Horticulture Innovation Australia

Final Report

National honey bee pest surveillance program

Plant Health Australia Limited

Project Number: MT12011

MT12011

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1. Summary

European honey bee (*Apis mellifera*) plays an important role in pollination of horticultural and agricultural crops, with $4-6 billion per annum in agricultural production estimated to be responsive to honey bee pollination (Department of Agriculture, 2011 and Keogh et al. 2010).

Australia's honey bee industry and pollination reliant industries maintain a production advantage over many other countries, as Australia is currently free of many bee pests and pest bees that cause significant issues overseas. As a result, exotic bee pests and pest bees pose a serious biosecurity risk, and the Honey Bee Industry Biosecurity Plan (2013) (Plant Health Australia Ltd., 2013) has identified 14 pests and diseases that have been ranked as the highest priority biosecurity threats. Of these 14 pests, *Varroa* mites (*Varroa destructor* and *Varroa jacobsoni*) are considered the most significant, and it is predicted an incursion of *Varroa* could cost as much as $1.3 billion to manage over a period of 30 years (Hafi et al. 2012; Cook et al. 2007).

A key component of biosecurity preparedness for the honey bee and pollinator-reliant industries is surveillance that contributes to early detection of high priority pest threats, as rapid detection of an incursion of a new pest will increase the likelihood that eradication or containment will be successful. The honey bee and pollinator-reliant industries and the regional economies they support will therefore benefit significantly from investment in a National Bee Pest Surveillance Program (NBPSP), that enables early detection of high priority pests.

The current NBPSP has been a leading example of a successful industry government partnership that has benefited from a nationwide approach to surveillance. This project has been effective in developing, managing and maintaining the NBPSP. Ensuring the support and resources are made available to jurisdictions to conduct surveillance effectively.

Dissemination of material to industry bodies and the involvement of beekeepers has been vital in the preparing the industry for the future in; either the event of an incursion, or should an exotic pest become established. This has been shown through successful programs within the NBPSP, such as Beeforce, BeeAware website, Operations Manual, Biosecurity Manuals and the development of bee biosecurity videos.

This program has set the industry up in preparation for an enhanced, next stage, NBPSP which is based on the current successful surveillance activities but also includes the important future recommendations from Hort Innovation report MT14057.

2. Keywords

National Bee Pest Surveillance Program; surveillance; bee biosecurity; honey bees

3. Abbreviations

Abbreviation/Word	Definition/Description
ABARES	Australian Bureau of Agricultural & Resource Economics & Sciences
ACPPO	Australian Chief Plant Protection Officer
AHBIC	Australian Honey Bee Industry Council
AHiA	Animal Health in Australia
APVMA	Australian Pesticides and Veterinary Medicines Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWR	Department of Agriculture and Water Resources
Hort Innovation	Horticulture Innovation Australia
MRLs	Minimum Residue Levels
NAQS	Northern Australia Quarantine Strategy
NBPSP	National Bee Pest Surveillance Program
NSHP	National Sentinel Hive Program
OIE	World Organisation for Animal Heath
PHA	Plant Health Australia
RCB	Remote catchbox

4. Introduction

Biosecurity risks to the bee industry

Exotic bee pests and pest bees pose a serious biosecurity risk to the honey bee industry and to industries reliant on honey bees for pollination in Australia. High priority pests and diseases identified in the Honey Bee Industry Biosecurity Plan (2013) (Plant Health Australia Ltd, 2013).

It is accepted that, given its spread and colonisation in other countries, there is a very high likelihood Varroa mite might enter and become established in Australia (Keogh et al. 2010) and, since 1995, at least 16 border interceptions of Varroa have occurred in Australia. While eradication of Varroa has not been successful in other countries where incursions have occurred, to have any possibility of eradicating or containing an incursion of this pest in Australia, populations would need to be detected before they are able to spread and establish widely. Surveillance for early detection of new incursions of Varroa and other exotic pest threats is therefore a high priority biosecurity preparedness activity.

Australia's honey bee industry and pollination reliant industries maintain a production advantage over many other countries, as Australia is currently free of many bee pests and pest bees that cause significant issues overseas. As a result, exotic bee pests and pest bees pose a serious biosecurity risk, and the Honey Bee Industry Biosecurity Plan (2013) (Plant Health Australia Ltd., 2013) has identified 14 pests and diseases that have been ranked as the highest priority biosecurity threats. These include Varroa mites (*Varroa destructor* and *V. jacobsoni)*, *Tropilaelaps* mites (*Tropilaelaps clareae* and *T. mercedesa*e), tracheal mite (*Acarapis woodi*), giant honey bee (*Apis dorsata*), Asian honey bee (*Apis cerana*), red dwarf honey bee (*Apis florea*), exotic strains of *Apis mellifera*, Africanized honey bees (*Apis mellifera scutellata*) and Cape honey bees (*Apis mellifera capensis*), Asian hornets (*Vespa velutina* subspecies *nigrithorax*), large hive beetle (*Oplostoma fuligineus*), and three exotic viruses (Deformed Wing Virus, Slow Paralysis Bee Virus and Acute Paralysis Bee Virus). Of these, the one that is the most serious is Varroa mite.

Pollination - reliant plant industries

Honey bees provide a major benefit to agriculture and the broader economy through the provision of pollination services to a range of agricultural and horticultural industries (Hafi et al. 2012; Gordon and Davis 2003). Of Australia's $30 billion agricultural production per annum, approximately $1.8 billion is estimated to be responsive to honey bee pollination (Keogh et al. 2010). These benefits are related particularly to 35 of the most pollination-responsive crops. When all agriculture is included, estimates run as high as $4–6 billion per annum (Department of Agriculture, 2011). The broad range of estimates reflects differences in how much crop yield the reports apportion to honey bee pollination (versus pollination by other insects) and how much crop yield is apportioned to other inputs (irrigation, nutrient and pest management) on crop production. Pollination-reliant industries that are represented by Horticulture Innovation Australia Ltd (Hort Innovation) include almonds, apple and pear, avocado, canned fruits, blueberry, cherry, lychee, macadamia, mango, melon, onion (for seed), papaya, passionfruit, prune, rubus, strawberry, summerfruit and vegetables (for seed).

Given the wide ranging impacts predicted for an incursion of a high priority pest in the honey bee industry, and the predicted flow on effects for both pollination services and the unmanaged bee populations undertaking pollination, these industries should be considered as key beneficiaries of a bee surveillance program.

For a high priority bee pest such as *V. destructor* mite, the potential present value of losses estimated to producers and consumers from an unhindered Varroa mite outbreak could be expected to range from $21.3–50.5 million per year or $630 million–1.3 billion over 30 years depending on the port of entry (Hafi 2012; Cook et al. 2007). However, if the spread of Varroa mite could be slowed through containment, it is estimated that the losses would range from $630 million–0.93 billion over 30 years, depending on the port of entry. It is important to understand that in addition to the pollination services provided by managed hives there are numerous colonies of unmanaged honey bee colonies established in most parts of Australia (Keogh et al. 2010). The impact of Varroa on these bees will have significant impact on industries that rely on these currently free pollination services alone.

A key component of biosecurity preparedness for the honey bee and pollinator-reliant industries is surveillance that contributes to early detection of high priority pest threats, as rapid detection of an incursion of a new pest will increase the likelihood that eradication or containment will be successful.

The National Bee Pest Surveillance Program (NBPSP)

In January 2012, the management of the National Sentinel Hive Program (NSHP, est. 2000) was transferred from Animal Health in Australia (AHiA) to Plant Health Australia (PHA). This followed the transfer in responsibilities for bees at a national level from Animal Biosecurity to Plant Biosecurity. Upon the transfer to PHA, the name of the surveillance program changed to the National Bee Pest Surveillance Program to reflect a transition to a more broadly based surveillance program for bee pests and pest bees. The NBPSP is one of the leading surveillance programs for bee pests in the world, and within Australia is an exemplar model for government and industry partnerships with wide ranging benefits. The NBPSP (2013–2016) is a key biosecurity preparedness program comprising several surveillance activities (Table 1), to protect the honey bee and pollination-reliant industries of Australia. It is also an important tool in providing the evidence of absence information from bee pests and pest bees, which assists maintaining market access for trade in bee queens.

Table 1 Summary of bee pest and pest bee surveillance activities at air and sea ports in Australia.

	Qld	NSW	Vic	WA	SA	NT	Tas
Number of ports	8 ports, 4 major	10 ports, 3 major	5 ports, 3 major	9 ports, 3 major	8 ports, 3 major	3 ports, 2 major	4 ports, 2 major
Ports with sentinel hives	4	10	5	8	3	2	4
Number of sentinel hives	24	27	32	27	24	6	23
Ports with Swarm capture	8/8	8/10	5/8	9/9	8/8	1/3	4/4
Number of catchboxes	11	50	54	2	56	0	0
Remote surveillance catchboxes	15	0	0	0	0	4	0
Ports with floral sweep netting	5/8	3/10	1/5	1/9	8/8	2/3	2/4
Ports with hobby beekeeper involvement	8/8	10/10	5/5	9/9	3/5	1/3	4/4
Ports where tracheal mite analysis is undertaken	4/8	3/10	4/5	4/9	1/8	2/3	2/4

This project has involved surveillance activities to cover the 14 high priority honey bee pests through the support for a national program of sentinel hives, remote surveillance hives, catchboxes, sweep netting, and hobby beekeeper involvement operating at 38 air and sea ports of entry throughout Australia. In addition, tracheal mite assessment and floral sweep netting has been conducted at 24 ports.

On 1 July 2013, the NBPSP became a cost-shared initiative between the honey bee industry (represented by the Australian Honey Bee Industry Council), plant industries that rely on pollination (represented by Hort Innovation) and the Australian Government Department of Agriculture and Water Resources (DAWR), as well as the support and involvement of state and territory governments and local beekeepers. The current National Bee Pest Surveillance Program has been a leading example of a successful industry government partnership that has benefited from a nationwide approach to surveillance.

A component of a successful national surveillance program is the continued involvement of beekeepers who provide resource material and skills needed for effective hive surveillance and good hive biosecurity practice. The Bee Biosecurity Video Series is a group of educational videos aimed at beekeepers, growers and the broader community in the importance of early detection of exotic pests, how beekeepers can be involved in surveillance, and the impact of exotic pests such as *V. destructor* poses to beekeepers, and growers.

5. Methodology

Methodologies used in the NBPSP

This project will undertake;

- Collection of data to support Australia's evidence of absence from external bee parasitic mites
- Surveillance will also be used to improve early detection of potential new pest incursions
- Data will be captured into the National Plant Pest Reporting Tool, a database that provide summary information on plant health status
- Information will also be provided for the National Animal Health Information System to assist meet Australia's international reporting obligations

Sentinel Hives

From 2013, apiary officers and beekeepers have assisted in inspections and maintenance of sentinel hives at high risk ports. This unit of inspection provides the opportunity for early detection of mites, beetles (small hive beetle, *Aethina tumida)* and braula fly (*Braula coeca)*. At the commencement of the sentinel hive program (2013) two sentinel hives were deployed in Western Australia, South Australia, Victoria, New South Wales, Tasmania, Queensland and Northern Territory. In 2015, the project was extended for a further seven months to continue surveillance activities and to ensure PHA had the time to establish a long term funding agreement for the period beyond 2015/2016 period. In 2016, 152 sentinel hives are deployed across eight jurisdictions.

The NBPSP is currently primarily based on sentinel hives, which are hives of *A. mellifera* of a known health status, placed in key and sea ports locations around Australia (Figure 1). The sentinel hives are provided, managed and tested by cooperating beekeepers under the support of AHBIC, or in some cases, the hives are provided, managed and tested by the respective State/Territory Departments of Agriculture.

Figure 1 Sentinel hives located at key sea and air ports around Australia, and incorporates the activities such as sugar shaking (credit PHA).

In these sentinel hives activities such as sugar shaking (Figure 1) or alcohol washing of adult honey bees, or uncapping of drone brood is used to detect the four mites of interest (*V. destructor*, *V. jacobsoni*, *T. clareae* and *T. mercedesae*), and braula fly. Depending on location, Apithor harbourages (containing insecticide Fipronil) are placed in colonies for small hive beetle surveillance. A sample of 50 bees is also sent off for tracheal mite (*A. woodi*) diagnostics by Bugs for Bugs Pty. Ltd. (Mundubbera, Queensland) whom performed diagnostics on 30 of these 50 (the extras are for any damages which would prevent dissections, also any storage needed).

Catchboxes

Catchboxes or bait hives (empty hives) positioned in high risk port areas provide a means of early detection of exotic species of Africanized honey bees (*A. m. scutellata*) and Cape honey bees (*A. m. capensis*) as well as newly arriving swarms of *A. mellifera* (i.e. inadvertently imported on cargo/vessels) and local *A. mellifera* population (Figure 2). Any bee swarm picked up using catchboxes are subsequently sampled for exotic internal and external mites.

Figure 2 Catchboxes located at the port of Kurnell (Sydney, NSW) (credit PHA).

Remote catchboxes

A remote surveillance catchbox (RCB) is an empty hive with a mobile phone camera and sensors that can detect when bees are present in the hive (Figure 3). The phone captures an image at frequent intervals (every 10 minutes) and performs image analysis to determine the presence of a swarm. Information is provided to PHA via an alert email if detection inside the box is made and PHA can further investigate this by accessing the PortBees website and viewing the uploaded images. If there is a concern, an electronic door on the catchbox entry can be triggered remotely to be closed (and/or opened), to trap the swarm inside. Cooperation with state and territory apiary officers allows for on the ground inspection of these hives if and when needed. Power to the phone is provided by a solar panel and batteries in the catchbox lid.

Figure 3 Remote catchboxes located at ports, and the internal image capture by the phone camera (credit S. Malfroy and PHA).

Floral sweep netting

Floral sweep netting has been proposed as the main surveillance method to provide early detection of exotic pest bees at high risk ports. Floral sweep netting consists of operators using insect sweep nets over floral sources where bees are present (Figure 4). Work conducted by Biosecurity Queensland and the Northern Australian Quarantine Strategy (NAQS), floral sweep netting represented the most efficient and effective sampling method to confirm the presence of Asian honey bee in the Cairns port area. For this reason, PHA have built on the work conducted by NAQS and developed a floral sweep mapping and netting method that targets all pest *Apis* species (*A. m. scutellata*, *A. m. capensis*, *A. cerana*, *A. dorsata*, and *A. florea*), as well as Bumblebees (*Bombus* species). The captured bee species can be further assessed for bee pests using techniques such as alcohol wash, sugar shake or dissection methods for internal pests.

Figure 4 Floral sweep netting perfomred on traget floral resources at key ports nationally (credit QDAF and PHA).

Swarm/feral nest capture

Swarms can be found hanging from any object (e.g. tree branch, house gutter, fence) as a dense cluster around a queen that can vary in size from hundreds to thousands of bees (Figure 5). Swarming usually occurs in spring but sometimes occurs at other times of the year when local conditions permit. Collection of swarms and/or feral nests in and around high risk ports. Honey bees collected through these methods can be examined for the presence of exotic mites using the alcohol washing procedure and Tracheal mite examination.

Figure 5 *A. cerana* (left), *A. mellifera* (right) swarms can form on tree branches, and are collected, identified and inspected for exotic bee pests (credit QDAF and S. Malfroy).

Rainbow bee-eater pellets

Rainbow bee-eater (*Merops ornatus*) pellets provide a tool for determining the presence of pest bees such as Asian honey bee (*A. cerana*). The method was developed following the 1998 incursion of *A. cerana* in Darwin and further developed to be used during the eradication efforts of the 2007 Cairns incursion.

The rainbow bee-eater is widespread across much of mainland Australia and occurs on several near-shore islands. It is absent from Tasmania, and is thinly distributed in the most arid regions of central and Western Australia. Although rainbow bee-eaters eat a variety of insects, their diet consists mainly of bees and wasps. When roosting, they regurgitate non-digestible parts of their prey (such as bee wings) in the form of a pellet. As pellets fall to the ground, they can be collected and the contents examined for the presence of *A. cerana* wings (Figure 6).

Figure 6 ***Merops ornatus*** **pellets are used to determine the presence of** ***A. cerana*** **within an area (credit P. Bray).**

Hobby beekeeper involvement

A BeeForce community engagement pilot project ran been 2010–2012 to test the involvement of urban hobbyist and professional beekeepers in a passive surveillance program for Varroa mites (Figure 7) in both Melbourne and Geelong in Victoria. BeeForce is now being implemented nationally. The BeeForce pilot demonstrated not only that an active task force could be enlisted and trained, but that after two years of testing in two separate locations, participants were still willing to be involved in such an initiative. It has enabled a higher number of sentinel hives to be deployed.

Figure 7 Beekeeper involvement is vital in the continued success of this program into the future, with the skills learned such as sugar shaking, for continued surveillance practices in their own hives (credit PHA).

Data collection

Surveillance activities for each jurisdiction was updated annually and agreed upon between PHA and the Chief Plant Manager from each state or territory. The milestone activities listed above were managed and performed by state or territory apiary officers with the involvement volunteer beekeepers. The surveillance data collected in the field was inserted into a specifically designed NBPSP workbook. This workbook was developed with the assistance of AusVet Animal Health Services (Bruce, ACT). Once PHA received these completed workbooks, PHA would check the data, and then upload the data to the NBPSP database http://nbpsp.planthealthaustralia.com.au/public.php?page=pub_home&program=5 (also supported by AusVet).

Bee Biosecurity Video Series development

Output of this component of the project;

- Develop a series of educational videos focusing on bee biosecurity and varroa mite surveillance
- Produce the videos specifically tailored to Australian beekeepers and growers of pollination-reliant crops

Late 2015, the current Hort Innovation NBPSP project was further extended to incorporate the development of educational videos around bee biosecurity, and this has since been an ongoing component of this current contract with PHA with the video project drawing to a close late 2016.

The project has been funded by the Australian Commonwealth Department of Agriculture and Water Resources (DAWR), Horticulture Innovation Australia (Hort Innovation), Australian Honey Bee Industry Council (AHBIC), Bayer, Syngenta, Capilano Honey, and The Wheen Bee Foundation, representatives from these contributors form the Steering Committee. Video development and production was subcontracted to Plant and Food Research New Zealand. All contributors have been appropriate acknowledged in the video series.

A Technical Working Group was established in December 2015 to discuss and agree on content material of the project. This group worked together to develop the information modules, decide on video numbers and titles, and correspond these to the module information. This group continually worked together to develop and improve the modules and video content.

Technical Working Group include:
Dr. Oksana Borowik – Plant and Food Research (director and producer)
Mr. Martin Heffer – Plant and Food Research (filming and editing)
Dr. Mark Goodwin – Plant and Food Research (Varroa expertise)
Ms. Alison Saunders – Plant Health Australia (manager, video material content)
Dr. Sharon Abrahams – Plant Health Australia (filming, editing, video material content)
Dr. Jenny Shanks – Plant Health Australia (filming, editing, material content, honey bee knowledge)

There are 12 videos of approximately 3–6 minutes in length. The 'look and feel' of the videos aim to be relaxed but informative. The footage locations captured what was a mix of commercial, hobby and urban beekeeping environments from Victoria, Australian Capital Territory, New South Wales and New Zealand. The videos covered footage of beekeeper activities, Varroa mite, inspection activities at sea- and air-ports, and crop growing areas. The videos include interviews from NSW Department Bee Biosecurity officer, Commonwealth biosecurity inspectors and entomologists, bee researchers and a variety of beekeepers. The project has been fortunate enough to obtain footage for use from Capilano Honey, and amateur beekeepers and PHA staff, and where footage has not been possible appropriate still images were supplied and used.

A professional voice over was decided upon for video dialogue between interviews, and background music was also included to add to the 'look and feel' desirability of the final products. All video scripts and final videos have been passed firstly through PHA for approval, and secondly through the Steering

Committee for final comments, and where needed changes have been made to reflect comments and concerns. The videos will be made available for viewing on the Farm Biosecurity Youtube page with links provided on the BeeAware and Farm Biosecurity websites. There has been a considerable volume of interest from contributing parties which will result in more media uptake once these videos are released.

6. Outputs

National Bee Pest Surveillance Program

- Collection and analysis of surveillance data on a 6–8 week scheduled program
- Increased number of sentinel hives and beekeeper involvement for early detection
- Improved upon additional surveillance activities such as the deployment of Remote catch boxes and floral sweep netting
- Gathered data via a specifically development spreadsheet which required jurisdictions to note presence or absence of pests
- Complied surveillance data which was uploaded to the NBPSP database managed by AusVet
- Annually and when requested provided reports on the NBPSP outcomes

The aims and objectives of this project have been successfully met, outlined below are the detailed outputs from the project against contract deliverables.

- *To involve each jurisdiction, the honey bee industry and plant industries in designing, implementing and driving the implementation of a National Bee Pest Surveillance. Develop and manage contracts for jurisdictions and sub-contractors*

All funding partners (Hort Innovation, Commonwealth government, state and territory governments, RIRDC, and AHBIC) have been involved in the process of conducting and maintaining the activity of the NBPSP. PHA have continued to consult with all stakeholders throughout their management of the NBPSP.

Contracts were developed by PHA and signed by all jurisdictions involved in the National Bee Pest Surveillance Program from 2013 through to 2016. The contract outlines a baseline level of surveillance that must be conducted in specified high risk locations. This means the minimum level of surveillance needed for the early detection of exotic pests, such as the inspection of set number of sentinel hives each milestone, the development of floral mapping and execution of floral sweep events. If jurisdictions do activities or deploy more sentinel hives or catchboxes beyond what is outlined in their contracts, this is recorded as additional, but valuable surveillance. As of 2016, 6–7 surveillance runs were met by all jurisdictions. ACT have now been incorporated into the surveillance activities exotic pests (including sugar shake activities) since 2016.

On conclusion of the project in August 2016, AusVet have continued to support the management of the NBPSP data and database (as contracted), and Bugs for Bugs continues to perform tracheal mite analysis (as contracted). As part of chemical compliance, honey and or wax samples form sentinel hives have been sent annually from all jurisdictions for Minimum Residue Levels (MRLs) analysis by AgriSolutions Australia Pty Ltd. (Brisbane) (as contracted).

- *Surveillance for a range of bee pests and pest bees conducted around Australia.*

While only formally recognised as the nationally coordinated NBPSP since 2013, surveillance for bee pests and pest bees has been undertaken by the Commonwealth government at Australia's border for several decades. In total between 1995–2016, there have been 93 Asian honey bee, 48 Giant honey bee and 12 Red dwarf honey bee detections (alive or dead) and 16 Varroa mites (*V. destructor* and *V. jacabonsi*) detections in this period. This data shows that surveillance for bee pests and pest bees is essential.

From 2013–2016, the NBPSP undertook targeted surveillance for Varroa mites, Tropilaelaps mites, tracheal mite, small hive beetle, braula fly, and pest bees such as Asian honey bee, giant honey bee, red dwarf honey bee, Africanized honey bees, Cape honey bees, bumble bee and exotic strains of *A. mellifera*. Surveillance activities included sentinel hives, swarm capture, catchboxes, floral sweep netting and awareness programs with 541 surveillance activities undertaken in 2013, 868 activities in 2014, 939 activities in 2015 and 630 in 2016 (the 2016 number is reflective for surveillance activities taken place from January to end of August 2016, and November 2016). If some activities have been unable to be conducted (i.e. storms in QLD), PHA has worked with the respective agencies to reposition milestones. Table 2 summarises the results for each bee pest and pest bees from surveillance activities undertaken (2015/2016). At the time of this report being written NSW November data had not been analysed, and therefore not included in the final numbers below.

Table 2 Summary of results from surveillance undertaken in the NBPSP (2013-2016).

Target	**Samples test**	**Comments**
2013		
Pest bees (*A. cerana, A. florea, A. dorsata*)	34	*Apis cerana* specimens were examined from known samples (nests and swarms) in the Cairns region during the Asian Honey Bee Transition to Management Program until 30 June 2013.
Tracheal mite	100	Tracheal mite specimens examined included 30 bees from sentinel hives being randomly selected and morphologically dissected to determine Tracheal mite presence.
Small hive beetle	39 traps	Small hive beetle samples included oil traps and hive inspection of sentinel hives in Northern Territory, Tasmania and Western Australia.
Varroa and Tropilaelaps mites	368	129 additional sugar shaking and alcohol washing samples were collected from hives across Australia throughout 2013. Each sample included approximately 300 bees.
Total	**541**	
2014		
Pest bees (*A. cerana, A. florea, A. dorsata*)	13	The development of floral maps and coordinated floral sweep netting began to be implemented in late 2014 around Australia for the detection of pest bees. This figure is the number of floral sweep netting surveillance runs conducted.
Tracheal mite	156	Tracheal mite specimens examined included 30 bees from sentinel hives being randomly selected and morphologically dissected to determine Tracheal mite presence.

Small hive beetle	142 traps	Small hive beetle samples included Apithor traps, oil traps and hive inspection of sentinel hives in WA, NT and Tas.
Varroa and Tropilaelaps mites	557	800 additional sugar shaking, alcohol washing and drone uncapping samples were collected from hives across Australia throughout 2014.
Total	**868**	
2015		
Pest bees (*A. cerana, A. florea, A. dorsata*)	61	A total of 23 swarms of Asian honey bee (*Apis cerana* Java genotype) were collected in the Cairns port area in 2015 by Operational Science Services (OSS). Diagnostics were performed on the bees and no *Varroa* sp., *Tropilaelaps* sp or *Acarapis woodi* were detected. This figure is the number of floral sweep netting runs conducted in 2015.
Tracheal mite	160	Tracheal mite specimens examined included 30-60 bees from sentinel hives being randomly selected and morphologically dissected to determine Tracheal mite presence.
Small hive beetle	138 traps	Small hive beetle samples included Apithor traps, oil traps and hive inspection of sentinel hives in WA, NT and Tas. All samples were negative for SHB.
Varroa and Tropilaelaps mite	580	814 additional sugar shaking, alcohol washing and drone uncapping samples were collected from hives across Australia throughout 2015. Of this, 669 were collected in Victoria as part of their routine sugar shaking program. Varroa and Tropilaelaps specimens examined is the number of sentinel hives tested with an acaricide and a sticky mat being examined.
Total	**939**	
2016		
Pest bees (*A. cerana, A. florea, A. dorsata*)	47	A total of 17 swarms of Asian honey bee (*Apis cerana* Java genotype) were collected in the Cairns port area in 2016 by Operational Science Services (OSS). Diagnostics were performed on the bees and no *Varroa* sp., *Tropilaelaps* sp. or *Acarapis woodi* were detected. This figure is the number of floral sweep netting runs conducted in 2016.
Tracheal mite	91	Tracheal mite specimens examined included 30 bees from sentinel hives being randomly selected and morphologically dissected to determine Tracheal mite presence.
Small hive beetle	79 traps	Small hive beetle samples included Apithor traps, oil traps and hive inspection of sentinel hives in WA, NT and Tas. All samples were negative for SHB.
Varroa and Tropilaelaps mite	413	118 additional sugar shaking, alcohol washing and drone uncapping samples were collected from hives across Australia throughout 2016.
Total	**630**	

Surveillance activities

In an effort to summarise all activities of the NBPSP, as well as provide detail information on surveillance methods, preliminary diagnostic information and how to send samples etc., PHA created a comprehensive Operations Manual for the NBPSP. The document was around 120 pages long, and included all information that jurisdictions, stakeholders or managers of the program would need to know about the NBPSP.

Sentinel hives

Since transferring management of the surveillance program to PHA in 2012, a large number of improvements have been made to the Program. One of the improvements made is an increase in sentinel hive numbers. In 2011, there were just 26 sentinel hives established in selected ports. As previously outlined by Barry et al. (2010), the increase to at least six sentinel hives within 3 km at nominated high risk ports was implemented from 2014, and was maintained as a minimum standard in jurisdictions with high risk-rated ports. As an outcome, sentinel hive numbers across Australia have increased. By the end August 2016 the NBPSP comprised 152 sentinel hives and 171 catchboxes operating at 32 air and sea ports of entry in Australia (Figure 8).

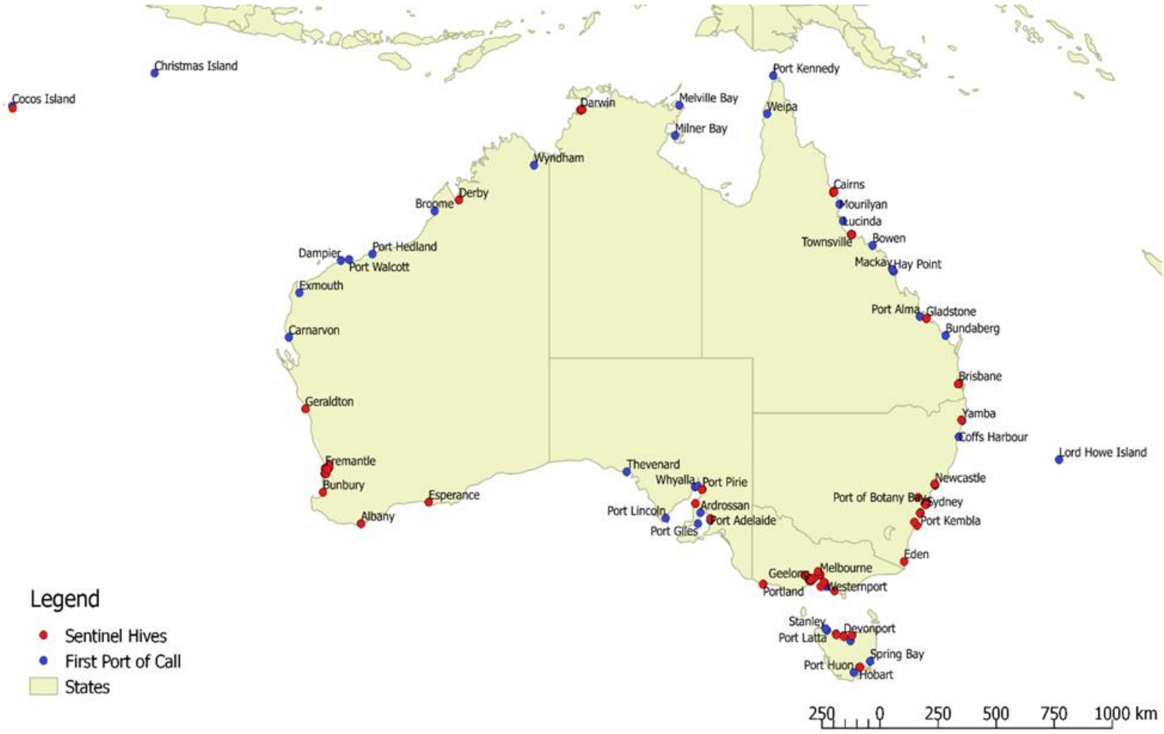

Figure 8 Map of sentinel hives and first ports of call in Australia.

Tracheal mite analysis was a key component of the NBPSP performed by Bugs for Bugs as well as trained apiary officers (New South Wales and South Australia), there were 19 ports which included tracheal mite surveillance.

In June 2013, surveillance for small hive beetle was incorporated into the Program for Tasmania and the Northern Territory, where it is currently not present, and also Western Australia, where it is currently restricted in distribution to the northern part of the state (Kununurra). Hives were tested every two months using oil traps or Apithor harbourages (containing the insecticide fipronil). This routine testing provides a means for early detection of small hive beetle as well as supporting export market access for Tasmania, the Northern Territory and parts of Western Australia through the collection of data demonstrating pest absence.

PHA continued to manage the APVMA permits for the NBPSP. A new permit was issued for use in the NBPSP by the Australian Pesticides and Veterinary Medicines (APVMA). The permit (PER80923), issued in September 2015, increased the use patterns for Bayvarol® and Apistan® in sentinel hives. The former permit only allowed for use for 24–48 hours every 6–8 weeks, while the new minor use permit allows for use for between 1–6 days every 6–8 weeks. From May 2016, a new minor use permit was issued for the use of formic acid (Mite Away Quick Strips®, MAQS) in the NBPSP by the APVMA. These strips can be left in a sentinel hive for seven days. Leaving miticide strips in sentinel hives for a longer period, and for alternating use of three strips types allows for much greater confidence of early detection, and lowers the risk of potential mite resistance.

Catchboxes

Currently there are 15 ports where 171 catchboxes are deployed. Establishment of the majority of these catchboxes are at high and medium risk ports adding value to the surveillance of *A. mellifera* and pest bees at these ports. In Victoria, 39 colonies of bees have been collected in catchboxes from 2005–2015. Review of the program suggests deployment of catchboxes could be increased in Western Australia, Norther Territory and Tasmania.

Remote catchboxes

A proof of concept trial of 20 remote surveillance catchboxes (RCB) was deployed in Brisbane, Gladstone, Weipa, Cairns and Darwin. PHA received alerts of movement inside the RCB via an email notification which was then checked in the PortBees website, and if needed the hive was remotely closed if there was a concern. The trial of remote catchboxes around Australia was finalised in 2016, and a further 20 remote catchboxes have been proposed to be deployed across ports in Australia, particularly where access is difficult in an enhanced NBPSP program. There have been no recorded catches to date, however there has been email notifications of "detected activity" in deployed catches. The detected activity has been from other insects, debris or movements inside the boxes. Despite no bee swarm catches the system is working sensitively enough to send through alerts which gives PHA confidence that a swarm will not go undetected. The plan to deploy a further 20 RCB, on top of the 20 already in existence, specific improvements and technology upgrades are required to improve the sensitivity and successfulness of this surveillance activity.

Swarm Capture

There were 41 ports which have recorded a swarm capture. The majority of these were at major ports across the jurisdictions, namely Queensland, New South Wales and Western Australia. All swarms that were captured were destroyed, identified, and inspected for mites and other exotic pests.

Floral sweep netting

Floral sweep netting was undertaken in a total of 19 ports. The success of this component was reliant on the development of floral maps targeting floral resources appropriate for area. The timing for floral sweep netting to capture targeted bee species was an important aspect to the success of the activity.

Beekeeper involvement

Beekeepers were involved in all port surveillance activities, undertaking sentinel hive inspections and any additional activities such as sugar shake, alcohol wash and drone uncapping. Beekeepers were vital in additional inspection of swarm captures and general observations of bee populations within areas.

PHA has also undertook work with the Norfolk Island Government to implement surveillance activities on the island. This was in recognition that Norfolk Island is part of a risk region with established Asian honey bee in the region and frequent shipping between New Zealand and Australia which presents a risk for Varroa mite.

- *Reporting obligations*

Annual surveillance data is collected and summary reports are generated as part of the requirements for the NBPSP and are reported by two formal reporting avenues; the *Animal Health in Australia* (AHiA) and PHA *National Plant Biosecurity Status Report* (NPBSR) both published yearly. The AHiA Report also fulfils the reporting obligation for the World Organisation for Animal Health (OIE). The current 2015/2016 reports are available at:

AHiA https://www.animalhealthaustralia.com.au/wp-content/uploads/2015/09/AHiA_REPORT_2015_WEBVERSIONFINAL.pdf

OIE http://www.oie.int/wahis_2/public/wahid.php/Countryinformation/Animalsituation

- *Scope for future NBPSP: including surveillance activities, design and funding for 2016-2021*

Development of a long-term funding model for the NBPSP 2016–2021 and proposed costings per annum was addressed as part of MT-14057 'Statistical Review and Redesign of the NBPSP'.

Expansion of the program to ensure surveillance is undertaken and maintained at high and medium risk ports: Where possible, six sentinel hives, should be placed at all high and medium risk ports. Four sentinel hives to be deployed at low and unknown risk ports. These sentinel hives need to be placed at a 2 km spacing, and inspected every 6 weeks (instead of 8 weeks as currently contracted). As previously outlined, formic acid (MAQS) has been approved for use in sentinel hives and this should be incorporated in a scheduled timing along with the Apistan and Bayvarol.

Other surveillance activities currently carried out at each of these ports should include sweep netting, tracheal diagnostic testing, catchboxes, honey testing, and beekeeper involvement should be maintained and further developed. One aspect of this, as previously mentioned, is regarding further deployment of RCBs.

Future additions: An increase in surveillance activity for Asian honey bee in the eastern states of Australia to monitor the spread of the existing populations and to provide early detection for new populations of this pest

A new component for bee virus diagnostics could be considered to provide early detection capability for high priority viruses listed in the Honey bee industry Biosecurity Plan. Virus surveys will assist with area freedom for export markets.

Surveillance for Asian Hornet. This pest will require specific surveillance techniques, including research to investigate a trap and lure for deployment at high risk sites.

Necessary improvements needed with a NBPSP 2016-2021: Update of Operations Manual, improved data capture and reporting to increase efficiencies and engagement amongst stakeholders, as well as developing a central database for ease of handling high volume, significant data, and the continued encouragement of beekeeper involvement to maintain sentinel hives and/or undertake other surveillance methods.

Bee Biosecurity Video Series

To address the above outputs, the project has undertaken the following;

- Collaborate with researchers, growers, beekeepers, and state and Commonwealth department quarantine inspectors for a variety of inputs about the importance of bee biosecurity and bee pest surveillance
- Develop the videos with both Australian and New Zealand input (varroa context)

This video series has covered off on topics listed below as the video titles. The video content provides information to industry, government and the public about the NBPSP. Videos have also explained the monitoring and surveillance methods, which re critical in the event of an exotic pest detection.

The 12 video titles are:

1) What is honey bee biosecurity?
2) National Bee Biosecurity Program and Biosecurity Code of Practice
3) National Bee Pest Surveillance Program
4) Introduction to the bee parasitic mite Varroa destructor
5) Varroa spread, life cycle and population growth
6) Effect of Varroa on European honey bees
7) A varroa incursion and effects on beekeeper movement
8) Effect of a varroa incursion on beekeepers and crop producers in Australia
9) Managing pollination services in the presence of Varroa
10) Inspecting hives for the presence of Varroa
11) Control options for managing Varroa
12) Chemical control of Varroa

In February 2016, a draft demo was provided to PHA from subcontractor Plant and Food Research New Zealand. Review and discussion of the demo had resulted in a re-vamp of the production and development style of the video series. PHA had a certain desired outcome and look for these videos. PHA had aimed for a far more engaging, aspiring, informative video series which was better suited to the intended audience. The videos aimed to put greater emphasis on healthy honey bees on Australian flowers, healthy bees flying around hives, and footage of good biosecurity practices.

The video project sought involvement from a range of beekeeping practices to include as much diversity and coverage of the Australian industry as possible. Small-scale hobby enterprises, commercial practices, and urban based businesses from Canberra and Sydney were sourced for involvement in these videos, including local pollinator-dependent crop growers. Maintaining the involvement of State and Commonwealth governments such as NSW Department of Primary Industries, NSW Bee Biosecurity Officer, ACT Beekeepers Association, and Commonwealth Biosecurity Inspectors, were used to ensure that there was input from staff who were involved in bee surveillance and who promote good bee biosecurity practices.

In addition to the interviews from the above representative bodies, bee and pollination researchers from Australia and New Zealand were included to add scientific value, and another dimension to the videos.

Footage for the videos was captured from New Zealand in March 2016 and Australia April 2016. All of the Varroa footage has been filmed in New Zealand, while majority of the remaining footage was captured in Australia or kindly provided from Australian businesses and researchers (Bees Business, Capilano Honey, Erica Wild Photography, and Dr Ros Gloag) and PHA staff.

PHA have had a great deal more input into the script development and writing than initially intended, this was to ensure correct information and appropriate messages are given informatively and concisely for the audience. The inclusion of a voiceover and background music, has added a great deal more professionalism to these videos.

The final 12 videos have now been released and made accessible on the Farm Biosecurity YouTube page. The videos are also accessible on the BeeAware website.

Figure 9 Behind the scences of the Bee Biosecruity Videos series production development (credit PHA).

Industry Adoption

These videos will be a valuable resource for the industry for many years to come, and will be a supporting resource to accompany the Bee Biosecurity Program, Code of Practice, and support in the National Bee Pest Surveillance Program.

A high level of industry adoption will be reached with the videos through its inclusion on the BeeAware website. Over a three-month period, up to 12,000 visits may occur on the website, in addition the BeeAware newsletter has over 1,400 subscriptions. The Bee Biosecurity Videos have been promoted via the newsletter, PHA twitter account and other media outlets. Completion and launch of the videos has promoted awareness of the importance of biosecurity to these industries and will encourage the adoption of surveillance methods in day-to-day apiary practices.

7. Outcomes

This project has achieved;

- Improved surveillance for early detection of new bee pests at high risk ports
- Improve the chances of eradication of a new pest introduction, before it establishes and spreads
- Develop a formal system of targeted surveillance nationally through combination of techniques
- Develop various resource materials to assist the industry in its involvement in surveillance

In providing specific surveillance activities for targeted, early detection of bee pests and pest bees at high risk ports of entry, this project has improved the chances of the eradication of a pest incursion before it becomes established and spreads to production areas. It is also an important tool in providing the evidence of absence information from pests, which assists in maintaining market access for trade. The program has been successful in maintaining Australia is free of key industry threats, namely Varroa destructor.

Despite successful surveillance monitoring, Australia has had an incursion of Apis cerana java genotype that has now established, though regionalised, in Cairns (Queensland). The program was adapted and modified to recognise this establishment, though surveillance for this pest bee within the Cairns region was maintained to monitor its population spread. Due to the establishment of this key pest bee which can carry the two varroa species, continued surveillance in other areas of Queensland, as well as nationally, was essential to maintain proof of absence for trade and market access issues. The adaptability of the Program to such incursions has meant that over time the Program has developed and improved in its own right, but also the enthusiasm of inspectors and demand from the honey bee industry for Australia to remain pest free from other threats, has ensured the Program has maintained drive. Over the life of this project, and despite the establishment of *A. cerana* in Cairns, the Program has proven to be successful with a further 93 Asian honey bee, 48 Giant honey bee, 12 Red dwarf honey bee detections (alive or dead) and 16 Varroa mites (*V. destructor* and *V. jacobsoni*) detections at ports (destroyed upon detection). Without the sensitive methodologies developed for this Program, a higher number of these exotic pests most likely would have entered Australia and become established.

Prior to the new investment in the NBPSP, a review of the program to ensure resources are being utilised effectively and efficiently, to maximise outcomes for early detection of pests and maintain bee health and pollination services in Australia, was undertaken (Hort Innovation project MT14057). The analysis of the program and the collected data shows that the program and the surveillance methodologies developed, are highly specific and sensitive for the early detection of bee pests and pest bees. The review of the Program (MT14057) achieved a Varroa Spread Model to evaluate the optimal surveillance design associated with the sentinel hive component operating at Australian ports. The model estimated broadly that the optimal arrangement of sentinel hives for detection of Varroa mites at high risk ports, is an array of 6 hives at 2 km spacings, inspected and checked every 6 weeks. This is largely consistent with this projects NBPSP design. This therefore supports that the current program has been developed to date in its most optimal form and has been highly successful in maintaining a proof of absence, as well as an early detection and eradication of key threats.

The program has achieved a number of elements that has resulted in a greater community awareness program. Over the life of this project, honey bees have gained a considerable volume of media and interest, namely due to threats such as *V. destructor* and the links it has with food security. It is because of the broader community drive that programs such as BeeForce was developed.

BeeForce is a community engagement project that examined the potential of urban hobby beekeepers in a post-border surveillance program for the early detection of Varroa mites around high-risk entry points in two locations in Victoria. BeeForce identified how community detective networks, or BeeForce task groups, could be recruited, structured, trained and motivated to assist in monitoring for a high priority honey bee pest over a two-year initiative in both Melbourne and Geelong. This project compared two models which arose in Melbourne and Geelong and the BeeForce participants' drivers and inspirations in both locations. A set of dependable BeeForce participants trained to perform a very simple set of tasks for the early detection of Varroa mites can enhance the current capability dedicated to post-border programs. The BeeForce pilot demonstrated that participants could be successfully enlisted, trained and relied upon. After the 2 years pilot phase, BeeForce was implemented at the national level.

It is now recognised by several environmental groups and government agencies that volunteers can assist with detection and or control of the growing number of pest threats facing Australia and value add to the set of programs already in place across the country. Such a task force has the potential to bridge the divide between government, industry and the community sectors. Most importantly, programs such as BeeForce increase community awareness, improve Australia's preparedness for new pest incursions and invasions, speed up responses and mobilise community vigilance in early detection for a more effective pest detection and control.

Along the path of community awareness programs, and enhancing the knowledge base and skills of our hobby and commercial beekeepers the development, launch and subsequent dissemination of the Bee Biosecurity videos will result in an increase in biosecurity awareness within the industry. Partnered with BeeForce and our volunteer beekeepers in the NBPSP these videos will be a useful piece of educational material. The Bee Biosecurity video series will not only help honey bee producers in setting up best practice now, but also prepares the growers and producers as a whole for the arrival of *V. destructor*. The videos are about current biosecurity issues facing the honey bee and pollination industries, and will assist beekeepers and growers in implementing biosecurity best management practices. These videos will also be critical in reaching a large audience of beekeepers and growers in a very short space of time in the event of a Varroa incursion.

8. Evaluation and Discussion

The development and implementation of the National Bee Pest Surveillance Program 2013–2016 has been an exemplar model for government and industry partnerships with wide ranging benefits. The Program to date as set a clear base line for surveillance activities for the next phase of the NBPSP 2016–2021.

By continuing to provide a nationally coordinated NBPSP which targets high risk ports of entry, this program will continue to greatly improve the chances of eradication of new pests before they become established and spread to production areas; effectively protecting the approximate $1.8 billion per annum agriculture production system that is highly reliant on honey bees for pollination.

The review of the Program (MT14057) investigated whether the current surveillance methodologies are adequate enough, moving forward into the future, to maintain absence of exotic threats. Currently, activities undertaken at high risk ports have been successful in capturing a number of key threats early, however a number of these methodologies have also proven to not be adequately executed or at least could be improved for extra sensitivity.

At least 171 catchboxes are deployed across 15 ports, however vary rarely are there swarms captured inside. Investigation has identified that a number of catchboxes are not deployed in ideal areas (aka on open dock areas, away from floral resources, in direct sunlight and exposed to other environmental elements), and genuinely not entirely attractive to bees. This appears the same for the remote catchboxes. These potentially can be a unique, and successful surveillance method covering areas of less accessibly, however since the deployment in 2014 there have been no swarm captures but there have been alerts of in-hive activities. It has since been identified that these catchboxes also have not been deployed in appropriate locations, and unlike standard catchboxes, have no foundation frames or any attractive prospects inside the hive for a swarm. The technology and phone camera software is not adequate enough to be confident that the system will detect a swarm should it enter, this is because the number of false alerts received, and malfunctions in technology occurring in the hives. There are issues around being able to remotely operate these hives from the desktop, as well as to confidently make a judgement call via the images captured as they are of poor resolution. The review of the program has outline these issues around catchboxes (standard and remote) and it is envisaged that these upgrades will occur in the new program.

Swarms located at ports (in open areas or hanging off equipment) has been identified in a total of 41 ports over the life of this project namely Queensland, New South Wales and Western Australia. Majority of these have been *A. mellifera* or *A. cerana* swarms, though other exotic pest bees have been located on vessels and containers, all of which are destroyed and inspected for exotic pests. More and more are port staff seen as playing an important role in the national surveillance program, and their alertness and vigilance needs the recognition it deserves. This is reflected in the 23 swarms collected in 2015 within the Cairns region. Floral sweep netting is a method that can help assist officers to identify if potential swarm or feral nest are within the vicinity of the foraging bee captured. In this project, floral sweep netting was undertaken in a total of 19 ports, however despite contract requires there appears to be a need for development and involvement of this activity. The success of this component is reliant on an understanding of the environment and key floral resources within the surveillance area, and floral maps are needed to enable sweep netting to be timed appropriately to achieve positive outcomes. This method can be beneficial in providing a better understanding of the movement of bee populations within an area (including *A. mellifera* and established *A. cerana* populations). Floral sweep netting has been flagged as an important method for improvements to target all pest bees for the new NBPSP, it is also flagged as being top priority on all jurisdictional contracts to be completed and performed much more routinely than it has been to date.

One methodology that has been identified as not being a useful surveillance activity in a scheduled program, is the analyse of rainbow bee-eater pellets. Though outlined in the operations manual, this activity has only been performed in an incursion situation of *A. cerana* and for that has been marked for removal in a new NBPSP operations manual. Discussions with jurisdictional officers have outlined that this method is difficult to use on a routine schedule. Though the birds are widespread in Australia (except desert areas), they are migratory from the south to the north for winter. To be able to successfully use this method officers and/or volunteers need to be specially trained to be able to identify rostering locations and examination of faeces for wing debris. Wing examination can also be difficult as specific skills need to be able to identify the differences in wing venation between *A. mellifera* and *A. cerana*. This method will remain as a part of an *A. cerana* incursion response, however will not fall a part of the regular NBPSP schedule.

The key component for this Program has been the sentinel hives at key sea and air ports around Australia, and is also one of the costliest components of the NBPSP. These surveillance hives play a significant central role for the detection of high priority mites that also vector viruses of serious concern. The sentinel hive component can be used in conjunction with other surveillance activities such as sugar shake, alcohol washing and drone uncapping, which are highly sensitive for detecting mites such as Varroa mite. Throughout this Program, sentinel hives have been routinely inspected every 6-7 weeks to ensure absence of bee pests, and it is the continued commitment from contracted departmental apiary officers and volunteer beekeepers that ensure this component of the surveillance program is maintained. The review of the NBPSP (MT14057) in early 2016 developed the *Varroa Spread Model*. This model was used to identify surveillance components that would be required to achieve the highest likelihood of detection. Results indicated that an inclusion of six sentinel hives at 2 km spacings, inspected every 6 weeks at all high and medium risk rated ports, plus a further four hives deployed at lower risk rated ports would confer an overall increase in the confidence of detection of bee mites from the sentinel hive program to 72%. It is envisaged that this key outcome of the review will be incorporated in to the new NBPSP program. MT12011 has already been successful in developing these key surveillance requirements, and have provided the support to deploy (at most times) the minimum number of sentinel hives at ports, nationally. The management of this project has ensured that the system is ready to take on an improved sentinel hive arrangement, either bringing high risk ports up to the hive number needed (6 or 4) or removing ports that are being utilised inefficiently and moving those resources to where they are needed.

Through review of the NBPSP, it was noted that a significant increase in resources is required simply to maintain the program. As the program expanded past what was originally contracted (aka more sentinel hives deployed at locations not outlined in contracts), the costings currently do not reflect the activities undertaken. A cost comparison of activities for the length of this project is outlined in Table 3.

Table 3 The following figures have been taken from the review of NBPSP (MT14057) and adapted for this report. The table outlines the summary the annual costings comparing the of what was contracted/budgeted in the contracts/program, against the 'actual' cost of this program. Total annual costs for the programs is provided, as well as the total costs for the 4-year program (2012/2013 to 2015/2016).

	What was contracted for the program	**'Actual' cost of current contracted program**
Sentinel hive arrangement	$134,910[1]	$284,000[3]
Additional surveillance activities	$ 83,000[2]	$294,500[4]
Annual cost	$217,910	$578,500
Total costs over a four-year period	**$871,640**	**$2,314,500**

[1]This cost is the contracted budget provided annually for jurisdictions to perform all sentinel hive inspections, as well as all other port surveillance activities (swarm capture, floral sweep netting, catchbox inspections)
[2] This cost is these specific inclusions: NAQS, Bugs for Bugs, AustVet, honey testing for Minimum Residue Levels of chemicals, and PHA facilitation
[3]This the actual cost of maintaining sentinel hives and undertaking the in hive surveillance methods
[4]Cost of all these additional inclusions plus the additional surveillance not included in dot point 3 above: NAQS, Bugs for Bugs, AustVet, swarm capture, floral sweep netting, catchbox inspections and PHA facilitation

Over the life of this project, there has been a considerable volume of successful surveillance outcomes achieved, an increase in number of samples and/or traps inspected upwards of 939 items at the end of 2015, with 630 inspected in 2016 (reflective for surveillance activities taken place from January to end of August 2016, and November 2016). This shows the efforts of all involved and the enthusiasm and understanding of the importance of such a surveillance program. With all programs there can be enhancements and improvement, the MT14057 has outlined clear recommendations for the future Program, and it is with great intention that majority of these will be developed into the next Program. These include, but are not limited to; increase in investment for the NBPSP in order to maintain and enhance components of the program, expansion of the program to ensure surveillance is undertaken at all high and medium risk ports by incorporating four and six sentinel hives (dependent on port risk rating), and improving upon the additional surveillance activities at these ports. An increase in activities such as sweep netting and installation of more remote surveillance catchboxes for ports where sentinel hives are not deployed. Two new surveillance activities including the incorporation of virus diagnostics for early detection of high priority bee viruses listed in the Honey bee industry Biosecurity Plan, and surveillance for Asian Hornet. Investigation of improved data capture and collation tools to increase efficiencies, and the engagement amongst stakeholders within the NBPSP by the recently developed web-based system, AusPestCheck, and establishing and maintaining formal links between the NBPSP, the National Bee Biosecurity Program, BeeForce and BeeAware to provide the most effective coverage of surveillance activities for high priority pests. These linkages will form part of the coordination role within the program and will inform the activities targeted by each program.

The development of the Bee Biosecurity Videos is already one step in the right direction of forming linkages with our industry, and providing the needed education in bee biosecurity best practices and surveillance of their own hives. It is important that both commercial and hobby keepers are the target audience for these Bee Biosecurity Videos, the industry will only ever be as strong in its biosecurity as its weakest link and therefore needs to deliver to as broader audience as possible. On review and reflection of this project, PHA would have preferred a greater input from commercial beekeeping practises; either as interviews or with footage, as well as the inclusion of more pollinator-reliant industries. However, this was not possible due to the timeline schedule of this project which was heavily influenced by the seasonal period. Where it was not possible to capture more footage, this was included as in-kind footage contributions from collaborators from archived footage, or substituted with still images. These videos will be a unique resource valuable for many years to come as more people become aware of the issues surrounding our honey bee industry, and hobby and/or urban beekeepers wanting to be involved in checking their hives for pest and disease, as majority of these beekeepers are close to ports.

The current NBPSP has been a leading example of a successful industry government partnership that has benefited from a nationwide approach to surveillance. This project has been effective in developing, managing and maintaining the NBPSP. Ensuring the support and resources are made available to jurisdictions to conduct surveillance effectively.

This program has set the industry up in preparation for an enhanced, next stage, NBPSP which is based on the current successful surveillance activities but also includes the important future recommendations from Hort Innovation report MT14057.

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