http://www.tocal.nsw.edu.au/publications

- Bee Agskills – available in a print form and electronic form, this 114-page basic skills book is mapped to the national competencies in beekeeping.

## Purpose of overview

The beekeeping industry is highly organised and complex, with multiple levels of participation. It can be divided into two groups: recreational and commercial.

The primary purpose of this overview is to explain the beekeeping industry. Commercial beekeepers may be concerned about where to place large apiaries. Recreational beekeepers may be concerned about what their neighbours think. Both groups will share concerns about biosecurity, as pests and diseases don't differentiate.

This overview should be useful to anyone interested in the beekeeping industry, be they existing beekeepers, students, investors or the general public. It does not explain how to manage bees or how to become a commercial beekeeper.

## Summary

NSW is the largest beekeeping state in Australia, accounting for 40% to 45% of the national honey crop. Commercial beekeepers own over 90% of the managed hives in NSW, but 80% of registered beekeepers own or manage only 8% of registered hives. Approximately 3000 registered beekeepers keep approximately 200 000 registered hives.

Beekeepers keep hives for pleasure and profit. Commercial beekeepers obtain their income mainly from honey production and to an increasing degree from the provision of pollination services.

Honey bees are the major insect pollinator of a significant number of flowering crops. Without them, it is unlikely that many important crops would be economically viable.

Honey bees and therefore beekeeping face a range of threats. The principal concerns are nutritional stress and biosecurity threats, both endemic and exotic.

The NSW DPI provides a range of advisory, educational, research, diagnostic and regulatory services to the beekeeping industry. It continues to be a major leader at the national level in many of these areas.

## Vital statistics

- There were 3461 registered beekeepers in NSW as at January 2014.
- There were 214 296 registered beehives in NSW as at January 2014.
- NSW accounts for an estimated 40%–45% of the Australian industry.[1]
- The gross value of honey and associated bee products in Australia is estimated at $94m.[2]
- The value of honey bees to Australian agriculture is estimated at $4 billion to $6 billion a year owing to the role of honey bees in pollinating economically important crops.[3]
- Australia produces between 20 000 and 30 000 tonnes of honey a year.[1]
- The NSW beekeeping industry is estimated to contribute $36 million annually to the state's economy.[4]

[1] Centre for International Economics (2005) Future directions for the Australian honey bee industry. Prepared for the Department of Agriculture, Fisheries and Forestry.

[2] Agricultural Commodities vol 4, no. 1 March 2014. Australian Bureau of Agricultural Resource Economics and Science, Canberra.

[3] House of Representatives Standing Committee on Primary Industries and Resources, More than Honey: the future of the Australian honey bee and pollination industries, May 2008, p 1.

[4] Australian Government Senate Inquiry (2014): Future of the beekeeping and pollination service industries in Australia. (NSW Apiarist's Association Inc. submission No. 58).

- Commercial beekeepers are based across regional NSW.
- Recreational beekeepers are found mainly in cities.
- Commercial beekeepers normally move apiaries several times a year to significant flowering events within a range of up to 1200 km.[5]
- Approximately 70% of the Australian honey crop is derived from eucalypt species.[6]
- NSW legislation manages biosecurity risks.
- Many commercial beekeepers rely on Crown Land, including state forests, national parks and stock reserves.

## SWOT analysis – strengths, weaknesses, opportunities and threats

### Strengths

- Long history of strong organisational structure in the form of industry associations.
- The strong 'natural' image of honey.
- Exponential growth and interest in recreational beekeeping.
- Ease of entry into the hobby of beekeeping.
- Over a dozen organisations that specialise in recreational beekeeping.
- The peak NSW beekeeping body, the NSW Apiarists' Association, which has several branches, holds an annual conference and publishes a comprehensive journal.
- A good reputation of Australian honey on the world market for cleanliness and lack of contamination.
- Historical support from state departments of primary industries, the CSIRO and various universities.

### Weaknesses

- Long shelf life, so honey is relatively easy to import.
- Few commercial participants in industry.
- Need for access to land over which beekeepers have no legal rights.
- Honey packers and farmers heavily influence prices for honey and pollination services.
- Physically demanding occupation.
- Limited training opportunities for current and new beekeepers.
- Little to no generic marketing of Australian honey.
- Competition among beekeepers for apiary sites and pollination contracts.

### Opportunities

- Marketing of the unique honeys produced in Australia (boutique honey).
- Growth in the demand for pollination services.
- Diversification of product range, such as pollen, propolis, mead and honey wine.
- Growth in the demand for active medicinal honey derived from *Leptospermum* species (equivalent to New Zealand manuka).
- Increasing interest from Asian markets for Australian honey and willingness to pay a premium.

[5] Hornitzky, McDonald, Kleinschmidt (1993) Commercial Beekeeping in New South Wales, Report by the Honey Bee Research and Development Council.

[6] Somerville DC, and Moncur MW (1997) The Importance of Eucalypt Species for Honey Production in New South Wales, Australia. XXXV International Apicultural Congress – Apimondia. Antwerp, Belgium, September 1997.

### Threats

- The parasitic mite *Varroa destructor*, which has jumped host from Asian bees (*Apis cerana*) to European honey bees (*Apis mellifera*). Without intense management, it is now impossible to carry out commercial beekeeping in most of the world owing to *Varroa*.
- Several other exotic pests with the potential to harm the keeping of honey bees in Australia, including *Tropilaelaps* mites, the large hive beetle and several Asian hornet species.
- Climate change, which is affecting the flowering patterns of key flora.
- Climate change, which is affecting the frequency and impact of the pests and pathogens already present.
- Cheap imported honey.
- Reduced access to public lands to source nectar- and pollen-producing flora.
- Increasing incidence of major climatic events such as flood and drought.
- Asian bees, which have proved to be highly invasive throughout PNG and Solomon Islands. They became established in Cairns in 2007 and are predicted to eventually spread the length of the east coast. They are highly competitive against *Apis mellifera.*
- Tracheal mites, which are common across the globe but are not present in Australia. They significantly reduce production by reducing the life span of adult bees.
- Any event that may cast aspersions over the quality of Australian honey.
- Pesticides.

## Industry business model

In NSW, around 400 beekeepers are registered as 'commercial', with 178 459 registered hives, and nearly 3000 as 'recreational' or 'other'.[7]

Commercial apiarist may be considered part-time (deriving only part of their main income from managing beehives) or full-time. A full-time apiarist may have a family-structured business, in which one person carries out most of the work, or a more complex business.

There are certain restrictions on entry into beekeeping. The single biggest issue is that bees sting. A significant proportion of the population has a low tolerance to honey bee venom, which precludes them from being regularly exposed to honey bees. In addition, most people show some degree of fear around honey bees and active apiaries.

Beekeeping is also a very physically demanding industry. This aspect probably explains the male domination of the working environment.

A successful commercial beekeeper must have a high degree of knowledge and understanding of a range of management issues associated with keeping honey bees, including:

- a comprehensive knowledge of pests and diseases
- a good understanding of the flowering cycle of key honey-bearing flora within a safe travelling range from the beekeeper's base
- food handling requirements of the market and a thorough understanding of the processes to produce a high-quality product under today's stringent quality assurance environment
- an understanding of the pollination needs of a range of commercial field and horticultural crops and the risks associated with pesticide use on these crops, and of the nutritional value of the pollen and nectar produced by these crops to honey bees

[7] NSW DPI beekeeper register, 5 September 2014.

- the ability to manipulate the nutritional inputs from targeted flowering events to maximise colony populations: colonies of honey bees need a range of pollen and nectar to promote bee breeding; honey crops occur only as a result of maintaining strong populous colonies
- business and financial skills appropriate to an extremely variable income stream. Beekeeping businesses have historically been based on honey production. The income is extremely variable owing to climatic factors and the flowering behaviour of the nectar-bearing flora on which beekeepers rely in different regions.

Beekeeping is constrained by knowledge of the flora in a given region, biosecurity threats to bees, and the physical limitation of the number of beehives which can be managed.

## Industry structure

The beekeeping industry comprises two loosely defined groups: recreational and commercial. There are no set hive numbers in each group, but commercial may be defined as keeping honey bees for profit, and recreational as keeping them for enjoyment. Those keeping up to 40 hives could reliably be considered recreational. For commercial beekeepers, the advice of a qualified accountant is essential.

The NSW beekeeper register showed 3821 registered beekeepers and over 265 000 beehives across NSW as at 13 April 2000, but it was estimated that nearly twice as many people kept hives as were registered (6700 beekeepers with 290 000 hives).[8] Most of these unregistered beekeepers were probably recreational and thus kept small numbers of hives.

Between 2007 and 2012, the number of recreational beekeepers (1–40 hives) as a ratio of the total number ranged from 76% to 82% (Table 1). The total number of registered beekeepers has remained around 3000. Thus, approximately 80% of registered beekeepers own or manage about 8% of the beehives, and commercial beekeepers own over 90% of hives (Table 2).

**Table 1. Numbers of beekeepers by size of holdings, 2007 to 2012.**

| Date | Number of hives | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1–10 | 11–40 | 41–200 | 201–400 | 401–1000 | >1000 | Total |
| **May 2007** | 1 893 | 519 | 396 | 131 | 149 | 36 | 3 124 |
| **Feb 2008** | 1 800 | 508 | 390 | 131 | 143 | 35 | 3 007 |
| **Aug 2009** | 1 819 | 478 | 357 | 114 | 121 | 38 | 2 927 |
| **Jul 2010** | 1 952 | 487 | 367 | 109 | 119 | 35 | 3 069 |
| **Apr 2011** | 2 272 | 467 | 386 | 114 | 120 | 22 | 3 381 |
| **June 2012** | 2 048 | 375 | 327 | 99 | 99 | 24 | 2 972 |

[8] Fogarty R, Somerville D, Garbin A. (2000). Inquiry into beekeeping in urban areas. Government of NSW, August 2000.

**Table 2. Numbers of beehives by size of holdings, 2007 to 2012.**

| Date | Number of hives | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1–10 | 11–40 | 41–200 | 201–400 | 401–1000 | >1000 | Total |
| **May 2007** | 8 599 | 11 374 | 41 143 | 40 924 | 99 750 | 61 518 | 263 308 |
| **Feb 2008** | 8 162 | 11 166 | 40 576 | 41 092 | 95 722 | 63 468 | 260 186 |
| **Aug 2009** | 7 870 | 10 575 | 38 331 | 362 56 | 80 923 | 67 995 | 241 950 |
| **July 2010** | 8 301 | 10 836 | 40 162 | 34 830 | 83 486 | 62 781 | 240 396 |
| **Apr 2011** | 9 345 | 10 593 | 41 995 | 36 741 | 85 013 | 40 141 | 223 828 |
| **June 2012** | 7 979 | 8 443 | 34 972 | 32 259 | 68 836 | 40 610 | 193 099 |

Even if we consider only the registered beekeepers, hive numbers have fallen, from 265 355 in 2000 to 193 099 in 2012, a reduction of 27%. In the same period, the numbers of commercial beekeepers have fallen, from 858 to 549, a reduction of 36%. This decline is likely to be due in part to the failure of recreational beekeepers to register (commercial beekeepers must register in order to enter public lands).

## NSW Department of Primary Industries

The NSW DPI delivers a wide range of services to primary industries and rural communities. Services to the beekeeping industry include R&D, education, training, regulation and diagnosis.

Dr Doug Somerville (Technical Specialist, Honey Bees), in Goulburn, and Nick Annand (Development Officer, Honey Bees), in Bathurst, are responsible for maintaining strong relationships between government and industry and driving projects of relevance to both. They develop best management practices for keeping honey bees, answer management enquiries, and advise on pest and disease management, starting in bees, and moving from amateur to commercial beekeeping.

The DPI's website provides extensive information on honey bees: www.dpi.nsw.gov.au/agriculture/livestock/honey-bees. It is divided into nine sections:

- Overview of the NSW honey bee industry
- Beekeeper registration – with a focus on biosecurity
- Industry contacts
- General public and bees – compliance information and general advice
- Compliance – with a focus on biosecurity
- Management – information on a vast range of topics, including insurance, cost-of-production software, organic certification, rearing queen bees, honey bee nutrition, pesticide poisoning, seasonal management and beekeeping equipment
- Pests and diseases – information sheets, videos, research reports and books
- Pollination – information sheets on a range of key crops cultivated in NSW and the impact and management of honey bees providing a pollination service. The key information sheet in this section is *'Best Practice in a Bee Pollination Service'*.
- Useful links.

Of particular note is 'Honey Money', a free cost-of-production calculator developed in consultation with the NSW beekeeping industry.

The DPI provides assistance to beekeeping industry organisations in a number of direct ways:

- The technical specialists sit on the NSW Apiarists' Association (NSWAA) executive in an honorary capacity to provide advice and guidance to industry and pass requests and information back to the DPI.
- From time to time assistance is provided in compiling focus reports and managing workshops. For example, the DPI conducted a focus workshop in conjunction with the NSWAA conference in 2014; and wrote a position paper on 'Apiary Sites on Public Lands' for the NSWAA in 2015 to help the industry to articulate its concerns and needs.
- From time to time, development officers facilitate discussions between beekeepers, government and other industry bodies.
- DPI staff write articles for *Australia's Honeybee News*, the official journal of the NSWAA.
- DPI staff present a report to the annual NSWAA conference to highlight the DPI's activities and achievements over the past 12 months. By attending the conference, staff meet key industry members and keep up to date on the important issues affecting the industry.
- DPI staff attend branch meetings and field days of the NSWAA, the Amateur Beekeepers' Association and other industry groups.
- The DPI has conducted short courses in beekeeping for over two decades. Courses cover beginning in bees, queen rearing, and pests and diseases. The pest and disease course is a specialist unit of study not available anywhere else in Australia. It became commercially available as an online course in 2015, with students from NSW and interstate.

The DPI manages the NSW component of the National Bee Pest Surveillance Program, an early warning system designed to detect new incursions of exotic bee pests and pest bees. The program's resources are focused on sites identified as the most likely points of entry. Beehives are managed at these high-risk sites and are tested every 2 to 4 months for exotic mites. The program is indebted to a team of volunteer beekeepers for carrying out the regular testing and submitting samples.

Complementing this program, the development team created a sugar shake kit for the detection of external mites. It uses a non-destructive and simple method to determine the presence of mites. Kits are free to beekeepers, who are encouraged to submit their results to the NSW DPI to enhance surveillance.

Mick Rankmore (Regulatory Specialist, Apiaries), in Gunnedah, coordinates compliance and regulatory activity. His principal focus is to ensure adherence to legislation. A network of apiary inspectors across the state enforce legislation and investigate non-compliance. These staff issue interstate health certificates, inspect exports, issue disease control orders, investigate breaches of legislation, investigate nuisance bees and participate in emergency management when beehives are involved.

The DPI provides diagnostic services through the Elizabeth Macarthur Agricultural Institute, Narellan. The Institute is the focal point for government veterinary diagnostic services in NSW. It assists with the diagnosis of diseases, routinely tests samples for export market requirements.

The research capacity of NSW DPI in the beekeeping field is strong, although notably without the services of a dedicated field scientist. Many projects have been conducted with funding from the Rural Industries Research and Development Corporation:

- Screened Bottom Boards
- Apithor™ Small Hive Beetle Harbourage Trap Safety and Residue Trials Project Summary
- Commercialisation of the Small Hive Beetle Harbourage Device
- A Study of *Nosema ceranae* in Honey Bees in Australia
- Small Hive Beetle Biology – Producing Control Options

- Forestry Plantations and Honey Bees
- Treating European Foulbrood in Australian Honey Bees
- Progress in Developing Strategies for the Insecticidal Control of Small Hive Beetle
- Semen Production in Drone Honey Bees
- Does *Nosema ceranae* Infect Bees and Contaminate Honey in Australia?
- A Study of New Zealand Beekeeping – Lessons for Australia
- Introduction and Performance of Queen Bees – Introductory Apiary Status and Post Introduction Results
- *Nosema* Disease – Literature Review and Three-Year Survey of Beekeepers – Part 2
- Insecticidal Control of Small Hive Beetle
- Field Trials to Test Supplementary Feeding Strategies for Commercial Honey Bees
- Nosema Disease: Literature Review and Survey of Beekeepers
- Fat Bees, Skinny Bees – A Manual on Honey Bee Nutrition for Beekeepers
- Oxytetracycline Sensitivity of *Paenibacillus larvae* subsp. *larvae* Isolates
- How Much Canola Pollen Is in Canola Honey?
- Small Hive Beetle in the USA
- Introduction and Early Performance of Queen Bees
- Fatty Acids – An Alternative Control Strategy for Honey Bee Diseases
- Literature Review of Chalkbrood, a Fungal Disease
- Controlling American Foulbrood
- Nutritional Value of Bee Collected Pollen
- Floral Resource Database for the NSW Apiary Industry

Several of these research studies and reports have been major game changers with extremely important outcomes. For example, the development of the Apithor™ Small Hive Beetle Harbourage is by far the most efficient and effective means to control and manage this major pest. The research work conducted on *Nosema* produced excellent guidelines for beekeepers to reduce the impact of this most serious of adult bee diseases. The research on queen bee longevity has major ramifications for increasing the efficiency of managing commercial beehives. The manual on honey bee nutrition, 'Fat Bees, Skinny Bees', has been downloaded over 26 000 times and translated into at least three other languages.

All these reports can be downloaded from the Rural Industries Research and Development Corporation's website: www.rirdc.gov.au.

The education and training role of the DPI is covered on page 22. Tocal Agricultural College offers short courses in a range of subjects concerned with beekeeping. Planned expansion of education and training is likely to make the DPI the national leader in beekeeper vocational training.

## Biosecurity

Biosecurity is increasingly becoming a complex topic with the arrival of new pests and diseases. Government involvement is major, although its role is changing, increasingly relying on industry partnership. For example, industry has developed a National Biosecurity Code of Practice. Government retains its focus on legislation, education and regulation.

Biosecurity concerns protecting beekeeping operations from pests and diseases, both endemic and exotic. It is crucial because the impact from pests and diseases is primarily financial, with

lost production and increased costs of production. This has a direct impact on the profitability of beekeeping and on the enjoyment of recreational beekeeping.

A study of the impact and cost of American foulbrood (AFB)[9] and small hive beetle (SHB)[10] illustrated the potential financial losses. On average, to eliminate AFB from a beekeeping enterprise would cost $13 000 and take 125 hours of additional labour. Likewise, SHB added $3835 to the cost of managing beehives and 150 hours of additional labour.

Biosecurity affects all beekeepers and the supply of beehives for pollination and honey production.

The significant pests and diseases of NSW are summarised below to illustrate the impact and potential economic cost of each.

## Brood diseases

### American foulbrood

AFB is caused by the bacterium *Paenibacillus larvae* and has been present in Australia for over 100 years. Its presence is a major concern as it kills infected colonies. The rate at which a colony declines depends on a range of factors.

Legislation in NSW covers management of this disease at an industry level. AFB is notifiable, and there is a legal requirement to actively manage any outbreak.

AFB is not activated by stress, as apparently healthy populous colonies can succumb if spores enter the hive. Infection requires six to ten spores to be fed to 1-day-old larvae. The spores germinate in the gut, and the bacteria rapidly multiply to fill the developing larvae, killing them. Each killed infected larva contains approximately 2.6 billion new spores, which can then be transferred by house bees to other areas of the hive where they can infect healthy larvae.

The rate at which the disease spreads through a hive varies. Some colonies will rapidly succumb and die, whereas other colonies may linger for months, with some larvae developing into adult bees. The disease is principally spread by the transfer of infected equipment (combs, boxes etc.) from a diseased colony to a clean colony. It can also be spread when diseased colonies become so depopulated that robber bees from other hives take infected honey back to their own hives.

The NSW Government and the beekeeping industry do not support the use of antibiotics to manage AFB, as the disease always develops resistance to antibiotics, and antibiotic residues remain in the honey.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Managing AFB – Guidelines for the identification and management of American foulbrood
- American foulbrood – Primefact 209
- American foulbrood in NSW – Primefact 878
- American foulbrood positive diagnosis – what should you do? – Primefact 744
- American foulbrood – tracing the source – Primefact 759
- American foulbrood disease – sending beehive material for irradiation – Primefact 194
- videos.

[9] Rhodes J, McCorkell B. (2007) American Foulbrood Disease *Paenibacillus larvae* in New South Wales apiaries. Survey Results 2006. NSW Department of Primary Industries.

[10] Rhodes J, McCorkell B (2007) Small Hive Beetle *Aethina tumida* in New South Wales Apiaries 2002–6. Survey Results 2006. NSW Department of Primary Industries.

### European foulbrood

European foulbrood (EFB) was first identified in Australia in 1977. It quickly spread from its point of entry in Victoria to all eastern states. It is not yet known to occur in WA.

EFB is caused by the bacterium *Melissococcus pluton* and reduces the productivity of colonies. EFB often but not always kills colonies. It can infect larvae at any age of development. An infected larva may survive and develop to adult stage, but the adult will be short-lived.

The symptoms associated with the disease are variable, owing to secondary bacteria. The symptoms may look similar to those of AFB, and thus experience is necessary to differentiate it.

EFB is considered to be more contagious than AFB and is often regarded as stress related. It may lay dormant for long periods, but rapidly multiplies if temperatures become cool and pollen quality declines.

Use of the antibiotic oxytetracycline hydrochloride is permitted to treat EFB.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- European foulbrood and its control – Primefact 1000

### Chalkbrood

Chalkbrood disease is caused by the fungus *Ascosphaera apis*. It was first identified in Queensland in 1993 and is now found in all states. While it is commonly recognised as being present in all hives in Australia, it does not multiply and kill larvae until temperatures become cool and there is a nectar shortage. Colonies vary widely in their susceptibility. Chalkbrood disease can cause serious economic losses but can also be managed by the use of hygienic lines of bees and good nutrition.

### Sacbrood

Sacbrood is the most common virus of bee brood and accounts for over half all virus-related infections. Many other types of viruses can infect the developing brood but are regarded as rare to uncommon.

### Viruses

Bee viruses are generally regarded as a nuisance and rarely cause large losses of bees. This is not the case elsewhere in the world, where larval deaths are often associated with bee viruses, but this is associated with the presence of *Varroa* mites.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Viruses of honey bees – Primefact 997

## Adult diseases

### Nosema

Nosema disease is caused by the microsporidia *Nosema apis* and *Nosema ceranae*, which infect the gut lining of adult bees. It is believed that *Nosema apis* has been in Australia for many decades, whereas *Nosema ceranae* was identified only in 2007. They look similar under the microscope and require DNA tests to distinguish them.

Generally, nosema affects a hive by significantly reducing the life span of adult bees. Beehive populations do not expand, and in serious cases they dwindle. Nosema is relatively common, and all hives are likely carry very low levels of spores.

Nosema becomes a problem when colonies are nutritionally and climatically stressed, more commonly in late winter to early spring, although *Nosema ceranae* can be problematic also during warmer weather.

Nosema is considered the most widespread bee disease in the world, but is difficult to diagnose in the field. Samples need to be microscopically examined. Nosema is considered major in its impact on the economics of managing bees and is responsible for lost honey production and major colony losses.

Good management practices to minimise the impact of this disease include:

- regular brood comb replacement
- annual requeening (younger queens)
- supplies of highly nutritious fresh pollen
- nectar flow or adequate stored honey.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Nosema disease – Primefact 699
- Nosema diagnosis – Primefact 901

### Viruses

Viruses go largely undiagnosed, and possibly cause only minor impacts on the health and wellbeing of colonies. Viruses are not considered to be a major problem in Australia, but their presence from time to time can cause local problems. Their impact may be multiplied in the presence of other pests and diseases such as nosema or *Varroa* mites.

'Chronic bee paralysis virus' can cause similar symptoms to the effects of exposure to agricultural chemicals. Bees become shiny and hairless, taking on a greasy appearance. They tremble, their wings become unlocked and their abdomen distends.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Viruses of honey bees – Primefact 997

## Hive pests

Many animals occasionally pose a problem to the management of beehives. Such hive pests include:

- livestock, which push over beehives
- mice, which inhabit weak and stored beehives
- cane toads, which eat large numbers of bees
- birds, several species of which will make a meal of honey bees
- ants, a few species of which can cause problems
- termites, which will damage untreated wood ware
- European wasps, which predate on adult and brood stages of bees
- dragonflies, which are known to take bees
- wax moth larvae, several species of which damage stored combs
- small hive beetles, both larvae and adults of which can cause major problems.

Most of these hive pests are a problem only in unusual circumstances. Pests of major consequence include wax moths, SHB, cane toads, ants and European wasps.

### Small hive beetle

Up until the late 1990s, SHB wasn't known outside of its home range in Africa. It has now appeared in several locations around the planet. It was officially recognised in Australia in 2002 and has now spread along the east coast.

SHB prefers and thrives in warm, moist conditions; thus, during the hot humid summers on the North Coast of NSW, its has become a major problem. SHB is a problem in all areas when the conditions suit its reproduction. Its activity and rate of development decline when conditions cool. Drought conditions also inhibit its development.

SHB larvae apply a slime coat to combs, making them unusable by the resident bees. At worst, the whole hive contents are slimed and the bees either leave or die.

Several management tools have been developed to control SHB, although many beekeepers continue to sustain losses. NSW DPI was involved in R&D to identify a suitable in-hive chemical control. This was eventually developed and marketed under the brand Apithor®.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Small hive beetle management options – Primefact 764
- Small hive beetle – video series
- Study of the small hive beetle in the USA (www.rirdc.gov.au)
- Small hive beetle *Aethina tumida* in New South Wales
- Apiaries 2002–2006 survey results 2006

### Wax moth

Several species of moths can be found in stored combs. The two most common are the greater wax moth, *Galleria mellonella*, and the lesser wax moth, *Achroia grisella*. Wax moths were listed in Australian publications over 100 years ago as being a primary pest of honey bees. It is presumed that the strains of bees being kept then were particularly susceptible. In all probability the moths arrived with the first honey bees in Australia.

These days, wax moths are not regarded as a serious pest of active bee colonies, only of stored combs. Warmer temperatures favour their activity, and thus they pose a bigger problem in summer and in locations where the microenvironment is warm.

The larvae burrow into the wax combs, leaving a web or thread behind. This destroys the comb and, in some cases, damages the wood ware. The moths are controlled either through the use of cool rooms or via fumigation. Most experienced beekeepers successfully manage wax moths.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Wax moth – Primefact 658

### European wasp

The European wasp is regarded locally as a significant pest of beehives. In New Zealand, it is responsible for many losses of bee colonies each year. Within NSW, it is localised to the Southern and Central Tablelands towards the coast.

European wasps build up from single fertile females at the end of winter into sizeable colonies in autumn. They are not normally a problem to honey bees until autumn, when food resources become scarce.

European wasps do not store food. They can be particularly aggressive to a honey bees and remove developing brood and stored nectar and pollen. Their activities may lead to the demise and death of the colony.

Given the public risk associated with stinging by European wasps, beekeepers have good reason to rid their area of this pest. Where this is not possible, the apiary may have to move.

### Cane toad

The cane toad is now without doubt a major environmental pest. Unfortunately, it also has a taste for honey bees. Adult toads sit outside a beehive and can eat many hundreds of adult bees. Placing beehives on stands at least 45 cm off the ground can reduce predation.

### Ants

Of the multitudes of species of ants in Australia, only a few cause bee colonies any grief, although no major study has investigated the significant species. The reaction by resident bees to the ants will quickly inform the beekeeper if there is a problem: bees become very defensive and actively attack ants coming into the hive.

For small apiaries, one strategy is to place the hives on stands with the legs in cans of oil. Alternatively, beekeepers can try to control the ants or move the apiary. It is important to recognise that any pesticide used to control ants is also likely to harm honey bees.

## Exotic pests and disease

Exotic pests and diseases are not known to occur within NSW but could enter.

There are no known major ‘diseases’ of consequence in this category at present, and all the known exotic pests are either insects or mites. They include:

- *Varroa* mites
- *Tropilaelaps* mites
- tracheal mites
- Asian bee
- Africanised honey bee
- Cape bee
- Asian hornet
- large hive beetle
- *Braula* fly.

Some of these species have a wide distribution occurring in many countries. For example, *Varroa* mites have a worldwide distribution. On the other hand, some pests have not escaped their original countries but are deemed to be potentially major risks. Examples include the Cape bee and the large hive beetle.

### *Varroa* mites

If any single pest or disease has defined modern beekeeping, it is *Varroa destructor*. The natural host of this parasite is the Asian honey bee, *Apis cerana*. Although it will not kill a colony of Asian honey bees, it will kill almost all colonies of European honey bees that it infests.

It is believed to have jumped hosts well over 50 years ago onto *Apis mellifera*. It has since spread to every major beekeeping country in the world except Australia. It is present even in New Zealand, being discovered in Auckland in 2000 and on the South Island in 2006.

Without intervention to control the mite, honey bee colonies will perish. From the time of initial invasion to complete colony death may take two to three years. Treatment and controls impose extra management costs and time commitments.

Diagnosis or identification is relatively easy: the mite measures 1.1 mm long by 1.5 mm wide and is reddish-brown. Unfortunately, most of the mites in a colony of bees are hard to find. Up to two-thirds could be in brood cells reproducing. Adult female mites attached to adult bees will more often than not be hiding in the bee’s segments. This cryptic behaviour makes it difficult to identify the presence and population of the mite in a hive.

As the mite will kill virtually all *Apis mellifera* colonies it infests, it also wipes out feral honey bee populations and any unmanaged colonies. Modern horticulture and many flowering agricultural crops rely heavily on pollination by honey bees. *Varroa* mites will remove this 'free' service and seriously reduce the yields of economically important crops. This has meant that *Varroa* mite invasions around the world have not just caused major harm to the beekeeping industry, but have also reduced the profitability of many economically important crops.

*Varroa* mites also appear to be major players in Colony Collapse Disorder, which is plaguing many countries, particularly the USA. Often the first symptom of a *Varroa* mite infestation is colony collapse. This effect is referred to as 'parasitic mite syndrome' and is often associated with brood-disease-like symptoms.

While there are now many strategies and means of controlling *Varroa* mites, many are problematic. Some of the earlier effective treatments have now become ineffective owing to a build-up of resistance. 'Organic' treatments are not as effective as synthetic chemical treatments, and some pose a hazard to beekeepers during application. While research into *Varroa* mite treatment continues, significant efforts are also being applied to breeding resistant strains of bees. This effort is proving to be extremely expensive, and despite several breeding programs around the world, no major breakthroughs have yet been reported.

While Australia has major measures in place to detect an incursion of *Varroa* mites, it is generally accepted that the mites will arrive here: it's not a matter of whether but when. As *Varroa destructor* can be found in *Apis mellifera* colonies in Java, Indonesia, the arrival of any *Apis mellifera* colonies into Australia has the potential of bringing it too.

The NSW DPI participates in the National Port Surveillance Program managed by Plant Health Australia. It also has a number of resources to help in surveillance by beekeepers.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- *Varroa* mites – Primefact 861
- A Study of New Zealand Beekeeping – Lessons for Australia (www.rirdc.gov.au)
- video on screen bottom boards.

### *Varroa jacobsoni*

A second species of *Varroa* mite, *Varroa jacobsoni*, occurs on the Asian honey bee to the north of Australia, in Indonesia and Papua New Guinea. This mite was thought not to reproduce on European honey bees, but recent studies in PNG indicate that it does. To what extent it does so is not yet known, but the mite is of concern as a potential biosecurity threat to Australia.

The arrival of Asian bees from our immediate north will likely bring *Varroa jacobsoni*.

### *Tropilaelaps* mites

These mites, also called Asian mites, have their natural host on the giant honey bee (*Apis dorsata*). Their distribution is restricted mainly to Asia, although they have been found in PNG.

These mites can multiply rapidly and are capable of killing a colony of honey bees within 6 months. Thus, they pose a much greater risk than *Varroa* mites.

*Tropilaelaps* mites are smaller than *Varroa* mites, measuring 1.0 mm long by 0.6 mm wide, and are light brown. They are highly mobile and scurry across the comb and between comb cells, in contrast to the crablike movement of *Varroa* mites.

The Achilles heel for these mites is that they can't live for more than 3 days without the need to re-enter a brood cell and breed. Thus, a broodless period of more than 3 days will ensure no surviving mites.

The potential for these mites to cause massive losses of honey bees in Australia is of major concern. The short adult life span may explain why these mites have not spread outside of Asia.

NSW DPI web resources for further information (www.dpi.nsw.gov.au):

- Tropilaelaps mites – Primefact 1105

### Tracheal mites

Tracheal mites are believed to occur naturally within honey bees. Occasional historical records reveal that they may have been responsible for occasional significant bee losses. Fortunately, breeding and selection for resistant bee lines have relegated this parasite to nuisance status in most countries in which it occurs.

The mites live and reproduce in the tracheae, or breathing tubes, of adult bees. Treatments can be applied to alleviate the burden of serious infections.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Tracheal mite – Primefact 1092

### Africanised honey bee

Among the 24 or so recognised subspecies of *Apis mellifera* in the world, most modern commercial bees are derived from the Italian, Caucasian or Carniolan subspecies. Crossing of any of these with the African subspecies (*Apis mellifera scutellata*) introduces the dominant defensive nature of *scutellata* into the offspring. As a consequence, 'Africanised' honey bees have a reputation for being particularly aggressive and for having a propensity to swarm a lot. They are not considered suitable for recreational or commercial purposes. The problem is currently confined to the warmer parts of the Americas, though not Canada.

### Cape bee

The Cape bee (*Apis mellifera capensis*) is found in the Cape region of South Africa.

Normally, the *Apis mellifera* queen is the only bee in the colony that can lay fertilised eggs. These fertilised eggs produce diploid female offspring. If a worker bee lays eggs, these are unfertilised and produce male offspring only. In the case of Cape bees, however, some of the worker bees are capable of producing diploid females without fertilisation. If Cape worker bees exhibiting this trait enter a beehive of another subspecies, they may mimic the resident queen with the production of pheromones and lay their own eggs. Thus, the number of Cape bees will increase in a colony over time.

However, Cape bees add more breeders to the colony, not more workers. Eventually the colony collapses and the Cape worker bees move onto another colony to repeat the process.

While this is a major problem for beekeepers in South Africa, it has not occurred anywhere else to date.

### Asian hornet

At least eight species of hornets are known to predate on and attack honey bee colonies. Most of these occur naturally in Asia. The Asian hornet, *Vespa velutina*, has established itself in Europe and become a major pest of honey bees.

Hornets can mount a full frontal attack on a colony of honey bees, killing all the bees and removing larvae, pupae, honey and pollen. Some species may prey on worker bees at the hive entrance, depleting the colony strength to the point at which it may die. Other hornets may ambush honey bees in the field.

All hornet species are social insects with an annual nesting cycle. Young mated queens leave the colony and begin new colonies, usually in early spring. Hibernating mated queens pose the biggest risk of being transported to other countries.

Hornets will sting humans if their colony is disturbed. They pose a major biosecurity threat, not just to honey bees, but also to native Australian insect populations.

### Large hive beetle

The large hive beetle (LHB), *Oplostomus fuligineus*, is considered a minor pest in its home range of South Africa. It is very similar in its behaviour and requirements to SHB, which is also considered a minor pest in its home range. Since SHB has spread to several countries, including Australia, it has become a major pest of honey bee colonies. LHB may do so too.

LHB is much larger than SHB, at 20–25 mm long, and larger than honey bees. For this reason, current control measures for SHB are unlikely to work for LHB.

### Braula fly

This wingless fly (*Braula coeca*) occurs naturally on honey bees in Europe. It is not considered highly significant as a pest species. Is present in Tasmania but not on mainland Australia.

The larval stage burrows under the cappings of honey comb and can adversely affect the appearance of comb honey. Many adult flies can also occasionally be observed piggy-backing on the queen bee. This may reduce the queen's food intake.

Its presence in Tasmania restricts the movement of queen bees from Tasmania to the mainland. It is possible to ship queens from Tasmania to NSW with the appropriate permits.

**NSW DPI web resources for further information** (www.dpi.nsw.gov.au):

- Braula fly – Primefact 649

## National Bee Pest Surveillance Program

This early warning system is designed to detect new incursions of exotic bee pests and pest bees into Australia. It involves a range of surveillance methods conducted at locations considered to be the most likely points of entry into Australia.

The program has two major objectives:

- **Trade support** – to facilitate the export of queen bees and packaged bees to countries sensitive to a range of bee pests and pest bees. It provides technical, evidence-based information to support Australia's pest-free status claims during export negotiations and assists exporters in meeting export certification requirements.
- **Early warning** – to detect new incursions of exotic bee pests and pest bees. This greatly increases the possibility of eradicating an incursion, and limits the scale and cost of an eradication program.

The program, run by Plant Health Australia, is jointly funded by the Australian Honey Bee Industry Council, Horticulture Australia Ltd, the Rural Research and Development Corporation and the Australian Department of Agriculture. In-kind contributions are provided through each state and territory department of primary industries and by volunteer beekeepers.

The National Sentinel Hive Program – a component of the National Bee Pest Surveillance Program – was established in 2000 for the early detection of honey bee parasites, most notably *Varroa* mites. Regular reviews by CSIRO and Biosecurity Australia aim at identifying the most at-risk factors and locations. Beehives are maintained at points of entry across Australia to test for the presence of pests. The program, run by Plant Health Australia, is managed in NSW by the NSW DPI and is dependent on several volunteer beekeepers.

For more information, see the Plant Health Australia website: www.planthealthaustralia.com.au.

## Floral resources

Floral resources supply the nectar and pollen on which hives depend. When nectar is collected in excess and stored as honey, beekeepers can remove it and extract it. A diversity of flora is critical for the successful management of commercial beehives.

Commercial beekeepers in NSW are essentially nomadic. They transport whole apiaries from one major flowering event to the next. Thus, diversity and choice of apiary sites have a direct impact on beekeepers' ability to turn a profit and maintain honey bee colonies in the best possible health.

Access to land to place apiaries depends on the land owners. Beekeepers negotiate permission to use various properties as apiary sites.

Many plant species of benefit to honey bees are located on government land managed by a number of government agencies. Depending on the agency, the conditions of use will vary. Access to such lands is vital to many beekeeping businesses.

Continued access to resources faces an extensive number of threats, namely:

- land clearing for agriculture
- forestry activities that remove flowering trees
- replacement of felled trees with pine and low-pollen- and nectar-yielding eucalypt plantations
- fires, including hazard reduction and natural bushfires
- reduced and unseasonal flooding of river red gum forests
- reduction of vehicle access to good-quality sites
- firewood harvesting
- salinity, which harms the health of the available flora
- droughts, which reduce flowering and interrupt growth cycles
- dieback of eucalypt species
- agricultural practices that reduce the abundance of flowering weed species
- biocontrol of flowering weed species that are of major benefit to honey bees, e.g. *Echium plantagineum* (Paterson's curse)
- pesticide use on flowering crops that are attractive to foraging honey bees
- newer varieties of agricultural crops that are not as beneficial to honey bees
- urban sprawl and rural subdivisions, which remove mature vegetation and reduce the number of apiary sites; this also has safety concerns
- loss of access to native forests due to changes in land tenure between government departments
- reduced access to native flora on private lands because of a perception by some landholders that honey bees are harmful to the ecosystem and a threat to personal safety.

The beekeeping industry has a clear objective of preserving native flora. It depends on the preservation of native flora and hence has much in common with those who support nature conservation and the establishment of conservation reserves.

### Secure tenure of apiary sites

Commercial beekeeping is a long-term investment; participants tend to be involved for decades, often generations. Knowledge of the flowering cycle of nectar-bearing flora is passed down from generation to generation or is hard won by experience. There is very little information published

on the honey and pollen potential of various plant species, and the information that is available is of a general nature.

Commercial beekeepers build up a working knowledge of specific apiary sites within their range over many years. This knowledge allows the beekeepers to make informed decisions on where and when to move apiaries for maximum benefit. It allows beekeepers to invest in capital and in beehives. A beekeeping business needs to invest in trucks, extracting plant, storage factories, workshops and hives. This amounts to a substantial financial investment.

Long-term investment in commercial beekeeping is strongly correlated with secure access to reliable flowering species. 'Long-term' in this context can relate to generational time periods.

There are no corporate-owned operations within NSW. This situation is probably due to the complex nature of the management knowledge required to conduct a long-term commercial beekeeping business, the extreme working conditions and the very unreliable seasonal conditions which dominate the Australian climate.

Most apiary sites occur on private property. Beekeepers usually pay for these sites in kind with honey. Given the nature of the free market, there is nothing legally stopping another beekeeper approaching land owners and offering them some honey to use a site already in use by another beekeeper. The honey payment system confers no legal right to the use of a site. Nevertheless, commercial beekeepers tend to respect any arrangement that a land owner already has with another beekeeper.

Site security also depends on a working knowledge of the biosecurity issues with a region, as a number of pests and diseases can cause major economic loss to any beekeeping business. Not all businesses are equal in their ability to manage and control certain diseases, notably AFB. Wherever this is prevalent, many beekeepers deliberately avoid such areas.

Knowing who your beekeeping neighbours are is of major importance to biosecurity. Any actions that detract from site security increase the difficulty of maintaining biosecurity. Thus, any policy or actions by a government department, land owner or corporation to remove long-term apiary site tenure will substantially reduce long-term investment security within the commercial beekeeping industry. Therefore, the NSW Apiarists' Association has requested that the NSW Government:[11]

- provide an 'all of government' approach to dealing with apiary sites on government land
- provide a policy on beekeeping from each government agency managing lands traditionally used by beekeepers for apiary sites
- provide a consistent set of site-use permit conditions across all government land tenures
- grant access to any government lands for apiary sites where this does not cause public risk or undue damage to the area
- recognise the 'National Best Management Practice Guidelines for Beekeeping in the Australian Environment'
- provide long-term permits of 5 years or greater.

[11] Somerville D (2015) Apiary Sites on Public Lands. A New South Wales Apiarist's Association Position Paper. www.nswaa.com.au

## Pollination and pesticides

Around 65% of agricultural production in Australia depends on pollination by honey bees.[12] At least 35 industries depend on it for most of their production.[12]

Crops vary in how much they rely on or respond to pollination by bees (Table 3). Some industries, such as almonds, apples, pears and cherries, depend almost totally on bees.

The economic value of pollination services has been estimated at $4–$6 billion. The types of crops involved range from horticultural crops such as almonds and apples to pasture plants and seed crops. The prevalence of feral honey bees masks the vital role of pollination.

**Table 3. Pollination responsiveness of selected crops (as percentage of yield).[12]**

| Commodity | Responsiveness (%) | Commodity | Responsiveness (%) |
|---|---|---|---|
| **Tree crops** | | **Bush & vine crops** | |
| Almond | 100 | Blueberry | 100 |
| Apple | 100 | Cucumber | 100 |
| Apricot | 70 | Kiwifruit | 80 |
| Avocado | 100 | Pumpkin | 100 |
| Cherry | 90 | Rockmelon | 100 |
| Citrus | 0–80 | Squash | 10 |
| Grapefruit | 80 | Watermelon | 70 |
| Lemon and lime | 20 | **Seed production** | |
| Macadamia | 90 | Beans | 10 |
| Mandarin | 30 | Broccoli | 100 |
| Mango | 90 | Brussels sprouts | 100 |
| Nectarine | 60 | Cabbage | 100 |
| Orange | 30 | Canola | 100 |
| Papaya | 20 | Carrot | 100 |
| Peach | 60 | Cauliflower | 100 |
| Pear | 50–100 | Celery | 100 |
| Plum and prune | 70 | Clover | 100 |
| **Ground crops** | | Lucerne | 100 |
| Peanut | 10 | Mustard | 100 |
| **Broadacre crops** | | Onion | 100 |
| Canola | 15 | | |
| Cotton | 10 | | |
| Soybean | 10–60 | | |
| Sunflower | 30–100 | | |

[12] Keogh R, Mullins I, Robinson A. (2010) Pollination Aware: The Real Value of Pollination in Australia. Rural Industries Research and Development Corporation, August. Publication No. 10–081.

Several issues affect pollination services. Beekeepers have an economic choice to pursue paid pollination services or to maximise the honey harvest. While combinations of these activities are also a business choice, the more astute commercial beekeepers focus on the most profitable activity for the time and capital invested.

For example, almond trees are 100% reliant on the services of honey bees for pollination. Almond growers and beekeepers continue to debate the price. Essentially this becomes a supply and demand equation. If beekeepers find honey production more profitable, fewer beehives will be made available for pollination. Likewise, if the demand for beehives for almond pollination exceeds supply, this will place upward pressure on pollination fees.

If wholesale honey prices are depressed or there is a shortage of honey crops available to harvest, then the provision of paid pollination services is an attractive business decision.

On the other hand, if the risks associated with providing pollination services to commercial crops – paid or not – are high from the potential exposure to pesticides, then this may be a major deterrent to providing such services. Pollination services by their very nature occur mainly in spring. Thus, a pesticide incident which may reduce or kill the population within a beehive will subsequently affect the ability of the beekeeper to harvest honey crops in the following summer and autumn.

The use of pesticides in agriculture and horticulture is generally considered to be a major threat to honey bees. While in some cases this is justified, in general, commercial beehives do not have the same degree of exposure as in many other countries. Even so, major bee kills are reported from time to time and are a cause of great concern to all beekeepers.

Providing paid pollination services must be financially attractive enough to match any loss of potential honey crop at the time when the plant crop to be pollinated is in flower. This decision must also take on board the possible harm of poor nutrition in-flows into the hives owing to the need to heavily stock a target crop with beehives to ensure maximum flower visitation.

Each crop or flowering event will have a different impact on the health and population of a honey bee colony. In many cases this will be negative owing to the need to ensure that there are plenty of field bees to pollinate the crop.

A beekeeper's skill is tuned towards maximising adult bee populations at the beginning of a pollination event or a honey flow. Those seeking paid pollination services should not underestimate this set of skills.

The presence of feral honey bees in Australian makes free or incidental pollination the norm. Wherever the *Varroa* mite has established, the entire feral honey bee population is eradicated. This has the immediate effect of escalating the need for managed beehives for honey production and pollination services. The costs of managing beehives in the presence of this parasite are substantially increased. The arrival of *Varroa* mites will inevitably lead to a rapid increase in the demand for managed honey bee colonies for commercial pollination purposes.

Even if a new pest or parasite becomes established within Australia, commercial beekeepers will base their business decisions on the best economic return for their effort and investment, be it honey production or paid pollination services. Thus, politically, there is a very strong case to ensure that Australia remain as free of major pests of honey bees as possible, particularly those that will devastate feral and unmanaged honey bee colonies.

## Profitability

The profitability of beekeeping depends simply on a fair and reasonable financial return for the beekeepers' time, expertise and capital investment. Historically, this has depended mainly on the wholesale price of honey and the seasonal honey crops.

While costs of production continue to rise, the price of honey does not always parallel this trend. Historically, when there was a shortage of honey nationally, the wholesale price of honey would increase. This has become less evident over the last one and a half decades, possibly owing to the ease with which bulk honey can be imported into Australia.

Beekeepers have a choice to pursue paid pollination services as part of their business mix. With increasing areas being planted to almond trees, this continues to provide opportunities.

Commercial beekeepers will provide a paid pollination service for a price that covers their costs and provides a reasonable return on effort and investment. If honey production is more profitable than paid pollination services, this will be a logical direction for the business to pursue.

Profitability varies from one industry structure to another, depending on the enterprise mix, costs of production and overall returns. While there has been a steady decrease in the number of commercial beekeepers in NSW over the past few decades, remaining beekeeping businesses have tended to expand. This is similar to the situation in other rural industries.

Ultimately the bottom line is supply and demand, plus the ability of the cropping industries to pay the fee that allows for the provision of a viable pollination service.

## Industry training

A Senate inquiry[13] into the Australian beekeeping industry found that the Australian honey bee industry faced a looming crisis due to:

- the ageing profile of commercial beekeepers, with very few new entrants
- the significant biosecurity threat for the honey bee industry and the industries it supports through pollination services
- the lack of industry specialists in research, extension and industry development
- no provision of the nationally recognised Certificate III in Beekeeping in most states
- no recognised training program that goes beyond Certificate III
- limited access and availability of industry short courses
- a reliance on overseas workers under the 457 visa scheme with no credible plan to reduce reliance on this scheme
- the poor coordination nationally of extension and industry development resources
- no succession planning.

The recognition of beekeeping as a skill through certificate-level assessment is necessary for the Australian honey bee industry. This need is generated by:

- an escalation in interest from the general public in keeping honey bees and an associated proliferation in basic beekeeping courses with no associated qualification
- the lack of a formal training pathway for participants to receive a nationally recognised certificate in beekeeping
- constant demand for a nationally recognised industry qualification in beekeeping
- an increase in the number of organisations and participants in recreational beekeeping; commercial beekeepers have historically had problems with attracting and retaining staff, and experience an annual turnover of 10%

[13] *More Than Honey: the future of the Australian honey bee and pollination industries*. Australian Government, House of Representatives, Standing Committee on Primary Industries and Resources, 2008.

- the need by larger commercial enterprises for proficient, trained staff in preference to overseas labour.

## Vocational training

Vocational training is distinct from the short introductory courses offered in proliferation around the country. In theory, anyone who knows a little about beekeeping can offer a course in it. As recreational beekeeping has become more popular, so too has the supply of 'basic' beekeeping courses. In contrast, vocational training provides good-quality, professional instruction to enable trainees to work in commercial beekeeping.

With a static or decreasing number of commercial beekeeping businesses in NSW, the demand for vocational training is likely to be small. On the other hand, more commercial beekeepers are increasing the size of their operations and managing ever increasing numbers of beehives. Finding it difficult to obtain a reliable workforce within Australia, commercial beekeepers have tended to source labour from overseas, particularly under the 457 visa scheme. But this is proving to be a problem, and beekeepers face pressure to find suitable staff within Australia.

In addition, although not all recreational beekeepers desire higher levels of training, some take their pastime very seriously and seek out good-quality training to improve their skills.

## NSW DPI's proposed training plan

Until recently, no institution in NSW has offered a full training program leading to a recognised qualification. Now, Tocal Agricultural College offers an online course on pests and diseases of honey bees mapped to national competencies.

Tocal has employed Elizabeth Frost as an education officer to develop a vocational training course in beekeeping in collaboration with the honey bee development team of Dr Doug Somerville and Nick Annand. They have developed an online national 'Master Beekeepers' program that maintains a strong focus on skills development through specialised intensive industry workshops in key regions of Australia. The primary objective is to provide accredited vocational training through a Registered Training Organisation (Tocal Agricultural College). The program covers:

- pests and diseases
- quality assurance
- queen bee breeding
- pollination
- nutrition
- flora
- honey products and marketing.

### Outline of proposed plan

1. Develop Rearing Queen Bees unit:
    - Produce an AgGuide – *Rearing Queen Bees*
    - Produce an e-book and multi-touch book
    - Produce an e-learning course.
2. Produce a basic skills unit.
3. Develop **a skills recognition package for all units** to allow participants to achieve AHC32010 Certificate III in Beekeeping.
4. Develop learning materials to deliver training and assessment in **Food Safety**.
5. Develop learning materials to deliver training and assessment in **Crop Pollination Services**.

6. Develop learning materials to deliver training and assessment in the residual core units to allow participants to achieve a **Certificate III in Beekeeping**.
7. Develop learning materials to deliver training and assessment in the **elective course areas**.
8. Review packages of learning materials and provide a **Master Beekeeper qualification,** i.e. Certificate III plus extra units deemed of value to a yet to be determined level.

### Pests and diseases

This online course is aligned to national units of competency and is assessable. Participants have 6 months to complete it and have full access to notes and tutors. The cost is $425.

The modules cover the honey bee, colony size, diseases of brood, diseases of adult bees, hive pests, surveillance of and response to exotic pests, and the law.

The course aims for each participant to be able to identify and manage the major domestic pests and diseases of honey bees so as to minimise their impact, while promoting awareness and surveillance of exotic pests and diseases threatening the Australian beekeeping industry.

### Publications

**The *Bee AgSkills* book**, which has step-by-step photographs and clear diagrams, is a resource for all beekeepers. It includes how to use a bee smoker and work safely with bees, how to maintain hives, how to catch a swarm, how to remove and extract honey, how to replace a queen bee, and common health and pest problems. It is available in hardcopy for $25, and as an e-book and a multi-touch book, which features swipe-through photo galleries, videos and animations, for $12.99 (available only for the iPad at this stage).

**The *Healthy Bees* AgGuide** is a specialist publication intended to help identify and treat common pests and diseases of honey bees. It covers seasonal factors that affect the health of the colony, nutrition, non-infectious disorders, diseases, exotic pests and strategies to prevent them, and is the basic text for the e-learning pest and disease course offered through Tocal. It is also available in hardcopy, e-book and multi-touch editions.

### Rearing Queen Bees course

This annual course has been conducted and updated over many years. As it has become increasingly difficult to attract the necessary numbers, the course notes have now been revised with the intention of producing a new AgGuide on rearing queen bees. Hardcopy, e-book and multi-touch editions and e-learning course will be available for purchase in the next 12 months.

## Beekeeping organisations

There are several regional or specific-interest beekeeping organisations in Australia.

### Australian Honey Bee Industry Council (AHBIC)

AHBIC (honeybee.org.au) is the peak national beekeeping organisation.

### Mission statement

‘To maximise the efficient use of industry resources and funds to ensure the long-term economic viability, security and prosperity of the Australian honey bee industry.’

### Roles and responsibilities

- To foster, promote, enhance and protect the interests of the Australian honey bee industry and the viability of its members.
- To represent industry policy at all levels of government, private enterprise and the public.
- To promote, support, seek amendments to, or oppose any legislation or measure that may affect the industry.

- To assist and/or cooperate with any organisation, body, association, person or persons in the best interests of AHBIC.
- To enhance the industry by encouraging the adoption of best practice in production, quality assurance, presentation and promotion of its products.
- To conduct educational, promotional and public relations campaigns in the best interest of the industry and AHBIC where appropriate.
- To gather and distribute to members industry intelligence from local and international sources, and to function as a channel for information exchange within Australia and between Australia and other countries, leading to better understanding.
- To enhance the development of all industry sectors through education and extension to interdependent industries within the public and agricultural communities.
- To act in any way not defined in these objects considered advisable in the best interests of the industry.
- To be accountable to the members of AHBIC.

AHBIC is made up of 6 state associations and 3 national associations, each representing various sections of the beekeeping industry in Australia:

- NSW Apiarists' Association
- Queensland Beekeepers' Association
- Victorian Apiarists' Association
- South Australian Apiarists' Association
- Western Beekeepers Section – Western Australian Farmers Association
- Tasmanian Beekeepers' Association
- Australian Queen Bee Breeders Association
- National Council of Pollination Associations
- Honey Packers and Marketers Association Inc.

## NSW Apiarists' Association (NSWAA)

NSWAA (www.nswaa.com.au) is the NSW peak beekeeping industry body and is focused primarily on commercial beekeeping. It is committed to ensuring the future of the beekeeping industry. The executive council represents its members in liaison with government, media and the general community.

### Stated objectives

- To provide a means whereby the apiarists of this state may be represented through a common organisation for the welfare of the Industry.
- To provide relevant information on the production of apiary products and services in NSW and to ensure an adequate return to the apiarist for his labour and capital in the industry.
- To increase the demand for apiary products and services by advertisement or any other means deemed advisable.
- To encourage direct marketing as between centres of production and other centres.
- To disseminate among members useful information relating to the industry.
- To secure business concessions and services for members.
- To cooperate with the relevant government agencies in instructional and experimental work connected with the industry.
- To assist members in their apicultural rights and to secure effective legislation and administration in affairs affecting the industry.

- To protect natural apicultural resources and to prevent the unnecessary destruction of flora of value to apiculture.
- To encourage research connected with the industry.

### Membership benefits

- Provides a means for the commercial apiarists of NSW to be represented through a common organisation.
- Lobbies to maintain access to essential floral resources.
- Helps to secure the industry's future.
- Provides strong representation to government.
- Organises an annual state conference and trade show for NSW commercial beekeepers.
- Provides opportunities to meet other beekeepers and NSW DPI representatives at meetings, workshops and conferences.
- Supports beekeepers in all regions through its branches.

Members also receive:

- a copy of the *Code and Practice of Keeping Bees on Forested Lands*
- an annual subscription to *Australia's Honeybee News*, the bi-monthly journal
- free classified advertising in *Australia's Honeybee News*
- insurance through Arthur J. Gallagher (formerly OAMPS Insurance Brokers Ltd)
- insurance through WFI
- special rates on intermediate bulk containers from Schütz DSL Australia.

### Branches

NSWAA has branches in:

- the Central Tablelands
- the Hunter Valley
- the North Coast
- the Northern Tablelands
- the Riverina
- the Southern Tablelands
- Sydney
- Tamworth
- the Western Plains.

### Amateur Beekeeper's Association of NSW (Inc.) (ABA)

The ABA (http://www.beekeepers.asn.au/) was formed over 50 years ago to foster clubs and other activities to improve the knowledge and skills of amateur beekeepers in NSW. The NSW ABA currently has 15 clubs or branches

Bathurst

- Bega Valley
- Central Coast
- Goulburn District
- Hunter Valley
- Illawarra
- Macarthur
- Manning Valley
- Mid North Coast
- Nepean
- Northern Rivers
- Parramatta
- Shoalhaven
- Southern Highlands
- Sydney Central

The ABA provides:

- a newsletter six times a year
- field days to improve practical beekeeping skills
- optional personal beekeeping insurance
- a swarm system to coordinate members' efforts in collecting bee swarms.

## Other recreational beekeeping organisations

### North Shore Beekeepers' Association

The aim of this association (northshorebeekeepersassociation.org.au) is to provide fun and educational activities for people interested in beekeeping and related subjects. Night meetings are held every 2 months, and bee garden field days are held every month. The club has members in most areas of northern Sydney. As at January 2015 it had 230 members and celebrated its 60th anniversary.

### Wagga Wagga Amateur Beekeeping Club

This club was formed in March 2013 to enable the sharing of knowledge and equipment among amateur beekeepers and has grown to around 25 members.

## Glossary of terms

| | |
|---|---|
| AFB | American foulbrood disease – a bacterial disease of brood caused by *Paenibacillus larvae* subsp*. larvae* |
| AHBIC | Australian Honey Bee Industry Council – national peak industry body |
| Apiary | One or more colonies; a place where bees are kept |
| Beeswax | A substance from which bees build their comb. It is secreted in the form of tiny scales from wax glands in the abdomen of the worker bee |
| Colony | The occupants of the hive, including the queen, drones, workers, brood stages and comb. When housed in a box it is called a hive |
| Drone | The male bee: large, with a square-ended abdomen, very large eyes and no sting |
| EFB | European foulbrood disease – a bacterial disease of brood caused by *Melissococcus plutonius* |
| Hive | A structure in which a colony of bees has been established. The term is often held to imply a colony of bees |
| Honey bee | European honey bee, *Apis mellifera* |
| Nectar | A sweet liquid secreted by plants, usually from the flower, but sometimes from extra-floral nectaries. It is a solution of sugars, principally sucrose, and other colouring and flavouring compounds |
| NSWAA | NSW Apiarists' Association – lead apiary industry body in NSW |
| Pollen | A nutritious feed which provides the protein component of the bees' diet. It is consumed by bees before they secrete royal jelly. It is collected from anthers of flowers and is carried on the hind legs of worker bees, then stored in cells in the hive. Pollen grains vary in colour and protein content |
| Propolis | A red or brown sticky substance collected by honey bees from plants and used to fill crevices and to fix and varnish honeycombs |
| Queen | The only reproductive female in the colony, and the mother of all the workers and drones. There is usually one queen in the colony |
| SHB | Small hive beetle – a pest of beehives |
| Virgin queen | A queen that has not mated and cannot lay fertilised eggs |
| Worker | A non-reproductive female bee. Workers collect nectar, pollen, water and propolis; rear brood; and carry out many other duties |