



Australian Government
Department of Agriculture
and Water Resources
ABARES

Australian honey bee industry: 2014–15 survey results

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Research by the Australian Bureau of Agricultural
and Resource Economics and Sciences

ABARES research report 16.18
December 2016



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Cataloguing data

van Dijk, J, Gomboso, J & Levantis, C 2016, *Australian honey bee industry: 2014–15 survey results*, ABARES research report 16.18, Canberra, December. CC BY 3.0.

ISSN 1447–8358

ISBN 978-1-74323-324-5

ABARES project 43581

Internet

Australian honey bee industry: 2014–15 survey results is available at agriculture.gov.au/abares/publications.

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Acknowledgements

This report uses data collected in the ABARES Australian Honey Bee Industry Survey 2014–15. This survey would not be possible without the cooperation and assistance of honey bee producers and their accountants, who provided information on business operations. ABARES also appreciates the support of Dave Alden (Rural Industries Research and Development Corporation), Sam Malfroy (Plant Health Australia), Trevor Weatherhead (Australian Honey Bee Industry Council) and Mike McDonald (Department of Agriculture and Water Resources) for information on the beekeeping industry. The survey was funded by the Department of Agriculture and Water Resources.

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Summary

In this report, data from the ABARES Australian Honey Bee Industry Survey are presented for 2014–15. Key performance measures for beekeeping businesses are presented, including analysis of pollination services, use of public lands, challenges facing the beekeeping industry and the extent to which research and information is sought and implemented.

Industry overview

The honey bee industry is an important sector of the Australian economy, with an estimated gross value of production of \$101 million in 2014–15. The primary commercial output of Australian beekeepers is honey, although bees wax, queen and packaged bees, and propolis add to the industry's income. Pollination services to agricultural and wild flora are also of significant value to the economy.

In 2015–16 there were over 13 000 registered beekeepers across Australia operating over 448 000 hives. New South Wales had the largest number of beekeepers, accounting for around 32 per cent of the national total, and the largest number of commercial beekeepers (operating 50 or more hives).

Over the 10 years to 2015–16, the number of registered beekeepers rose by more than 3 000, although many of these were non-commercial operators. Over the same period, both the number of hives and the number of commercial beekeepers fell by around 25 per cent.

On average, in 2014–15 Australian beekeepers obtained around 39 per cent of their honey production from private land other than agriculture. Honey was also obtained from agricultural land (both with and without paid pollination services), state forests, national parks and other public land.

On average, Australian beekeepers sold 53 per cent of their honey to major processors in 2014–15. The remainder was sold to other processors, direct to retail, local markets and door sales. Average sales of honey directly to export was minimal (less than 1 per cent).

Financial performance

Australian beekeepers received on average \$198 500 in total cash receipts from their business activities in 2014–15, with \$184 400 (93 per cent) derived from beekeeping-specific production activities.

Honey sales formed the largest component of total cash beekeeping receipts (85 per cent). Cash receipts from paid pollination services formed the next largest component (11 per cent). All other honey bee production activities (queen bees, wax, hives, packaged bees and pollen production) represented less than 5 per cent of total cash beekeeping receipts, on average at the national level.

There was a strong, positive relationship between business size and financial performance. Small operators (50 to 249 hives) had a negative average rate of return and business profit. Small-medium beekeeping businesses (operating 250 to 499 hives) had a small, positive business profit and average rate of return to capital. Large beekeeping businesses (operating over 1 000 hives) had the highest average rate of return to capital and business profit.

Pollination services

Across Australia, an estimated 44 per cent of beekeepers conducted paid pollination services in 2014–15. The proportion was highest in South Australia and Tasmania—states that produce high levels of almonds, cherries, apples, pears and other crops dependent on bee pollination.

Australian beekeepers who provided paid pollination services received an average of \$44 200 from pollination in 2014–15. Paid pollinators in New South Wales and Victoria received significantly more on average than paid pollinators in the other states.

An estimated 43 per cent of beekeepers across Australia who provided paid pollination services in 2014–15 planned to expand this aspect of their business over the next five years; 32 per cent stated that they would remain the same. Among those beekeepers who did not provide paid pollination in 2014–15, around 8 per cent indicated they were likely to commence paid services over the next five years.

Public land access and use

Nationally, an estimated 39 per cent of honey production was derived from public land in 2014–15. Tasmania derived the greatest proportion of honey production from public land (82 per cent) and South Australia derived the lowest (7 per cent). Generally, those beekeeping businesses that operated a greater number of hives used public land for honey production to a greater extent than operators with fewer hives.

Nationally, around 32 per cent of beekeeping businesses decreased their usage of public land over the five years to 2014–15, 21 per cent increased usage and 47 per cent remained the same. The main reasons reported for decreasing use of public land for honey production included restricted site access as a result of government policy/regulatory challenges and extreme weather events (such as bushfires).

Industry challenges

The beekeeping industry faces a number of challenges through issues affecting the floral resource base which in turn impact the volume and quality of production. Drought was the most commonly reported challenge—with 70 per cent of beekeepers indicating that drought had affected their floral resource base over the five years to 2014–15. Around 50 per cent of beekeepers indicated that use of agricultural chemicals such as pesticides, fungicides and herbicides also impacted floral resources.

Another challenge for the beekeeping industry is the presence of pests and diseases. Over the five years to 2014–15, small hive beetle and the fungal disease chalkbrood were the two most common pests and diseases identified by beekeepers. Over 50 per cent of beekeepers also indicated that wax moth and American foulbrood had some impact on their honey and related production over the five years to 2014–15.

Research uptake and impact

Nationally, an estimated 74 per cent of beekeeping businesses changed their management practices in 2014–15 as a result of research. Large beekeeping businesses changed their management practices to a greater extent than smaller operators. The majority of beekeepers felt that production had increased by between 5 per cent and 25 per cent over the five years to 2014–15 as a result of research. Western Australia reported the greatest increase in production,

with 20 per cent of beekeeping businesses reporting an increase of over 50 per cent as a result of changing their management practices.

1 Introduction

The honey bee industry makes an important contribution to the Australian and regional economies. In 2014–15 the estimated gross value of production was \$101 million. The primary commercial output of Australian beekeepers is honey, although bees wax, queen and packaged bees, propolis and the provision of pollination services are also of significant value to the economy.

In 2016 ABARES conducted a survey of beekeeping businesses across Australia (excluding the Northern Territory and the Australian Capital Territory). The ABARES Australian Honey Bee Industry Survey collected information for 2014–15 on the financial performance of beekeeping businesses, as well as data on pollination services, biosecurity, research uptake and public land use.

The survey was funded by the Department of Agriculture and Water Resources, as part of the Australian Government's response to a recommendation from the Rural and Regional Affairs and Transport References Committee report on the future of the beekeeping and pollination service industries in Australia (RRATRC 2014).

As well as providing a 'point in time' reference, the survey results also provide an opportunity to monitor changes in industry performance because this is the third Australian honey bee survey conducted by ABARES. The two previous surveys were for 2000–01 (Rodriguez et al. 2003) and 2006–07 (Crooks 2008). Where relevant, results from the previous surveys have been included in this report.

The ABARES Australian Honey Bee Industry Survey 2014–15 comprised registered beekeeping businesses from New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania that operated 50 or more hives in 2014–15. An estimated 1 280 beekeepers were in this category across Australia. Financial and physical information collected included hive numbers, honey bee production types, business receipts and costs, labour use, debts and assets, market value of business capital, seasonal conditions, public land access for hives, industry challenges and research uptake.

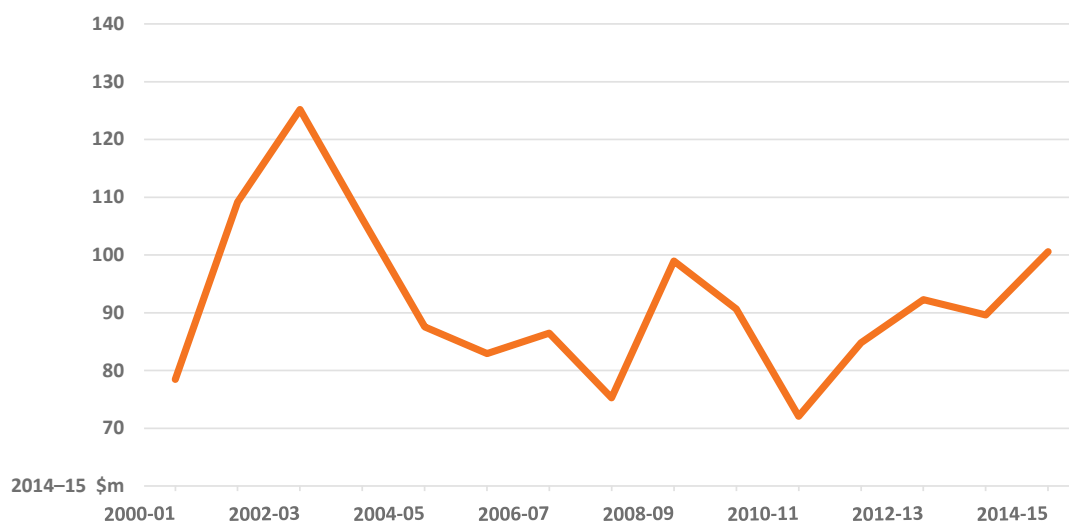
Results are reported at national, state and size levels. Industry size was categorised into four groups according to the number of hives operated: small (50 to 249 hives), small-medium (250 to 499 hives), medium (500 to 999 hives), and large (1 000 or more hives) beekeeping businesses.

Survey methodology and definition of terms are reported in Appendix A.

2 Australian beekeeping industry

In 2014–15 the gross value of production (GVP) of the honey bee industry in Australia was estimated to have been \$101 million (Figure 1). This estimate of GVP was 20 per cent higher than the 10-year average of \$92 million, largely because higher prices more than offset reduced production.

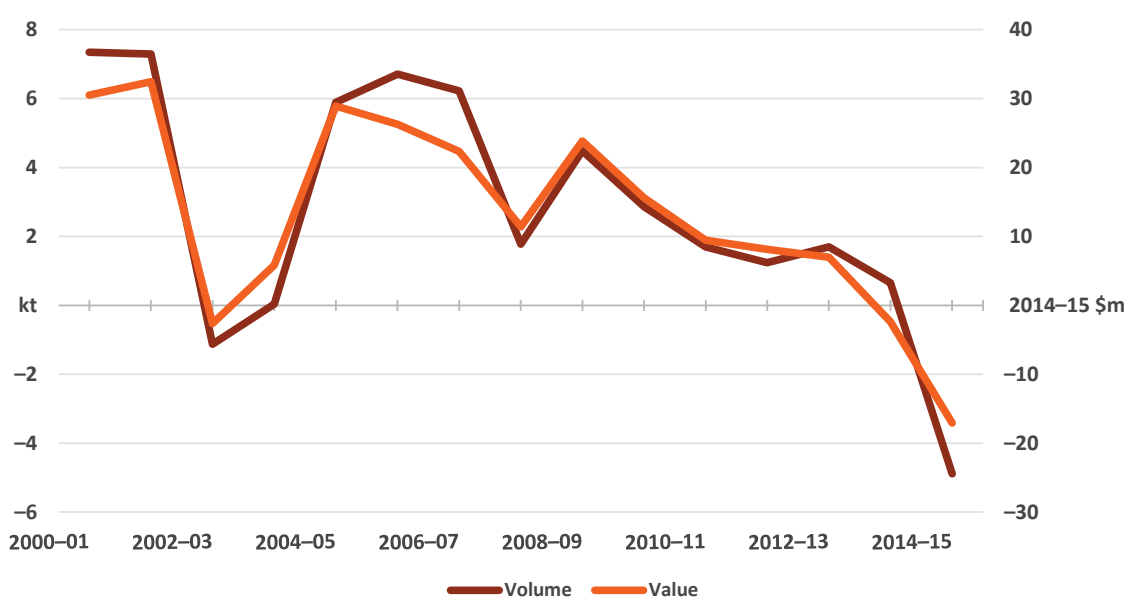
Figure 1 Gross value of production, honey bee industry, Australia, 2000–01 to 2014–15



Source: ABARES

Australia has historically been a net exporter of honey (Figure 2). In 2014–15, however, the trend reversed and honey imports were more than double the volume of exports, with imports increasing by 143 per cent compared with the previous year, to 9.1 kilotonnes. This was mostly due to a significant rise in honey imported from China. The volume of Australian honey exported has been relatively steady at around 4.6 kilotonnes since a 36 per cent fall in 2010–11. In 2014–15 exports made up around 14 per cent of total honey production.

Figure 2 Net exports, honey, Australia, 2000–01 to 2014–15



Source: ABS 2016, International Trade, Australia, cat. no. 5465.0, Canberra

In 2015–16 there were over 13 000 registered beekeepers across Australia operating around 448 000 hives (Table 1). Registration of beekeepers and hives is compulsory in all states and territories except Tasmania, for which registration is required only for access to leatherwood forests.

New South Wales had the largest number of beekeepers, accounting for around 32 per cent of the national total and 43 per cent of total hives. New South Wales also had the largest number of beekeepers operating 50 or more hives. Victoria accounted for around 23 per cent of the total number of beekeepers, but most were at the smaller end of the production scale, with the state accounting for only 15 per cent of total hives. New South Wales, Victoria and Queensland together accounted for 76 per cent of total registered Australian beekeepers and 74 per cent of total hives in 2015–16.

Over the 10 years to 2015–16 the number of registered beekeepers increased by over 3 000, many of which were non-commercial operators (with fewer than 50 bee hives). Over the same period, the total number of hives fell by 22 per cent. The number of commercial beekeepers (those with 50 or more hives) fell by 25 per cent to 1 280. From 2006–07 to 2015–16 the number of commercial beekeepers declined in all states except Western Australia and Tasmania.

Table 1 Number of registered beekeepers and hives, by state, 2006–07 and 2015–16

State	Year	Number of beekeepers	% of beekeepers	Number of hives	% of hives	Beekeepers with more than 50 hives
New South Wales	2006–07	3 060	31	236 200	41	660
	2015–16	4 250	32	192 900	43	490
Victoria	2006–07	2 140	22	99 300	17	340
	2015–16	3 030	23	68 200	15	220
Queensland	2006–07	3 110	31	127 100	22	370
	2015–16	2 820	21	73 700	16	230
South Australia	2006–07	720	7	67 300	12	190
	2015–16	1 180	9	61 000	14	170
Western Australia	2006–07	710	7	26 900	5	100
	2015–16	1 730	13	33 400	7	120
Tasmania	2006–07	160	2	13 900	2	30
	2015–16	180	1	16 400	4	40
Australia	2006–07	9 920	100	572 000	100	1 700
	2015–16	13 390	100	448 300	100	1 280

Sources: Department of Primary Industries (New South Wales); Department of Economic Development, Jobs, Transport and Resources (Victoria); Department of Agriculture and Fisheries (Queensland); Department of Primary Industries and Regions (South Australia); Department of Agriculture and Food (Western Australia); Department of Primary Industries, Parks, Water and Environment (Tasmania)

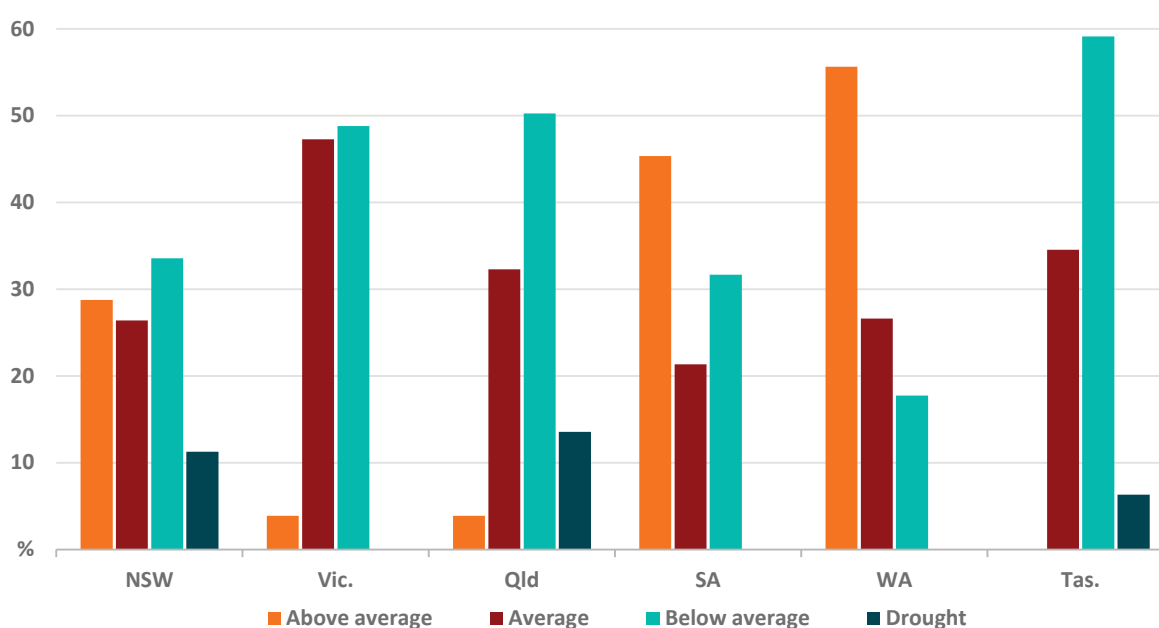
3 Physical characteristics

Seasonal conditions

In 2014–15 an estimated 39 per cent of Australian beekeepers reported below average seasonal conditions, 31 per cent reported average conditions and 23 per cent reported above average seasonal conditions. Average or above average seasonal conditions were reported by the majority of beekeepers in New South Wales, South Australia and Western Australia (Figure 3). A number of beekeepers reported below average seasonal conditions in all states, with some reporting drought in New South Wales (11 per cent), Queensland (14 per cent) and Tasmania (6 per cent).

Figure 3 Reported seasonal conditions, by state, 2014–15

percentage of beekeepers



Source: ABARES Australian Honey Bee Industry Survey 2014–15

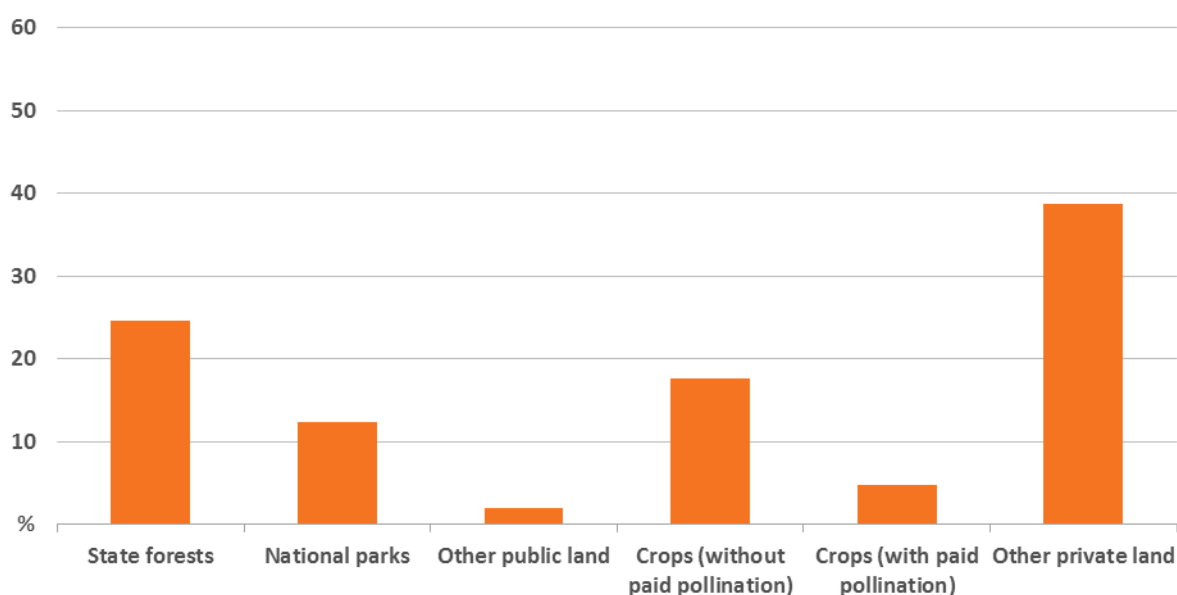
Honey origin

Throughout Australia, beekeepers obtained their honey from a range of land types—state forests, national parks, other public land (such as conservation reserves and stock routes), agricultural crops (with and without pollination services) and other private land.

As part of the survey, beekeepers were asked to indicate the proportion of their honey that came from each land type in 2014–15. On average, 39 per cent of honey production per beekeeping business was derived from private land other than agriculture in 2014–15 (Figure 4). The next largest category was honey obtained from state forests (25 per cent), followed by crops without providing paid pollination services (18 per cent), national parks (12 per cent), paid pollination services for crops (5 per cent) and other public land (2 per cent).

Figure 4 Proportion of honey produced, by land type in Australia, 2014–15

average per beekeeping business



Source: ABARES Australian Honey Bee Industry Survey 2014–15

Honey origin differed slightly by state (Table 2). Tasmanian beekeepers obtained 81 per cent of their honey from national parks and state forests, reflecting the large proportion of leatherwood honey produced in that state. By contrast, beekeepers in South Australia produced very little honey from any public land (including state forests and national parks).

Table 2 Proportion of honey produced, by land type, by state, 2014–15

average percentage per beekeeping business

Land type	NSW	Vic.	Qld	SA	WA	Tas.	Australia
State forests	26	40	22	0	37	51	25
National parks	14	11	5	7	26	30	12
Other public land	1	8	1	0	0	0	2
Total public land	41	58	28	7	63	82	39
Crops (without paid pollination)	22	16	22	16	0	7	18
Crops (with paid pollination)	1	3	6	16	1	1	5
Other private land	36	23	44	61	36	10	39
Total private land	59	42	72	93	37	18	61

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Large beekeeping businesses (operating 1 000 or more hives) produced significantly more honey from state forests (31 per cent) and national parks (22 per cent), and less from other private land (26 per cent), compared with all other size businesses.

Honey production

On average, Australian beekeepers operated 393 hives in 2014–15. New South Wales had the highest average number of hives per beekeeping business (524 hives) while Queensland had the lowest average number of hives per business (226 hives) (Table 3). Australian beekeepers produced an average of 23.4 tonnes of honey in 2014–15, however, the scale of production

around this estimate varied widely, with approximately one-half of beekeepers producing less than 8 tonnes. The mix of products also varied across the industry—25 per cent of beekeepers produced bees wax for sale, however less than 1 per cent produced and sold pollen.

Table 3 Hive numbers and honey production, by state, 2014–15

average per beekeeping business

State	Number of hives		Honey produced		Average honey production	
	Average (no.)		Average (tonnes)		kg per hive	
New South Wales	524	(12)	26.0	(19)	49.7	(13)
Victoria	380	(17)	22.5	(22)	59.4	(16)
Queensland	226	(16)	12.5	(25)	55.3	(13)
South Australia	354	(9)	32.5	(12)	91.8	(8)
Western Australia	241	(12)	22.1	(15)	91.6	(10)
Tasmania	386	(17)	22.5	(8)	58.2	(22)
Australia	393	(7)	23.4	(10)	59.5	(7)

Note: Figures in parentheses are relative standard errors (RSEs). A guide on how to use RSEs is in the survey methods and definitions section (Appendix A).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

In 2014–15 average honey production was greater in South Australia than in other states. South Australian beekeepers produced nearly 33 tonnes of honey on average and also produced the most honey per hive (91.8 kilograms on average). Although New South Wales beekeepers operated more hives on average, they produced a slightly lower average of 26 tonnes of honey per beekeeping business due to a lower average volume of honey produced per hive (49.7 kilograms). Victorian, Western Australian and Tasmanian beekeepers produced over 22 tonnes of honey on average, while beekeepers from Queensland produced 12.5 tonnes.

Australian beekeepers increased their stocks of honey over the 12 months ending 30 June 2015 (Table 4). Nationally, beekeepers purchased 5.5 tonnes of honey on average in 2014–15 and sold 26.1 tonnes.

Table 4 Honey production, by size of beekeeping business, Australia, 2014–15

average tonnes per beekeeping business

Stocks/flows	Small		Small–medium		Medium		Large		Australia	
Opening stock of honey	0.7	(38)	1.5	(220)	3.7	(76)	10.4	(23)	2.0	(51)
Quantity purchased	1.3	(77)	0.2	(83)	2.9	(47)	48.8	(85)	5.5	(67)
Quantity produced	6.1	(13)	19.0	(18)	43.8	(10)	118.9	(13)	22.9	(7)
Quantity given away	0.3	(71)	0.3	(39)	0.4	(27)	0.8	(29)	0.4	(37)
Quantity sold	6.8	(20)	17.3	(10)	46.4	(10)	149.4	(27)	26.1	(14)
Closing stock of honey	1.0	(23)	3.1	(45)	3.5	(38)	27.8	(33)	4.0	(22)

Note: Businesses are categorised as small (50 to 249 hives), small–medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives). Figures in parentheses are relative standard errors (RSEs). A guide on how to use RSEs is in the survey methods and definitions section (Appendix A).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

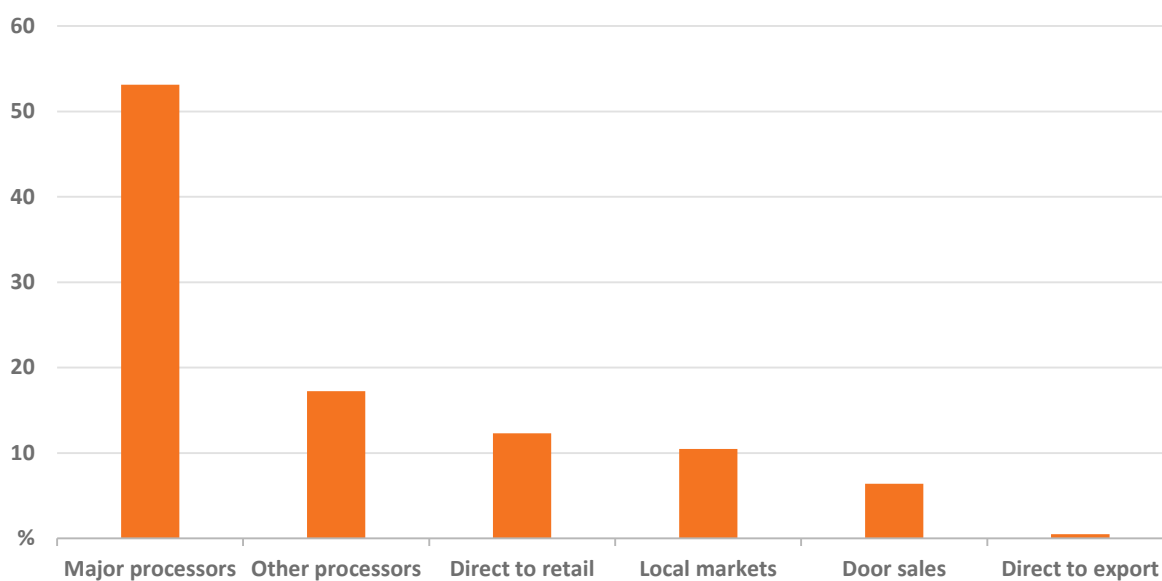
Honey sales

On average, Australian beekeepers sold around 53 per cent of their honey to major processors in 2014–15 (Figure 5). Around 17 per cent was sold to other processors, while the remainder was sold direct to retail (12 per cent), local markets (10 per cent) and door sales (6 per cent). Average sales of honey directly to export were minimal (0.5 per cent). This pattern was similar for all states except Tasmania, where a larger proportion of beekeepers sold honey to other processors and directly to retail (34 per cent and 33 per cent, respectively), and 8 per cent sold honey direct to export.

Beekeepers of all sizes sold the majority of honey to processors and direct to retail. However, small beekeeping businesses sold a larger percentage at local markets and door sales compared with those with 250 or more hives.

Figure 5 Method of honey sale, Australia, 2014–15

Average per beekeeping businesses



Source: ABARES Australian Honey Bee Industry Survey 2014–15

4 Financial performance

Financial performance is a key driver of change in the structure of the honey bee industry. Key measures of financial performance include beekeeping business cash income, business profit and return to capital. These are defined in Box 1 and discussed in this chapter.

Box 1 Key financial performance measures

Beekeeping business cash income is defined as total cash receipts minus total cash costs. It is a short-term measure of the cash surplus available to a business for reinvestment or drawing family income after costs have been taken into account.

Total cash receipts are the cash revenues received by a beekeeping business during the financial year.

Total cash costs are the payments made by the beekeeping business for materials and services, and include administration costs, production-related expenses, interest and payments for permanent and casual labour (excluding owner, manager, partner and family labour).

Beekeeping business profit refines business cash income by adding changes in trading stocks (inventories of honey and other products held by the business) and deducting depreciation and payments to family labour (imputed labour costs).

Rate of return is a measure of the annual profit generated by a business expressed as a percentage of the value of the capital used to generate that profit.

Business cash income

Australian beekeepers received an average \$198 500 in total cash receipts from their business activities in 2014–15, with \$184 400 (93 per cent) derived from beekeeping-specific production activities such as honey production and pollination (Table 5).

Honey sales formed the largest component of total cash receipts in 2014–15, providing \$156 400 per beekeeping business on average. Total cash receipts from beekeeping activities differed across the states, with Tasmania (\$301 200) and New South Wales (\$248 100) generating the highest average total cash receipts from beekeeping activities in 2014–15. Beekeepers in Queensland obtained the lowest receipts from beekeeping activities with an average \$62 700 per business.

Nationally, cash receipts from paid pollination services formed the second largest component with an average of \$19 500 per beekeeping business. Receipts from pollination services per beekeeping business ranged between \$20 000 and \$27 000 in New South Wales, Victoria, South Australia and Tasmania. Average cash receipts from all other honey bee production activities (queen bees, wax, hives, packaged bees and pollen production) represented less than 5 per cent of total cash receipts (\$8 500).

Total cash costs of Australian beekeepers averaged \$128 100 in 2014–15 (Table 5). The purchase of honey and other produce (\$28 400) accounted for the largest component of total cash costs, followed by hired labour (\$21 400), repairs and maintenance (\$13 000) and fuel, oil and grease (\$11 300).

The highest expenditure items differed between the states, with New South Wales and Victoria spending the highest proportion of their total costs on honey and other produce—\$53 200 (30 per cent) and \$25 400 (23 per cent), respectively. The greatest proportion of business cash costs in Tasmania was spent on hired labour at \$71 000 (30 per cent), as was the case in Western Australia (\$21 500 or 20 per cent), South Australia (\$17 000 or 15 per cent) and Queensland (\$10 100 or 19 per cent) (Table 5).

Table 5 Financial performance estimates, by state, 2014–15

average per beekeeping business

Measure	Unit	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Total cash receipts	\$	259 000	202 200	75 500	185 100	157 300	328 600	198 500
Honey	\$	209 500	141 500	52 700	152 700	137 000	270 600	156 400
Pollination	\$	23 500	27 000	6 400	24 500	5 100	20 400	19 500
Queen bees	\$	9 100	400	200	0	100	0	3 600
Bees wax	\$	4 000	2 100	1 800	2 900	2 000	1 700	2 900
Hives	\$	1 400	1 800	1 500	1 000	200	100	1 300
Packaged bees	\$	700	300	200	0	1 400	8 400	700
Other receipts	\$	10 900	29 100	12 700	4 100	10 800	27 400	14 100
Total cash costs	\$	174 600	109 500	52 300	112 100	108 000	234 500	128 100
Honey purchased and other produce	\$	53 200	25 400	400	10 400	19 800	7 700	28 400
Hired labour	\$	26 700	16 500	10 200	16 900	21 500	71 000	21 400
Repairs and maintenance	\$	14 100	13 000	5 500	15 700	15 900	23 900	13 000
Fuel, oil, grease	\$	14 200	9 700	6 200	15 600	6 600	7 200	11 300
Other cash costs	\$	66 600	45 500	30 100	53 700	44 300	124 600	54 200
Business cash income	\$	84 300	92 700	23 100	72 900	49 300	94 100	70 400
Depreciation	\$	26 300	26 400	13 800	22 800	19 700	24 300	22 900
Imputed labour	\$	50 800	44 200	37 200	45 000	50 600	38 600	45 900
Business profit	\$	7 300	22 100	–27 800	5 200	–21 000	31 200	1 600
Rate of return	%	5.0	9.6	–17.1	5.4	–4.7	17.9	3.3

Note: Financial performance data including relative standard errors (RSEs) are provided in Appendix B.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Victorian beekeepers had the lowest total cash costs, on average, as a proportion of total cash receipts (54 per cent), followed by South Australia (61 per cent), New South Wales (67 per cent), Queensland and Western Australia (both 69 per cent) and Tasmania (71 per cent). The national average was 65 per cent.

Average total business cash income for Australian beekeepers in 2014–15 was estimated to have been \$70 400 per business (Table 5). Tasmanian beekeepers received the highest average business cash income (\$94 100), followed by Victoria (\$92 700) and New South Wales (\$84 300). Beekeepers from Queensland and Western Australia had the lowest average business cash income in 2014–15.

Business profit

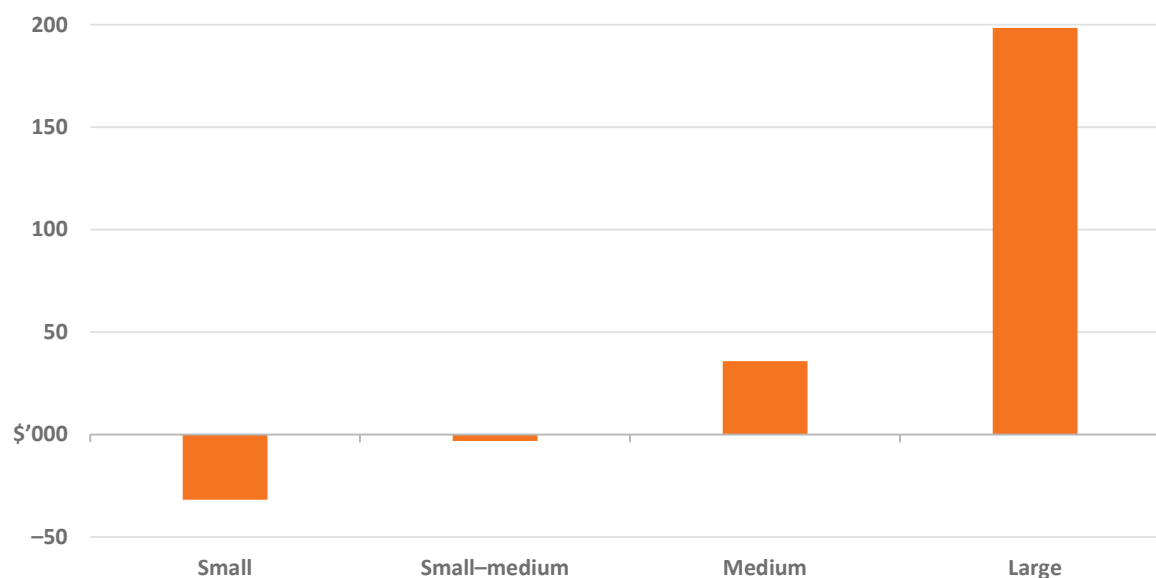
At the national level, beekeepers had an average business profit of \$1 600 in 2014–15 (Table 5). Tasmanian beekeepers had the highest average profit of \$31 200, followed by Victoria (\$22 100), New South Wales (\$7 300) and South Australia (\$5 200). Western Australia and Queensland recorded average business losses of \$21 000 and \$27 800, respectively.

There was a strong positive relationship between business size and business profit (Figure 6). Small beekeeping businesses had a negative average business profit of \$31 800. Small–medium

beekeeping businesses had negative average business profit of \$3 200. Average profit for medium businesses was \$35 800, while large beekeeping businesses received the highest average profit (\$198 400).

Figure 6 Average business profit, by size of beekeeping business, 2014–15

average per beekeeping business



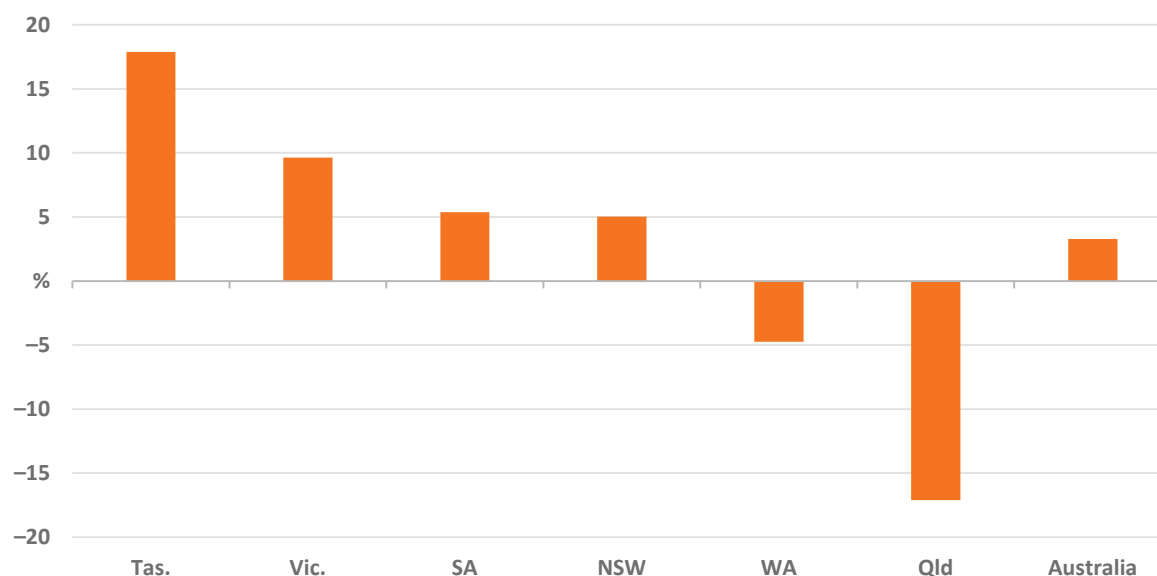
Note: Businesses are categorised as small (50 to 249 hives), small-medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives)

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Return to capital

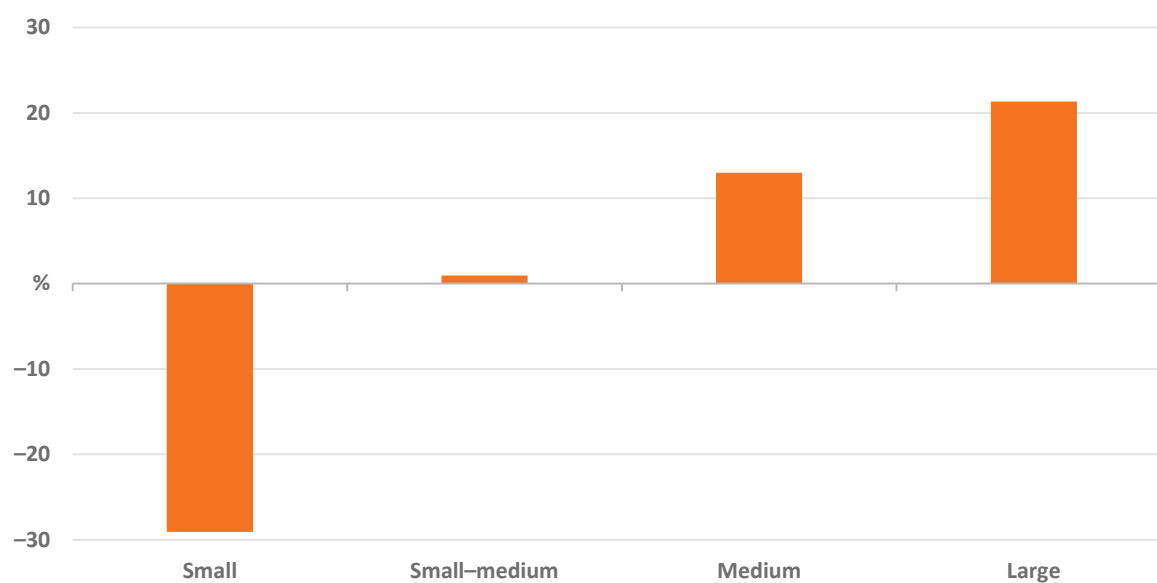
Measures of return to capital are important indicators of the economic performance of beekeeping businesses and the incentives for beekeepers to continue investing in the industry. Figure 7 shows average rate of return to capital (excluding capital appreciation) for beekeepers.

In 2014–15 the rate of return to capital for beekeepers was 3.3 per cent at the national level (Figure 7, Table 5). Rates of return varied considerably between states, with Tasmania reporting the highest average rate of return of 17.9 per cent, followed by Victoria (9.6 per cent), South Australia (5.4 per cent) and New South Wales (5.0 per cent). In line with corresponding negative business profits, the average rate of return for Western Australia and Queensland in 2014–15 was -4.7 per cent and -17.1 per cent, respectively.

Figure 7 Rate of return, beekeeping businesses, by state, 2014–15

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Reflecting average business profit, average rates of return to capital vary by size of business, with larger businesses receiving higher average rates of return (Figure 8).

Figure 8 Rate of return, by size of beekeeping business, 2014–15

Note: Businesses are categorised as small (50 to 249 hives), small-medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives)

Source: ABARES Australian Honey Bee Industry Survey 2014–15

5 Industry issues

The Australian honey bee industry faces a number of challenges and threats that risk both the quantity and quality of honey and bee products. Most of the industry relies on wild (or non-agricultural) flora for collection of pollen and nectar and a variety of factors may reduce access or availability of that resource. Bushfires, droughts and floods all reduce the availability of flowers, and land clearance, reduced access to public lands and the removal of weeds visited by bees may reduce the resource base available to beekeepers. Additionally, the use of pesticides on crops can be harmful to bees and the quality of honey produced.

Pests and diseases also significantly impact the industry and have the potential, if not managed carefully, to severely reduce the quantity and quality of honey bee products and services. Currently, the industry is affected by American foulbrood, European foulbrood, chalkbrood, sacbrood, nosema, small hive beetle, and wax moth. The varroa mite is also a constant threat, particularly in the port regions of Queensland, and is the subject of large biosecurity control efforts. Beekeeping terms are defined in Box 2.

Box 2 Glossary of beekeeping terms

Term	Definition
Chalkbrood	A disease of honey bees that is fatal to developing larvae and is caused by a fungus (<i>Ascophaera apis</i>).
Foulbrood	A destructive disease of honey bee larvae caused by bacteria (as <i>Bacillus larvae</i>).
Nosema	A spore-forming parasitic protozoan that chiefly affects insects.
Overwintering	The process by which honey bees pass through or wait out the winter season, or pass through that period of the year when 'winter' conditions make normal pollination and hive-related activity or even survival difficult.
Propolis	A red or brown resinous substance collected by honey bees from tree buds, used by them to fill crevices and to fix and varnish honeycombs.
Sacbrood	A virus disease of the honey bee affecting the larvae and causing them to shrivel and become scalelike.

Four key industry issues were included in the ABARES Australian Honey Bee Industry Survey: provision of paid and unpaid pollination services; use of public land for honey production; challenges facing the flora resource base; and uptake and impact of best management practice information on beekeeping.

Pollination services

Australian agricultural crops have a large reliance on pollination by various insect species. Although wild native bee and honey bee populations are important, managed pollination by beekeepers is fundamental for many crops. Bee pollination increases the yields and quality of many crops. Approximately 65 per cent of Australian agricultural production relies on pollination by honey bees, and 35 industries depend on the pollination services for the majority of their production. These industries include almonds, avocados, apples, pears and cherries (RIRDC 2013).

The stocking rate of hives per hectare varies significantly by crop, largely due to differences in the optimal amount of pollination and number of bee visits per flower. The stocking rate varies from one hive to more than 12 hives per hectare (Monck, Gordon & Hanslow 2008).

Provision of paid pollination services

Some beekeepers are paid to provide pollination services for crops and others are paid in kind by using the nectar for their bees to make honey. Across Australia, the number of beekeepers providing paid pollination services has increased—the survey results show that 44 per cent of beekeepers conducted paid pollination services in 2014–15, up from 28 per cent in 2006–07.

The proportion of beekeepers providing paid pollination services increased in all states except Western Australia and Queensland. South Australia and Tasmania had the highest proportion of beekeepers providing paid pollination services, although the number of beekeepers providing these services was lower than states with a larger beekeeping industry, such as New South Wales (Figure 9). Larger scale beekeeping businesses had a higher proportion of beekeepers conducting paid pollination services in 2014–15 (78 per cent) than small beekeeping businesses (33 per cent).

Figure 9 Beekeeping businesses conducting paid pollination services, by state and size, 2006–07 and 2014–15

percentage of businesses



Note: Businesses are categorised as small (50 to 249 hives), small–medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives)

Source: ABARES Australian Honey Bee Industry Surveys 2006–07 and 2014–15

Pollination receipts

Australian beekeepers who provided paid pollination services received an average of \$44 200 from the service in 2014–15. Paid pollinators in New South Wales and Victoria received significantly more on average than paid pollinators in the other states (Figure 10).

Figure 10 Total payment received for paid pollination services, by state, 2014–15

average per beekeeping business



Note: Beekeeping business providing paid pollination services

Source: ABARES Australian Honey Bee Industry Survey 2014–15

In-kind benefits

Although some beekeepers are paid to provide pollination services, a significant number do not receive monetary payment for the service and are paid ‘in kind’. The benefit derived from using a landholder’s crops as a source of nectar to produce honey is one example of an ‘in-kind’ benefit (Crooks 2008).

Overall, 12 per cent of Australian beekeepers reported receiving in-kind benefits from providing pollination services in 2014–15. Many of these beekeepers also undertook paid pollination services. A number of beekeepers received in-kind benefits without providing paid pollination services.

The receipt of in-kind benefits varied across the states. South Australia had the highest proportion of beekeepers receiving in-kind benefits from providing pollination services (34 per cent). Victoria (15 per cent), Queensland (15 per cent) and New South Wales (12 per cent) had lower proportions of beekeepers receiving in-kind benefits. In Tasmania, where fewer beekeepers undertook paid pollination services, only 7 per cent of beekeepers received an in-kind benefit from pollination services. In Western Australia, no beekeepers surveyed reported in-kind benefits.

Crops pollinated

The types of crops pollinated by beekeepers conducting paid pollination services varied considerably by state in 2014–15 (Table 6). Almost all (94 per cent) paid pollinators surveyed in Victoria operated on almond crops, using an average of 502 hives per crop. The next most common crop type in Victoria was oilseeds, including canola and sunflowers (18 per cent).

Almonds were also identified as a major crop pollinated by beekeepers in New South Wales and South Australia, at 79 per cent and 65 per cent, respectively. In South Australia, two-thirds of beekeepers identified lucerne as a major crop pollinated. In Tasmania, cherries were reported as the major crop pollinated by beekeepers (92 per cent). In Western Australia, cherries

(48 per cent), pome fruits (37 per cent) and other fruits, including avocados (54 per cent), were reported as the major crops pollinated, while in Queensland it was predominantly vegetables (64 per cent).

Table 6 Crops pollinated by paid pollination services, by state, 2014–15

percentage of beekeeping businesses

State	Almonds	Cherries	Pome fruits	Other fruit	Lucerne	Oilseeds	Vegetables	Other
New South Wales	79	7	5	4	3	12	12	31
Victoria	94	4	7	11	0	18	4	6
Queensland	6	0	8	22	0	7	64	22
South Australia	65	6	3	3	67	18	5	0
Western Australia	0	48	37	54	0	12	30	0
Tasmania	0	92	32	16	0	9	50	9
Australia	65	11	8	10	18	14	16	14

Note: Beekeeping businesses can pollinate multiple types of crops throughout a given year.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Travel distance

At the national level, the average distance travelled by beekeepers to undertake paid pollination services was 310 kilometres in 2014–15, with around 50 per cent of beekeepers travelling between 85 and 400 kilometres.

Beekeepers in New South Wales and Western Australia travelled the largest average distances—over 390 and 334 kilometres, respectively—while Tasmanian beekeepers travelled the least distance (133 kilometres on average). In all states, large beekeeping businesses tended to travel further to provide paid pollination services than smaller beekeeping businesses.

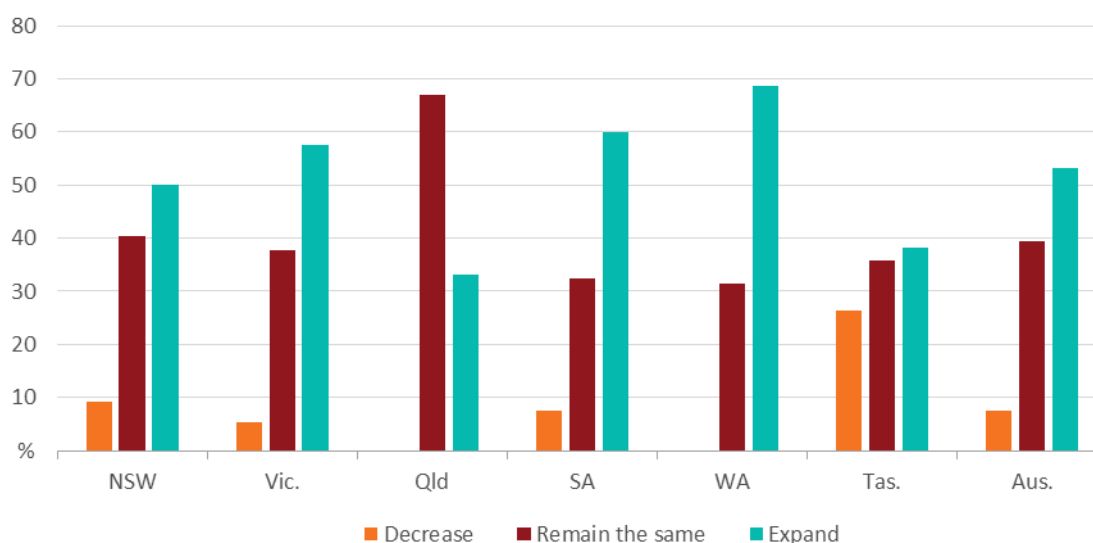
Future pollination service provision

An estimated 53 per cent of beekeepers across Australia who provided paid pollination services in 2014–15 planned to expand their pollination services over the next five years, while 40 per cent stated they would remain the same (Figure 11). Only 7 per cent of beekeepers planned to reduce their pollination services.

Of those beekeeping businesses currently involved in pollination services, their plans to expand, decrease or leave pollination services unchanged over the next five years differed across the states (Figure 11).

Figure 11 Expected changes in pollination services, by state, 2014–15

percentage of beekeeping businesses



Note: Expected over the next five years commencing 2014–15. Proportion of beekeeping businesses that were paid for providing pollination services.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Of those beekeepers surveyed who did not provide paid pollination in 2014–15, approximately 8 per cent planned to commence paid pollination operations over the next five years. In Victoria an estimated 14 per cent of beekeeping businesses planned to commence paid pollination services, with lower proportions of businesses planning this service in Queensland (11 per cent), South Australia and Western Australia (6 per cent each) and New South Wales (5 per cent). No beekeepers surveyed in Tasmania that did not already provide paid pollination in 2014–15 expected to move into paid pollination services over the next five years.

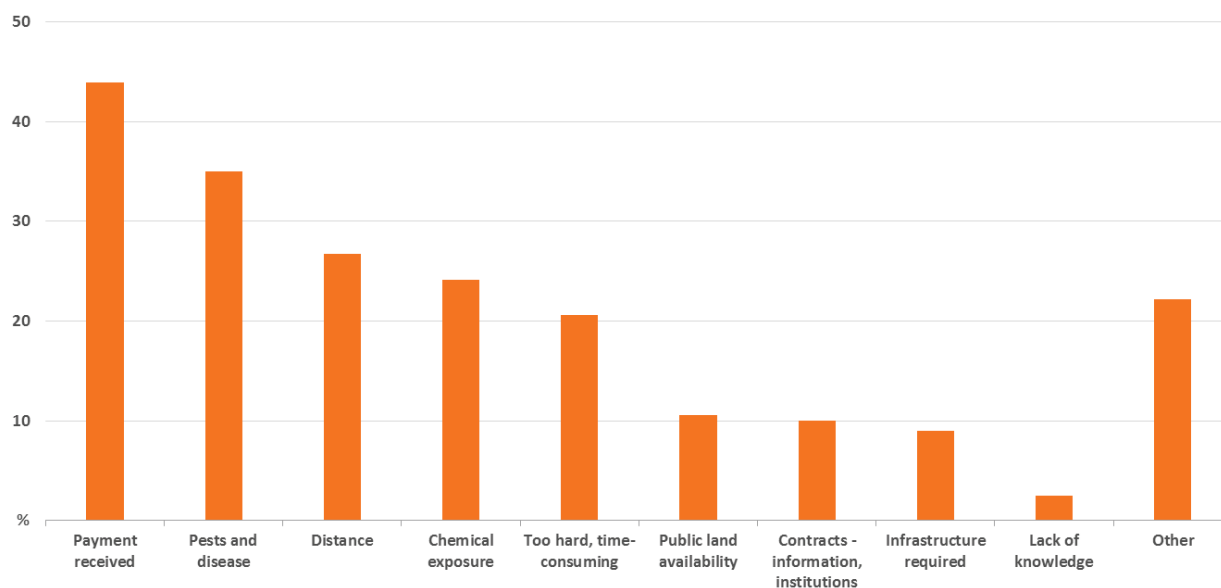
Impediments to paid pollination uptake and expansion

The survey included questions on impediments to commencement or expansion of paid pollination services. The most common response (44 per cent) was that the payment received for pollination services was not high enough to encourage commencement or expansion of this service (Figure 12).

Pest and disease transfer from other beekeepers (35 per cent) and the inability or unwillingness to travel longer distances (27 per cent) were also common responses. Around one-quarter of beekeepers reported lack of control or knowledge about exposure to agricultural chemicals, such as pesticides, fungicides and herbicides and the difficulty and/or time-consuming nature of undertaking paid pollination services (21 per cent) as major impediments.

Less commonly reported impediments were: accessibility to suitable build and re-build conditions for colonies, such as public land (11 per cent); the absence of institutional arrangements to enter into contracts with farmers, or lack of information on payment rates (10 per cent); the need for additional infrastructure or assets for transport, storage and packaging (9 per cent); and a lack of knowledge and experience (2 per cent).

Figure 12 Impediments to commencing or expanding paid pollination services, 2014–15
percentage of beekeeping businesses



Source: ABARES Australian Honey Bee Industry Survey 2014–15

Public land access

Honey production on public land

Public land—including national parks, state forests and other public land such as conservation reserves and stock routes—is important for the beekeeping industry in Australia. Public land benefits the beekeeping industry by providing diverse floral resources (including native flora) for nectar and pollen; sites to accommodate seasonal migratory requirements for hives; and pesticide-free refuges in which hives susceptible to toxicity from insecticides, fungicides and herbicides may rehabilitate.

An estimated 39 per cent of Australian honey production was derived from public land in 2014–15 (Figure 13). Tasmania derived the greatest proportion of its honey from public land (82 per cent) while South Australia derived the lowest (7 per cent). In Western Australia and Victoria around 60 per cent of honey produced (by volume) was derived from public land (64 per cent and 58 per cent, respectively), followed by New South Wales (41 per cent) and Queensland (28 per cent).

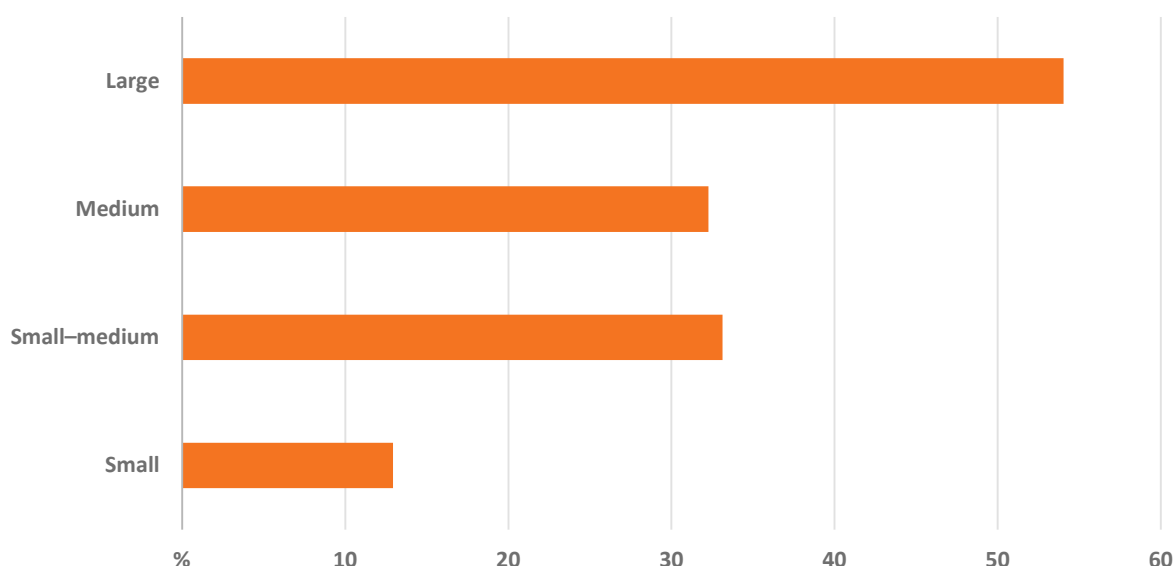
Figure 13 Proportion of honey production derived from public land, by state, 2014–15



Source: ABARES Australian Honey Bee Industry Survey 2014–15

Large beekeeping businesses derived over 50 per cent of their honey production from public land (Figure 14). Medium and small-medium beekeeping businesses both derived around 32 per cent, and small beekeeping businesses derived 13 per cent of their honey production from public land.

Figure 14 Proportion of honey production derived from public land, by size of beekeeping business, 2014–15



Note: Businesses are categorised as small (50 to 249 hives), small-medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Land use trends

Over the five years to 2014–15, an estimated 57 per cent of beekeepers had used public land for honey production (Table 7), but some beekeepers didn't use public land every year.

Of those beekeepers that had used public land for honey production over the five years to 2014–15, 32 per cent reduced their use of public land, 21 per cent increased their use and the remaining 47 per cent stayed the same.

New South Wales reported the largest proportion of beekeeping businesses decreasing their use of public land over the five years to 2014–15 (43 per cent), while Tasmania reported the biggest increase (39 per cent).

Table 7 Change in the use of public land for honey production, by state

percentage of beekeeping businesses

Public land use	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Used public land in past 5 years	63	78	48	21	49	88	57
Use of public land in past 5 years has:^a							
– decreased	43	17	31	37	31	14	32
– remained the same	45	53	45	52	34	47	47
– increased	12	30	24	11	35	39	21

^a Percentage of beekeepers who used public land for honey production in the past five years

Note: Over the five years ending 2014–15.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

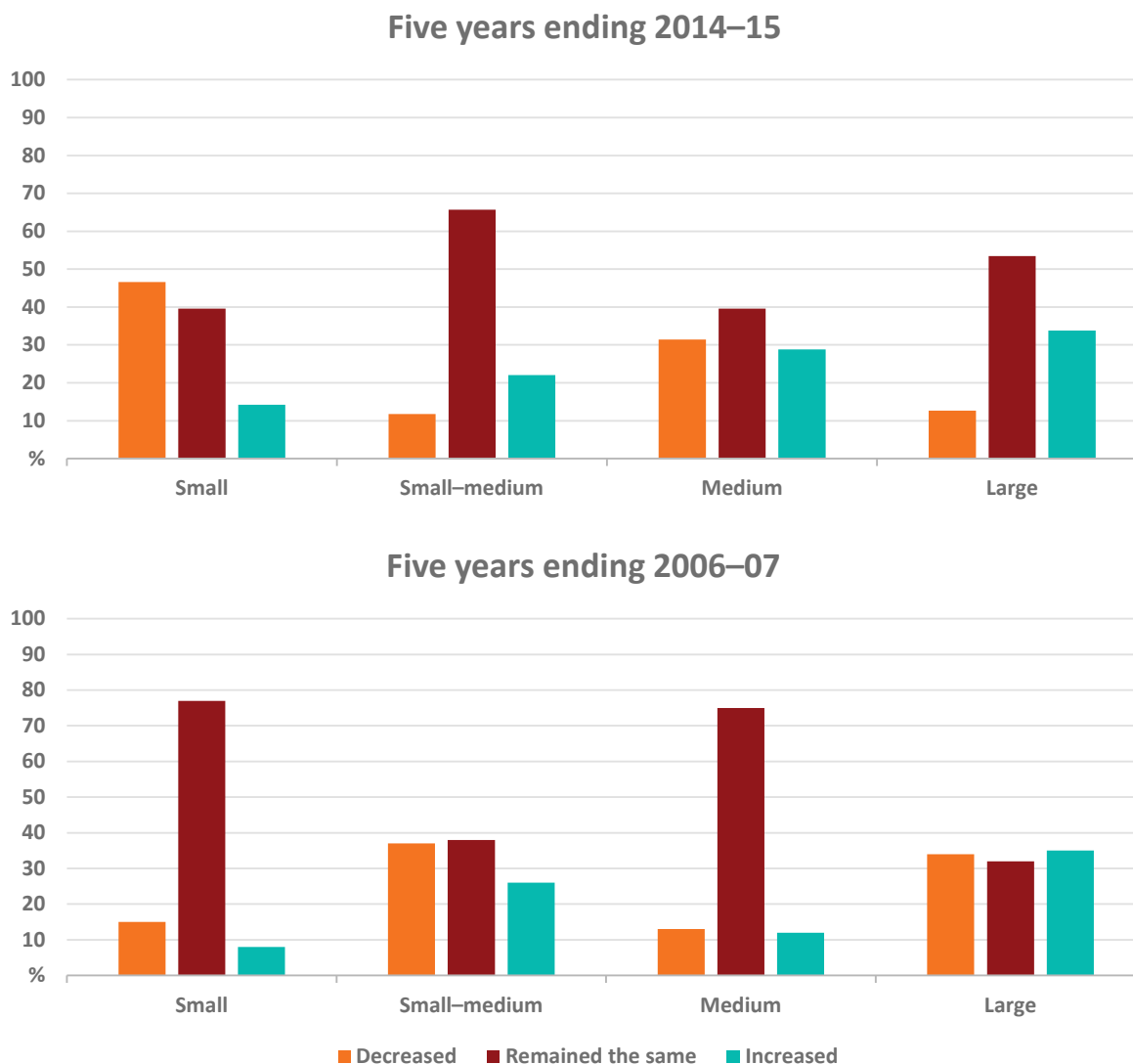
Nationally, 32 per cent of beekeepers reported a decrease in their usage of public land for honey production over the five years to 2014–15. The main reasons given for the decline were: restricted site access as a result of government policy (30 per cent), extreme weather events such as bushfires (26 per cent), difficulty in site access (9 per cent) and inconsistent flowering patterns (7 per cent).

Beekeepers in New South Wales and Western Australia reported restricted site access as the major reason for the decrease in the use of public land for honey production. Beekeepers in Victoria and Tasmania reported difficult site access, and beekeepers in Queensland and South Australia reported extreme weather events as the major reason for the decline in use of public land.

There appears to be no distinct trend in the proportion of beekeepers that increased or decreased their use of public land for honey production over the five years to 2006–07 compared with the five years to 2014–15 (Figure 15). However, in general, higher proportions of beekeepers did not change their use of public land for honey production over these two five-year periods.

Figure 15 Changes in public land used for honey production, by size of beekeeping business, five years ending 2006–07 and 2014–15

percentage of beekeeping businesses



Note: Businesses are categorised as small (50 to 249 hives), small-medium (250 to 499 hives), medium (500 to 999 hives) and large (1 000 or more hives). Per cent of beekeeping businesses using public land.

Source: ABARES Australian Honey Bee Industry Survey 2014–15; Crooks (2008)

Industry challenges

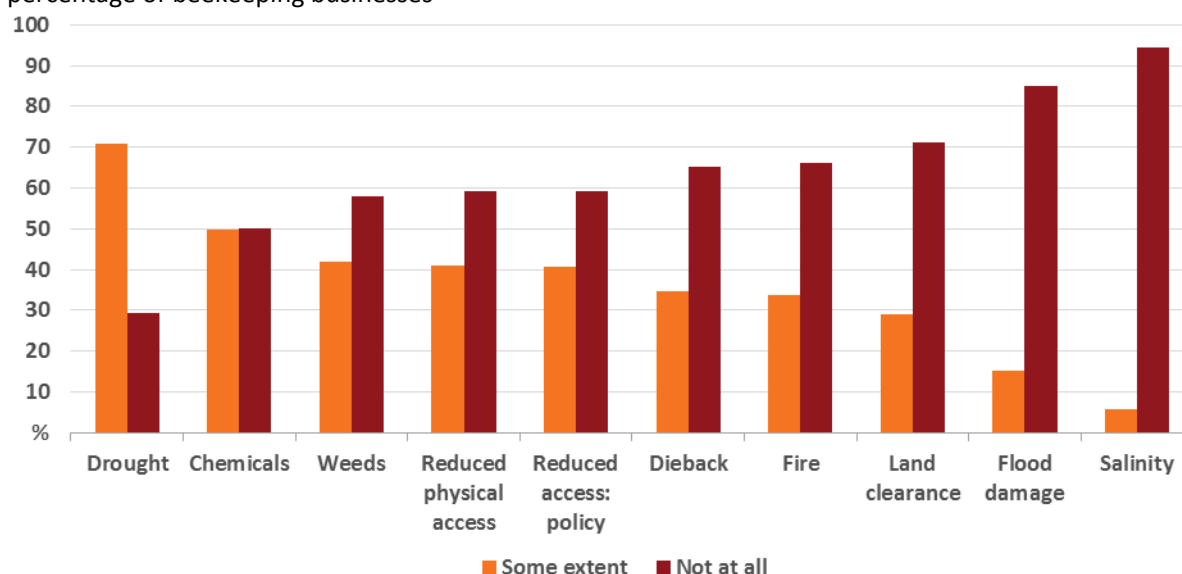
A number of challenges are facing the beekeeping industry that impact both the volume and quality of production, including weeds, pests and diseases, natural disasters, environmental impacts and government/regulatory challenges.

Resource base

The most commonly reported issue impacting the use of floral resources over the five years to 2014–15 was drought, indicated by 71 per cent of beekeepers surveyed (Figure 16). A similar result was obtained in the 2006–07 honey bee survey (Crooks 2008).

Figure 16 Factors affecting beekeepers' floral resource base in Australia

percentage of beekeeping businesses



Note: For the five years ending 2014–15.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

In addition to drought, around half of beekeepers indicated agricultural chemicals such as pesticides, fungicides and herbicides also impacted the floral resource base. These results show a considerable change in floral resource based challenges, compared with those reported in 2006–07. In 2006–07 drought, agricultural chemical use, tree dieback, weed control, conserved area access, land clearance and fire damage were all reported as challenges by over 50 per cent of beekeepers. In both surveys flood damage and salinity were reported as minor factors affecting the floral resource base.

The challenges to beekeepers' floral resources for each state surveyed are shown in Table 8. Drought was identified as the most common challenge facing the industry in all states except Tasmania, where it was estimated to be the second most common challenge. Flood damage and salinity were the least common issues reported.

Table 8 Factors affecting beekeepers' floral resource base, by state

percentage of beekeeping businesses

Factor	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Chemicals	43	79	40	58	36	18	50
Dieback	26	63	35	34	19	19	35
Drought	60	84	77	88	57	49	71
Fire	27	62	20	23	53	38	34
Flood damage	25	8	11	12	0	5	15
Land clearance	30	40	31	4	36	32	29
Reduced access	54	64	35	36	47	76	50
Salinity	7	2	0	14	8	0	6
Weeds	38	74	19	53	33	17	42

Note: For the five years ending 2014–15.

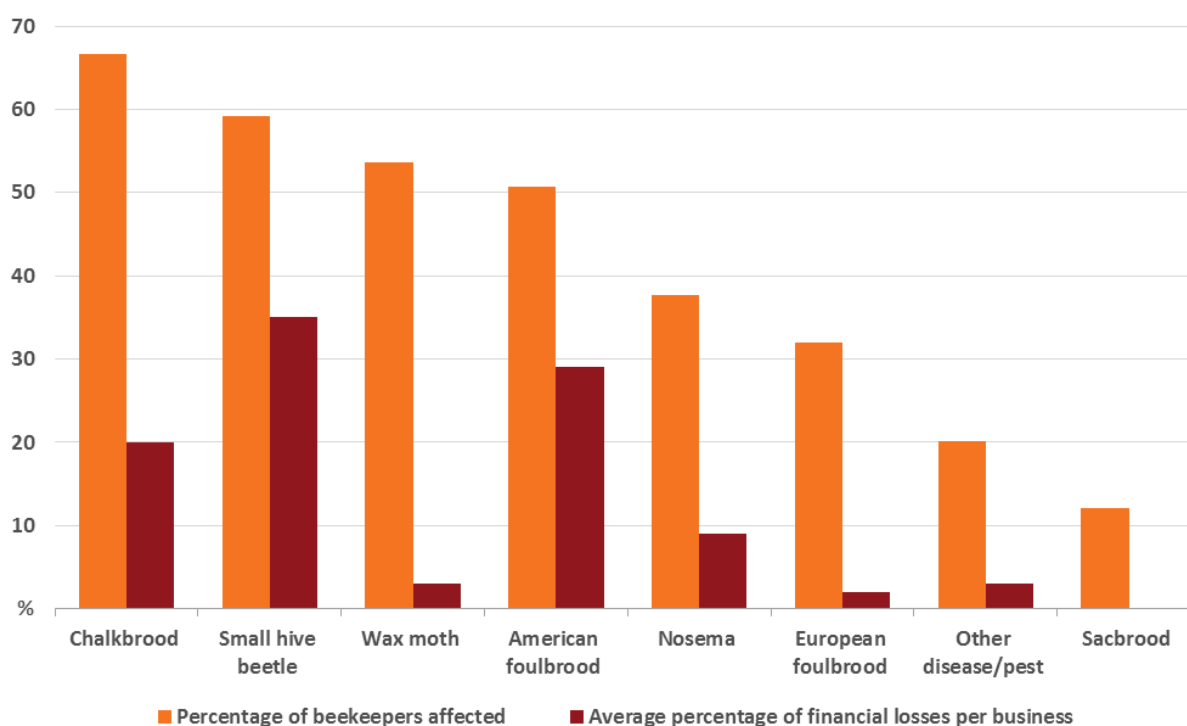
Source: ABARES Australian Honey Bee Industry Survey 2014–15

Pests and diseases

The presence of pests and diseases is also a challenge for the beekeeping industry. The survey results show that the small hive beetle and the fungal disease chalkbrood were the two greatest pest and disease challenges affecting honey and honey bee–related production in Australia over the five years to 2014–15 (Figure 17). Over 50 per cent of beekeeping businesses also indicated that wax moth and American foulbrood had some impact on their honey and related production over the past five years.

The financial impact of pests and diseases is not reflected in their prevalence alone. The small hive beetle was the most common pest affecting beekeepers and also made up the largest proportion of financial losses from pests and diseases on average (35 per cent). While only around half of beekeeping businesses were affected by American foulbrood and it represented the second highest proportion of financial losses (29 per cent). This was 9 percentage points higher than the average relative financial impact of chalkbrood which affected two thirds of beekeepers. Conversely, the wax moth, while highly prevalent (54 per cent of beekeepers) was amongst the least costly pest or disease.

Figure 17 Pests and diseases affecting honey bee–related production in Australia



Note: For the five years ending 2014–15.

Percentage of beekeepers affected by each pest or disease includes businesses impacted to at least a small extent.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

New South Wales had the largest financial losses resulting from pests and diseases—an average of \$54 700 per beekeeping business in 2014–15 (Table 9). Most of these losses were the result of the small hive beetle (45 per cent) and American foulbrood (33 per cent). Queensland, Tasmania and South Australia also recorded relatively large financial losses as a result of pests and diseases. Most of Queensland’s pest and disease losses were from the small hive beetle and American foulbrood; in South Australia and Tasmania it was chalkbrood. Reported losses from pests and diseases in Western Australia and Victoria were comparatively low.

Table 9 Financial losses in honey-related production due to pests and diseases, 2014–15

average per beekeeping business

Loss/cause	Unit	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Total financial loss	\$	54 700	8 500	25 600	20 900	4 500	25 300	31 500
Proportion of loss due to:								
Small hive beetle	%	45 (43)	5 (48)	32 (29)	0 (0)	0 (0)	0 (0)	35 (37)
American foulbrood	%	33 (72)	9 (53)	31 (30)	7 (76)	44 (35)	14 (66)	29 (56)
Chalkbrood	%	13 (37)	40 (45)	8 (64)	65 (51)	13 (23)	72 (60)	20 (24)
Nosema	%	6 (28)	18 (67)	15 (80)	11 (38)	0 (77)	8 (53)	9 (27)
Wax moth	%	1 (47)	7 (38)	0 (62)	11 (48)	38 (30)	4 (63)	3 (24)
European foulbrood	%	0 (46)	5 (61)	5 (63)	4 (40)	0 (0)	2 (72)	2 (31)
Sacbrood	%	0 (63)	1 (40)	0 (0)	0 (45)	0 (90)	0 (0)	0 (28)
Other pest or disease	%	1 (47)	15 (87)	9 (55)	1 (63)	4 (74)	0 (0)	3 (35)

Note: Figures in parentheses are relative standard errors (RSEs). A guide on how to use RSEs is in the survey methods and definitions section (Appendix A).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Table 10 Number of hives lost, by cause, 2014–15

average per beekeeping business

Cause	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Pests and diseases	81 (45)	22 (30)	24 (22)	12 (38)	4 (26)	1 (57)	42 (33)
Exposure to agricultural chemicals	11 (34)	3 (37)	3 (51)	6 (49)	1 (63)	4 (45)	7 (24)
Extreme weather events	6 (34)	5 (37)	3 (77)	2 (47)	11 (75)	0 (0)	5 (24)
Theft	2 (40)	4 (71)	0 (80)	0 (73)	0 (75)	1 (78)	2 (36)
Other	2 (73)	1 (54)	5 (31)	2 (71)	1 (62)	3 (54)	2 (27)

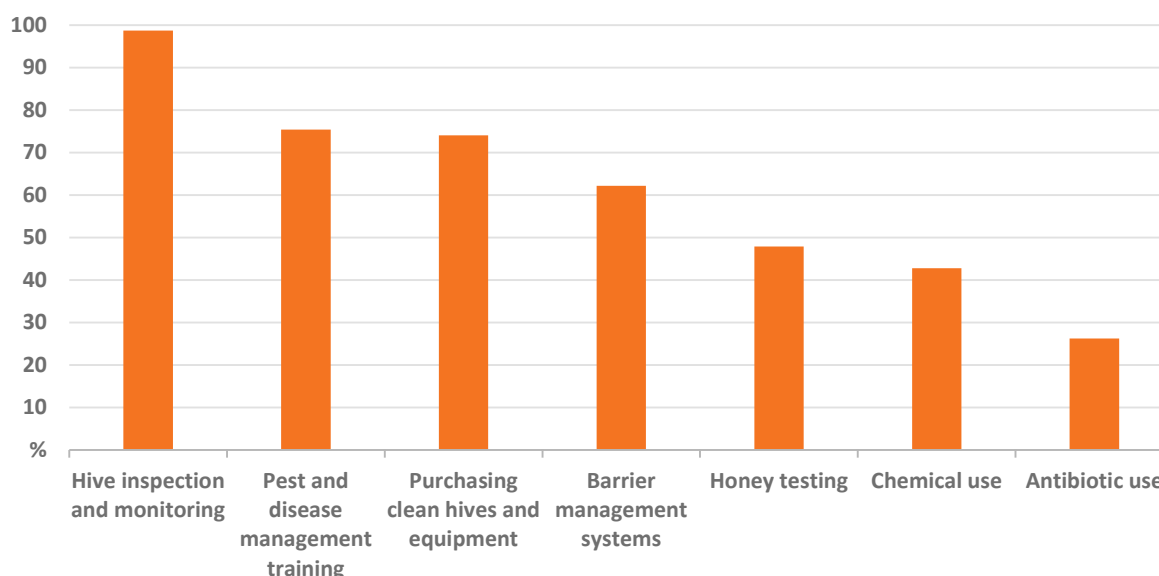
Note: Figures in parentheses are relative standard errors (RSEs). A guide on how to use RSEs is in the survey methods and definitions section (Appendix A).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Almost all beekeeping businesses across Australia reported hive management and monitoring as one of the most important methods for pest and disease management (Figure 18). Pest and disease management training (75 per cent) and purchasing clean hives and equipment (74 per cent) were also reported as important.

Figure 18 Importance of pest and disease management methods to beekeeping businesses, Australia, 2014–15

percentage of beekeeping businesses



Source: ABARES Australian Honey Bee Industry Survey 2014–15

Beekeeping businesses reported on the number of hives lost in 2014–15 due to pests and diseases, exposure to agricultural chemicals, overwintering, extreme weather events, theft and other factors (Table 10). Nationally, pests and diseases were the largest contributor to hive losses, with an average of 42 hives (74 per cent) lost per beekeeping business in 2014–15. Exposure to agricultural chemicals accounted for 12 per cent of hive losses per beekeeping business, while extreme weather events and theft accounted for 9 per cent and 4 per cent, respectively. No beekeepers surveyed reported hive losses due to overwintering.

Beekeepers in New South Wales, Victoria, Queensland and South Australia identified pests and diseases as the largest contributors to hive loss; in Western Australia, extreme weather events were the largest contributors. Exposure to agricultural chemicals was identified as the largest contributor to hive loss in Tasmania, but this number was relatively small compared with the number of hives lost in other states.

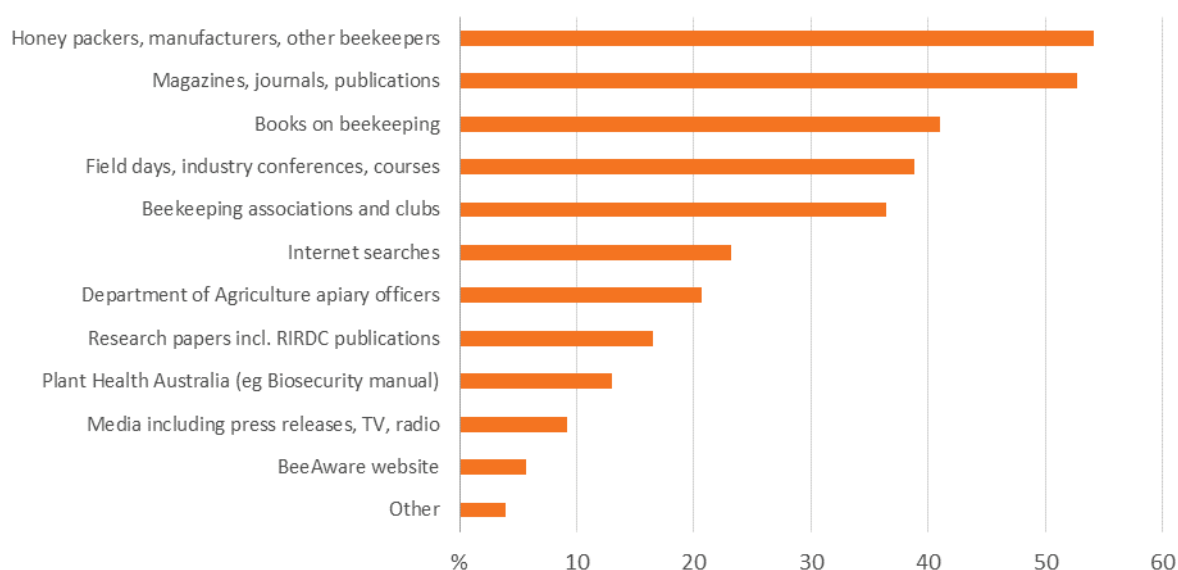
Research uptake and impact

Sources of information

Beekeepers sourced information from a wide range of sources (Figure 19). Over 50 per cent of beekeepers sourced information from other beekeepers, honey packers and manufacturers, or found the relevant information in magazines, journals and publications (such as *The Australasian Beekeeper*, *Australian Bee Journal*, *Australia's Honeybee News* and other online publications). Other common sources of information included books on beekeeping, field days, industry conferences and courses, and beekeeping associations and clubs.

Figure 19 Sources of best management practices information, 2014–15

percentage of beekeeping businesses



Source: ABARES Australian Honey Bee Industry Survey 2014–15

Research uptake and impacts

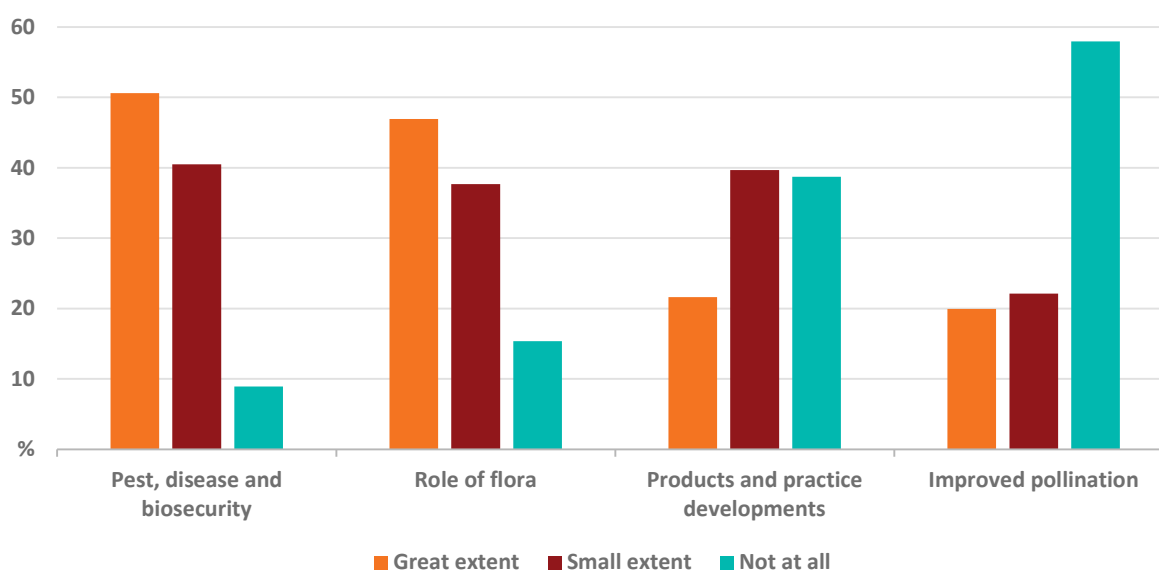
Research uptake was strong within the beekeeping industry. Nationally, an estimated 74 per cent of beekeeping businesses changed bee management practices as a result of research. A higher proportion of larger beekeeping businesses changed their management compared with smaller operators.

Research on pests, diseases and biosecurity and on the role of flora in honey bee management benefited beekeeping businesses to the greatest extent, with an estimated 51 per cent and 47 per cent of beekeeping businesses, respectively, reporting strong research benefits (Figure 20). The research area reported to have had the least impact was improved pollination. A total of 58 per cent of beekeepers felt they received no benefit from this research area.

An estimated 22 per cent of beekeepers surveyed indicated that research into the development of products (for example, active honey) and beekeeping practices (such as genetic improvement of the honey bee stock) improved the profitability of their business to a great extent.

Figure 20 Extent to which selected research areas have benefited beekeeping businesses, Australia, 2014–15

percentage of beekeeping businesses



Source: ABARES Australian Honey Bee Industry Survey 2014–15

The extent to which beekeeping production has increased over the past five years as a result of research varied across the states (Table 11). The majority of beekeepers felt that production had increased between 5 per cent and 24 per cent. Western Australia reported the greatest increase in production, with 20 per cent of beekeeping businesses reporting an increase of over 50 per cent.

Table 11 Change in honey production as a result of research

percentage of beekeeping businesses

Extent of increase	NSW	Vic.	Qld	SA	WA	Tas.	Aus.
Nil	27	10	32	29	26	0	25
Less than 5 per cent	30	25	20	35	19	24	27
Between 5 and 24 per cent	27	46	43	24	28	76	34
Between 25 and 50 per cent	16	19	0	8	7	0	11
Over 50 per cent	0	0	3	3	20	0	2

Note: For the five years ending 2014–15.

Source: ABARES Australian Honey Bee Industry Survey 2014–15

Appendix A Survey methods and definitions

The Australian Honey Bee Industry Survey 2014–15 was undertaken by ABARES field officers, by conducting face-to-face interviews with the business owner–manager of the beekeeping business, between March and May 2016.

Industry-level financial and physical information collected included hive numbers, honey bee production types, business receipts and costs, labour use, debts and assets, market value of business capital, and seasonal conditions. The survey also included supplementary questions on the use of public land for honey production, provision of pollination services, industry challenges, research uptake and future intentions.

Target population

The sample population for the ABARES Australian Honey Bee Industry Survey was selected from a list of registered beekeepers provided by Department of Agriculture and Water Resources apiary officers in each state.

To be eligible for participation in the survey, a beekeeper must have operated at least 50 hives during 2014–15. A sample of 180 beekeepers was selected from a total population of 1 280 commercial beekeepers (those who operated 50 hives or more).

The sample included beekeeping businesses from New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania. Northern Territory and the Australian Capital Territory beekeeping businesses were excluded from the survey because of their small populations of commercial beekeepers.

Results are reported at national, state and industry-size levels. Industry size was categorised into four groups according to number of hives: small (50 to 249 hives), small–medium (250 to 499 hives), medium (500 to 999 hives), and large (1 000 or more hives) beekeeping businesses.

Survey design

The beekeeping sample was stratified by state and number of hives operated, with the sample selected randomly from within each stratum, such that larger operators had an increased probability of being included in the sample than smaller operators.

Sample weighting

Industry-level estimates were calculated by appropriately weighting the data collected from each sample beekeeping business and then using the weighted data to calculate population estimates.

Sample weights are calculated so that population estimates from the sample for numbers of beekeeping businesses and total number of hives, correspond as closely as possible to the total population and number of hives provided by state departments. The weighting methodology uses a model-based approach, with a linear regression model linking the survey variables and the estimation benchmark variables. The details of this method are described in Bardsley and Chambers (1984).

Generally, larger businesses have smaller weights and smaller businesses have larger weights, reflecting both the strategy of sampling a higher fraction of large businesses than small businesses (the former having a wider range of variability of key characteristics and accounting for a much larger proportion of total output), and the relatively lower number of large businesses.

Reliability of estimates

Reliability of the estimates of population characteristics presented in this report depends on the design of the sample and on the accuracy of the measurement of the characteristics for the individual sample beekeeping business.

Sampling errors

Only a small number of businesses out of the total number of businesses in the beekeeping industry are surveyed. The data collected from each sample business are weighted to calculate population estimates. Estimates derived from these businesses are likely to be different from those that would have been obtained if information had been collected from a census of all businesses. The census value is the value that would have been obtained if all businesses in the target population had been surveyed. Any such differences between the survey estimate and the census value are called sampling errors.

The size of the sampling error is most influenced by the survey design and the estimation procedures, as well as the sample size and variability of each business in the population. The larger the sample size, the lower the sampling error is likely to be. Therefore, national estimates are likely to have smaller sampling errors than state or industry-size related estimates.

Sampling errors are a guide to the reliability of survey estimates and have been calculated for all estimates in this report. These sampling errors, expressed as percentages of the survey estimates are termed relative standard errors.

Calculating confidence intervals using relative standard errors

Relative standard errors can be used to calculate confidence intervals; these indicate how close the actual (census) population value is likely to be to the survey estimate.

The standard error is obtained by multiplying the relative standard error by the survey estimate and dividing by 100. For example, if average total cash receipts are estimated to be \$100 000 with a relative standard error of 6 per cent, the standard error for this estimate is \$6 000. One standard error is equal to \$6 000 and two standard errors are equal to \$12 000.

For a 66 per cent confidence interval, there is roughly a two-in-three chance that the census value is within one standard error of the survey estimate. This range of one standard error is described as the 66 per cent confidence interval. In this example there is an approximately two-in-three chance that the census value is between \$94 000 and \$106 000 (\$100 000 plus or minus \$6 000).

For a 95 per cent confidence interval, there is roughly a 19-in-20 chance that the census value is within two standard errors of the survey estimate (the 95 per cent confidence interval). In this example there is an approximately 19-in-20 chance that the census value lies between \$88 000 and \$112 000 (\$100 000 plus or minus \$12 000).

Comparing estimates

When comparing estimates between two groups, it is important to recognise that the differences are subject to sampling error. A conservative estimate (an overestimate) of the standard error of the difference can be found by adding the squares of the estimated standard errors of the component estimates and taking the square root of the result.

For example, suppose estimates of cash income are \$84 300 for beekeeping businesses in New South Wales and \$92 700 for businesses in Victoria, and the relative standard errors are 28 per cent and 20 per cent, respectively. The difference between these two estimates is \$8 400. The standard error of the difference is estimated as:

$$\sqrt{(28 \times \$84300 / 100)^2 + (20 \times \$92700 / 100)^2} = \$30015$$

A 95 per cent confidence interval for the difference is:

$$\$8400 \pm (1.96 \times \$30015) = (-\$50429, \$67229)$$

Hence, if 100 different samples are taken, in 95 of them the difference between these two estimates would be between minus \$50 429 and \$67 229.

Similar calculations can be made when comparing estimates of change from year to year. However, the industry populations change from one year to the next. If these population changes are substantial, differences in estimates, such as business incomes, might be due more to the changes in population than changes in incomes of beekeepers between years. There may also be differences in data quality between the two estimates being compared—final estimates are more reliable than preliminary estimates.

Definition of terms

Term	Definition
Area of land at business premises	Includes all land operated by the business, whether owned or rented.
Business profit	Business cash income plus build-up in trading stocks, less depreciation, less the imputed value of the owner–manager, partners and family labour.
Business cash income	Total cash receipts minus total cash costs. It is a short-term measure of the cash surplus available to a business for reinvestment or drawing family income after costs have been taken into account.
Capital	Value of capital employed by the business is market value of all assets used, including leased items but excluding machinery and equipment either hired or used by contractors. Market valuations were provided by the owner–manager of surveyed businesses. Included market value of land and fixed improvements used by the business but excluded value of the owner–manager’s house. House value deducted from total value of land and fixed improvements was the present day replacement cost, depreciated for age.
Depreciation	Estimated by applying diminishing value depreciation method to market value of capital items at 30 June. Capital items are categorised into several groups and relevant depreciation rates are applied. Capital groups include vehicles; handling, harvesting and packing equipment; cultivation and sowing equipment; computers, electronic and communications equipment; other plant and equipment; and buildings on the business premises.

Term	Definition
Hired labour	Excludes owner–manager, partners and family labour, and work undertaken by contractors. Expenditure on contract services appears as a cash cost.
Imputed labour cost	Payments for owner–manager and family labour may bear little relationship to actual work input. An estimate of the labour input of the owner–manager, partners and their families is calculated in workweeks and a value is imputed at the relevant Pastoral Award 2010 rates.
Labour	Measured in workweeks, as estimated by the owner–manager. Includes all work on the business by the owner–manager, partners, family and hired permanent and casual workers but excludes work done by contractors.
Owner–manager	Primary decision-maker for the business. This person is identified by discussion between interviewer and interviewee as (one of) the key decision-maker(s). Primary decision-maker usually responsible for day-to-day operation of business and may own or have a share in the business.
Rate of return	Return to all capital used. Computed by expressing business profit as a percentage of total opening capital of the business.
Total cash costs	Payments made by business for materials and services and for permanent and casual hired labour (excluding partner and other family labour). Includes value of any lease payments on capital, produce purchased for resale, rent, interest, beekeeping and honey-production related purchases. Capital and household expenditures are excluded from total cash costs. Handling and marketing expenses include commission and levies for business produce sold. Administration costs include accountancy fees, banking and legal expenses, postage, stationery, subscriptions and telephone. Other cash costs include relatively small cost items like stores, advisory services and travelling expenses.
Total cash receipts	Total of revenues received by the business during the financial year, including revenues from honey, paid pollination services, queen bees, wax, hives, packaged bees and pollen production. Includes revenue received from royalties, rebates, refunds, plant hire, contracts, insurance claims and compensation, and government assistance payments.

Appendix B Financial performance estimates, by state

Table 12 Financial performance estimates, by state, 2014–15

average per beekeeping business

Measure	Unit	NSW		Vic.		Qld		SA		WA		Tas.		Aus.	
Total cash receipts	\$	259 000	(35)	202 200	(23)	75 500	(15)	185 100	(13)	157 300	(17)	328 600	(6)	198 500	(18)
Honey	\$	209 500	(41)	141 500	(30)	52 700	(15)	152 700	(13)	137 000	(18)	270 600	(9)	156 400	(22)
Pollination	\$	23 500	(20)	27 000	(22)	6 400	(42)	24 500	(13)	5 100	(43)	20 400	(35)	19 500	(12)
Queen bees	\$	9 100	(24)	400	(67)	200	(99)	0	(0)	100	(94)	0	(0)	3 600	(23)
Bees wax	\$	4 000	(30)	2 100	(41)	1 800	(30)	2 900	(25)	2 000	(32)	1 700	(58)	2 900	(18)
Hives	\$	1 400	(56)	1 800	(93)	1 500	(66)	1 000	(70)	200	(94)	100	(62)	1 300	(36)
Packaged bees	\$	700	(78)	300	(85)	200	(92)	0	(0)	1 400	(77)	8 400	(68)	700	(40)
Other receipts	\$	10 900	(36)	29 100	(24)	12 700	(15)	4 100	(12)	10 800	(17)	27 400	(6)	14 100	(19)
Total cash costs	\$	174 600	(43)	109 500	(28)	52 300	(21)	112 100	(15)	108 000	(21)	234 500	(18)	128 100	(23)
Produce (purchased honey)	\$	53 200	(92)	25 400	(76)	400	(85)	10 400	(55)	19 800	(63)	7 700	(40)	28 400	(68)
Hired labour	\$	26 700	(33)	16 500	(37)	10 200	(49)	16 900	(38)	21 500	(34)	71 000	(17)	21 400	(18)
Repairs and maintenance	\$	14 100	(25)	13 000	(17)	5 500	(17)	15 700	(17)	15 900	(16)	23 900	(22)	13 000	(12)
Fuel, oil, grease	\$	14 200	(25)	9 700	(15)	6 200	(18)	15 600	(23)	6 600	(13)	7 200	(12)	11 300	(13)
Other cash costs	\$	66 600	(44)	45 500	(35)	30 100	(33)	53 700	(29)	44 300	(28)	124 600	(43)	54 200	(21)
Business cash income	\$	84 300	(28)	92 700	(20)	23 100	(22)	72 900	(18)	49 300	(33)	94 100	(51)	70 400	(14)
Depreciation	\$	26 300	(13)	26 400	(14)	13 800	(18)	22 800	(13)	19 700	(11)	24 300	(14)	22 900	(7)
Imputed labour	\$	50 800	(8)	44 200	(11)	37 200	(9)	45 000	(10)	50 600	(9)	38 600	(13)	45 900	(4)
Business profit	\$	7 300	(258)	22 100	(64)	-27 800	(22)	5 200	(212)	-21 000	(74)	31 200	(151)	1 600	(498)
Rate of return	%	5.0	(131)	9.6	(53)	-17.1	(20)	5.4	(94)	-4.7	(154)	17.9	(102)	3.3	(104)

Note: Figures in parentheses are relative standard errors (RSEs). A guide on how to use RSEs is in the survey methods and definitions section (Appendix A).

Source: ABARES Australian Honey Bee Industry Survey 2014–15

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