



Honey Bee Health Survey 2018

Improving national biosecurity outcomes through partnerships



Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of members and independently advocates on behalf of the national plant biosecurity system.

PHA's efforts help minimise plant pest impacts, enhance Australia's plant health status, assist trade, safeguard the livelihood of producers, support the sustainability and profitability of plant industries and the communities that rely upon them, and preserve environmental health and amenity.

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The Australian Honey Bee Industry Council (AHBIC) is the peak honey bee industry body that represents the interests of its member state beekeeping organisations and apiarists from around Australia

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Executive summary

The Honey Bee Health Survey 2018 examined the health of Australian honey bees, focusing on issues such as pests and diseases, pollination services and the level of biosecurity awareness amongst Australian beekeepers. The survey had 3927 participants representing ~15% of Australian beekeepers. Of these participants ~6% were defined being commercial beekeepers (50 or more hives) with ~94% being hobby beekeepers (less than 50 hives)¹.

Key findings include:

- During the 2017–18 financial year hobby beekeepers estimated 17% of hives were lost due to factors such as pests and diseases, overwintering and queen loss. Similarly, commercial beekeepers estimated 12% of hives were lost during the same period. In both cases pests and diseases were a major factor causing hive loss.
- Most commercial beekeepers had a below average (39%) or average (42%) honey crop during the 2017–18 financial year. Only 14% had an above average honey crop during this period.
- Almost half (46%) of commercial beekeepers provided paid pollination services during the 2017–18 financial year, with a further 9% providing unpaid pollination services.
- Most beekeepers (85%) have heard about the Australian Honey Bee Industry Biosecurity Code of Practice (Code of Practice).
- Forty percent of Australian beekeepers have completed pest and disease training (of any kind) in the last three years, though fewer beekeepers (32% of commercial and 7% of hobby beekeepers) have completed training approved under the Code of Practice.
- Most beekeepers (95%) inspected their hives for established pests and diseases (eg. American foulbrood, European foulbrood, chalkbrood, sacbrood, nosema, small hive beetle, wax moth) in the last 12 months, though fewer beekeepers (21%) are inspecting hives for exotic pests such as Varroa and Tropilaelaps mites.

¹ These definitions are in accordance with those outlined in the Australian Honey Bee Industry Biosecurity Code of Practice.

Introduction

Background and objectives

The Honey Bee Health Survey 2018 was designed to provide a snapshot of bee health in the Australian honey bee industry, focusing on issues such as pests and diseases and pollination. The survey also examined the level of knowledge of pest and disease symptoms and the Australian Honey Bee Industry Biosecurity Code of Practice, amongst Australian beekeepers. The survey follows on from the ABARES Australian Honey Bee Industry Survey 2014–15², and it is intended for the survey to be repeated at yearly intervals, providing a mechanism to monitor bee health and the level of biosecurity awareness amongst Australian beekeepers over multiple years.

The results obtained from this survey will assist in determining which biosecurity areas should be the focus for education and awareness activities by industry and government. The survey was supported by funding from AgriFutures Australia as part of the AgriFutures™ Honey Bee and Pollination Program as part of the project (PRJ-010226): “Improving Biosecurity Resources and Better Understanding Bee Health in Australia” and delivered by Plant Health Australia.

Survey design

The online survey consisted of 33 questions (see Appendix 2). Twenty-nine of these questions were multiple choice, though an ‘other’ option enabled participants to specify additional responses.

The online survey was designed using the web-based platform Survey Monkey. The survey was pilot tested by a small subset of beekeepers prior to its release, enabling refinement and fine-tuning of the questions. The survey was distributed electronically *via* a number of mechanisms including: the BeeAware website and newsletter; industry newsletters; Bee Biosecurity Officers; email; and social media platforms. The survey was open for eight weeks between 2 November and 31 December 2018.

Whilst electronic distribution was a cost-effective mechanism to ensure wide distribution of the survey, this distribution methodology is associated with some limitations. Primarily, the members of the beekeeping community who may have limited access or skill with using computers or the internet are less likely to participate in an online survey. A hard copy of the survey was available on request in order to address this limitation. Participation was voluntary and respondent anonymity was maintained during the collection and collation of the survey data.

Survey analysis

The Honey Bee Health Survey 2018 had 4645 participants. Partially completed surveys, defined as having more than four unanswered questions (excluding Q32 and Q33 which were considered non-essential responses), were removed prior to analysis, to ensure integrity of the dataset. A total of 3927 survey results were analysed following the removal of partially completed responses³. Commercial beekeepers were defined as having 50 or more hives, with hobby beekeepers defined as having less than 50 hives, as per the definitions outlined in the Australian Honey Bee Industry Biosecurity Code of Practice. A break down of participant numbers is presented in Appendix 1 (page 39).

The results from this survey are presented below. Where possible, comparisons with the results obtained from the the ABARES Australian Honey Bee Industry Survey 2014–15² have been made. The 2014–15 ABARES survey examined key issues relating to the honey bee industry amongst beekeepers who operated 50 or more hives including financial performance, provision of pollination services and the impact of pests and diseases.

² Australian Bureau of Agriculture and Resource Economics and Sciences. Australian honey bee industry: 2014-15 survey results. Accessed online 10 October 2019 <https://data.gov.au/dataset/ds-dga-e41d9562-9f5a-4932-b1cb-82e5c3461f30/details?q=>

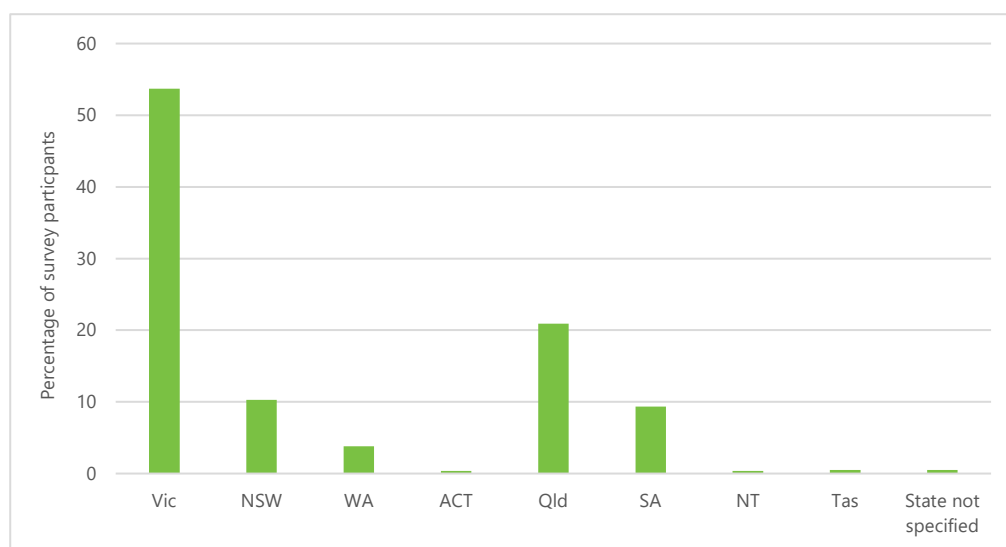
³ The overall survey margin of error (confidence interval) was calculated to be 1% assuming a confidence level of 95%.

Survey Results

Jurisdiction

The majority of survey participants were based in Victoria (54%), followed by Queensland (21%), New South Wales (10%), South Australia (9.5%) and Western Australia (4%). Lower levels of participation were observed in Tasmania (0.5%), Australian Capital Territory (0.4%) and Northern Territory (0.4%) reflecting the lower numbers of beekeepers present within these jurisdictions (**Figure 1**). There was a small number of participants (0.5%) who did not indicate which jurisdiction they were based in.

Figure 1: Percentage of survey participants based in each state/territory



Hobby vs Commercial

Of the 3927 survey participants, 244 (6.2%) were commercial beekeepers (defined as having 50 or more hives) with 3675 (93.6%) participants being hobby beekeepers (less than 50 hives)⁴. A small number of survey participants did not indicate hive number (0.2%). A breakdown of survey participants (hobby vs commercial beekeepers) is presented for each jurisdiction in (**Figure 2**). For each jurisdiction, hobby beekeepers comprised the majority of survey participants. Due to the small sample sizes for the Northern Territory and Tasmania results presented for these jurisdictions throughout the survey should be interpreted with caution.

Survey participation levels were also analysed based upon the number of registered beekeepers within each jurisdiction (**Figure 3**). The survey participants comprised ~15% of registered hobby beekeepers (less than 50 hives) and ~15% of registered commercial beekeepers (50 or more hives), though this value varied between jurisdiction.

⁴ The margin of error was calculated to be 6% for commercial beekeepers and 1% for hobby beekeepers assuming a confidence level of 95%.

Figure 2: Percentage of commercial and hobby beekeepers based in each state/territory

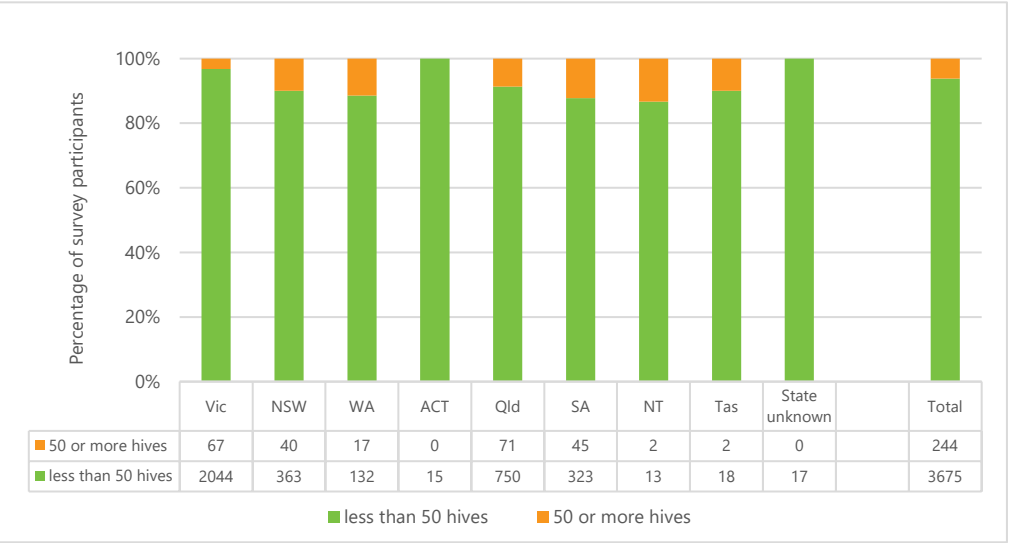
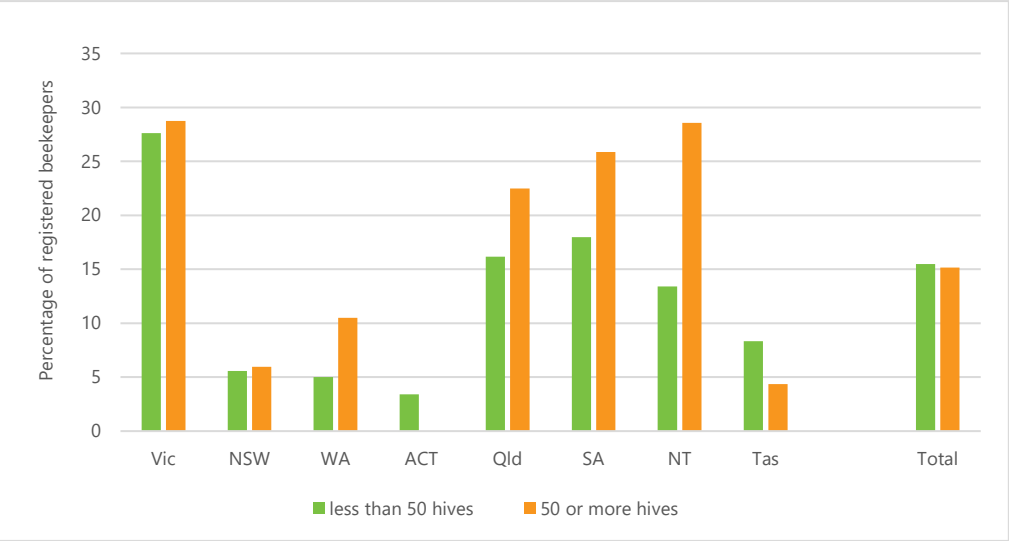


Figure 3: Survey participants as a percentage of number of registered beekeepers in each jurisdiction

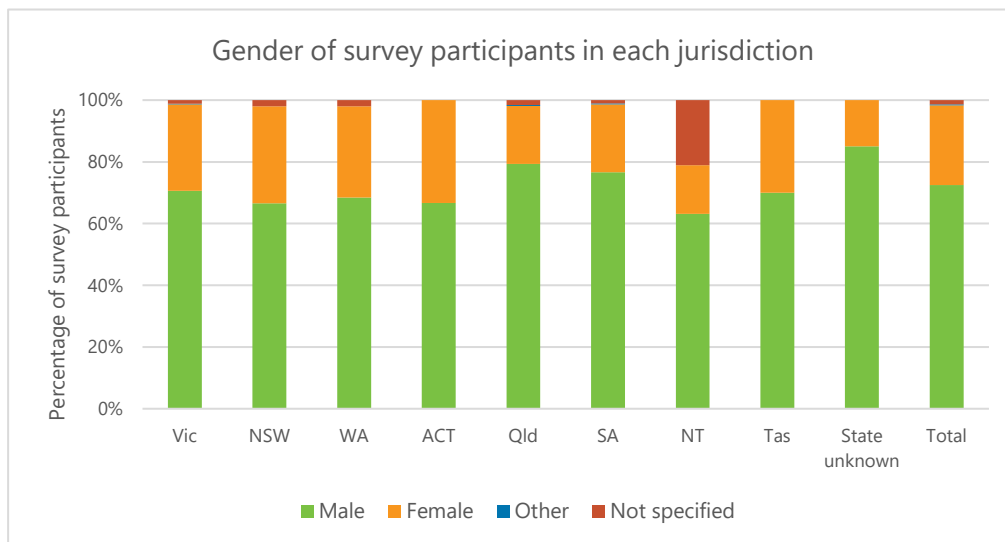


Participant gender

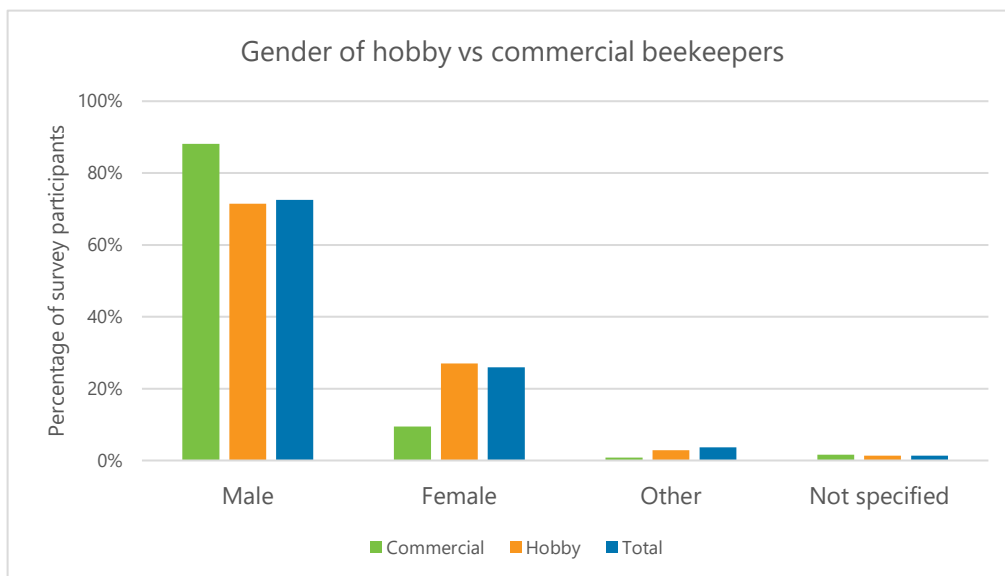
Participants were predominately male (73%) with lower numbers of female participants (26%). A small number of participants either identified as other (0.2%) or did not provide an answer (1.4%). Similar trends were present across the jurisdictions (**Figure 4A**). A slightly higher proportion of commercial beekeepers were male (~88%) comparatively to hobby beekeepers (~73%) (**Figure 4B**).

Figure 4: Gender of survey participants in each jurisdiction (A) and gender of hobby vs commercial beekeepers (B)

A.



B.

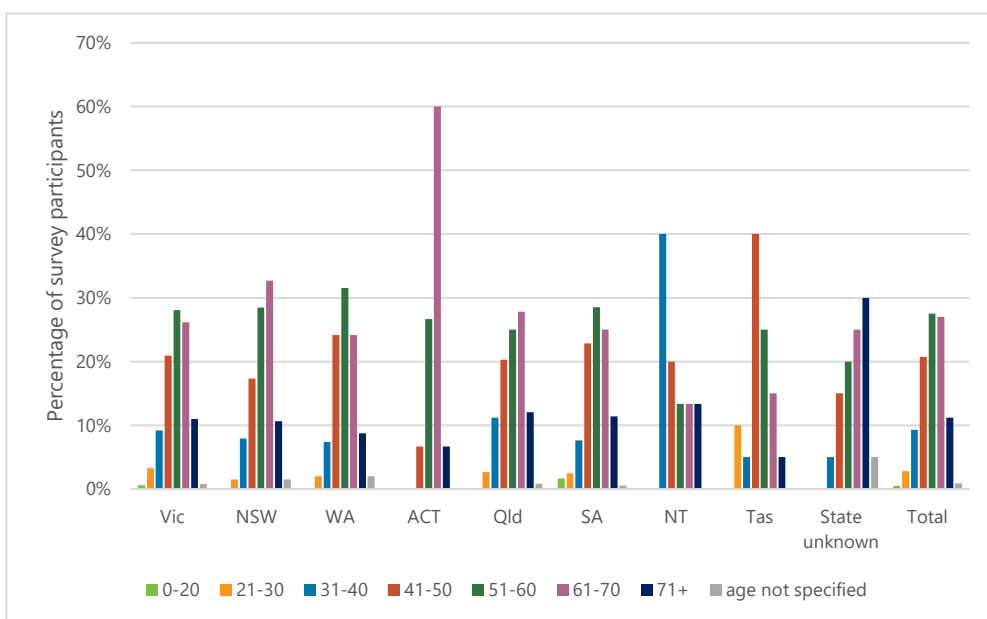


Participant age

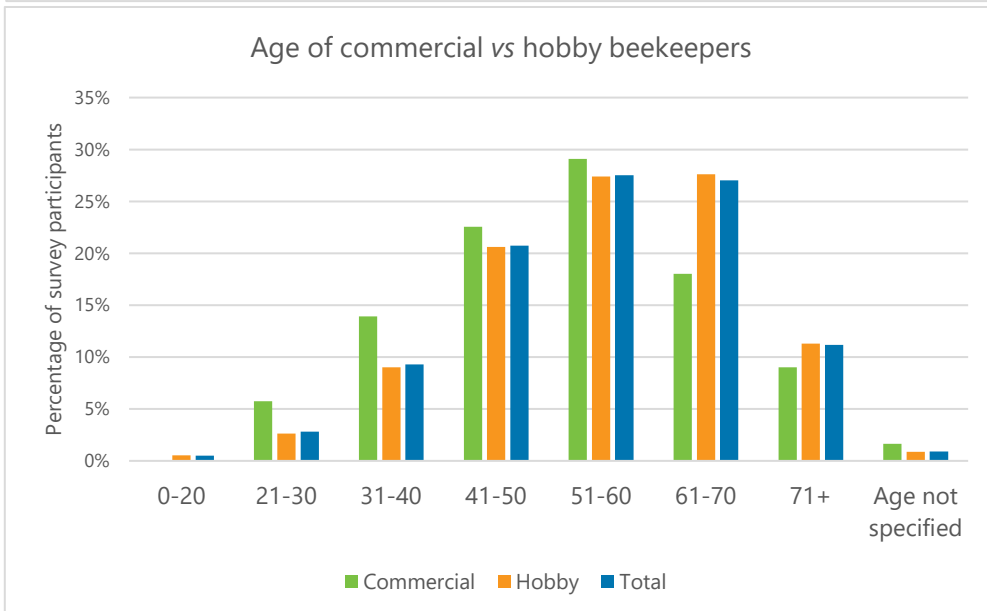
The majority of survey participants were aged over 51 years old (~66%), with most of these participants falling within the 51-60 (~27%) or the 61-70 (~27%) age groups. Only ~10% of participants were aged over 71 years old. Approximately 3.3% of survey participants were under 30 years old, with 30% of survey participants aged between 31-50. A small number of participants did not indicate their age (0.9%) (**Figure 5A**). Similar age distributions were observed between commercial and hobby beekeepers (**Figure 5B**).

Figure 5: Age of survey participants in each jurisdiction (A) and age of commercial vs hobby beekeepers (B)

A.



B.

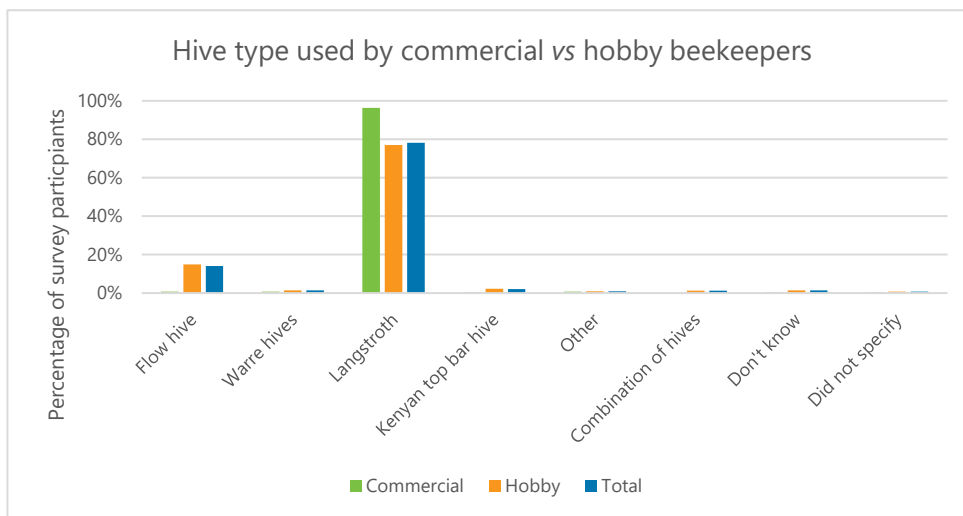


Type of hive used by participants

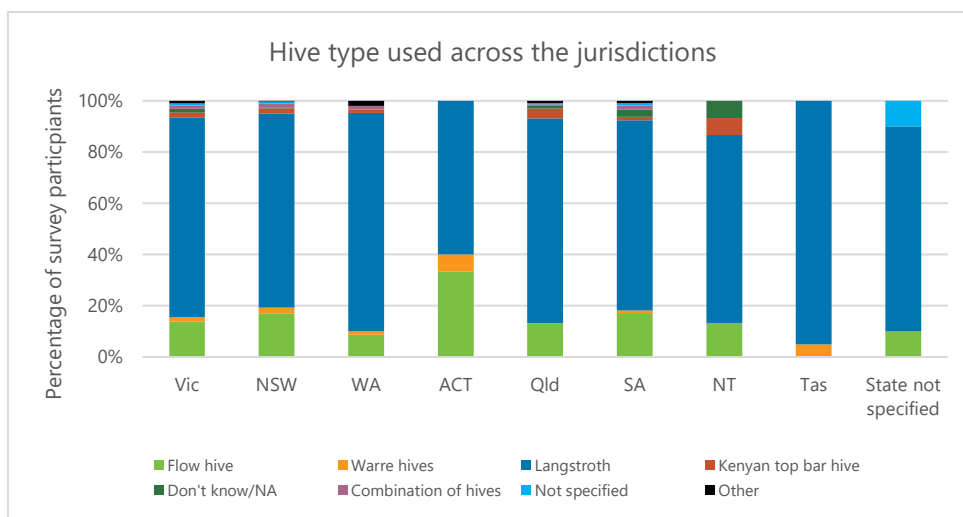
Approximately 78% of survey participants use Langstroth hives, with a smaller number of participants using flow hives (14%), Warré hives (1.5%) and Kenyan top bar hives (2%) (**Figure 6A**). A small proportion of survey participants either did not know what type of hive they used (1.4%), did not specify (0.8%) or used a combination of hive types (1.2%). A small number of participants used other types of hives that were not listed (0.9%) including; home-made hives, polystyrene/plastic hives, hybrid hives, horizontal/long Langstroth hives. Similar trends were reflected across the jurisdictions with Langstroth the main type of hive used in all jurisdictions (**Figure 6B**). The majority of commercial beekeepers (~96%) indicated that they used Langstroth hives comparatively to hobby beekeepers (~77%) (**Figure 6A**).

Figure 6: Main hive type used by survey participants (A) and survey participants in each jurisdiction (B)

A.



B.



Pollination services

Honey bees are important pollinators of agricultural crops in Australia, with 35 industries including almonds, avocados, apples, pears and cherries, reliant upon pollination by honey bees for majority of production⁵. Six percent of survey participants provided pollination services during the 2017–18 financial year (**Figure 7**), with the majority of these being commercial beekeepers (60%) (**Figure 8**). Only a small number of participants from Tasmania and Northern Territory provided pollination services, so the results presented for these jurisdictions should be interpreted with caution.

Figure 7: Percentage of participants providing pollination services across the jurisdictions.

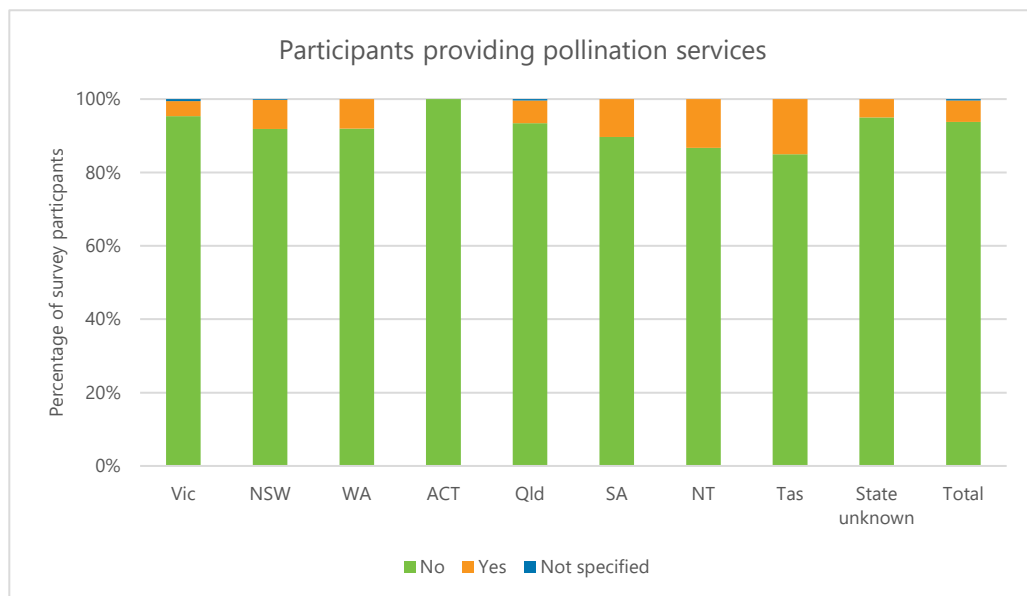
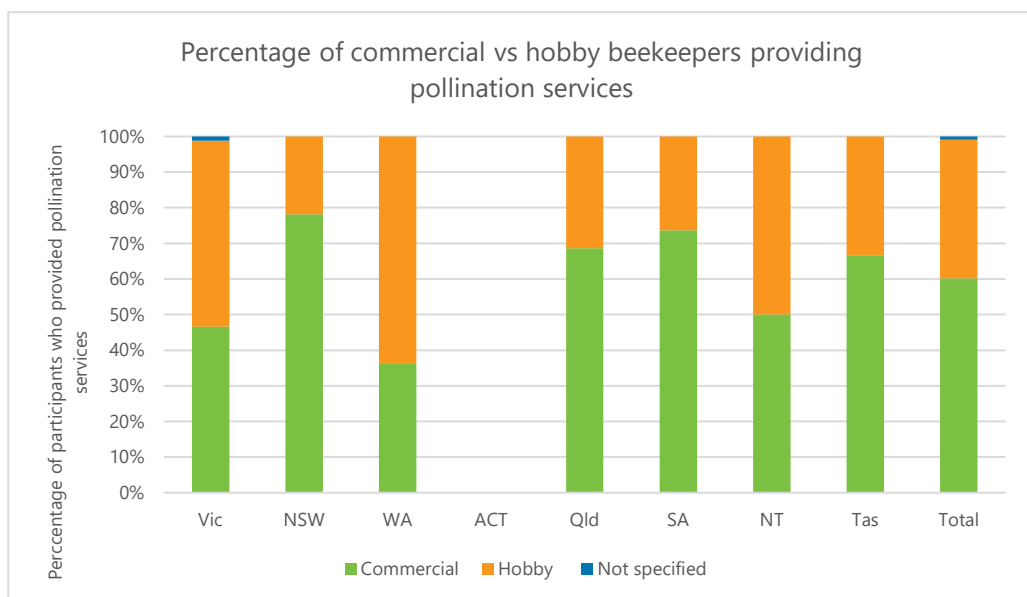


Figure 8: Breakdown of participants (hobby vs commercial) who provided pollination services across the jurisdictions



⁵ RIRDC Pub. no. 13/115. Pollination Factsheet: The real value of pollination

Crops pollinated

A breakdown of the major crops beekeepers in each jurisdiction provided pollination services for is presented in **Figure 9**. Almonds were the major crop pollinated by Victorian, New South Wales and South Australian beekeepers, whereas macadamias were the major crop pollinated by Queensland beekeepers. In Western Australia, avocados were the major crop, with apples and cherries the major crops pollinated by Tasmanian beekeepers⁶.

Other crops pollinated by survey participants include: cucumbers, alfalfa, chickpeas, beans, mung beans, faba beans, vetch, citrus, dill, Chinese radish, parsnip, fennel, brassica (including cabbage), clover, kiwi fruit, sunflowers, lavender, pomegranate, lychee, mangoes, pumpkin, onion, peas, passionfruit, carrots, zucchini, grapes, local vegetable gardens, community gardens, tea tree, fruit orchards, feijoa and paw paw. Three participants did not indicate which crops they provided pollination services for.

These results are broadly similar to those obtained in the ABARES Australian Honey Bee Industry Survey 2014–15², which examined the types of crops pollinated by commercial beekeepers who were paid for their services. In that survey, almonds were identified as the major crop pollinated in NSW and Victoria, with almonds, lucerne and oilseeds the major crops pollinated in South Australia. In Western Australia, fruits (including cherries and pome fruits) and vegetables were identified as the major crops pollinated, with cherries, vegetables and pome fruits pollinated in Tasmania. The 2014–15 ABARES survey identified vegetables as the major crop pollinated by commercial beekeepers in Queensland, which is in contrast to the current study where macadamias were identified as the major crop. Whilst this could be a reflection of the growth of the macadamia industry in Queensland⁷, it should be noted that the current study included responses from beekeepers who were both paid and unpaid for their services, which may have influenced results. Furthermore, other factors such as drought and other extreme weather conditions may have influenced the types of crops pollinated during the 2017-18 financial year.

⁶ Beekeepers often travel large distances to provide pollination services – often crossing into other jurisdictions to do so.

⁷ <https://beeaware.org.au/pollination/pollinator-reliant-crops/macadamias/>

Figure 9: Major crops pollinated by beekeepers in each jurisdiction. Note berries represents blueberries, strawberries and raspberries.



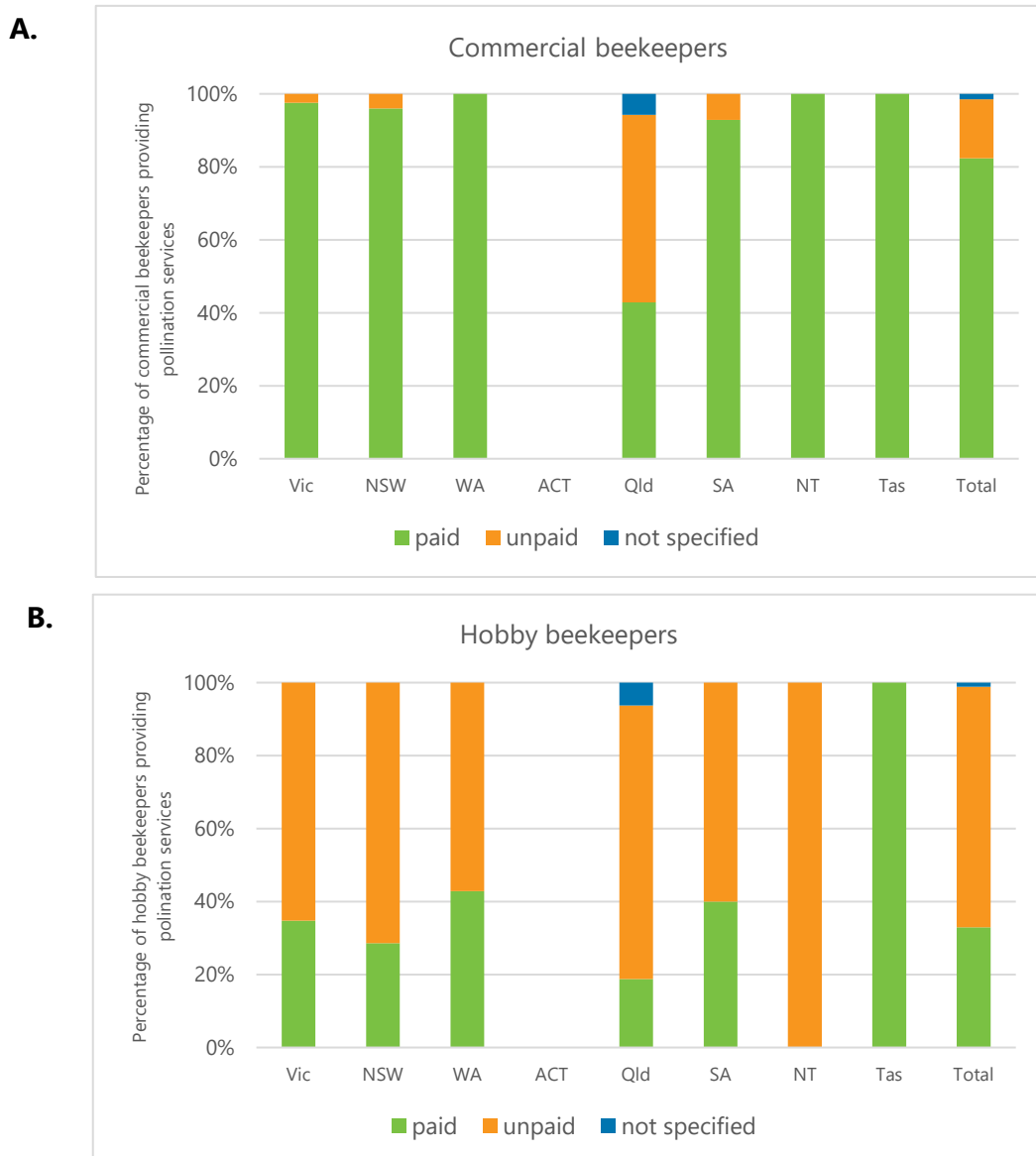
Paid pollination services

For those commercial beekeepers providing pollination services, the majority were paid for these services (~80%) (**Figure 10A**). This trend was reflected across the jurisdictions, except for Queensland where only ~43% of commercial beekeepers were paid for the pollination services they provided. The majority of hobby beekeepers providing pollination services were not paid for these services (~67%) (**Figure 10B**).

In total 46% of all commercial beekeepers provided paid pollination services during the 2017–18 financial year, with 9% providing unpaid pollination services. This is consistent with results obtained from the ABARES Australian Honey Bee Industry Survey 2014–15² where 44% of beekeepers with more than 50 hives provided paid pollination services and 12% provided unpaid (in kind) pollination services in the 2014–15 financial year.

In total less than 1% of all hobby beekeepers provided paid pollination services with 1.6% providing unpaid pollination services.

Figure 10: Percentage of commercial (A) and hobby (B) beekeepers who were paid for the pollination services they provided

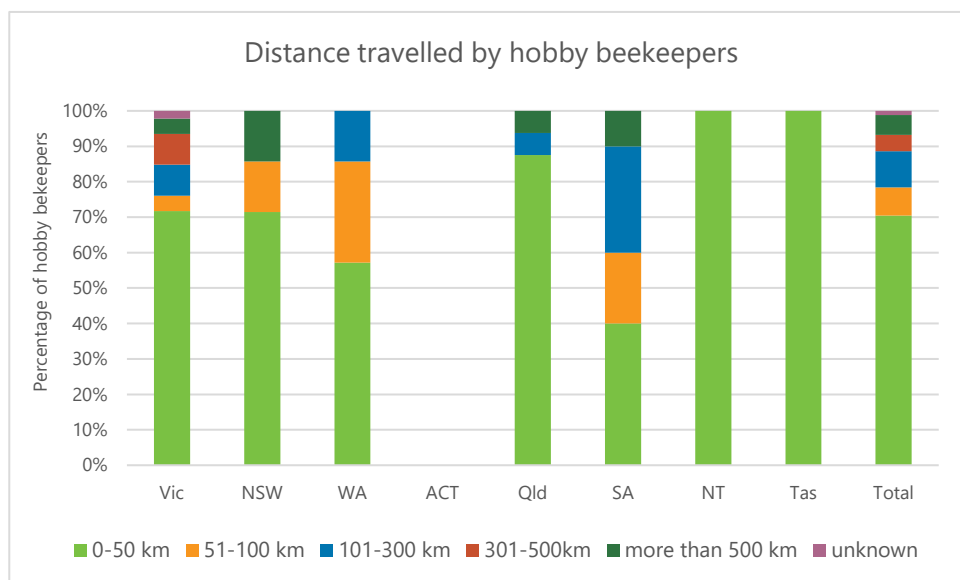


Distance travelled to provide pollination services

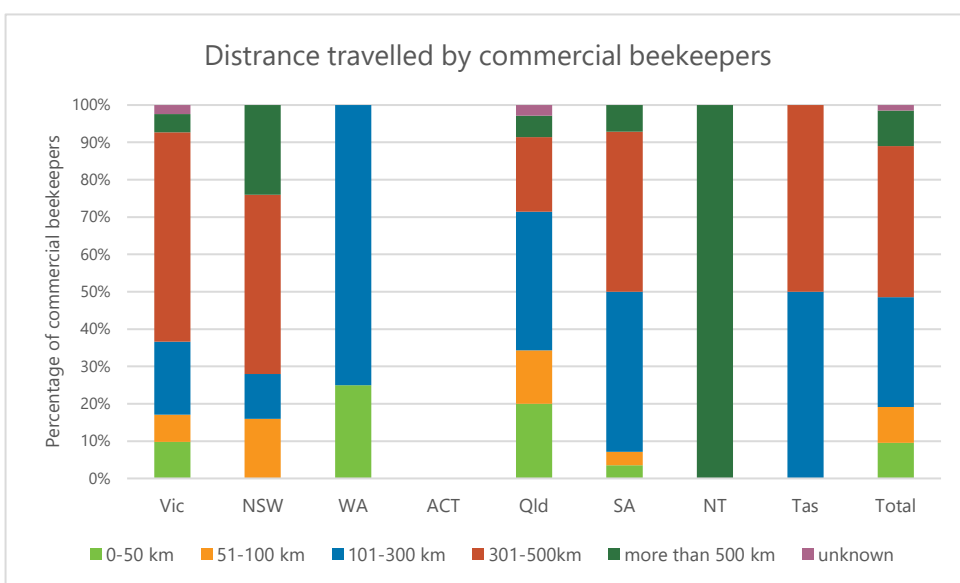
Most hobby beekeepers (~70%) travelled under 50 km to provide pollination services (paid and unpaid), this trend is for the most part reflected across the jurisdictions (**Figure 11A**). Commercial beekeepers generally travelled further distances to provide pollination services (paid and unpaid) with the majority (80%) of commercial beekeepers travelling over 101km (**Figure 11B**). These results are similar to the ABARES Australian Honey Bee Industry Survey 2014–15², which indicated that approximately 50% of beekeepers with more than 50 hives, travelled between 85 and 400 kilometres to provide paid pollination services.

Figure 11: Distance travelled by hobby (A) and commercial (B) beekeepers to provide pollination services

A.



B.



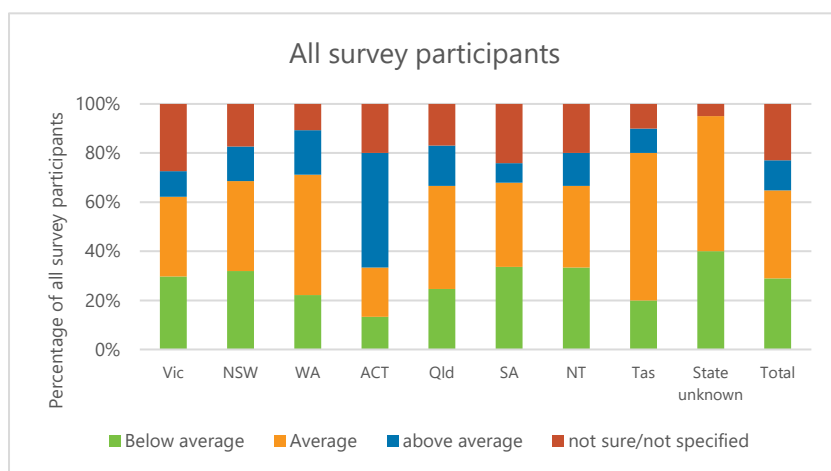
Honey crop

The majority of survey participants had a below average (~29%) or average (~35%) honey crop in the 2017–18 financial year (**Figure 12A**). Only ~12% of participants indicated that their honey crop was above average. Approximately 23% of survey participants indicated that they were unsure or did not provide an answer. This trend was similar across the jurisdictions, with the exception of the ACT, where a higher proportion of participants (~47%) indicated their honey crop was above average in the 2017–18 financial year.

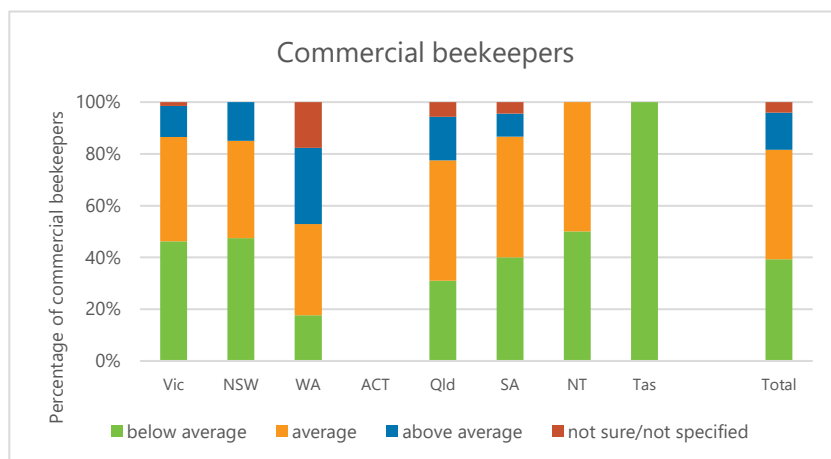
Approximately 39% of commercial beekeepers had a below average honey crop during the 2017–18 financial year, with 42% indicating their crop was average (**Figure 12B**). Only 14% had an above average honey crop during the 2017–18 financial year. A small percentage of survey participants (<1%) did not specify. Similar trends were observed between commercial (**Figure 12B**) and hobby (**Figure 12C**) beekeepers.

Figure 12: honey crop during the 2017-18 financial year for all survey participants (A), commercial beekeepers (B) and hobby beekeepers (C)

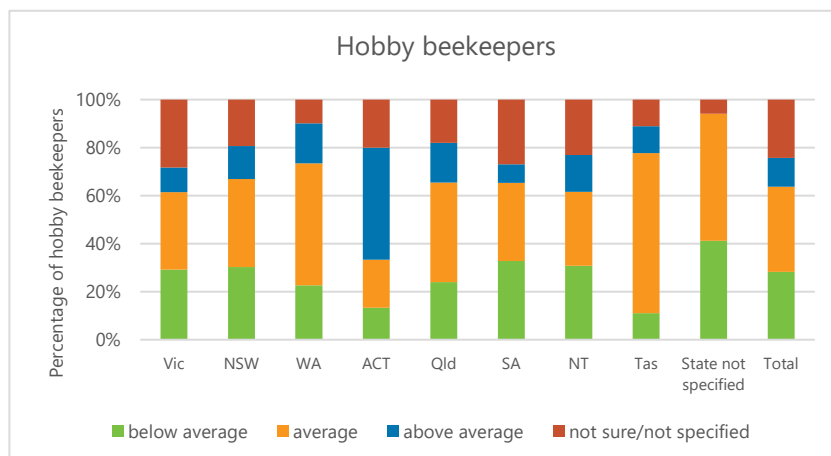
A.



B.



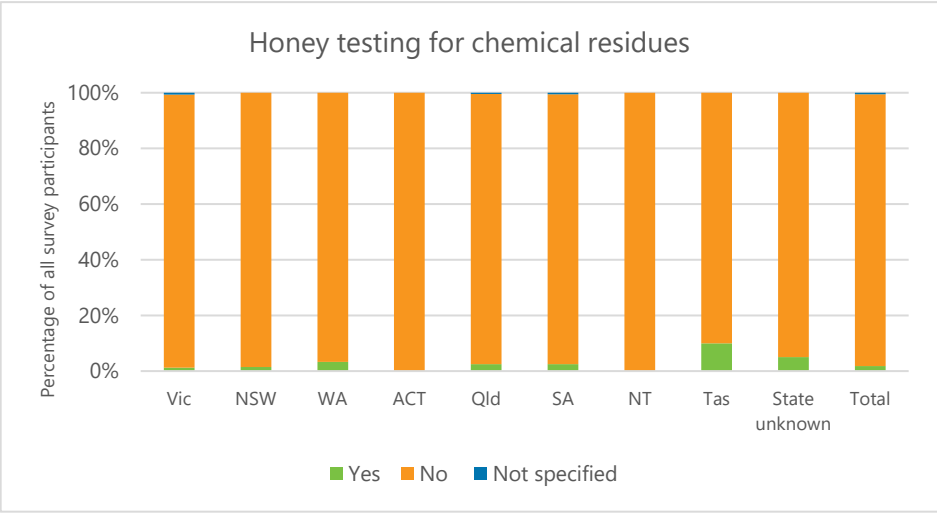
C.



Testing for chemical residues (eg. pesticides, fungicides, herbicides)

Most survey participants (98%) did not have their honey tested for chemical residues (e.g. pesticides, fungicides, herbicides) during the 2017–18 financial year (**Figure 13**). Of those participants who had their honey tested, ~43% were commercial beekeepers. Most participants (60%) had their honey tested once during the 2017–18 financial year. Approximately 15% of survey participants had their honey tested 2-4 times, with a small number (4%) undergoing honey testing five or more times. The remaining participants either did not provide a response (14%); or indicated that testing was undertaken by honey packers (9%). It should be noted that honey packers regularly test honey for chemical residues, and that the results of this survey likely reflect beekeepers being unaware that honey testing is being performed, as beekeepers are only advised if there is a positive result.

Figure 13: Honey testing for chemical residues



Australian Honey Bee Industry Biosecurity Code of Practice

Approximately 85% of survey participants have heard about the Australian Honey Bee Industry Biosecurity Code of Practice (the Code) (**Figure 14A**). A slightly higher percentage of commercial beekeepers (**Figure 14B**) indicated that they had heard about the Code when compared to hobby beekeepers (91% vs 84%) (**Figure 14C**).

Figure 14: Percentage of all survey participants (A), commercial (B) and hobby (C) beekeepers who have heard about the Australian Honey Bee Industry Biosecurity Code of Practice in each of the state/territory jurisdictions.

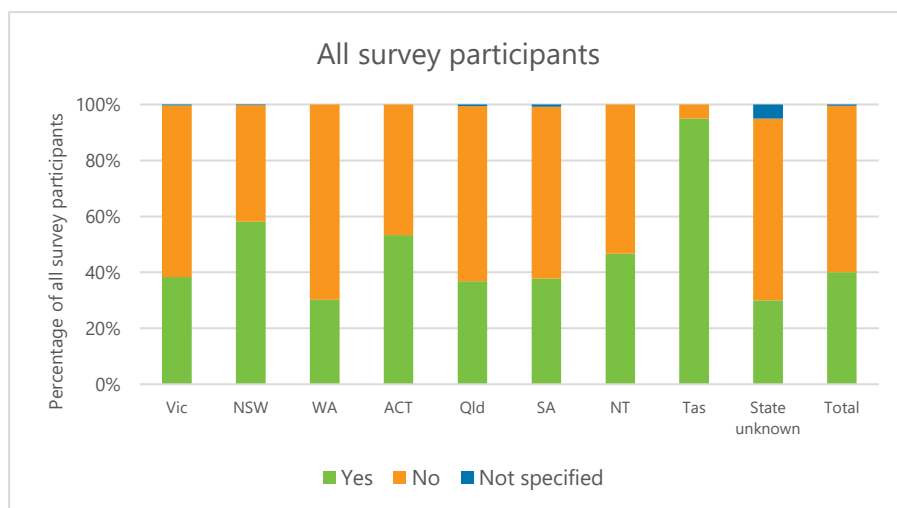


Pest and disease training completed in the last three years

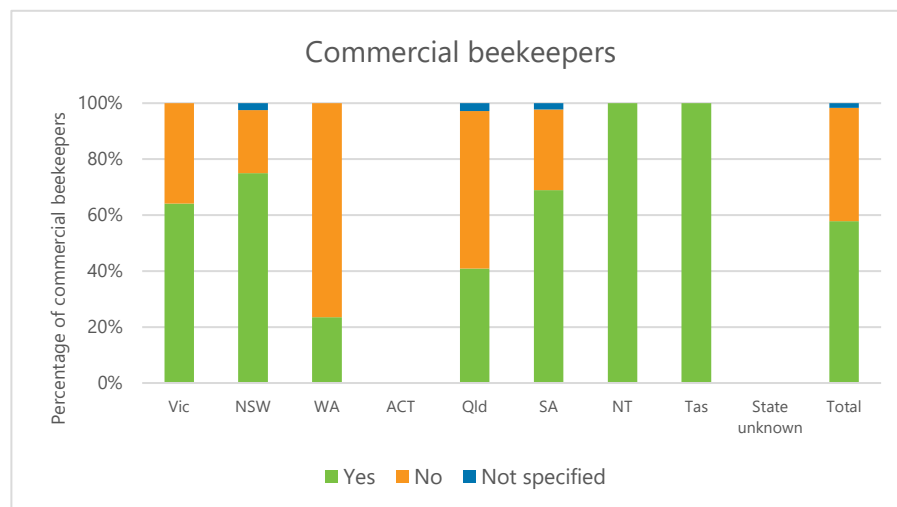
Forty percent of survey participants indicated that they had completed pest and disease training (of any kind) in the last three years (**Figure 15A**). This trend was similar across most of the jurisdictions, with the exception of Tasmania where 95% of participants indicated that they had undertaken training. A slightly higher percentage of commercial beekeepers (~60%; **Figure 15B**) had performed training (of any kind) in the last three years compared to hobby beekeepers (~39%; **Figure 15C**).

Figure 15: Pest and disease training completed in the last three years by all survey participants (A), commercial (B) and hobby (C) beekeepers.

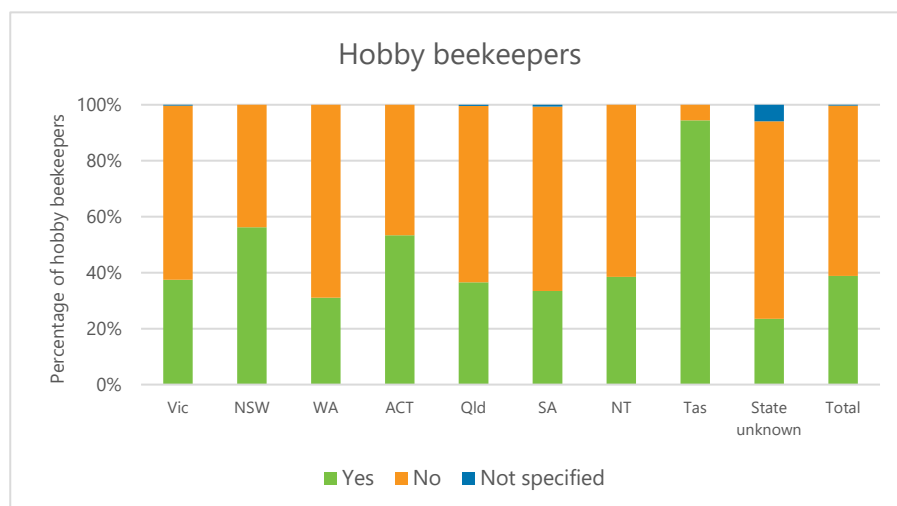
A.



B.



C.



Type of training completed in the last three years

Under the Australian Honey Bee Industry Biosecurity Code of Practice, beekeepers with 50 or more hives are required to complete approved pest and disease training within three years of implementation of the Code of Practice (2016) and then every three years thereafter. The *Biosecurity for Beekeepers* online BOLT course, Pests and diseases of honey bees (AHCBEK306⁸) and Certificate III in Beekeeping⁹ and are all approved pest and disease training under the Code of Practice. Approximately 32% of commercial beekeepers indicated that they had completed approved training in the last three years (note: approved means *Biosecurity for Beekeepers* online BOLT course; Certificate III in Beekeeping; or Pests and diseases of honey bees (AHCBEK306)) (**Figure 16A**). Other types of informal pest and disease training were also completed by commercial beekeepers in the last three years; Bee Biosecurity Awareness online BOLT course (12%); Training or presentation given by Bee Biosecurity Officer (22%); Field day demonstration (23%); Training at local beekeeping club (11%); and other training (including books, online research and mentoring; 11%).

Hobby beekeepers with less than 50 hives are not required to complete approved pest and disease training every three years under the Code of Practice. As such, lower numbers of hobby beekeepers (7%) completed approved training in the last three years (*Biosecurity for Beekeepers* online BOLT course; Certificate III in Beekeeping; or Pests and diseases of honey bees (AHCBEK306)) (**Figure 16B**). Informal pest and disease training was also completed by hobby beekeepers in the last three years including; Bee Biosecurity Awareness online BOLT course (2.4%); Training or presentation given by Bee Biosecurity Officer (9%); Field day demonstration (13%); Training at local beekeeping club (26%); and other training (including books, online research and mentoring; 7%).

Figure 16: Type of pest and disease training completed by commercial beekeepers (A) and hobby beekeepers (B) in the last three years



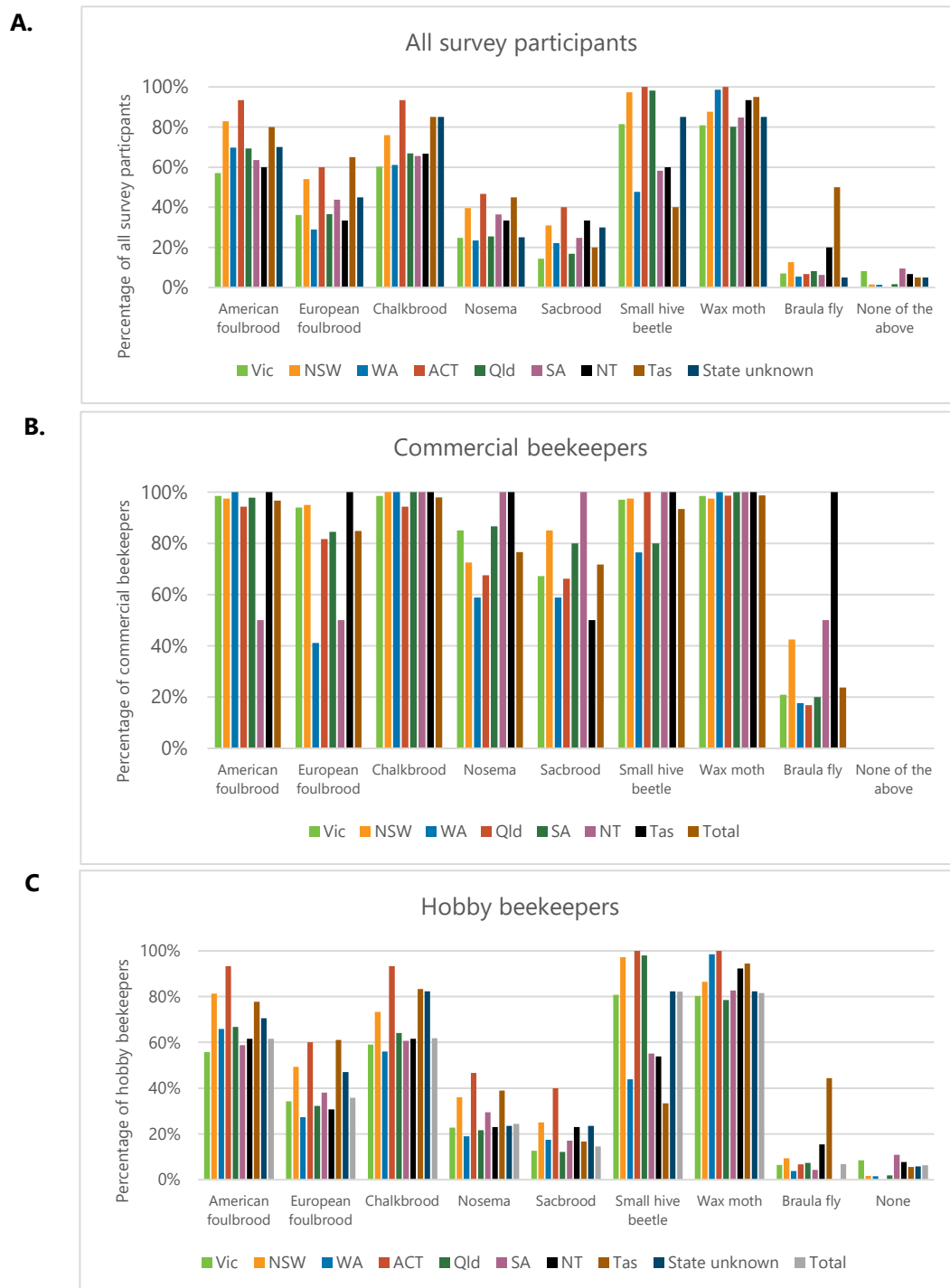
⁸ Note that AHCBEK306 (Manage pests and disease within a honey bee colony) was superseded by AHCBEK313 in 2018

⁹ Note that AHC32016 (Certificate III in Beekeeping) was superseded by AHC31818 in 2018

Identification of established pests and diseases

Over 97% of commercial beekeepers said that they could identify American foulbrood, chalkbrood, and wax moth. A high percentage of commercial beekeepers also could identify small hive beetle (93%), European foulbrood (85%), nosema (76%) and sacbrood (72%). A much lower percentage of beekeepers could identify braula fly (23%), with the exception of Tasmania where 100%¹⁰ of commercial beekeepers could identify this pest which is established in Tasmania. Lower percentages of hobby beekeepers could identify American foulbrood (61%), chalkbrood (62%), wax moth (81%), small hive beetle (82%), European foulbrood (36%), nosema (25%) or sacbrood (14%), braula fly (6%). A small percentage (6%) of hobby beekeepers claimed that they could not identify any of these established pests (**Figure 17**).

Figure 17: Percentage of all survey participants (A), commercial (B) and hobby (C) beekeepers who can identify established pests



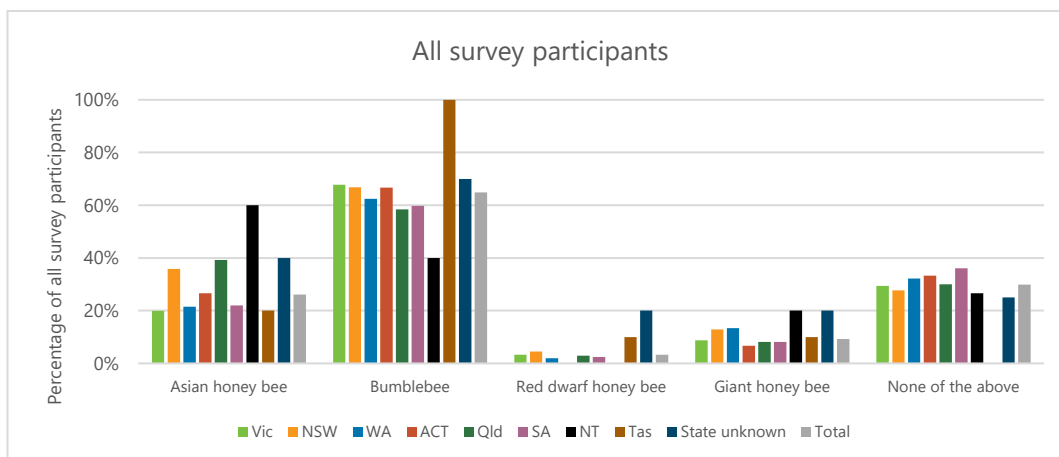
¹⁰ Note that only two commercial beekeepers from Tasmania participated in the Honey Bee Health Survey 2018, therefore results should be interpreted with caution.

Identification of exotic bees

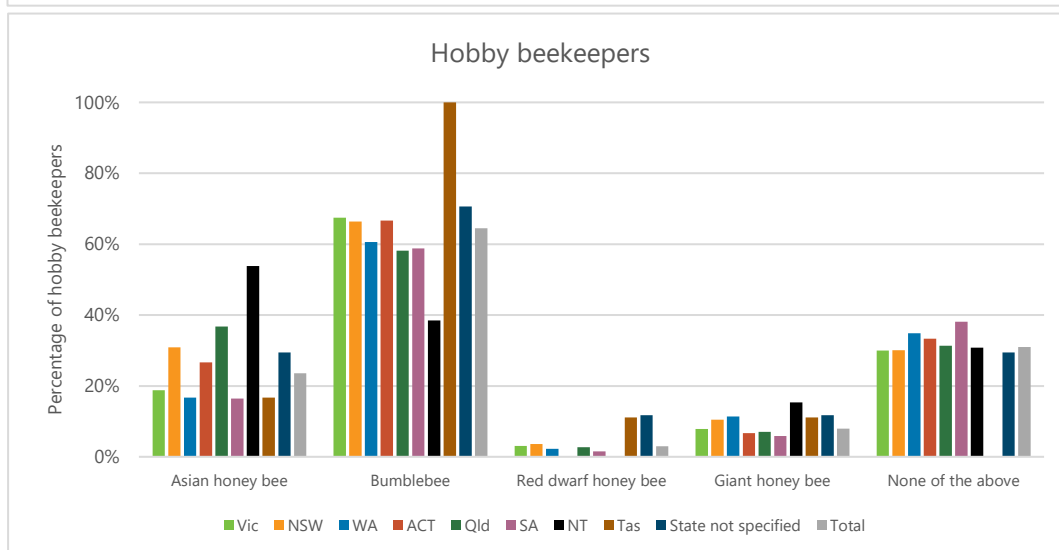
A high percentage of commercial beekeepers could identify bumblebee (70%) and Asian honey bee (65%), with a smaller number of participants able to identify red dwarf honey bee (8%) and giant honey bee (28%). Approximately 14% of commercial beekeepers could not identify any of these exotic bees (**Figure 18C**). A high percentage of hobby beekeepers could also identify bumblebee (64%), with lower numbers of participants able to identify Asian honey bee (24%); red dwarf honey bee (3%) and giant honey bee (8%). Approximately 30% of hobby beekeepers said that they could not identify any of these exotic bee pests (**Figure 18B**).

Figure 18: Percentage of all survey participants (A), hobby (B) and commercial (C) beekeepers who can identify exotic bee pests

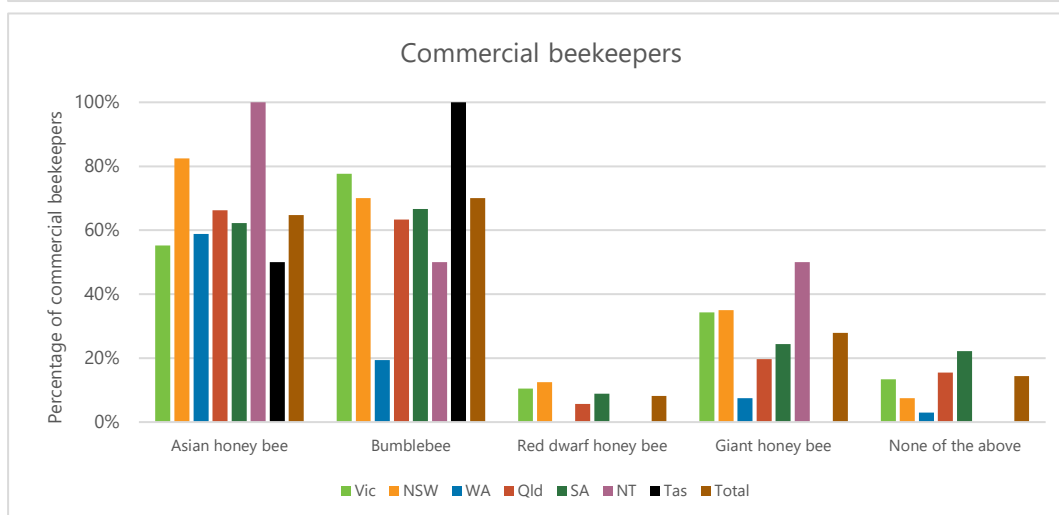
A.



B.



C.

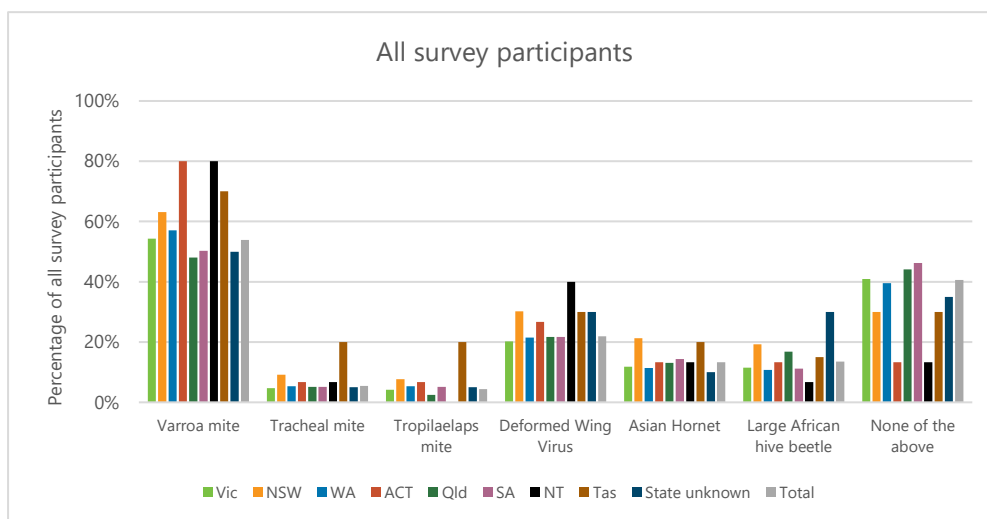


Identification of exotic pests and diseases

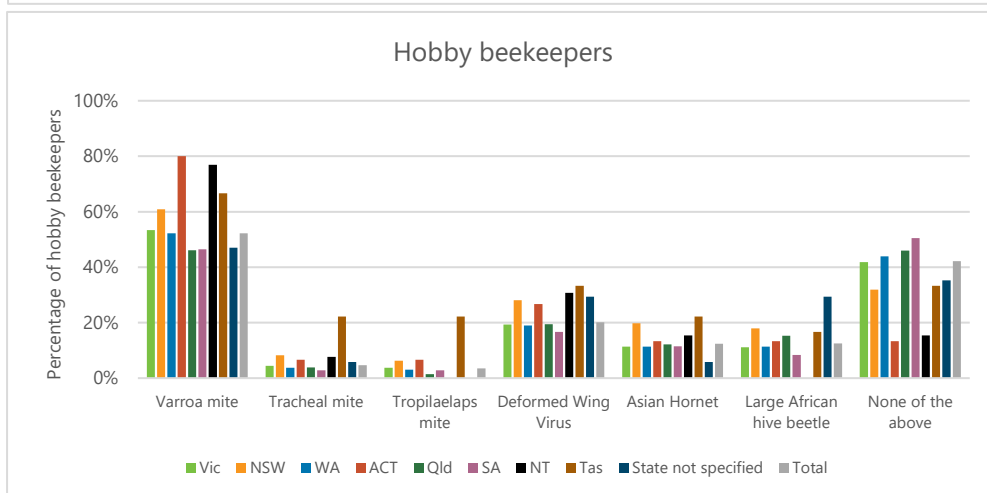
A large percentage of both hobby (~53%) and commercial (~79%) beekeepers could identify Varroa mites (**Figure 19**). Lower numbers of hobby beekeepers could identify tracheal mite (4%), tropilaelaps mite (3%), symptoms of deformed wing virus (20%), Asian hornet (12%) and large African hive beetle (12%). Similarly, lower numbers of commercial beekeepers could identify tracheal mite (18%), tropilaelaps mite (17%), deformed wing virus (48%), Asian hornet (27%), and large African hive beetle (28%). Approximately 42% of hobby beekeepers and 16% of commercial beekeepers could not identify any of these exotic pests and diseases.

Figure 19: Percentage of all survey participants (A), hobby (B) and commercial (C) beekeepers who can identify exotic pests and diseases

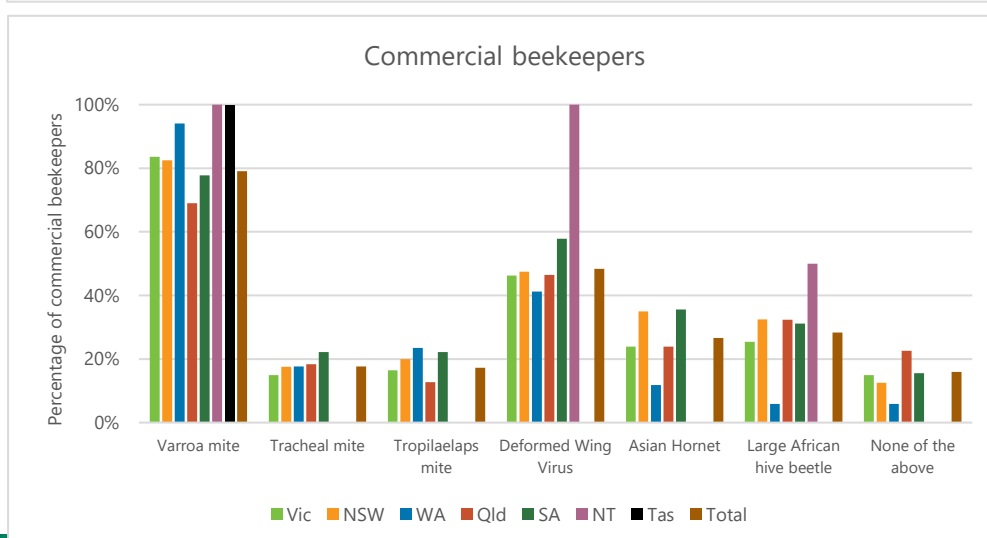
A.



B.



C.

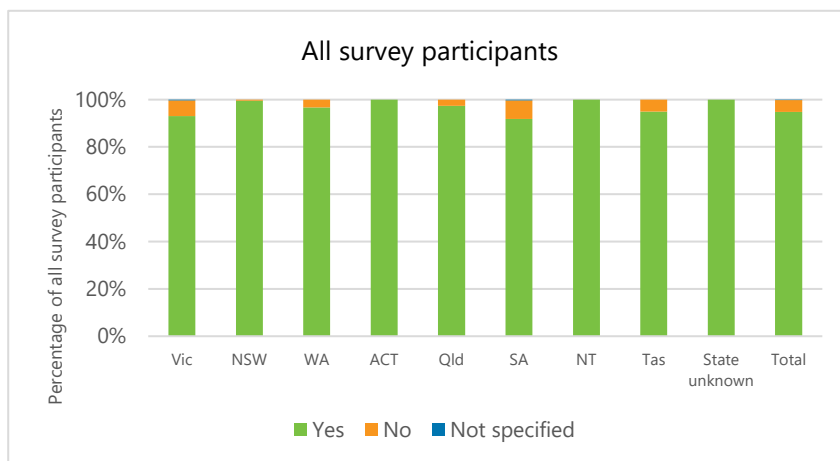


Hives inspected for established pests and diseases in the last twelve months

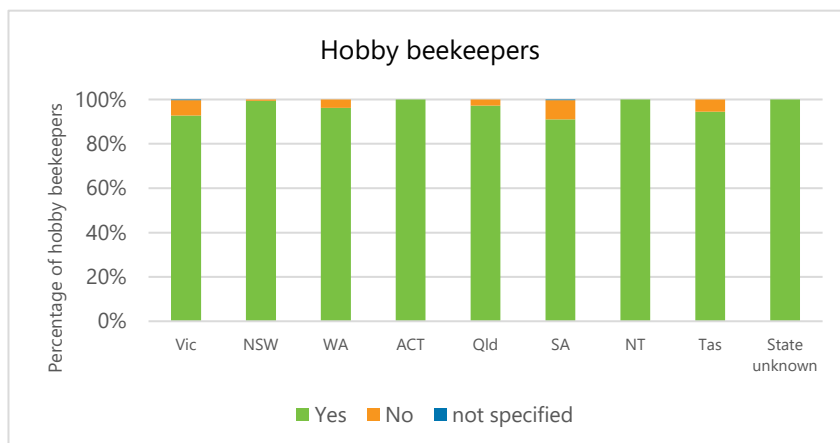
Approximately 95% of survey participants inspected their hives for established pests and diseases (eg. American foulbrood, European foulbrood, chalkbrood, sacbrood, nosema, small hive beetle, wax moth) in the last 12 months (**Figure 20A**). With a slightly higher percentage of commercial beekeepers (~99%; **Figure 20C**) compared to hobby beekeepers (~95%; **Figure 20B**) inspecting their hives for pests and diseases in the last 12 months.

Figure 20: Percentage of all survey participants (A), hobby (B) and commercial (C) beekeepers that had inspected their hives for established pests and diseases in the last 12 months.

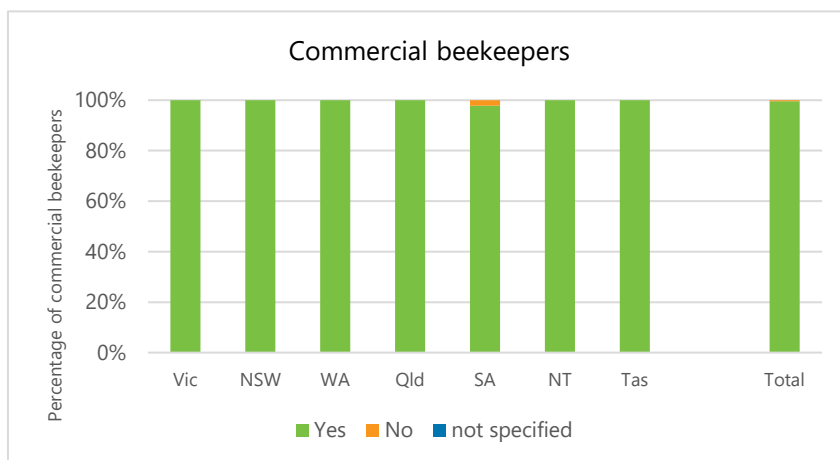
A.



B.

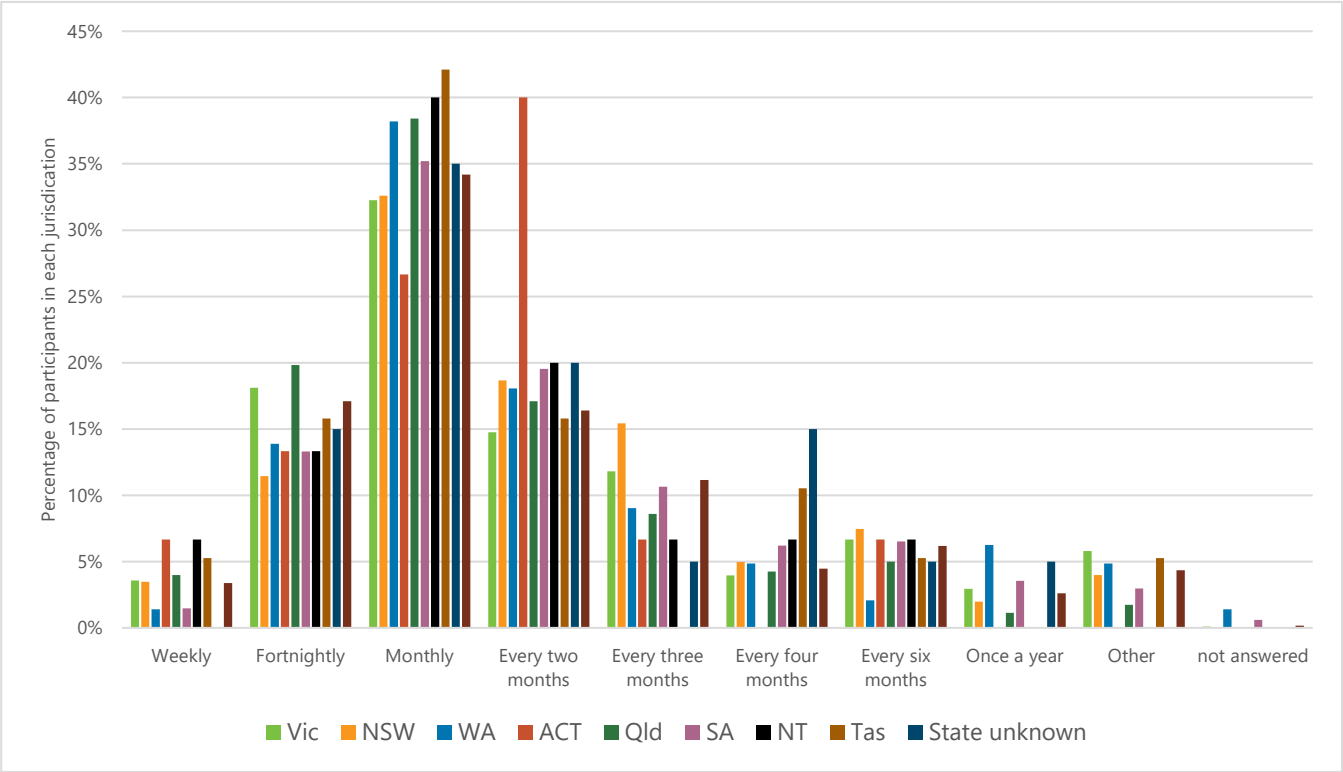


C.



Most beekeepers inspect their hives for pests and diseases on a fortnightly (17%), monthly (34%) or two-monthly basis (16%) (**Figure 21**). These results are in accordance with the Australian Honey Bee Industry Biosecurity Code of Practice (Section 3.1) which requires beekeepers to visually inspect hives for pests and diseases at least twice each year, at a minimum of four consecutive calendar months apart.

Figure 21: Frequency that beekeepers inspect hives for pests and diseases within each jurisdiction

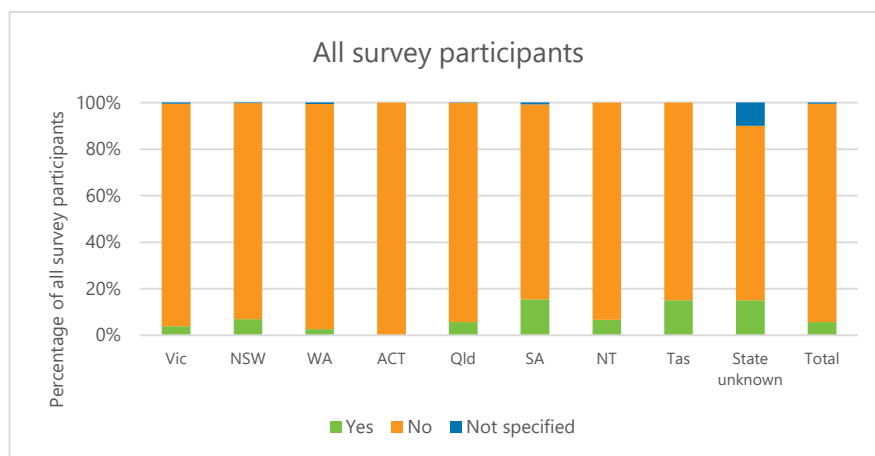


Honey tested for American foulbrood in the last 12 months

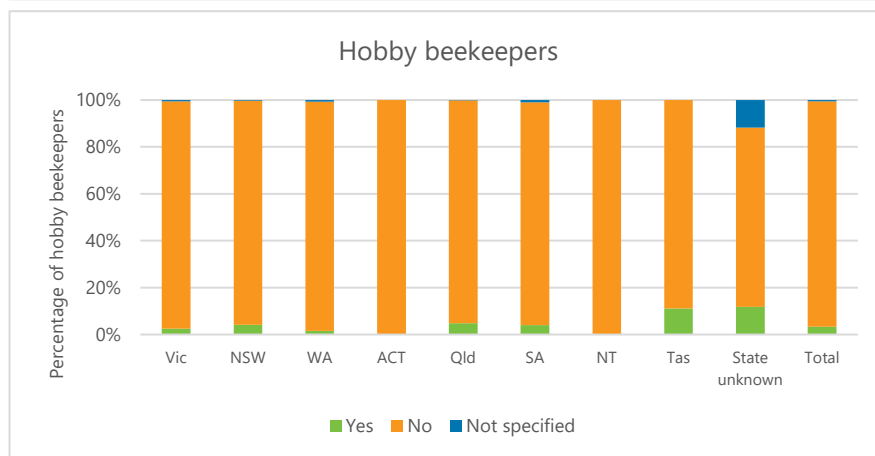
American foulbrood (AFB) is a bacterial disease of honey bee brood caused by the spore forming bacterium *Paenibacillus larvae*. AFB is present throughout Australia; however, it has not been reported or confirmed in the NT. The Australian Honey Bee Industry Biosecurity Code of Practice requires beekeepers with 50 or more hives to test their honey annually for American foulbrood (AFB). Forty percent of commercial beekeepers had their honey tested for AFB in the last 12 months, though results differed across the jurisdictions (**Figure 22C**). In South Australia, 98% of commercial beekeepers performed honey testing for AFB in the last 12 months. Lower numbers of commercial beekeepers in Queensland (~18%) and Western Australia (~11%) tested their honey for AFB compared to other jurisdictions (Victoria 42%; New South Wales 33%; Northern Territory 50%; Tasmania 50%). Only three percent of hobby beekeepers had their honey tested for AFB in the last 12 months (**Figure 22B**).

Figure 22: Percentage of all survey participants (A), hobby (B) and commercial (C) beekeepers that performed honey testing for American foulbrood in the last 12 months.

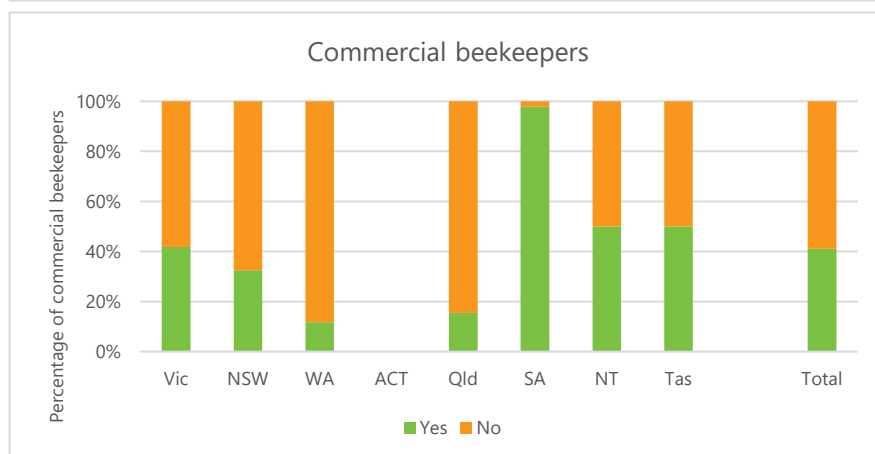
A.



B.



C.

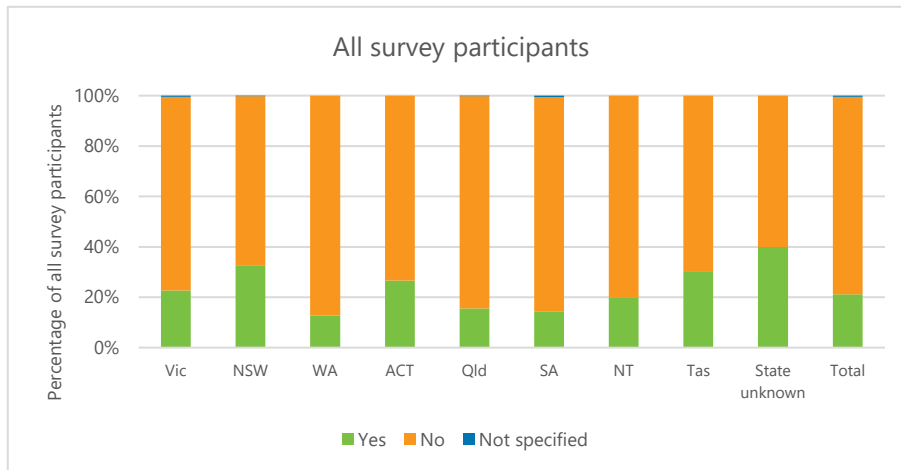


Hives inspected for for exotic pests like Varroa and Tropilaelaps mites using sugar shake, alcohol wash or drone uncapping in the last twelve months

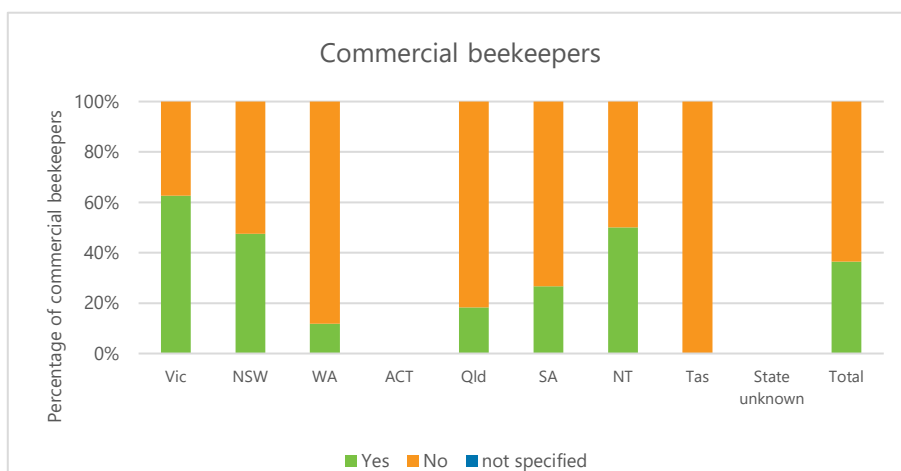
Approximately 21% of survey participants inspected their hives for exotic pests for Varroa and Tropilaelaps mites using sugar shake, alcohol wash or drone uncapping in the last 12 months (**Figure 23A**). With a slightly higher percentage of commercial beekeepers (~36%; **Figure 23B**) compared to hobby beekeepers (~20%; **Figure 23C**) inspecting their hives for exotic pests for Varroa and Tropilaelaps mites in the last 12 months.

Figure 23: Percentage of all survey participants (A), commercial (B) and hobby (C) beekeepers that have inspected hives for exotic pests for Varroa and Tropilaelaps mites using sugar shake, alcohol wash or drone uncapping in the last 12 months

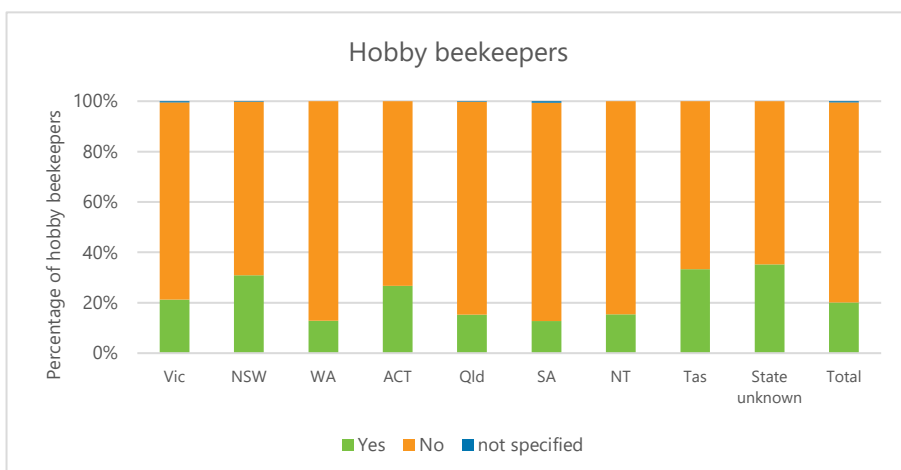
A.



B.



C.



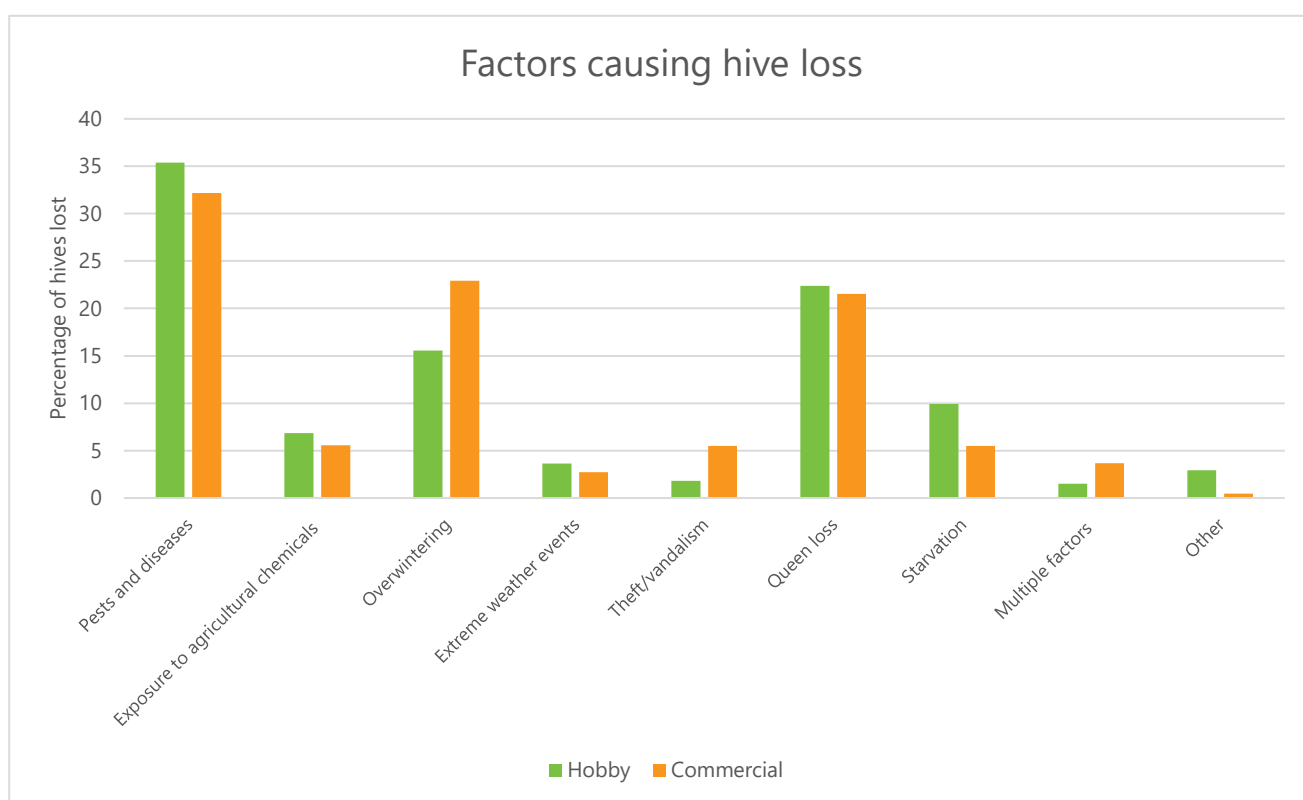
Factors causing hive losses

Overall hobby beekeepers estimated approximately 17% of hives were lost during the 2017–18 financial year. Similarly, commercial beekeepers estimated approximately 12% of hives were lost during this period.

Of the 17% of hives lost by hobby beekeepers, a third were lost due to pests and diseases (~35%), with queen loss (22%) and overwintering (16%) the other major contributing factors.

Similarly, of the 12% of hives lost by commercial beekeepers a third were lost to pests and diseases (32%), followed by overwintering (23%) and queen loss (22%), with smaller numbers of hives lost to agricultural chemicals (6%), extreme weather (3%) and theft/vandalism (5.5%) (**Figure 24**). These results are broadly similar to those obtained in the ABARES Australian Honey Bee Industry Survey 2014–15², which reported pests and diseases as the major factor causing hive loss amongst commercial beekeepers nationally, accounting for 74% of all hives lost. The 2014–15 ABARES survey reported similar levels of hives lost nationally to agricultural chemical (12%), extreme weather (9%) and theft (4%) for commercial beekeepers. However, in contrast to the current study, no hives were reported lost to overwintering.

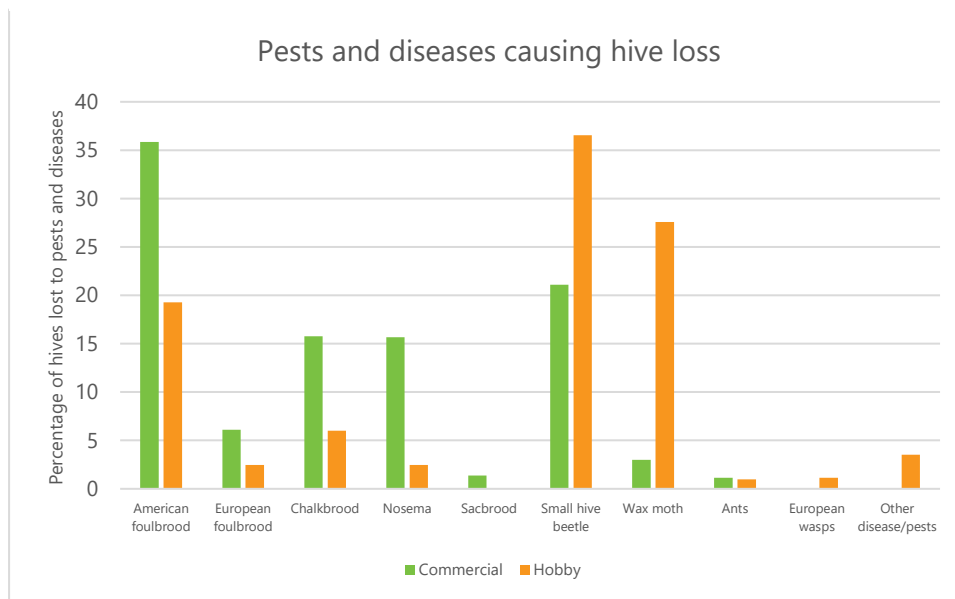
Figure 24: Factors causing hive loss amongst commercial and hobby beekeepers.



Commercial beekeepers indicated that the major pests and diseases causing hive loss during the 2017–18 financial year included American foulbrood (36%), small hive beetle (21%), chalkbrood (15%) and nosema (16%) (**Figure 25**). The ABARES Australian Honey Bee Industry Survey 2014–15² also identified small hive beetle, American foulbrood and chalkbrood as the pests and diseases causing the highest levels of financial loss amongst commercial beekeepers nationally, supporting the results of the current study.

For hobby beekeepers the majority of hives lost to pests and diseases were due to small hive beetle (36%), wax moth (28%) and American foulbrood (19%) (**Figure 25**). However, these results should be interpreted with caution, as limited capacity appears to exist, particularly amongst hobby beekeepers, to identify established pests and diseases (see **Figure 17** page 20).

Figure 25: Pests and diseases causing hive loss

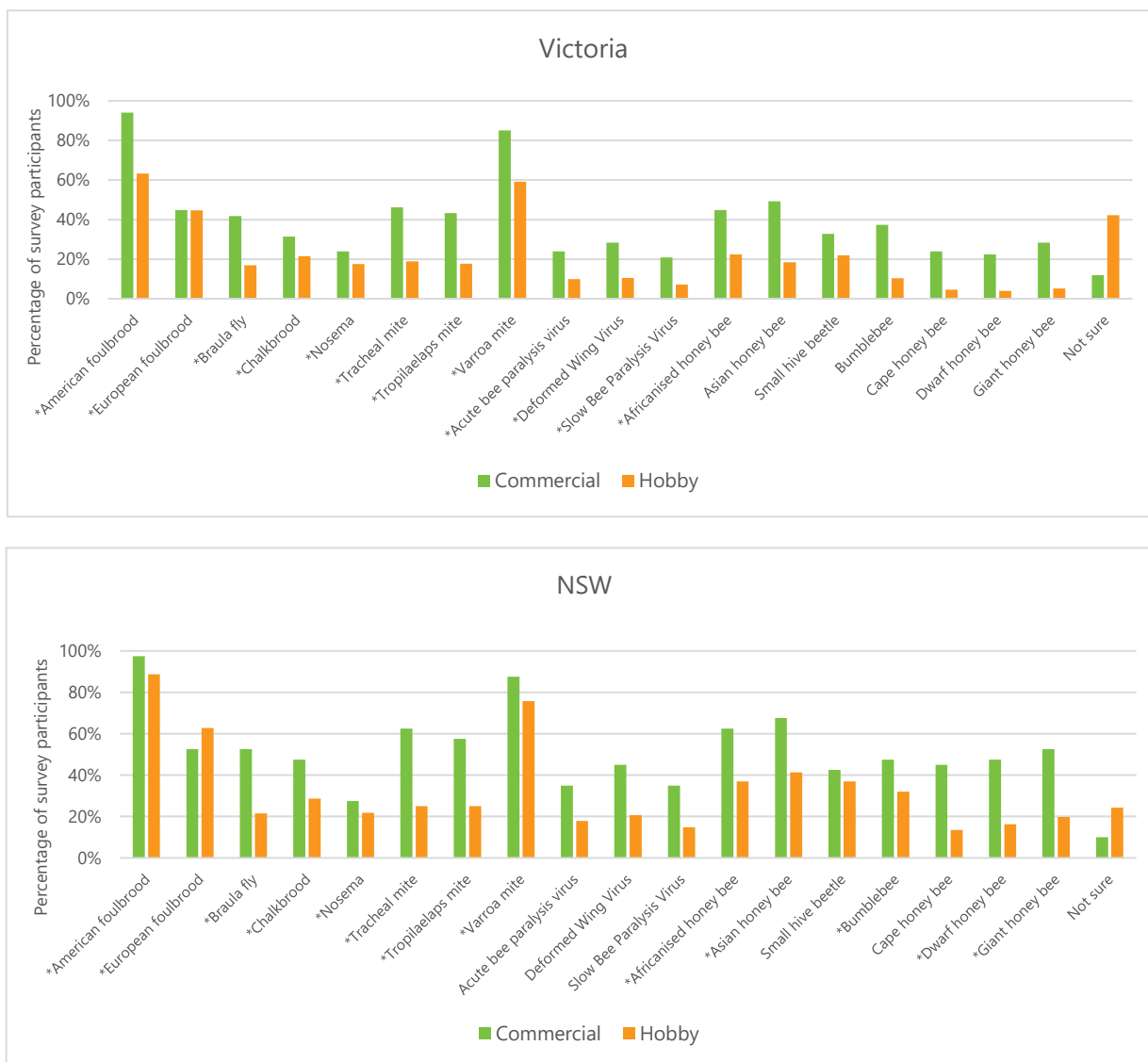


Knowledge of notifiable pests and diseases

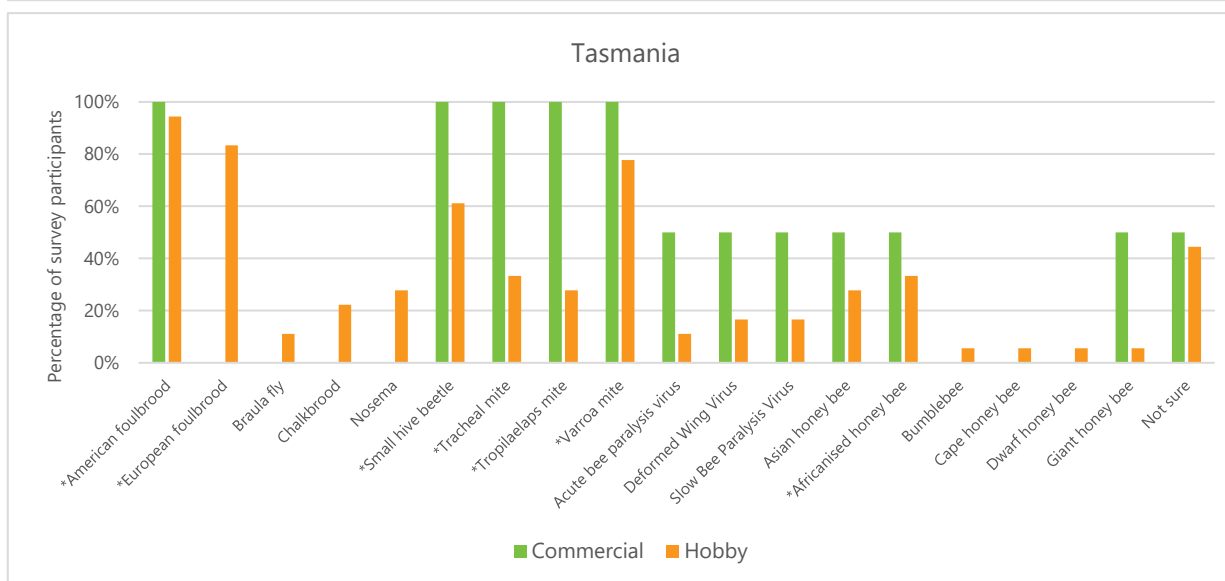
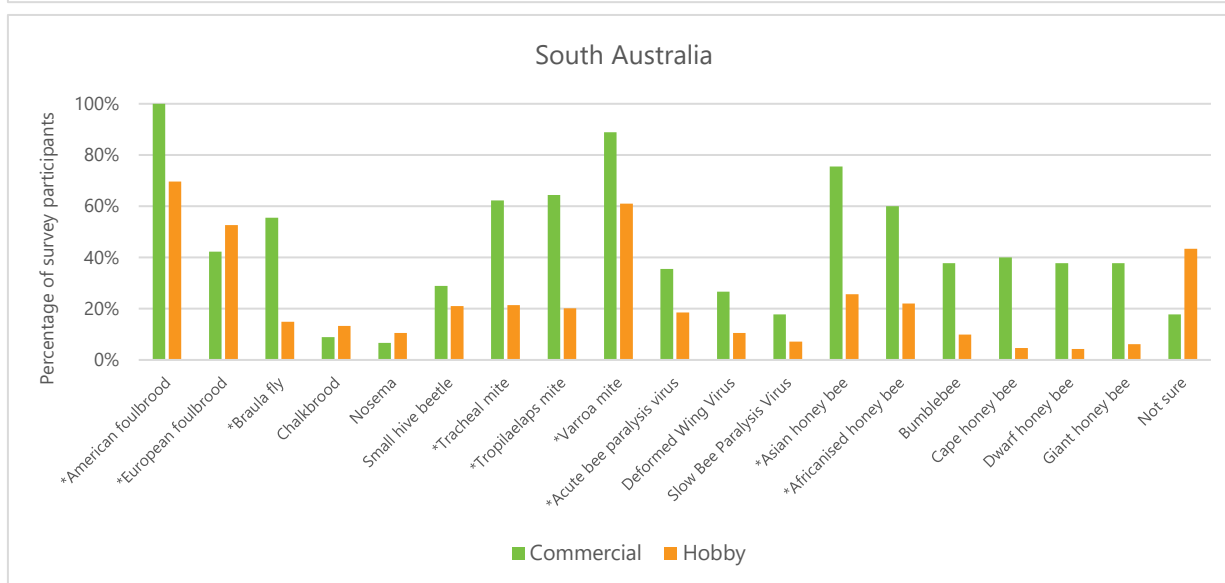
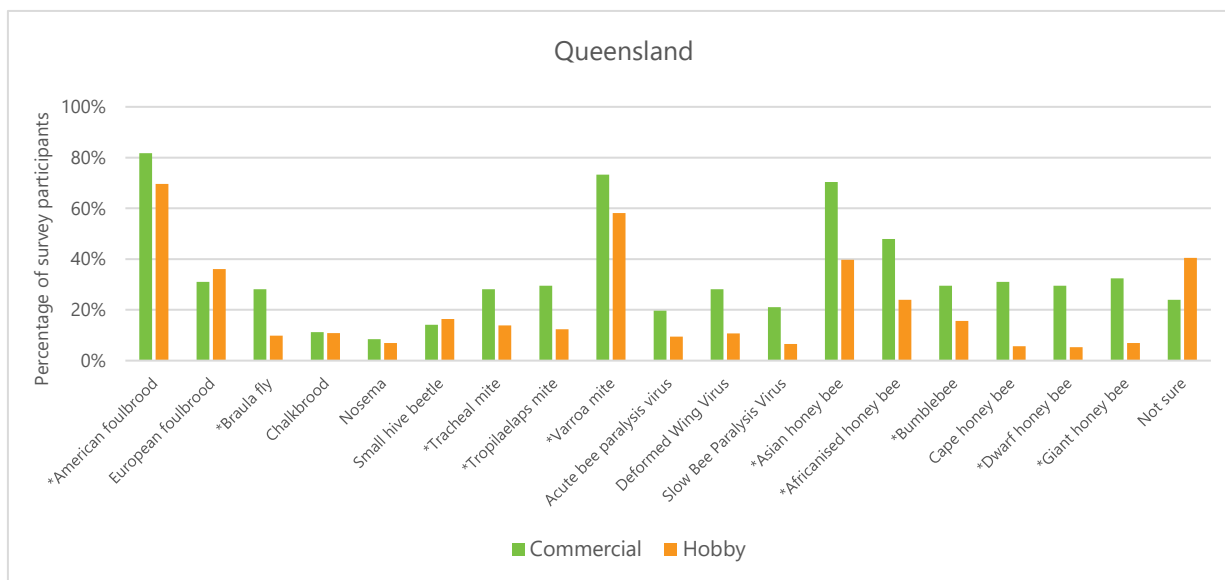
Survey participants were also asked to indicate which pests and diseases were notifiable in their jurisdiction (**Figure 26**). American foulbrood, tracheal mites, varroa mites and tropilaelaps mites are notifiable within all jurisdictions. Several other pests are also notifiable in each jurisdiction.¹¹ Most hobby (68%) and commercial (92%) beekeepers were aware that American foulbrood was a notifiable pest. Similarly, most hobby (61%) and commercial (beekeepers (83%) were aware varroa mites were notifiable. Much lower proportions of commercial (~47%) and hobby (~18%) beekeepers were aware that tracheal and tropilaelaps mites were also notifiable. Similarly, both hobby and commercial beekeepers had limited knowledge of other notifiable pests within their jurisdictions.

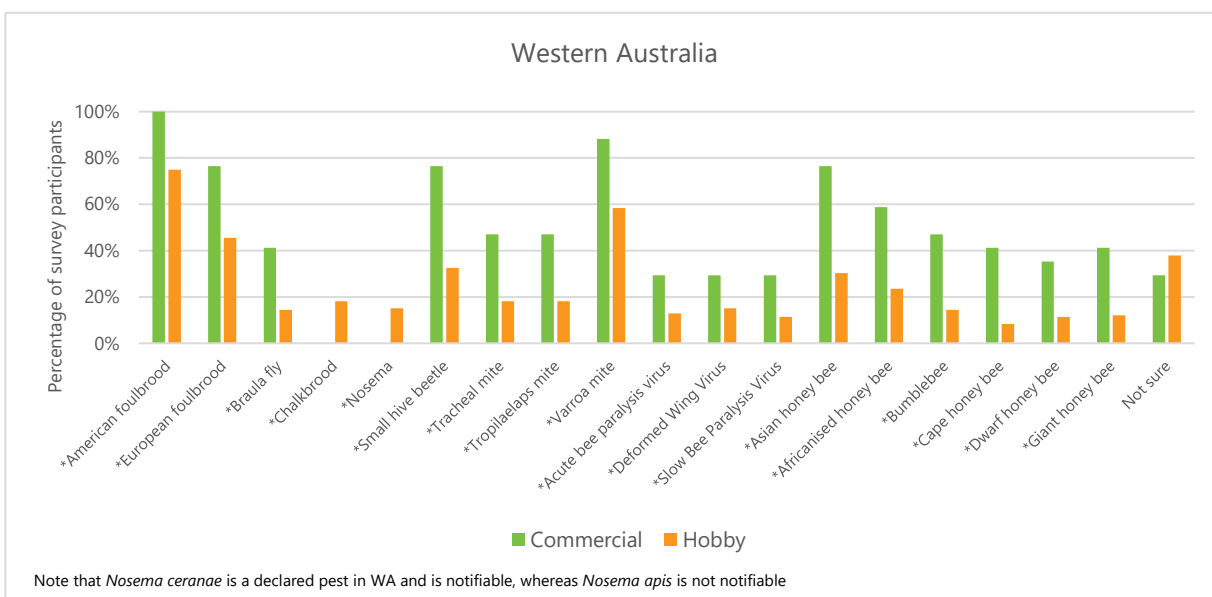
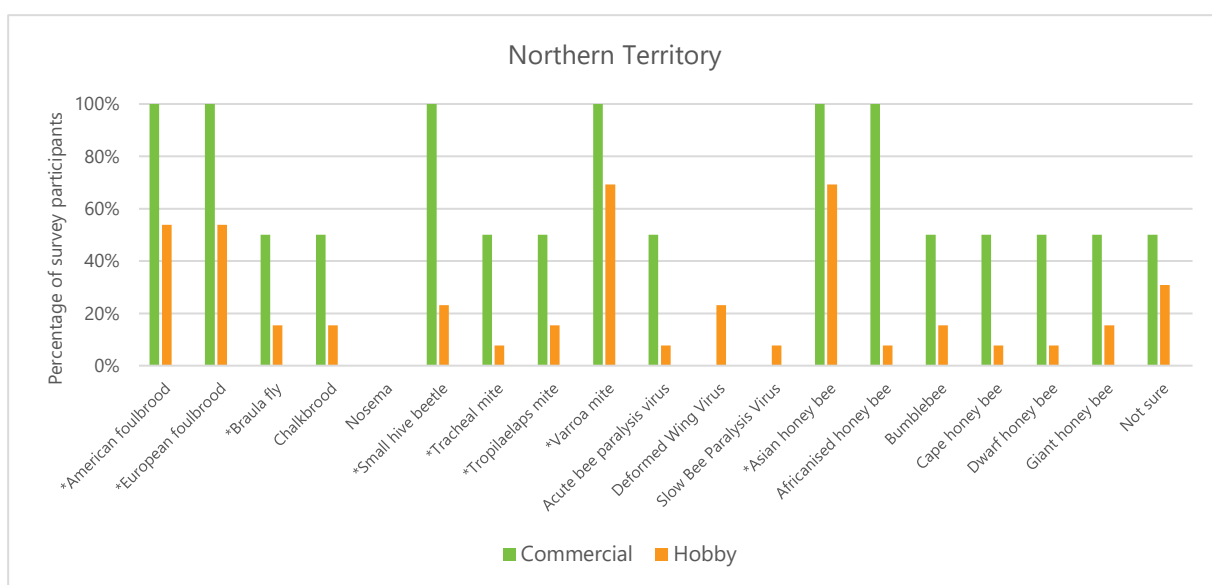
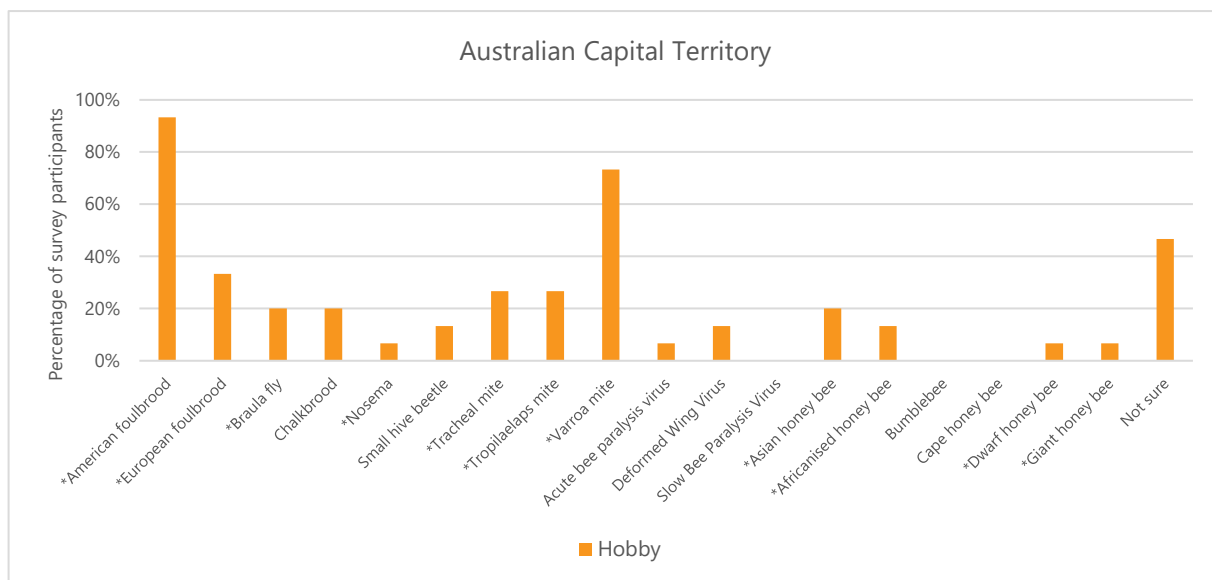
Figure 26: Percentage of survey participants which have knowledge of notifiable pests and diseases within their jurisdiction.

Notifiable pests in each jurisdiction are indicated with *



¹¹ For a list of notifiable pests in each jurisdiction see <https://beeaware.org.au/code-of-practice/reporting-diseases/>.





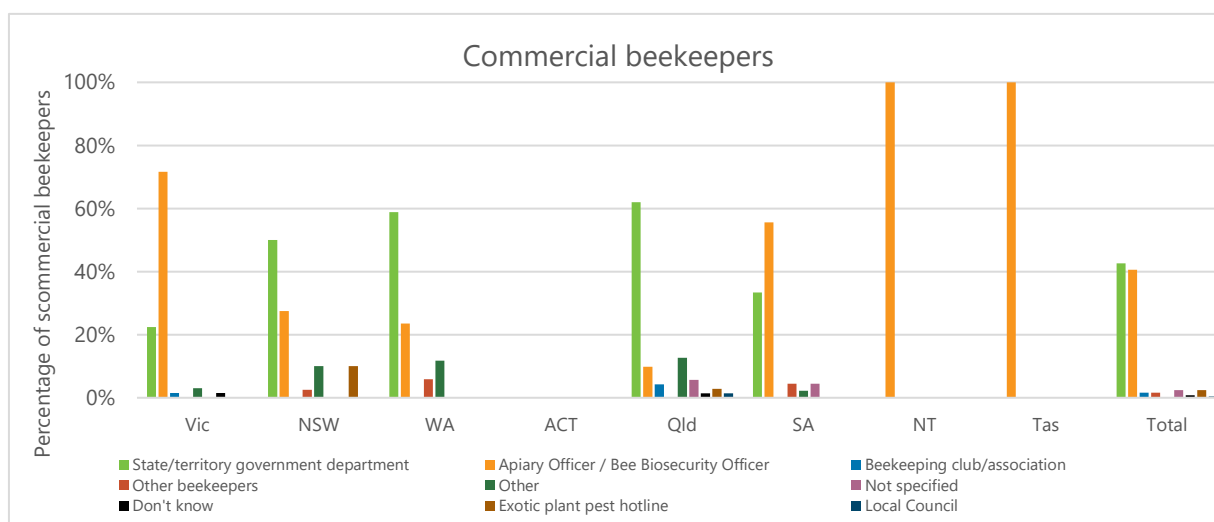
Who beekeepers would contact if they suspected a notifiable pest or disease was in their hives

Eighty three percent of commercial beekeepers would contact either their relevant state/territory government (42%) or their Apiary/Bee Biosecurity Officer (40%) if they thought they had a notifiable pest or disease. Lower numbers of commercial beekeepers would contact the Exotic Plant Pest Hotline (2.5%), beekeeping club/associations (1.6%), other beekeepers (1.6%), local council (0.4%), didn't know (1%), other organisations (7%) or did not specify (2%) (**Figure 27A**).

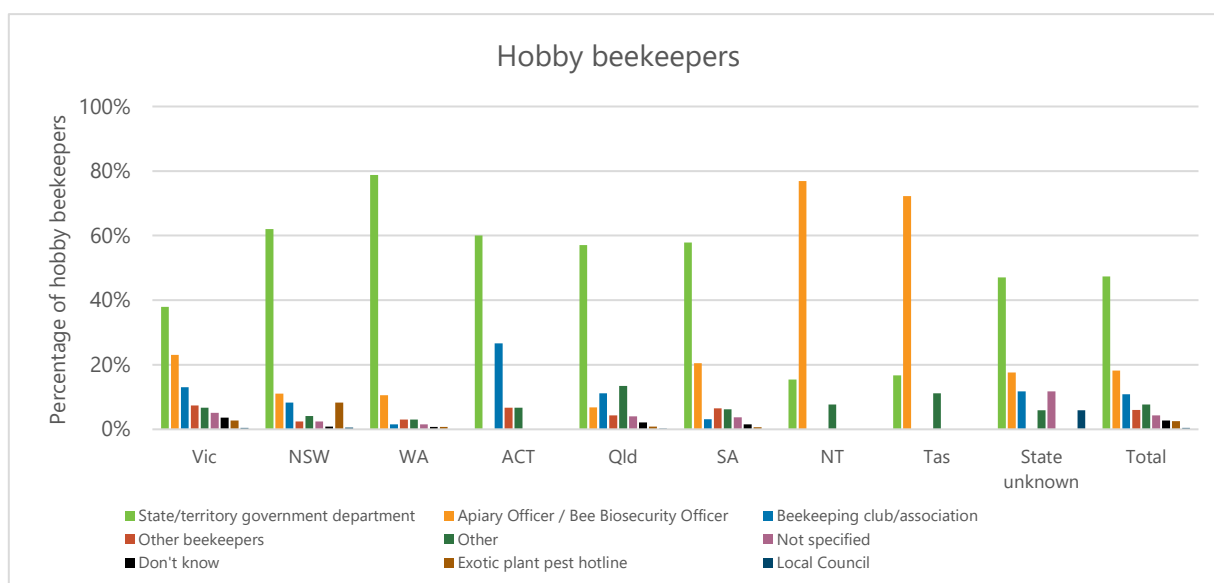
Sixty five percent of hobby beekeepers indicated they would contact either their relevant state/territory government (47%) or their Apiary/Bee Biosecurity Officer (18%) if they thought they had a notifiable pest or disease. Lower numbers of hobby beekeepers would contact the Exotic Plant Pest Hotline (2.5%), beekeeping club/associations (11%), other beekeepers (6%), local council (0.4%), didn't know (2.7%), other organizations (7.6%) or did not specify (4%) (**Figure 27B**).

Figure 27: Who commercial beekeepers (A) or hobby beekeepers (B) would contact if they suspected a notifiable pest or disease

A.



B.



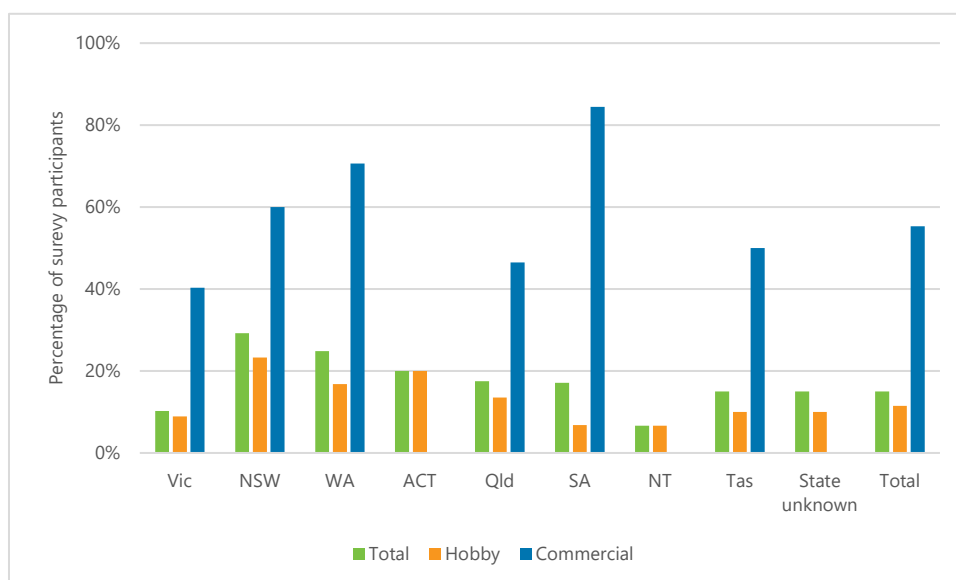
Barrier management system

Approximately 84% of commercial beekeepers (**Figure 28B**) *know* what a barrier management system is compared to 24% of hobby beekeepers (**Figure 28A**). Fifty five percent of commercial beekeepers and 11% of hobby beekeepers who knew what a barrier management system was, indicated that they *used* a barrier management system (**Figure 29**). Whilst similar trends were observed across all jurisdictions, slightly higher percentages of commercial beekeepers in SA (84%), WA (70%) and NSW (60%) indicated that they used a barrier management system compared to the other jurisdictions.

Figure 28: Percentage of hobby (A) and commercial (B) beekeepers who know what a barrier management system is



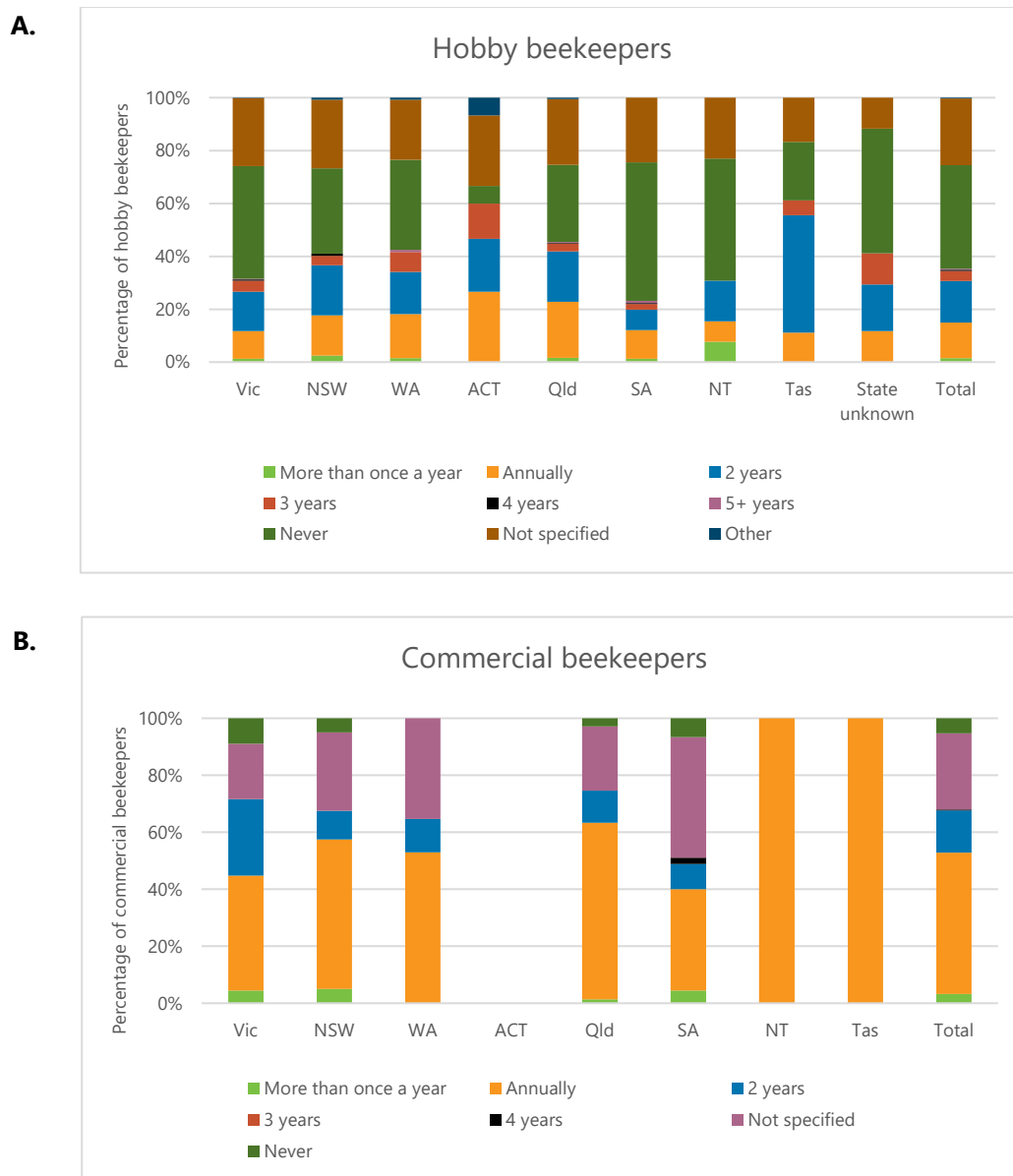
Figure 29 Percentage of beekeepers using a barrier management system



Requeening

Most commercial beekeepers requeened at least annually (53%) or every two years (14%). In contrast, lower proportions of hobby beekeepers requeened at least annually (14%) or every two years (16%) with a large proportion (39%) of hobby beekeepers indicating that they never requeened their colonies (**Figure 30**). It is recommended that beekeepers requeen their colonies every two years with a young and healthy queen bee from a reputable breeder, in order to maintain strong and healthy colonies¹².

Figure 30: Frequency that hobby (A) and commercial (B) beekeepers requeen their colonies



¹² Biosecurity Manual for Beekeepers. Downloaded from <https://www.farmbiosecurity.com.au/wp-content/uploads/2019/05/Biosecurity-Manual-for-Beekeepers.pdf>

Where beekeepers get their information on pests and diseases

Survey participants obtained their information on pests and disease from a variety of sources. Seventy five percent of participants used online sources, with friends and other beekeepers the other main source of information (74%). Information was also obtained from books (61%), beekeeping associations/clubs (51%) and state/territory agriculture departments (37%) (**Figure 31A**). Similar trends were observed between commercial and hobby beekeepers (**Figure 31B**), though higher levels of commercial beekeepers obtained information from industry magazines (62% vs 18%), Bee Biosecurity Officers (54% vs 21%) and AHBIC (47% vs 17%). Online was considered to be the most useful source of information (71%), followed by beekeeping associations/clubs (66%), Bee Biosecurity Officers (65%), friends and other beekeepers (66%) (**Figure 32**).

These results are broadly similar to those found in the ABARES Australian Honey Bee Industry Survey 2014–15², which identified other beekeepers, honey packers, and manufacturers as the main source of information on best management practices along with magazines, journals and publications. Books on beekeeping, field days, industry conferences and courses, and beekeeping associations and clubs were also identified as common sources of information. In contrast to the current survey, the 2014–15 ABARES survey indicated lower numbers of participants obtaining information from the internet (<25%) and the BeeAware website (<10%).

Figure 31: Sources of information on pests and diseases for all survey participants (A) and for hobby vs commercial beekeepers (B)

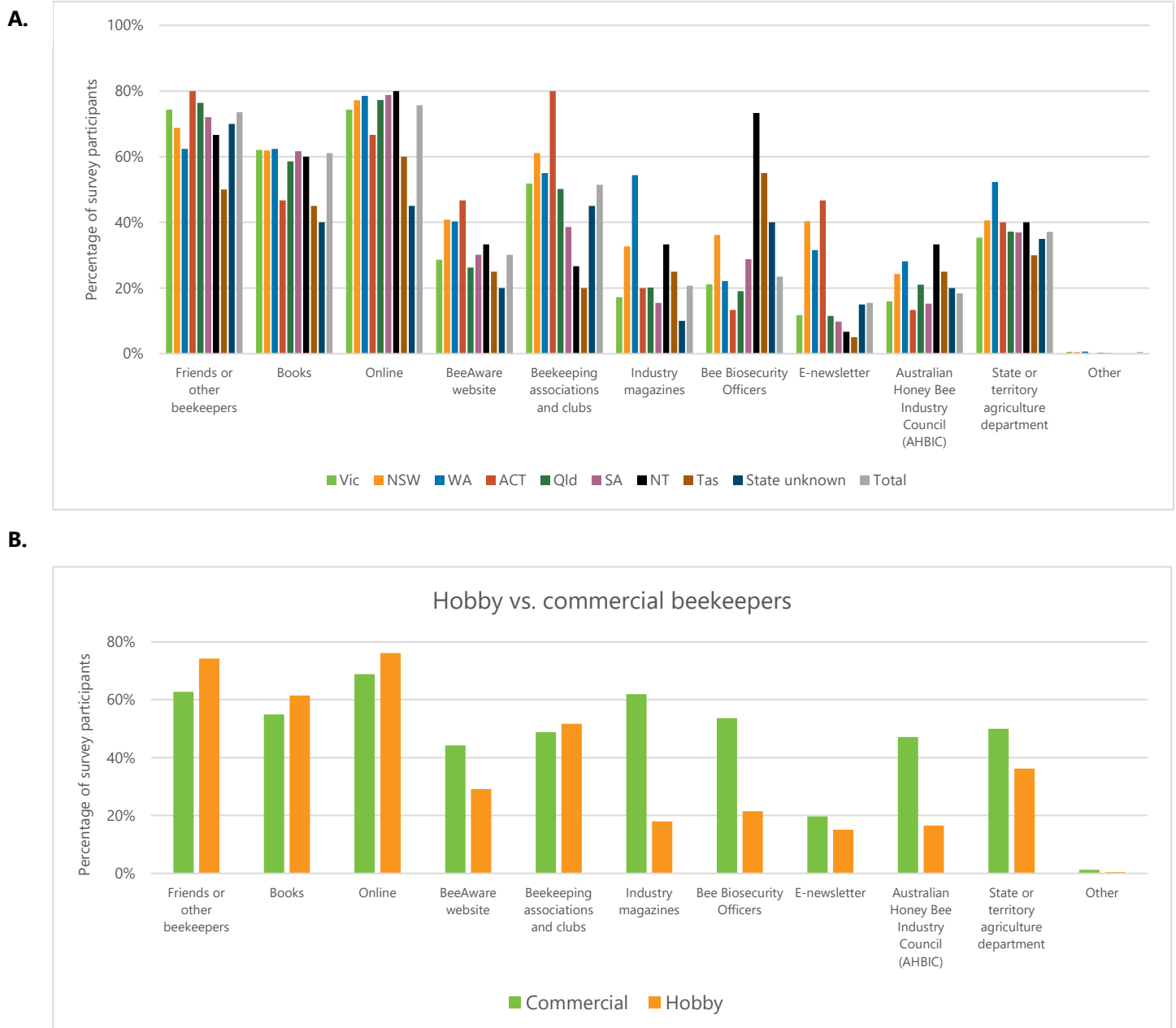
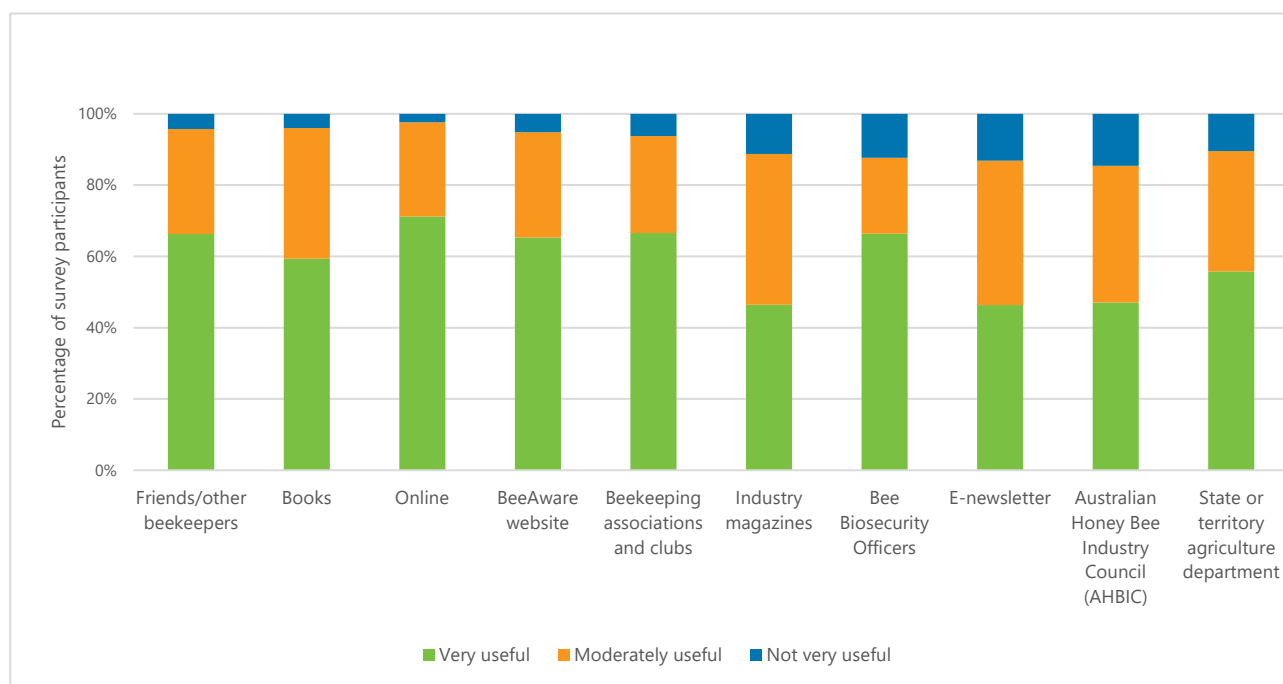


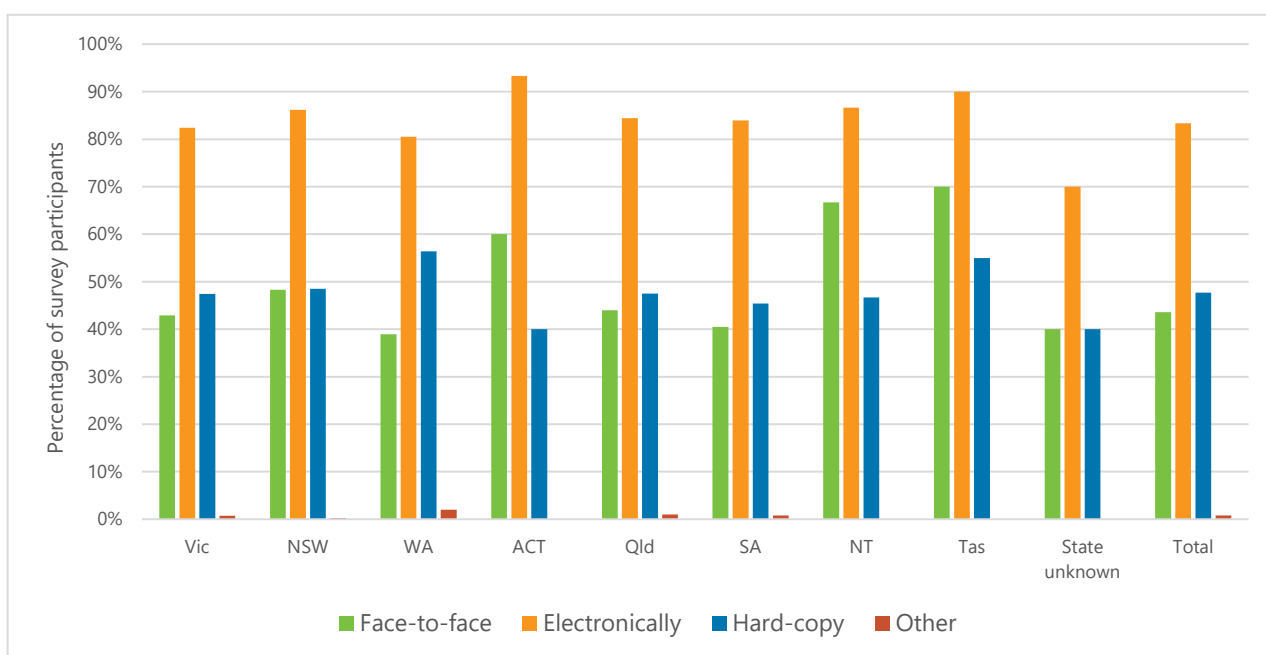
Figure 32: Usefulness of pest and disease information sources



Preferred format for information (face-to-face; hard copy or electronically)

Survey participants preferred to receive their information in a variety of formats including face-to-face (43%), electronically (83%) and hard copy (48%). A small percentage (<1%) indicated other types of formats including; phone/text, email, postal, videos and webinars (**Figure 33**).

Figure 33: Preferred format of information (face-to-face; hard copy or electronically)



Recommendations

Identification of pests and diseases

Summary: Survey participants were asked to indicate what pests and diseases they could identify. Compared to commercial beekeepers, knowledge of all pests and diseases was more limited amongst hobby beekeepers. Commercial beekeepers generally had a good knowledge of established pests and diseases, however had a more limited knowledge of exotic pests and diseases and exotic bees.

Recommendation: Increase awareness of all pests and diseases amongst hobby beekeepers, through provision of extension materials, and promotion of pest and disease courses such as *Biosecurity for Beekeepers* BOLT course.

For commercial beekeepers, increased focus should be placed on pests and diseases where more limited knowledge exists (eg. braula fly for mainland commercial beekeepers). Increased emphasis should also be placed on the identification of exotic pests and diseases (other than Varroa mites) and exotic bees.

Surveillance:

Summary: According to the Australian Honey Bee Industry Biosecurity Code of Practice beekeepers must regularly inspect their hives for pests and diseases; at least twice in every year, at a minimum of four consecutive calendar months apart. Ninety five percent of survey participants inspected their hives for established pests and diseases in the last 12 months, with most beekeepers inspecting at the required frequency.

Under the Code of Practice beekeepers are also required to inspect their hives for Varroa and Tropilaelaps mites using sugar shake, alcohol wash or drone uncapping, at least twice a year, at a minimum of four consecutive calendar months apart. Survey results indicate that only 36% of commercial beekeepers and 20% of hobby beekeepers had inspected their hives for these exotic pests in the last 12 months.

Recommendation: Increase awareness of the need for surveillance techniques such as sugar shake, alcohol wash and drone uncapping to detect external exotic mites such as Varroa and Tropilaelaps, and inspection requirements outlined in the Code of Practice. Provide beekeepers with information on how to perform the sugar shake, alcohol wash and drone uncapping surveillance techniques, including factsheets, videos, and face-to-face workshops.

Honey testing for AFB

Summary: The Australian Honey Bee Industry Biosecurity Code of Practice requires beekeepers with 50 or more hives to test their honey annually for American foulbrood. Survey results indicated that only 40% of commercial beekeepers had their honey tested for AFB in the last 12 months.

Recommendation: Increase awareness about the requirement for annual testing of honey for AFB for commercial beekeepers as outlined in the Code of Practice.

Reporting:

Summary: Under the Australian Honey Bee Industry Biosecurity Code of Practice and state/territory legislation, it is a requirement for all beekeepers to report notifiable diseases. Survey results indicated a lack of knowledge amongst all beekeepers about what pests were notifiable. Furthermore, only 65% of hobby beekeepers and 83% of commercial beekeepers indicated they would contact their relevant state/territory government or their Apiary/Bee Biosecurity Officer to report a notifiable pest.

Recommendation: Increase awareness amongst all beekeepers of where to find information on what pests and diseases are notifiable in each jurisdiction and how beekeepers should report these pests. Encourage beekeepers to seek advice about any signs of pests or diseases of which they are unsure.

Training

Summary: Under the Australian Honey Bee Industry Biosecurity Code of Practice, beekeepers with 50 or more hives are required to complete approved pest and disease training every three years. Only 32% of commercial beekeepers and 7% of hobby beekeepers indicated that they had completed approved training in the last three years (namely *Biosecurity for Beekeepers* online BOLT course, Certificate III in Beekeeping or Pests and diseases of honey bees module (AHCBEK306)).

Recommendation: Continue to promote the *Biosecurity for Beekeepers* BOLT course to commercial beekeepers. Investigate mechanisms to provide the course free to hobby beekeepers to increase uptake amongst this group.

Barrier management system:

Summary: Under the Australian Honey Bee Industry it is recommended that all beekeepers should use a barrier system of hive management. Approximately 84% of commercial beekeepers and 24% of hobby beekeepers indicated they knew what a barrier management system was, with 55% of commercial beekeepers and 11% of hobby beekeepers using a barrier management system in their apiaries.

Recommendation: Increase awareness about the benefits of using a barrier management system amongst both commercial and hobby beekeepers.

Recommendations for future surveys

Summary: The 2018 Bee Health survey had approximately 4000 participants representing ~15% of Australian beekeepers. Whilst the survey had a high level of participation overall, low levels of participation were observed in some jurisdictions.

Recommendation: Active face-to-face promotion of the survey by Bee Biosecurity Officers at industry events may increase uptake of the survey. Hard copies of the survey should also be distributed to provide a mechanism for people with limited computer abilities to participate. Furthermore, additional surveys should be conducted over successive years. These surveys will provide additional confidence about the reliability of the results particularly in jurisdictions with lower numbers of participants.

Appendix 1

Table 1: Breakdown of Survey Participants

		Completed survey	% registered beekeepers	Confidence Interval ¹³	Total # registered beekeepers (2018)
NSW/ACT	Hobby beekeepers	378	6	5	6941
	Commercial beekeepers	40	6	15	671
	Unspecified hive number	1			
NT	Hobby beekeepers	13	13	25	97
	Commercial beekeepers	2	29	63	<10
QLD	Hobby beekeepers	750	16	3	4636
	Commercial beekeepers	71	22	10	316
	Unspecified hive number	2			
SA	Hobby beekeepers	323	18	5	1797
	Commercial beekeepers	45	26	13	174
	Unspecified hive number	0			
TAS	Hobby beekeepers	18	8	22	216
	Commercial beekeepers	2	4	69	46
WA	Hobby beekeepers	132	5	8	2634
	Commercial beekeepers	17	10	23	162
VIC	Hobby beekeepers	2044	28	2	7404
	Commercial beekeepers	67	29	10	233
	Unspecified hive number	2			
State not specified	Hobby beekeepers	17			
	Commercial beekeepers	0			
	Unspecified hive number	3			
Total	Commercial beekeepers	244	15	6	23725
	Hobby beekeepers	3675	15	1	1609
	Unspecified hive number	8			
Total Number of Participants		3927	15	1	

¹³ With a confidence level of 95%

Bee Health Survey

2018 HONEY BEE HEALTH SURVEY

The [Australian Honey Bee Industry Council](#), [Plant Health Australia](#) and [AgriFutures Australia](#), encourage all Australian beekeepers to take part in this survey.

We are asking these questions to find out how healthy Australian honey bees are, and what pests and diseases might be causing problems for beekeepers.

The results from the survey will be used to decide what help you might need to keep your honey bees healthy. It will also provide statistics for use by the industry.

Just so you know, we can't identify anyone who does this survey, and the raw data will not be distributed to third parties.

Thank you for giving your time to answer these questions. It should only take about 10-12 minutes to complete.

1. What state or territory are you based in?

- | | |
|---------------------------------------|--|
| <input type="radio"/> Queensland | <input type="radio"/> South Australia |
| <input type="radio"/> New South Wales | <input type="radio"/> Western Australia |
| <input type="radio"/> Victoria | <input type="radio"/> Northern Territory |
| <input type="radio"/> Tasmania | <input type="radio"/> Australian Capital Territory |

2. How many hives do you own?

3. What type of hive do you mainly use?

- | | |
|--|---|
| <input type="radio"/> Langstroth | <input type="radio"/> Warre hives |
| <input type="radio"/> Flow hive | <input type="radio"/> Kenyan top bar hive |
| <input type="radio"/> Other (please specify) | |

4. Did you provide pollination services in 2017-18 financial year?

- ☐ Yes
- ☐ No

5. What were the main crops you provided pollination services for in 2017-2018 financial year? (select all that apply)

- | | |
|---|---------------------------------------|
| <input type="checkbox"/> Almonds | <input type="checkbox"/> Cherries |
| <input type="checkbox"/> Apples | <input type="checkbox"/> Plums |
| <input type="checkbox"/> Avocados | <input type="checkbox"/> Raspberries |
| <input type="checkbox"/> Blueberries | <input type="checkbox"/> Strawberries |
| <input type="checkbox"/> Canola | <input type="checkbox"/> Watermelon |
| <input type="checkbox"/> Other (please specify) | |

6. Were you paid for the pollination services you provided in the 2017-2018 financial year?

- ☐ Yes
- ☐ No

7. What was the furthest distance (km) you travelled from your business location to provide pollination services?

- ☐ 0-50 km
- ☐ 51-100 km
- ☐ 101-200 km
- ☐ 201-300 km
- ☐ 301-400 km
- ☐ 401-500 km
- ☐ More than 500 km (please specify)

8. In the 2017-18 financial year, was your honey crop

- ☐ below average
- ☐ average
- ☐ above average
- ☐ not sure

9. For the 2017-18 financial year, please provide an estimate of the number of hives lost to:

Pests and diseases

Exposure to agricultural
chemicals (eg. pesticides,
fungicides, herbicides)

Overwintering

Extreme weather events
(eg. bushfire)

Theft

Queen loss

Starvation

Multiple factors (please
specify)

Other (please specify)

10. In the 2017-18 financial year did you have your honey tested for chemical residues (eg. pesticides, fungicides, herbicides)?

☐ Yes

☐ No

If yes - how many times did you have your honey tested for chemical residues?

11. Have you heard about the Australian Honey Bee Industry Biosecurity Code of Practice?

☐ Yes

☐ No

☐ Not sure

12. Do you know who your local Bee Biosecurity Officer is?

☐ Yes

☐ No

☐ Not sure

13. Have you ever contacted your Bee Biosecurity Officer?

- ☐ Yes
- ☐ No

14. Have you done any pest and disease training in the last three years?

- ☐ Yes
- ☐ No

Bee Health Survey

15. What pest and disease training have you completed in the last three years? (select all that apply)

- ☐ Biosecurity for Beekeepers online BOLT course (Plant Health Australia)
- ☐ Bee Biosecurity Awareness online BOLT course (Plant Health Australia)
- ☐ Tocal College - Pests and diseases of honey bees
- ☐ Tocal College - Certificate III in Beekeeping
- ☐ Western Australian Apiarists' Society - 101 - Introduction to Responsible Beekeeping
- ☐ Training or presentation given by Bee Biosecurity Officer
- ☐ Field day demonstration
- ☐ Training at local beekeeping club
- ☐ Other (please specify)

16. Which of the following **established** pests and diseases can you identify (select all that apply)?

- ☐ American foulbrood
- ☐ European foulbrood
- ☐ Chalkbrood
- ☐ Nosema
- ☐ Sacbrood
- ☐ Small hive beetle
- ☐ Wax moth
- ☐ Braula fly
- ☐ None of the above

17. In the last 12 months, have you inspected your hives for **established** pests and diseases (eg. American foulbrood, European foulbrood, chalkbrood, sacbrood, nosema, small hive beetle, wax moth)?

- ☐ Yes
- ☐ No

Bee Health Survey

18. In the last 12 months, how often did you inspect your hives for **established** pests and diseases (eg. American foulbrood, European foulbrood, chalkbrood, sacbrood, nosema, small hive beetle, wax moth)?

- ☐ Weekly
- ☐ Fortnightly
- ☐ Monthly
- ☐ Every two months
- ☐ Every three months
- ☐ Every four months
- ☐ Every six months
- ☐ Once a year
- ☐ Never
- ☐ Other (please specify)

19. In the last 12 months have you had honey samples tested for American foulbrood?

- ☐ Yes
- ☐ No

If yes - how often have you undertaken honey testing for American foulbrood in the last 12 months

20. Which of the following **exotic** pests and diseases of bees can you identify? (select all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Varroa mite | <input type="checkbox"/> Asian Hornet |
| <input type="checkbox"/> Tracheal mite | <input type="checkbox"/> Large African hive beetle |
| <input type="checkbox"/> Tropilaelaps mite | <input type="checkbox"/> None of the above |
| <input type="checkbox"/> Deformed Wing Virus | |

21. Which of the following **exotic** bees can you identify? (select all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Asian honey bee | <input type="checkbox"/> Giant honey bee |
| <input type="checkbox"/> Bumblebee | <input type="checkbox"/> None of the above |
| <input type="checkbox"/> Red dwarf honey bee | |

22. In the last 12 months have you inspected your hives for **exotic** pests like Varroa and Tropilaelaps mites using sugar shake, alcohol wash or drone uncapping?

- ☐ Yes
- ☐ No

If yes - how often have you inspected your hives in the last 12 months

23. Estimate the **number of hives** lost to the following pests and diseases, during the 2017-18 financial year.

American foulbrood

European foulbrood

Chalkbrood

Nosema

Sacbrood

Small hive beetle

Wax moth

Other disease/pests
(please specify)

24. Which of the following pests and diseases are notifiable in your state and territory? (select all that apply)

☐ American foulbrood

☐ Deformed Wing Virus

☐ European foulbrood

☐ Slow Bee Paralysis Virus

☐ Braula fly

☐ Asian honey bee

☐ Chalkbrood

☐ Africanised honey bee

☐ Nosema

☐ Bumblebee

☐ Small hive beetle

☐ Cape honey bee

☐ Tracheal mite

☐ Dwarf honey bee

☐ Tropilaelaps mite

☐ Giant honey bee

☐ Varroa mite

☐ Not sure

☐ Acute bee paralysis virus

25. Who would you contact if you thought you had a notifiable pest or disease in your hive?

26. Do you know what a barrier management system is?

☐ Yes

☐ No

☐ Not sure

27. Do you use a barrier management system?

☐ Yes

☐ No

28. How often do you requeen?

☐ Once a year

☐ Twice a year

☐ Never

☐ Other (please specify)

29. Where do you obtain information on pests and diseases? (select all that apply)

☐ Friends or other beekeepers

☐ Industry magazines

☐ Books

☐ Bee Biosecurity Officers

☐ Online

☐ E-newsletter

☐ BeeAware website

☐ Australian Honey Bee Industry Council (AHBIC)

☐ Beekeeping associations and clubs

☐ State or territory agriculture department

☐ Other (please specify)

30. How useful do you find each of the following sources of information on pests and diseases

	Not very useful	Moderately useful	Very useful	N/A
Friends/other beekeepers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Books	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BeeAware website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beekeeping associations and clubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bee Biosecurity Officers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E-newsletter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Australian Honey Bee Industry Council (AHBIC)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State or territory agriculture department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31. In what format do you like to receive information? (select all that apply)

☐ Face-to-face

☐ Hard-copy (handouts, pamphlets, books)

☐ Electronically

☐ Other (please specify)

32. What is your age?

☐ 0-20 ☐ 51-60

☐ 21-30 ☐ 61-70

☐ 31-40 ☐ 71+

☐ 41-50

33. What is your gender?

☐ Male

☐ Female

☐ Other