The Senate

Environment and Communications References Committee

Risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial pollination purposes

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Table of contents

Recommendations

Recommendation 1

3.93 The committee recommends that the Commonwealth introduce amendments to the *Environment Protection and Biodiversity Conservation Act 1999* to amend the live import list to allow for the use of existing feral populations and that the proposed amendments be referred to the Environment and Communications Legislation Committee for inquiry and report.

Recommendation 2

3.94 The committee recommends that any proposed amendment of the live import list to allow the use of existing feral populations provide for a review mechanism after two years of operation. The committee further recommends that, should any adverse environmental impacts be identified in the review, the *Environment Protection and Biodiversity Conservation Act 1999* be amended to omit Part 3 of the live import list.

Recommendation 3

3.95 The committee recommends that the Commonwealth Government work with state governments to fund further research into the use of native bees as pollinators.

Chapter 1

Introduction

1.1 On 2 February 2016, the Senate referred the following matter to the Environment and Communications References Committee for inquiry and report by 22 June 2016:

> The risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial pollination purposes, including:
>
> (a) the existing distribution and population density of exotic bumblebees;
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> (b) productivity and economic benefits of the commercial use of bumblebees for agricultural producers;
>
> (c) the potential environmental impacts associated with the commercial use of bumblebees, including whether their use is likely to:
>
> i. impact the conservation status of a species or ecological community,
>
> ii. impact biodiversity,
>
> iii. cause unintended ecological impacts, and
>
> iv. contribute to a wider distribution of bumblebees;
>
> (d) the implications for Australia's biosecurity regime of any approval to use bumblebees in Tasmania for commercial purposes;
>
> (e) the potential economic outcomes;
>
> (f) the effectiveness of alternative pollination options; and
>
> (g) any other related matters.[1]

1.2 On 9 May 2016, the Senate and the House of Representatives were dissolved for a general election on 2 July 2016. As a result of the dissolution of the Senate for the election, the committee ceased to exist and the inquiry lapsed.

1.3 The 45th Parliament commenced on 30 August 2016 and members of this committee were appointed on 1 September 2016. On 13 September 2016, the Senate agreed to the committee's recommendation that this inquiry be re-adopted with a reporting date of the second last sitting day in February 2017.[2] The Senate also agreed to the recommendation that the committee have the power to consider and use the records of the Environment and Communications References Committee appointed in the previous parliament that related to this inquiry. The reporting date for the inquiry was subsequently extended to 13 June 2017.[3]

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1 *Journals of the Senate*, No. 135, 2 February 2016, p. 3663.

2 *Journals of the Senate*, No. 5, 13 September 2016, p. 177.

3 *Journals of the Senate*, No. 28, 14 February 2017, p. 945.

Conduct of the inquiry

1.4 As noted above, the inquiry spans two parliaments—the 44th and 45th—with the conduct of the inquiry interrupted by the dissolution of the Senate prior to the 2016 general election.

Progress during the 44th Parliament

1.5 In accordance with its usual practice, the committee appointed in the previous parliament advertised the inquiry on its website. The committee also wrote to relevant organisations and individuals inviting submissions. The committee received 22 submissions which are listed at Appendix 1. The committee also received nine form letters.

Progress during the 45th Parliament

1.6 Following the re-adoption of the inquiry on 13 September 2016, the committee resolved not to call for new submissions but to refer to the evidence received during the 44th Parliament.

1.7 The committee held public hearings in Hobart on 21 February 2017 and in Canberra on 29 March 2017. The witnesses who appeared at the hearings are available in Appendix 2.

Acknowledgement

1.8 The committee thanks all of the individuals, organisations and government departments which made submissions to the inquiry and gave evidence at the public hearings.

References

1.9 In this report, the name 'bumblebee' refers to *Bombus terrestris* which is commonly known as the Large Earth Bumblebee or Buff-Tailed Bumblebee. In addition, in July 2016, the Department of the Environment became the Department of the Environment and Energy. References in this report may be made to the department's former name.

Background

1.10 The following discussion provides an overview of the bumblebee population in Tasmania and the relevant provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Bumblebee population in Tasmania

1.11 There are no native species of bumblebees in Australia.[4] *Bombus terrestris* is native to Europe and was accidentally or illegally introduced in Hobart in the early 1990s. The Department of the Environment and Energy referred to studies which show the Tasmanian population originated from the South Island of New Zealand and appears to have been established from as few as two queens.[5]

1.12 Bumblebees were first observed in Hobart in 1992 and by 1993 it was accepted that bumblebees had become established in Tasmania.[6] There were no attempts to eradicate the population. Associate Professor Geoff Allen, University of Tasmania, commented that by the time the population was identified, bumblebees had been in Hobart for some time and had gone through 'at least a couple of generations, so the opportunity was lost to eradicate it'. Professor Allen also noted that social insects are very hard to eradicate as access to queens is necessary.[7]

1.13 The University of Tasmania and Tasmanian Institute of Agriculture commented that it is estimated that bumblebees spread at least 20 kms per year in the dispersive phase and had spread throughout Tasmania within at most 14 years.[8] Populations are now found in all major vegetation habitats, including urban and agricultural areas, from sea level to altitudes of approximately 1 180 metres above sea level.[9] Bumblebees have been observed in at least ten Tasmanian national parks, the Tasmanian Wilderness World Heritage Area and on offshore islands including Cape Barren and Maatsuyker Island.[10]

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4 Department of the Environment, *Submission 22*, p. 2.

5 Department of the Environment, *Submission 22*, p. 2. See also University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 2.

6 Department of the Environment and Energy, *Submission 22*, p. 2.

7 Associate Professor Geoff Allen, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 27.

8 University of Tasmania and Tasmanian Institute of Agriculture, *Submission* 6, p. 2.

9 Department of the Environment, *Submission 22*, p. 4. See also Dr Anne Dollin, *Submission 15*, p. 1; Geelong Beekeepers Club, *Submission 18*, p. 1.

10 Dr Andrew Hingston, *Submission 11*, p. 2.

1.14 Dr Andrew Hingston noted that the population density varies throughout the year but during spring and summer the population can reach high densities.[11] In their native environments bumblebees die off in winter and re-establish colonies in spring from a single queen. However, research suggests that in Tasmania winter die off may not be significant and bumblebees may produce two colonies per year rather than the normal one colony seen in the northern hemisphere.[12]

1.15 Dr Peter McQuillan, University of Tasmania, added that the spread of bumblebees appear to have plateaued from the end of the 1990s after having increased and spread rapidly. Dr McQuillan stated that over the last 15 years the populations have not risen very much which may be due to inbreeding.[13]

1.16 Bumblebees forage on a wide variety of plants. The University of Tasmania and Tasmanian Institute of Agriculture commenting that:

> Bumblebees have been observed foraging in Tasmania at native flowers in natural habitats as diverse as saltmarshes and alpine heathlands. Similarly, garden flowers of temperate European origin are very common in domestic gardens and are well visited by bumblebees (e.g. lavender).[14]

1.17 Submitters noted that as the population of bumblebees in Tasmania originated from one or two queens, it is genetically poor.[15] The University of Tasmania and Tasmanian Institute of Agriculture commented that the 'Tasmanian population's gene pool is less than half of the allelic richness and levels of heterozygosity that endemic populations of *Bombus terrestris audax* (the subspecies it came from via New Zealand) have in the United Kingdom'.[16]

1.18 The Tasmanian Government also commented on the lack of genetic diversity and stated that:

> Tasmania's population of bumblebees is also known to be highly inbred. It is understood that the limited gene pool may be acting as a biological constraint on the species, through reduced worker bee numbers and increased sterility amongst the drones.[17]

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11 Dr Andrew Hingston, *Submission 11*, p. 2.

12 Department of the Environment, *Submission 22,* p. 4.

13 Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 24.

14 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6,* p. 2

15 Dr Katja Hogendoorn and et al, *Submission 16*, p. 1.

16 University of Tasmania and Tasmanian Institute of Agriculture, *Submission* 6, p. 2.

17 Tasmanian Government, *Submission 20*, p. 2. See also Department of the Environment, *Submission 22*, p. 4.

Environment Protection and Biodiversity Conservation Act 1999

1.19 The EPBC Act establishes a List of Specimens Taken to be Suitable for Live Import (the live import list). If a specimen is included on the live import list it can be imported as either a whole organism or as reproductive material. It is an offence to import an unlisted specimen or to possess an unlisted specimen that was unlawfully imported or its progeny.[18]

1.20 As bumblebees are not included on the live import list, any person wishing to import bumblebees would be required to make an application under the EPBC Act. The application would be subject to the risk assessment process for amending the live import list.[19] In addition, any person wishing to undertake a trial for the commercial use of an unlisted specimen that has established a feral population would be unable to do so without amendment of the live import list.

1.21 Mr Stephen Oxley, Department of the Environment and Energy, explained further:

> The live import list is what we call a white list. That is, it is a list of exotic species that are allowed into Australia. If the species is not on the list, it is illegal to import it and possess it…the notion of importation seems is little bit weird in this context, because we are dealing with a feral species that is established in Tasmania and we can only speculate, in the end, about how it got here. But as the first bumblebees were not lawfully imported, they and their progeny cannot be possessed lawfully and that is the legislative barrier to a trial being conducted now.[20]

Previous applications to include bumblebees on the live import list

1.22 As noted above, a species not included on the live import list cannot be used or trialled for a commercial purpose. However, there has been ongoing interest from some sectors of the horticulture industry in Tasmania to use bumblebees for commercial pollination purposes.[21]

1.23 The Department of the Environment and Energy indicated that it has previously received applications to allow the importation and use of bumblebees in the horticulture industry. An application by the Australian Hydroponic and Greenhouse Association in 2005 to include the bumblebee on the live import list was rejected in

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18 Department of the Environment, *Submission 22*, p. 3.

19 The process for amending the list is outlined at: http://www.environment.gov.au/biodiversity/wildlife-trade/live/import-list/how-to-amend

20 Mr Stephen Oxley, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, pp. 1–2.

21 Costa Group, *Submission 12*.

2008 'after a thorough environmental assessment'.[22] The grounds for the rejection of the application were that the bumblebee posed an unacceptable risk to the Australian environment. In rejecting the application, the then minister cited the escape of bumblebees from greenhouses overseas, the potential contribution to the spread of weeds and competition with native species for food.[23] The Department of the Environment and Energy also noted that, at that time, no state or territory supported the proposed inclusion of the bumblebee on the live import list.[24]

1.24 A further application was made in August 2013 by the Costa Group to amend the live import list and for a testing permit to trial the use of bumblebees in greenhouses. The application was rejected by the Department of the Environment and Energy 'as not fitting the requirements of the legislation'.[25] Mr Paul Murphy, Department of the Environment and Energy, commented on the scope of testing permits and stated:

> The testing permit that is under the EPBC Act is designed to allow the environmental impacts to be tested in the process of considering whether or not to put the species on the live import list, but the testing proposed in that application more went to commercial viability than assessing environmental impacts. It also was not going to be conducted in a quarantine facility, which would have made it very high risk to the Australian mainland where it was proposed to be conducted.[26]

1.25 Mr Oxley went on to comment that testing permits are more commonly used in relation to testing of biological control agents being brought into Australia to deal with a particular pest species or weed. The testing considers efficacy in the context of the Australian environment and the impact on other species 'to prove that the biological control agent is specific to the species' in Australia that is to be controlled.[27]

1.26 In early 2015, the Tasmanian Government proposed commercial scale trials. While not condoning the breach of biosecurity law associated with the introduction of bumblebees in Tasmania, the Tasmanian Government stated that is was seeking to:

> …carefully and cautiously explore whether the existing feral population of bumblebees could be put to a beneficial purpose, without posing any further threat to the environment or any other existing industry.[28]

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22 Mr Stephen Oxley, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, p. 2.

23 Geelong Beekeepers Club, *Submission 18*, p. 1.

24 Department of the Environment, *Submission 22*, p. 3.

25 Department of the Environment, *Submission 22*, p. 3.

26 Mr Paul Murphy, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, p. 3.

27 Mr Stephen Oxley, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, p. 2.

28 Tasmanian Government, *Submission 20*, p. 2.

1.27 The proposed trial would enable the costs and benefits of using the existing Tasmanian bumblebee population for pollination to be fully understood and quantified.[29] The proposed trial would comprise two parts: first to determine whether a population of wild caught bumblebees can pollinate glasshouse tomatoes effectively and efficiently and to test associated containment procedures; and secondly, to focus on breeding. The second part would proceed only if the first stage were successful.[30]

1.28 Should the trials prove successful, the Tasmanian Government outlined the basis of its support for the commercial use of bumblebees as follows:

> To ensure that Australia can continue to operate a robust and credible biosecurity regime, it is the position of the Tasmanian Government that the only permissible use of bumblebees in Australia should be of the existing Tasmanian feral population in fully enclosed facilities in Tasmania.[31]

1.29 The Tasmanian Government was clear that it would not support the introduction of new genetic material as this was seen as a threatening risk.[32]

1.30 Ms Carole Rodger, Tasmanian Department of Primary Industries, Parks, Water and Environment, stated that the approach supported by the Tasmanian Government was the 'sensible centre on this matter'. Ms Rodger added that the existing feral bumblebee population cannot be eradicated and, as such, its impacts are already being experienced and the Government's view was that 'if Tasmanian horticultural producers can benefit from the limited and controlled use of this existing population, then this possibility should be explored'.[33]

1.31 The Department of the Environment and Energy indicated that it has been working with the Tasmanian Government to finalise terms of reference for a proposed trial into the use of bumblebees for crop pollination. A draft proposal had been provided with the Department of the Environment and Energy commenting on assessment and the environmental factors and risks that it would like to see addressed in the scope of the trial.[34]

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29 Tasmanian Government, *Submission 20*, p. 2. See also Ms Carole Rodger, Tasmanian Department of Primary Industries, Parks, Water and Environment, *Committee Hansard*, 21 February 2017, p. 28.

30 Ms Carole Rodger, Tasmanian Department of Primary Industries, Parks, Water and Environment, *Committee Hansard*, 21 February 2017, p. 28.

31 Tasmanian Government, *Submission 20*, p. 9.

32 Dr Lloyd Klumpp, Tasmanian Department of Primary Industries, Parks, Water and Environment, *Committee Hansard*, 21 February 2017, p. 29.

33 Ms Carole Rodger, Tasmanian Department of Primary Industries, Parks, Water and Environment, *Committee Hansard*, 21 February 2017, p. 28.

34 Mr Paul Murphy, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, p. 2.

1.32 However, the Department of the Environment and Energy emphasised that before the trial could commence, amendments to the EPBC Act would need to be passed.[35] Mr Oxley added:

> …trial of the terms proposed—that is, using the existing feral bumblebee population in Tasmania—cannot be done under the EPBC Act as it stands today. That is why there was a proposal before the parliament to amend the act.[36]

Proposed amendment of the EPBC Act

1.33 During the 44th Parliament, the Government introduced the Environment Protection and Biodiversity Conservation Amendment (Bilateral Agreement Implementation) Bill 2014 (the bill). The Senate, on the recommendation of the Selection of Bills Committee, referred the provisions of the bill to the Senate Environment and Communications Legislation Committee for inquiry and report by 23 June 2014.[37]

1.34 After the Legislation Committee's report was tabled, proposed amendments to the bill were introduced in the Senate to insert provisions to amend the live import list. The live import list currently consists of two parts: Part 1 contains specimens that can be brought into Australian without a permit; and Part 2 contains specimens that require a permit to be imported. The proposed amendments sought to establish a new Part 3 to the live import list. The amendments would create an exemption to the offence provision so as to allow companies or individuals to possess live specimens that are part of an existing feral population in a state or territory and that are listed under the new Part 3. Specimens would be listed for specific states, and could be listed with or without conditions for use.

1.35 The criteria for adding a specimen to Part 3 of the list for a state or territory would include:

- the specimen is part of a feral population in that state or territory; and
- possession of the specimen in the state or territory would not be:
    - likely to threaten the conservation status of a species or ecological community in Australia; or
    - likely to threaten biodiversity; or
    - likely to contribute to a wider distribution of the species.[38]

35 Department of the Environment, *Submission 22*, p. 4.

36 Mr Stephen Oxley, Department of the Environment and Energy, *Committee Hansard*, 29 March 2017, p. 1.

37 *Journals of the Senate*, No. 29, 15 May 2014, p. 818.

38 Department of the Environment, *Submission 22*, p. 3.

1.36 The amendments also proposed to create a mechanism for the Minister for the Environment and Energy to issue a permit to trial the use of bumblebees for up to two years.[39]

1.37 It was proposed that any amendments to the proposed Part 3 of the live import list would use the existing process in the EPBC Act for amending the live import list. That is, amendments to the list could be initiated by the Minister or by application from the public. Before amending the list, environmental impact assessment including consultation with the public and state Ministers, would be undertaken. The decision to add a species to the live import list would only be able to be made by the Minister for the Environment and Energy.[40] Amendments would be made by disallowable instrument. Mr Paul Murphy commented further:

> If the act were amended as proposed then the department would look at running a very similar process to what we use now to amend the live import list. That involves public consultation, including with the states based on the application and the risk assessment supplied with the application. We give the comments back to the applicant so that they can finalise their proposal and their risk assessment, and then we draft a decision and go back to each state and territory with the proposal and get any final comments from them before providing advice to the minister for a decision.[41]

1.38 The Department of the Environment and Energy went on to note that the states and territories would be provided with an 'opt in' mechanism. It is proposed that after a specimen is listed on Part 3, each listed state would advise the Minister in writing whether it wanted to 'opt in' to the exemption. The offence of possessing specimens would continue to apply until the state 'opts in'.[42]

1.39 In closing the second reading debate on the bill, Senator the Hon Simon Birmingham, then Assistant Minister for Education and Training, commented that the amendments proposed a:

> …practical, common-sense approach whereby we seek to facilitate potential for economic development and the potential to create more jobs, to grow more opportunities in Australia and, in doing so, to maintain strong

39 Senator the Hon Simon Birmingham, Assistant Minister for Education and Training, *Senate Hansard*, 14 September 2015, p. 6731.

40 Department of the Environment, *Submission 22*, p. 3.

41 Mr Paul Murphy, Department of the Environment, *Environment and Communications Legislation Committee, Supplementary Budget Estimates Hansard*, 13 November 2015, p. 3.

42 Department of the Environment, *Submission 22*, p. 3. See also Mr Paul Murphy, Department of the Environment, *Environment and Communications Legislation Committee, Supplementary Budget Estimates Hansard*, 13 November 2015, p. 4.

> protections for the environment and strong protections for our threatened species and biosecurity.[43]

1.40 The department has also noted that the proposed amendments were not aimed at the importation of species into Australia. Rather, they were about the utilisation of existing populations of feral species.[44]

1.41 The bill did not proceed beyond the second reading debate in the Senate and lapsed on 17 April 2016 when the Parliament was prorogued. The bill was not restored to the Senate notice paper before the Senate and House of Representatives were dissolved for the July 2016 federal election. To date, the amendments have not been re-introduced in the 45th Parliament.

43 Senator the Hon Simon Birmingham, Assistant Minister for Education and Training, *Senate Hansard*, 14 September 2015, p. 6732. See also Mr Malcolm Thompson, Deputy Secretary, Department of the Environment, *Estimates Hansard*, 13 November 2015, p. 6.

44 Mr Stephen Oxley, Department of the Environment, *Environment and Communications Legislation Committee, Supplementary Budget Estimates Hansard*, 13 November 2015, p. 6.

Chapter 2

Support for the commercial use of bumblebees

2.1 This chapter outlines the arguments provided to the committee supporting the commercial use of bumblebees in Tasmania. The arguments centered on increased productivity in greenhouses and thus economic benefits to producers and the state of Tasmania, and the use of bumblebee pollination should honey bee populations be affected by the varroa mite.

Potential productivity and economic benefits

2.2 The committee received evidence on the potential productivity benefits of the successful commercialisation of the Tasmanian bumblebee population. Submitters commented that productivity benefits arise as bumblebees are efficient pollinators. This efficiency has been utilised in many overseas countries particularly in greenhouses. CSIRO commented:

> In agriculture, *Bombus terrestris* is used in many countries around the world as a pollinator, especially for greenhouse crops. There are some crops (e.g. greenhouse tomatoes) for which this species is a more effective pollinator than the widely available managed pollinator, the European honeybee, *Apis mellifera*.[1]

2.3 Bumblebees pollinate flowers through 'buzz pollination', that is, a rapid vibrating motion which releases large amounts of pollen onto the bee. The Tasmanian Government explained that:

> In most situations, "buzz pollination" will allow a bumblebee to pollinate a flower in a single visit. A honey bee typically needs to visit a flower between 7–10 times before it is fully pollinated.
>
> Bumblebees are fast workers, visiting twice as many flowers per minute as honey bees. Because of their size, they can carry relatively heavy loads, which enables them to make long foraging trips. They also often achieve better contact with stamens and pistils than smaller insects.[2]

2.4 The buzz pollination of bumblebees makes them very effective pollinators in comparison to other pollinating insects such as honey bees and are preferred in glasshouse crops due to their superior performance in enclosed environments.[3] In a

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1 CSIRO, *Submission 7,* p. 6.

2 Tasmanian Government, *Submission 20*, p. 3.

3 Tasmanian Institute of Agriculture and University of Tasmania, *Submission 6*, p. 2; Department of Agriculture and Water Resources, *Submission 19*, p. 3.

glasshouse tomato crop, for example, a single bee has the ability to pollinate 450 flowers per hour.[4]

2.5 Submitters also noted that other attributes of bumblebees may provide potential productivity benefits for pollination services. These attributes include that bumblebees are attracted to flowers with long narrow tubes, such as blueberries and tomatoes, while honey bees are not. Bumblebees are also more efficient pollinators than honey bees as they mainly forage for pollen rather than nectar, and transfer more pollen to the pistils of flowers with each visit.[5]

2.6 A further advantage provided by bumblebees for pollination is that bumblebees are less affected by adverse and cooler weather conditions than honey bees.[6] Honey bees become active at temperatures of 15ºC to 18ºC while bumblebees are active at temperatures around 5ºC. Bumblebees are also active on cloudy, foggy and rainy days and can fly in windy weather.[7] Raspberries & Blackberries Australia stated that:

> In Tasmania, it has been observed that wild bumble bees also act as pollinators of berry crops. It has long been known that bumble bees are more reliable than honey bees as pollinators as they will forage during inclement weather and are less hesitant to forage in crops grown under plastic.[8]

2.7 Other advantages of bumblebees include that they are not tied to a specific area of a crop and will change trees more often and more easily than honey bees. This provides benefits for cross-pollination which is often required for fruit crops.[9]

Increased crop yields and reduction of costs

2.8 The committee received evidence regarding crop yields associated with pollination by honey bees, bumblebees and wand pollination. Wand pollination uses handheld vibrating wands which mimic buzz pollination. Wand pollination is commonly used for tomatoes grown in glasshouses rather than honey bee pollination.[10]

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4 Costa Group, *Submission 12*, p. 3.

5 Tasmanian Government, *Submission 20*, p. 3.

6 Fruit Growers Tasmania, *Submission 1*, p. 2; Raspberries & Blackberries Australia Inc, *Submission 5*, p. 1;

7 Tasmanian Government, *Submission 20*, p. 3.

8 Raspberries & Blackberries Australia Inc, *Submission 5*, p. 1.

9 Tasmanian Government, *Submission 20*, p. 4.

10 Department of Agriculture and Water Resources, *Submission 19*, p. 2.

2.9 Submitters pointed to increases in both yield and fruit quality—size, weight and shape—in plants such as blueberries, tomatoes, capsicum, eggplant and kiwi fruit from buzz pollination services especially in glasshouses. Protected Cropping Australia emphasised the benefits of bumblebees and stated that they are:

> …far more effective at pollination, than human efforts, resulting in a substantial yield increase and quality, on greenhouse crops, stone fruit and berries. This can happen at a much lower cost than manual pollination (currently the practice in greenhouse crops).[11]

2.10 The University of Tasmania and Tasmanian Institute of Agriculture (TIA), for example, noted the increased yield for some glasshouse crops overseas due to the use of bumblebees rather than honey bees for pollination:

> Increases in agricultural productivity derived from bumblebee pollination services in glasshouses are well documented. Investigations of the magnitude of these yield increases when compared to honey bee (*Apis mellifera*) pollination have demonstrated significant increased returns to growers; tomato (19%); capsicum (6%); eggplant (25%); cucumber (22%); raspberry (8%) and strawberry (13%) to name but a few.[12]

2.11 The Department of the Environment and Energy (the department) also noted reports that yields and fruit size have improved by about 20 to 30 per cent in fruit pollinated by bumblebees compared to fruit pollinated by vibrating wand.[13]

2.12 In relation to greenhouse tomatoes, the Department of Agriculture and Water Resources noted that European honey bees are not well suited for pollination. Wand pollination is preferred over honey bees. However, compared to wand pollination, bumblebee pollination gives increased yields according to some studies. Bumblebee pollination also increases quality such as individual tomato weight and more seeds per tomato.[14] Other submitters noted that bumblebees are less aggressive than honey bees and are therefore more suitable for use in greenhouses.

Reduction of costs

2.13 There are costs associated with both honey bee and wand pollination. Apiarists provide hives for a fee. Fruit Growers Tasmania commented that pollination prices have risen as much as seven times in the last season for some crops.[15] The factors contributing to the increased cost of hives are examined later in this chapter.

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11 Protected Cropping Australia, *Submission 10*, p. 1

12 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 2. See also Tasmanian Government, *Submission 20*, p. 3.

13 Department of the Environment, *Submission 20*, p. 5.

14 Department of Agriculture and Water Resources, *Submission 19*, p. 1.

15 Fruit Growers Tasmania, *Submission 1*, p. 4.

2.14 Wand pollination is labour intensive requiring 40 to 60 hours of labour per hectare per week during the flowering period. This imposes significant costs on producers. The University of Tasmania and TIA stated that:

> …the labour cost of having to physically vibrate each flowering stem within the crop is significantly higher when compared to the cost of a bumblebee hive/s which may provide daily pollination services for up to 8 weeks.[16]

2.15 Similarly, the Geelong Beekeepers Club commented that:

> To grow large, round tomatoes, the tomato flower must be well pollinated. Outdoor tomato crops are pollinated by wind currents, but inside a greenhouse flower trusses must be individually vibrated. In Australia this is currently done with an electric wand—a labour intensive process. Consequently growers are keen to utilize an alternative, far less costly process.[17]

2.16 Estimates of the reduction in pollination costs gained through the use of bumblebees were provided by the Tasmanian Government which cited a study by the Australian Hydroponic and Greenhouse Association in 2006. That study estimated that the manual pollination of one hectare of tomatoes costs Australian growers $25,000, against $7,000 for bumblebee pollination, a saving of $18,000 per hectare. The Tasmanian Government noted that this is a 72 per cent saving or in excess of $8 million annually industry-wide. It went on to comment that it is highly likely that manual pollination costs have increased significantly in the decade since that estimate was made, but bumblebee pollination costs (in other jurisdictions) have since come down.[18]

2.17 The Tasmanian Government also noted that Mr Brandsema, Protected Cropping Australia, has indicated that the use of bumblebees would cut pollination costs to 25 per cent of manual pollination.[19] Costa Group provided detailed evidence on cost savings and commented that the cost for hand pollination of a 10 hectare greenhouse is approximately $475,000 per year. If bumblebees were used exclusively to pollinate the crop, Costa expects this would result in a production cost saving of $315,000 per annum for the 10 hectare crop.[20]

16 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, pp. 5–6. See also Tasmanian Government, *Submission 20*, p. 4.

17 Geelong Beekeepers Club, *Submission 18*, p. 1.

18 Tasmanian Government, *Submission 20*, p. 7.

19 Tasmanian Government, *Submission 20*, p. 7.

20 Costa Group, *Submission 16*, p. 3.

Economic benefits

2.18 A major consideration for those supporting the use of bumblebees for commercial purposes in Tasmania is the potential economic benefits. With increased yields and quality and lower production costs, submitters argued that Tasmanian growers would reap a comparative advantage and therefore enable them to expand their markets on the mainland and overseas. In turn, this could fund expansion, particularly of greenhouse crops, and provide more employment opportunities.

2.19 Mr Michael Toby, from the Costa Group (one of Australia's largest horticultural companies and a major grower, packer and distributor of fresh fruit and vegetables), commented that should the proposed trial be successful, Tasmania would have a competitive advantage over every other Australian state and the potential economic benefits would be significant.[21]

2.20 This view was supported by the Tasmanian Government. The Tasmanian Government noted that a report prepared by an independent agricultural economist commissioned by the then Department of Economic Development had found that the use of bumblebees as pollinators would create a major competitive advantage for Tasmanian producers by significantly reducing production costs.[22] It went on to comment that bumblebee pollination 'would also enable Tasmania's CEA [controlled environment agriculture] sector to compete more effectively with countries such as New Zealand and Chile, which already receive a productivity advantage from access to bumblebees'.[23]

2.21 The Costa Group provided an indication of the comparative advantage to be gained through the reduction of current greenhouse tomato pollination costs. It noted that the price of New Zealand tomatoes is much lower than the price of those produced in Australia as pollination costs in New Zealand have been reduced through bumblebee pollination. The Costa Group stated:

> New Zealand (where bumble bees are present and legal) exports about 4000 tonnes of tomatoes p.a. to Australia (worth about $A4.26m), the Pacific Islands and Japan.
>
> In recent years, New Zealand grown glasshouse tomatoes have sold at cheaper prices in Australian supermarkets compared to the Australian grown equivalent.
>
> This price difference is in large part attributable to the significant labour cost savings provided by the use of bumble bees in New Zealand horticulture.[24]

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21 Mr Michael Toby, Costa Group, *Committee Hansard*, 21 February 2017, p. 2.

22 Tasmanian Government, *Submission 20*, p. 8.

23 Tasmanian Government, *Submission 20*, p. 8.

24 Costa Group, *Submission 12*, p. 8.

2.22 Should the trial of bumblebee pollination be successful, it was argued that greenhouse production could expand. The Tasmanian Government noted that 'the economic benefits of bumblebees have been a key driver behind the growth of large scale greenhouse horticulture in many countries throughout Europe and Asia'.[25] The Department of the Environment also commented that there has been a very rapid uptake of bumblebee services by growers where they are available.[26] Both the Tasmanian Government and the department cited to a report produced by the horticultural industry in 2008 in which it was estimated that the economic benefit of bumblebee pollination across Australia could be $40 million per year.[27]

2.23 Mr Marcus Brandsema, Protected Cropping Australia, also commented on potential growth of greenhouse production and associated economic benefits. He stated:

> Why can't a 20-hectare struggling potato farm convert to a 20-hectare high-tech greenhouse employing 300 to 400 people, having this pollination advantage? Why can't Tasmania be the head and not the tail in this industry sector? I am looking much further than our current Tassie footprint. I am looking at our potential.[28]

2.24 The Tasmanian Government suggested that the economic benefits could include significant expansion of the state's CEA sector in which commercial agricultural crops are grown in fully enclosed secure greenhouses. However, while other crops are grown in protective poly-tunnels, there are very few crops apart from tomatoes, capsicums and cut-flowers where fully enclosed greenhouses are employed in Tasmania.[29]

2.25 Total Tasmanian production of tomatoes for fresh markets is small—about 0.42 per cent of the total volume of Australian production with 1.1 per cent of total undercover tomato production. However, the Tasmanian Government submitted that the comparative advantaged gained through bumblebee pollination could lead to an expansion of the production area through investment. It stated that Tasmania could become a future hub for CEA.[30]

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25 Tasmanian Government, *Submission 20*, p. 4. See also University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 3.

26 Department of the Environment, *Submission 22*, p. 5.

27 Department of the Environment, *Submission 22*, p. 5.

28 Mr Marcus Brandsema, Protected Cropping Australia, *Committee Hansard*, 21 February 2017, p. 10.

29 Tasmanian Government, *Submission 20*, p. 7.

30 Tasmanian Government, *Submission 20*, p. 8.

2.26 The Tasmanian Government went on to comment that there had been interest, including from a large grower with significant investment in Tasmania, in investment in CEA in Tasmania if bumblebee pollination were to become available.[31]

2.27 Apart from tomatoes, the potential use of bumblebee pollination for other commercial agricultural crops grown in fully enclosed secure greenhouses such as capsicums, eggplant and cut flowers was outlined. Production of fresh berries was also mentioned, noting the structures used with berries are not fully enclosed.[32]

Employment opportunities

2.28 The University of Tasmania and TIA discussed potential increased employment opportunities resulting from commercial bumblebee pollination. It was noted that increased production levels may result in demand for workers for crop harvesting and subsequent cold chain logistics.[33]

2.29 It was also suggested that opportunities could exist for the development of a bumblebee hive production industry. In those countries using bumblebee pollination services, the bumblebees are commercially bred.[34] The University of Tasmania and TIA commented that a small-to-medium scale bumblebee hive production industry may develop. Their submission explained that this could be undertaken by either the state's beekeeping industry, whose extensive knowledge of crop pollination would seem best suited to this role, or by other commercial parties. The University of Tasmania and TIA concluded:

> It is envisaged that production of hives would positively impact on the State's economy due to increased employment.[35]

2.30 Mr Toby, Costa Group, was similarly of the view that a new industry for research, production, pollination services and export was likely to develop in Tasmania should the proposed trial be successful. He reported that there had already been overseas interest, including for investment, in the commercial production of bumblebees in Tasmania.[36]

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31 Tasmanian Government, *Submission 20*, p. 8.

32 Tasmanian Government, *Submission 20*, p. 7; Department of the Environment, *Submission 22*, p. 5.

33 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 5.

34 Department of the Environment, *Submission 22*, p. 5.

35 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 5.

36 Mr Michael Toby, Costa Group, *Committee Hansard, 21 February 2017*, p. 2. See also Tasmanian Government, *Submission 20*, p. 8.

Other possible benefits

2.31 Other potential benefits from the use of bumblebees as pollinators were highlighted in evidence. These included addressing unmet demand for pollination services at peak times and as additional pollinators should the varroa mite establish in the honey bee population.

Pollination issues

2.32 The committee received evidence that some agricultural industries in Tasmania are heavily reliant on honey bees, both feral and commercial, for pollination services. These include the fruit industry (for example, apricots, blueberries, strawberries, raspberries, cherries, apples, pears and plums), the vegetable industry (for example, brassicas, onions and fennel) and seed industry (for example, carrot seed) as well as for clover, lavender, lucerne and red clover.

2.33 Pollination services are provided by commercial honey producers as part of their overall operations with crop producers paying for hives to be placed on their properties to pollinate crops.[37] The Tasmanian Government noted that agricultural industry peak bodies have expressed concern that during critical peak demand periods there is a critical shortage of honey bee pollination hives available.[38] Mr Phil Pyke, Fruit Growers Australia, commented that a number of the larger berry farms are moving into their own bee production because they cannot access enough hives to meet demand.[39]

2.34 Factors contributing to the unmet demand for pollination services are the value of honey production and the timing of demand for pollination services. Fruit Growers Tasmania pointed to the high prices received from key Asian export markets for honey as reason for beekeepers to prioritise honey production over pollination services.[40] The University of Tasmania and TIA similarly stated:

> The lucrative returns for beekeepers for honey, and especially leatherwood honey, together with the current relative size, scale and timing of the Tasmanian agricultural sector creates significant supply issues for managed honey bee pollination services in Tasmania.[41]

37 Tasmanian Government, *Submission 20,* p. 1.

38 Tasmanian Government, *Submission 20,* p. 1.

39 Mr Phil Pyke, Fruit Growers Tasmania, *Committee Hansard*, 21 February 2017, p. 12.

40 Fruit Growers Tasmania, *Submission 1*, p. 3.

41 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 2.

2.35 The Tasmanian Government explained the impact of the timing of peak demand for pollination services:

> Many of Tasmania's apiarists consider pollination secondary to the more lucrative honey production activity. They make their hives available for pollination outside the key honey production time. However, the key honey production time for Leatherwood coincides with the flowing of many annual horticultural crops…The pollination season extends from late-July through to early April, which overlaps with the leatherwood honey season that commences late December and finishes in early March.[42]

2.36 A further matter impacting on demand during peak times is the limitations to honey bee pollination if the weather is not suitable for honey bee activity. As noted above, honey bees will not forage if the temperature is below 15°C or during inclement weather or rain events. The University of Tasmania and TIA commented that this can create problems with the pollination of several field crops, including apples, berries and cherries, if such conditions are experienced during their pollination window.[43]

2.37 Submitters also noted that some apiarists are unwilling to provide pollination services as they have experienced damage to hives placed on farms. For example, producers irrigating or spraying at the times bees are pollinating can lead to damage to the colony.[44] Mr Lindsay Bourke, Tasmanian Beekeepers' Association, stated:

> There is not a shortage of bees; it is just that some beekeepers choose not to pollinate, because previous fruit growers and vegetable growers have done the wrong thing in the past by spraying them at the wrong times of the day, and beekeepers do not want to do it.[45]

2.38 A further matter contributing to apiarists being less inclined to provide pollination services is their use in protected environments, for example, orchard bird netting. The University of Tasmania and TIA stated that hive health declines when deployed in these environments.[46]

2.39 With increased demand, the cost of pollination services has increased. Fruit Growers Tasmania, for example, commented that pollination prices have risen as much as seven times in the last season for some crops.[47]

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42 Tasmanian Government, *Submission 20*, p. 1.

43 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 5.

44 Fruit Growers Tasmania, *Submission 1*, p. 3. See also Mr Phil Pyke, Fruit Growers Tasmania, *Committee Hansard*, 21 February 2017, p. 12.

45 Mr Lindsay Bourke, Tasmanian Beekeepers' Association, *Committee Hansard*, 21 February 2017, p. 15.

46 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 6.

47 Fruit Growers Tasmania, *Submission 1*, p. 4.

2.40 The Tasmanian Government noted that there are apiarists who are dedicated to providing pollination services only. These services are increasingly in demand because of the growth across a range of sectors including cherries, berries, pasture and vegetable seed crops.[48] However, submitters argued that given forecast growth in the Tasmanian agricultural sector commercial bumblebees may help alleviate some of these supply issues.[49]

Insurance against the varroa mite

2.41 A further matter noted by submitters was the potential importance of bumblebee pollination should the varroa mite[50] enter Australia and spread to the honey bee population. Currently, honey bee populations are under threat 'globally, from pest and disease issues, such as varroa mite and colony collapse disorder'.[51] Mr Michael Toby, Costa Group, commented that:

> Varroa remains the greatest threat to pollination within Australian horticulture and honey production. The varroa mite is a well-adapted parasite of the Asian honey bee, both of which are present at the moment in northern Queensland. *Varroa jacobsoni* is currently being eradicated from Australia under an emergency response. However, the more destructive *Varroa destructor* is not yet present in Australia. It is in New Zealand, where evidence suggests it arrived on illegally imported honey bees.[52]

2.42 The University of Tasmania and TIA also provided evidence on the potential impact of varroa on pollination of crops by honey bees. It was stated that:

> If Varroa mite invades Australia then the significant pollination services of feral honey bee populations will be lost, costs of managed honey bee populations will rise and a pollinator deficit is probable in the agricultural industry.[53]

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48 Tasmanian Government, *Submission 20*, p. 1. See also Fruit Growers Tasmania, *Submission 1*, p. 4.

49 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, pp. 2, 5, 6.

50 External parasites of honey bees. Although they can feed and live on adult honey bees, they mainly feed and reproduce on larvae and pupae in the developing brood, causing malformation and weakening of honey bees and well as transmitting numerous viruses. See http://beeaware.org.au/archive-pest/varroa-mites/#ad-image-0 (accessed 30 September 2016). Note: The varroa mite was found in a nest of honey bees in the Port of Townsville in far north Queensland. The hive was destroyed by staff from the Department of Agriculture and Water Resources. See Matt Watson, 'Bee-killing varroa mites found in Port of Townsville nest', *ABC News*, 6 July 2016.

51 Tasmanian Government, *Submission 20*, p. 1.

52 Mr Michael Toby, Costa Group, *Committee Hansard*, 21 February 2017, p. 2.

53 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 6.

2.43 Similarly, Mr Brandsema commented on the potential impact of varroa and stated that, based on overseas experience, 'it is expected varroa will progressively kill between 95 and 100 per cent of Australia's feral European honey bee population, greatly reducing the pollination service they provide'.[54]

2.44 Submitters commented that there is a very high risk that *Varroa destructor* will eventually enter Australia and establish in the honey bee population. However, it was noted that bumblebees, along with some native bees, are resistant to varroa.[55] As such, it was argued that bumblebees will be vital to ensure that pollination of crops can continue.[56]

2.45 Raspberries & Blackberries Australia, for example, commented that:

> In New Zealand, the Varroa mite (*Varroa destructor*) has severely reduced wild honey bee populations. Bumblebees are not a carrier or host of Varroa mite. Should Varroa mite enter Australia then we will be faced with the same challenge as in New Zealand in maintaining viable honey bee populations for pollination purposes. In New Zealand, bumblebees are commercially used as pollinators for a number of agricultural and horticultural crops. As a minimal strategy in any contingency plan, bumble bees should be considered as complementary pollinators (but not necessarily an alternative) to honey bees.[57]

Need for further research

2.46 The University of Tasmania and TIA stated that the current legislation is a major impediment to setting up a bumblebee colony for research which could include:

> …environmental research requiring manipulation of bumblebee numbers, pollination research to quantify their impact, and economic research to ascertain the viability of the limited gene pool for commercial rearing and associated rearing costs. Furthermore, bumblebees are ideal models for a joint CSIRO–University of Tasmania project currently underway developing tracking sensors for mounting on flying insects because of their larger size and social behaviour where they return to a hive regularly. None of this work can be undertaken under the current legislation.[58]

2.47 While advocating a cautious approach to the use of bumblebees as pollinators for protected cropping in Tasmania, the Tasmanian Farmers & Graziers Association also suggested that further research be undertaken:

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54 Mr Marcus Brandsema, Protected Cropping Australia, *Committee Hansard*, 21 February 2017, p. 9.

55 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 6.

56 Fruit Growers Tasmania, *Submission 1*, p. 4; *Submission 6*, p. 6; Mr Marcus Brandsema, Protected Cropping Australia, *Committee Hansard*, 21 February 2017, p. 9.

57 Raspberries & Blackberries Australia, *Submission* 5, p. 2.

58 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 6.

> With the limited amount of current research been undertaken there is an opportunity to undertake research on bumblebees to provide guarantees that any change to legislation is favourable for all stakeholders.[59]

2.48 Other submitters also advocated further research is required into the impacts of bumblebees on the environment.[60] Fruit Growers Tasmania, for example, stated that:

> …to allow research into the effect of its presence on native bee populations, environmental risks and other impacts including competition for floral resources, weed spread, effectiveness as a pollinator and potential for spreading of pathogens and parasites.[61]

2.49 Dr Katja Hogendoorn, Ms Elisabeth Fung, Dr Remko Leijs and Dr Richard Glatz provided a useful summary of the research conducted and outlined the areas where further research is required:

> Bumblebees have been present on Tasmania for more than 20 years and research has identified a number of potential impacts of the species: The species has been demonstrated to cause an increase in the seed set of weeds …a decrease in the nectar availability for the swift parrot…displacement of native Tasmanian bees from flowers through competition…and rob nectar without pollination...
>
> However, we do not as yet fully understand the ecological implications of the introduction of this feral pollinator, because (a) the impact of bumblebees on Tasmania has not been structurally monitored; (b) the last research done on the impact of bumblebees was 10 years ago, and (c) insufficient experimental research has been done.
>
> By now, vegetation changes due to the introduction of bumblebees should start to become visible and should be researched. Therefore, the impact of any decision to legalise breeding (and enhance the feral population) should be assessed by establishing the ecological effects of experimentally increased and decreased bumblebee densities on:
>
> - Commercial honey and pollen yield for *Apis mellifera*;
> - Native bird foraging;
> - Seed set and propagation of weeds, including tree lupin, foxgloves, scotch broom and rhododendron;
> - Native bee reproduction;
> - Presence and spread of bee viruses.[62]

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59 Tasmanian Farmers & Graziers Association, *Submission 13*, p. 2.

60 Dr Anne Dollin, *Submission 15*, p. 1.

61 Fruit Growers Tasmania, *Submission 1, p. 2.*

62 Dr Katja Hogendoorn et al, *Submission 16*, p. 2.

Chapter 3

Potential risks arising from the commercial use of bumblebees

3.1 Submitters opposed to the commercial use of bumblebees argued that such a proposal presents significant risks to the environment, biosecurity and agriculture. Submitters also suggested native bees as an alternative pollution option and argued that further research is required to establish the effectiveness of native bees for commercial pollination.

Environmental risks

3.2 The population of feral bumblebee in Tasmania is well established. Some submitters stated that the environmental impacts in Tasmania have been minimal. The University of Tasmania and Tasmanian Institute of Agriculture (TIA), while noting that there have been limited empirical studies, stated:

> …with the existing population already widespread, commercial bumblebee production is unlikely to add any additional impact on the conservation status of other species or ecological communities.[1]

3.3 Other submitters, however, highlighted the invasive nature of the species and the wide range of environmental risks associated with bumblebees. The following paragraphs examine this evidence.

Possible distribution

3.4 The major concern with the commercial use of bumblebees is the invasive nature of species. While it is acknowledged that the existing feral population has a low genetic diversity, they have been highly invasive and have now spread throughout Tasmania.[2] Many submitters commented that improved characteristics through breeding would enable bumblebees to establish more widely and in greater density should they escape from greenhouses.

3.5 The committee received evidence that the bumblebee is considered an invasive species wherever it has been introduced.[3] The Department of the Environment and Energy (the department) commented:

> Internationally *B. terrestris* has been shown to be very invasive—in almost all regions/countries where *B. terrestris* has been released, it has established wild or feral colonies. This has occurred in countries where no native

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1 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 3.

2 Department of the Environment, *Submission 22*, p. 4. See also Dr Megan Halcroft, *Submission 2*, p. 1.

3 Invasive Species Council, *Submission 4*, Attachment, p. 2.

> Bombus species existed, such as New Zealand and Australia, and also in regions where native Bombus species were present such as Europe, the Middle East (Israel), Asia (Japan, Korea and China), North America and South America.[4]

3.6 Dr Peter McQuillan, University of Tasmania, provided further information on the invasive nature of bumblebees and noted that *B. terrestris* and a second European bumblebee species have established in Argentina and Chile. He commented that the second bumblebee species had presumably established from a single individual, and had spread widely to occupy most of the available habitat that it can tolerate. Dr McQuillan concluded that bumblebees have 'a history of invasibility from small populations or even potentially from a single individual. It is a rare event, but it is not zero'.[5]

3.7 In addition, the department noted that studies in Poland showed a high proportion of wild bumblebees had descended from greenhouse populations, being the offspring of queens which had escaped from greenhouses or workers which were conducting foraging flights outside the greenhouse. Further studies have shown that bumblebees in greenhouses, despite the abundant food source within the greenhouse, seek out other plants if given the opportunity.[6]

3.8 The department went on to comment that these studies provided evidence that bumblebees escape greenhouses used for tomato growing. Further, the department stated that 'it is plausible that bumblebees would seek alternative pollen sources if used in commercial glasshouses'. As a consequence, density of bumblebees would increase around glasshouses.[7]

3.9 A further matter raised in evidence was the possible distribution of bumblebees should they reach the mainland. As part of the 2008 application to list the bumblebee on the live import list, modelling was undertaken to chart the possible distribution of bumblebees should they establish on the mainland. The modelling showed that bumblebees could establish over much of the southern, south western and eastern parts of Australia.[8]

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4 Department of the Environment, *Submission 22,* p. 9. See also Geelong Beekeepers Club, *Submission 18,* p. 3.

5 Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 21.

6 Department of the Environment, *Submission 22,* p. 5.

7 Department of the Environment, *Submission 22,* p. 6.

8 CSIRO, *Submission* 7, p. 4; South Australian Government, *Submission 21*, p. 1.

3.10 Dr McQuillan also commented on the possible distribution of bumblebees should they establish on the mainland. He stated:

> We need to be careful now as to the opportunities we open up that may come back to bite us in terms of the species becoming a more serious environmental pest than it already is. That is why you would not want them to get onto the mainland, because they would expand quite effectively over the cooler south-eastern part of the mainland, across the Mount Lofty Ranges and perhaps near Perth.[9]

3.11 The invasive nature of the bumblebee has already been recognised by the Victorian and New South Wales Governments: the Victorian Government has listed the introduction of the bumblebee as a potentially threatening process while the New South Wales Government has listed the introduction of the bumblebee as a key threatening process.[10]

3.12 In response to this evidence, Mr Phil Pyke, Fruit Growers Tasmania, asserted that bumblebees would not survive on the mainland due to the climate of 'superheated days'. Mr Pyke noted that the feral population are European bumblebees suited to a temperate climate.[11]

3.13 In relation to the escape of bumblebees, Mr Marcus Brandsema, Protected Cropping Australia, stated that 'queen excluders', used overseas to prevent the bee exiting the hive, could be used in Tasmania. He noted that if the queen does not escape, bumblebees cannot replicate.[12]

3.14 The University of Tasmania and TIA also noted that European studies suggested that male bumblebees are most likely to escape and are mating with endemic queens. It was further stated that 'in the case of the proposal for Tasmania, there are no endemic bumblebees other than the existing invasive population'.[13] However, it was submitted that queens are most relevant to colonisation and devices to prevent the queen escaping should be fitted to hives. In addition, hives should be destroyed before new queen production can be undertaken to minimise queen dispersal.[14]

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9 Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 25.

10 Department of the Environment, *Submission 22*, p. 10. See also The Geelong Beekeepers Club *Submission 18*, p. 3.

11 Mr Phil Pyke, Fruit Growers Tasmania, *Committee Hansard*, 21 February 2017, pp. 4–5.

12 Mr Marcus Brandsema, Protected Cropping Australia, *Committee Hansard*, 21 February 2017, p. 9.

13 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 3.

14 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 4.

Adverse environmental impacts

3.15 The department noted that research on the environmental impacts of bumblebees throughout the world is limited.[15] However, CSIRO outlined a range of adverse environmental impacts of bumblebees which have occurred:

> In Japan and South America *Bombus terrestris* is considered a harmful invader because of the negative impact it has on local environments. It can harm native bees through direct competition for food and nest sites…and can be a conduit for new diseases into the bee community…In some places invasive *Bombus* have become such abundant and aggressive flower visitors, they damage the flowers of commercially important species, leading to reduced crop production and losses for producers.[16]

3.16 Similarly, the committee received evidence which outlined the possible adverse environmental impacts of bumblebees in Australia. It was noted that bumblebees exhibit a range of characteristics which enable to them to establish quickly and to impact negatively on native ecosystems. These characteristics include having a generalist foraging strategy, high reproductive capacity, few natural predators, the ability to be active in a range of temperatures and environmental conditions, and a high dispersal rate.[17]

3.17 Submitters argued that these impacts could be exacerbated by an increase in the density, or improved breeding, of the existing feral pollution through commercial activities.[18] Dr McQuillan, University of Tasmania, stated:

> …[the bumblebee populations in Tasmania] look to be on a plateau and have been for at least 15 years, I would say. That may well be due simply to the fact that they are highly inbred and the populations are limited by that genetic inbreeding, but if you diversify the genetic base of the species they may step up to much higher populations because they are more vigorous, they are more fecund, they tolerate the conditions better—whatever it might be.[19]

3.18 Dr Andrew Hingston commented similarly:

> If bumblebees are deployed in Tasmanian greenhouses escaping bumblebees will increase the density of the species in the immediate vicinity, potentially increasing the ecological impact of the species in the local area and possibility of it spreading to the Australian mainland.[20]

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15 Department of the Environment, *Submission 22*, p. 6.

16 CSIRO, *Submission 7*, p. 5. See also Department of the Environment, *Submission 22*, p. 5.

17 Tasmanian Government, *Submission 20*, p. 4.

18 Dr Megan Halcroft, *Submission* 2, p.1; Department of the Environment, *Submission 22*, p. 6.

19 Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 24.

20 Dr Andrew Hingston, *Submission 11*, pp. 1–2.

3.19 Other submitters also commented on the effects of improved genetic diversity. Dr Halcroft stated:

> With an increase in genetic diversity comes an increase in species fitness and vigour…This could potentially lead to enhanced aggression and competition with native flower-visitors, at floral resources. Increased hybrid vigour could also see an increase in individual colony populations, which would increase overall floral resource competition and also increase the incidence of exotic weed pollination and weed seed distribution…[21]

Competition for food sources

3.20 It was stated that bumblebees may compete for food sources with native bees and other species.[22] Dr Hingston advised that the bumblebees have the potential to compete with a wide variety of native animals for nectar and pollen and that there is 'evidence of bumblebees displacing native Tasmanian bees from flowers through competition'.[23] Dr Halcroft noted that a 2004 report by the NSW Office of Environment and Heritage Scientific Committee determined that bumblebees were a threat to native species. Bumblebee colonies contain between 300 and 1000 workers which compete heavily with flower-visiting native animal species, both vertebrate and invertebrate.[24]

3.21 The University of Tasmania and TIA also reported on the competition for food sources:

> In some flowers such as native heath (*Epacris impressa*) bumblebees have been observed as nectar robbers, stealing nectar from flowers but not successfully causing pollination in the process. Similarly, some reduction of available nectar due to bumblebee consumption in local areas is also hypothesised in regions where nectar is in short supply but this has not been quantified.[25]

Less effective pollination of native plants

3.22 The department commented that research has shown that bumblebees may affect the pollination of native plants and seed production. Bumblebees foraging on some native plants resulted in fewer visits by its native pollinator. As bumblebees are not as effective at transferring pollen as native bee species, this may reduce pollination

21 Dr Megan Halcroft, *Submission 2,* p. 1.

22 CSIRO, *Submission 7,* p. 5.

23 Dr Andrew Hingston, *Submission 11,* p. 3.

24 Dr Megan Halcroft, *Submission 2,* p. 1.

25 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6,* p. 3.

and seeding rates of native plants. As a consequence, species dependent on these native plants may be affected.[26]

Swift parrot

3.23 The potential risk to the critically endangered swift parrot was noted by some submitters. The Tasmanian Government noted that bumblebees could reduce nectar available to the swift parrot:

> In Tasmania, potential impacts to threatened species have been identified with *B. terrestris* under some conditions reducing eucalypt nectar availability to the critically endangered swift parrot (*Lathamus discolor*) in spring, which may negatively impact the parrots' reproductive output.[27]

3.24 Dr Hingston also pointed out the potential for bumblebees to compete with the swift parrot for nectar, including during the swift parrot breeding season:

> This includes competing for nectar of Eucalyptus trees with the Critically Endangered swift parrot *Lathamus discolor*…Indeed, bumblebees markedly reduced nectar standing crops in two trees of *E. ovata* in an area where swift parrots foraged on this species of tree.[28]

3.25 Dr Hingston added that swift parrots are more effective than bumblebees at pollinating the Tasmanian blue gum (*Eucalyptus globulus).*[29]

Biodiversity

3.26 Submitters also suggested that there are risks to biodiversity from the spread of weeds through bumblebee activity. The department noted that there is evidence from Tasmania and New Zealand that some previously minor weeds, for example tree lupin, become much more prevalent and problematic as bumblebee numbers increase. As bumblebees utilise both native and introduced plant species in Tasmania, changes to pollination rates of introduced plant species could result in more successful pollination and therefore higher seed production rates. The department commented that:

> …this may result in an increase in abundance of those plants over native species and therefore impact any species dependent on the native plants such as other insects, animals or birds.[30]

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26 Department of the Environment, *Submission 22,* p. 6. See also Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 22.

27 Tasmanian Government, *Submission 20,* p. 8. See Also Mr Robert J Bell, *Submission 9*, p. 1.

28 Dr Andrew Hingston, *Submission 11,* p. 3. See also AB Hingston and S Wotherspoon, 'Introduced social bees reduce nectar availability during the breeding season of the swift parrot (*Lathamus discolour)*', *Pacific Conservation Biology*, 2017, 23, 52–62.

29 Dr Andrew Hingston, *Submission 11,* p. 3.

30 Department of the Environment, *Submission 22,* p. 7. See also South Australian Government, *Submission 21,* p. 3.

3.27 The Tasmanian Government also noted the link between the feral bumblebees and the spread of weeds. It stated that there is now evidence of a positive link between the spread of weeds and the presence of introduced *B. terrestris* around the world including evidence to support the enhanced pollination of weeds in Tasmania. It went on to note that currently many weeds in Tasmania originate from Europe where they have evolved complex mutualistic relationships with bumblebees. This could result in increased seed production and dispersal in these species. Research has also indicated that several species of introduced plants have become more invasive in Tasmania since bumblebees arrived.[31]

3.28 Submitters pointed to a range of weeds that have become more invasive in Tasmania since the arrival of bumblebees including *Rhododendron ponticum, Solanum marginatum, Buddleja davidii, Agapanthus praecox* and foxglove.[32] CSIRO pointed to the potential for the increase of *Cytisus scoparius* (Scotch broom). This weed is of concern in a number of states and is known to be well pollinated by bumblebees. CSIRO commented that the potential for bumblebees to accelerate the spread of Scotch broom was one of the primary reasons for the New South Wales Government to list the introduction of *Bombus terrestris* as a key threatening process.[33]

3.29 The department stated that weeds impact on biodiversity by out-competing native plants and degrading habitat. Almost all Australian native vegetation communities have been invaded, or are vulnerable to, invasion by introduced species that 'could result in changes to the structure, species composition, fire frequency and abundance of native flora and fauna'.[34] The impact of increased density of weeds on agricultural production is discussed below.

3.30 It was also noted that bumblebees are nectar robbers, that is, the bee steals nectar from the flower by cutting a hole at the flower base rather than entering the plant and interacting with pollen stamens. As a consequence, the hole may be used by other nectar feeding species without entering the flower, thereby reducing pollination and cross-pollination. There may also be insufficient nectar left for the usual pollinator species leading to fewer visits to the plant. This may result in decreased pollination rates and seed production in native plants.[35]

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31 Tasmanian Government, *Submission 20*, p. 8. See also Dr Megan Halcroft, *Submission 2*, p. 1.

32 University of Tasmania and Tasmanian Institute of Agriculture, *Submission 6*, p. 4; Geelong Beekeepers Club, *Submission 18*, p. 2; Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 22.

33 CSIRO, *Submission 7*, p. 5. See 'Introduction of the Large Earth Bumblebee *Bombus terrestris* (L) – profile' at:http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20005 (accessed 6 October 2016)

34 Department of the Environment, *Submission 22*, p. 8.

35 Department of the Environment, *Submission 22*, p. 7; Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 22.

3.31 It has also been suggested that the greater foraging activity of bumblebees (they are larger and able to forage for greater lengths of time than honey bees and native bees) may result in nectar or pollen being depleted by the time other bee species become active. As a consequence, the diversity and abundance of native bees may be altered.[36]

Biosecurity risks

3.32 Concerns about biosecurity risks focussed on the introduction of diseases and pests and the incentive for illegal imports of both bumblebees and other illegal species.

Diseases and pests

3.33 A major concern for submitters was the risk related to the introduction of new pathogens to the Australian environment. CSIRO commented that while it may be considered that using the feral population will ameliorate those risks, this may not be the case. CSIRO stated that:

> …the use of bumblebees in commercial operations may change the dynamics of disease transfer within existing populations, because bumblebees will be transported and managed in Tasmania in a way that differs radically from their current free-living circumstances. This could increase the risk of disease transfer from bumblebees to managed European honeybees (*Apis mellifera*) in and around the managed greenhouse environment.[37]

3.34 Of greater concern to submitters was the potential for diseases and pests to be introduced through the importation of new genetic material. The committee notes that the Tasmanian Government and supporters of trialling the commercial use of bumblebees have indicated that there are no plans to introduce new genetic material should the existing feral population of bumblebees prove not to be viable pollinators. However, submitters raised concerns that the poor genetic diversity of feral bumblebees in Tasmania would inevitability lead to the importation of new genetic material to 'improve their genetic diversity and ensure the populations are suitable for commercial rearing'.[38] The following discussion canvasses concerns about biosecurity risks should new genetic material be imported.

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36 Department of the Environment, *Submission 22,* p. 8. See also Tasmanian Government, *Submission 20,* p. 6.

37 CSIRO, *Submission 7,* p. 5.

38 Dr Megan Halcroft, *Submission 2,* p. 1.

3.35 Presently, Australia has a largely disease-free bee population which has created a thriving honey and live bee export industry.[39] Submitters argued that importation of genetic bumblebee material could put the health of honey bee populations at risk through the introduction of new pests and diseases.[40] In addition, it was argued there is no way of knowing if native bees will be affected by these pests and diseases.[41]

3.36 The Australian Honey Bee Industry Council (AHBIC) agreed with this view:

> AHBIC is fearful that, if the use of bumble bees for pollination in Tasmania is permitted, then the pressure to import other stock to improve the genetic diversity of the current stock will be mounted. This is when there is a great biosecurity risk to the current honey bee industry in Tasmania and maybe Australia.[42]

3.37 Submitters noted that in other countries, bumblebees have been found to carry multi-host pathogens such as deformed wing disease.[43] Dr Katja Hogendoorn, Ms Elisabeth Fung, Dr Remko Leijs and Dr Richard Glatz in a joint submission highlighted the impact of diseases spread by the bumblebee:

> A newly introduced parasite can jump onto local species and, because the disease is novel, the new host is unlikely to have any defence mechanism against the disease. This is seen in Argentina, where, due to a microsporidian parasite that was introduced together with *Bombus terrestris*, the native bumblebee, *B. dalbohmii*, has become extinct in large areas wherever the introduced *B. terrestris* has invaded.[44]

3.38 Of particular concern was the introduction of the varroa mite. As discussed in chapter 2, introduction of *Varroa destructor* would have a devastating impact on honey bees and thus agricultural production generally. The Tasmanian Beekeepers' Association commented that introduction of new genetics into Tasmania could provide a vector for this mite.[45]

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39 For further detail on the biosecurity measures for the Australian honey bee industry, not specific to Tasmania, see House of Representatives Standing Committee on Agriculture and Water Resources, Biosecurity in the Australian honey bee industry, *Proof Committee Hansard*, 24 November 2016.

40 Dr Megan Halcroft, *Submission 2*, p. 1; Tasmanian Beekeepers' Association, *Submission 3*, p. 1.

41 Dr Megan Halcroft, *Submission 2*, p. 2.

42 Australian Honey Bee Industry Council, *Submission 8*, p. 2.

43 Dr Megan Halcroft, *Submission 2*, p. 1.

44 Dr Katja Hogendoorn et al, *Submission 16*, p. 4.

45 Tasmanian Beekeepers' Association, *Submission 3*, p. 2. See also Australian Honey Bee Industry Council, *Submission 8*, p. 2.

3.39 Dr Hingston indicated that in addition to the varroa mite, bumblebees can carry other pathogens that affect honeybees:

> …an investigation into 48 commercially produced colonies of *B. terrestris* in 2011–12 found five species of pathogens that affect honeybees: deformed wing virus and *Nosema ceranae* were found in the bumblebees; while both of those pathogens and *N. apis*, American foulbrood, and chalkbrood were found in pollen in the colonies…Many of these pathogens are difficult to detect visually and cannot be cultured in vitro, and can only be detected through molecular methods. As a result, colonies of *B. terrestris* that were certified as 'disease-free' often carried these pathogens.[46]

3.40 The Department of Agriculture and Water Resources also commented on biosecurity concerns of introduced diseases and pests. Dr Taylor stated:

> From a biosecurity perspective, given the history of the bumblebees in Tasmania, we have not found traces of introduced diseases, but importing them from another country would be a different risk. We would only really start to look at the risks if they were added to the list, and there are a number of them. We have a favourable honey bee disease status in Australia, and there are a number of diseases that could cross from the bumblebee to the honey bee, which we would be very keen to keep out of Australia.[47]

3.41 A further concern raised by submitters was that the commercial use of bumblebees would increase the risk of transferring diseases and pests, such as the Braula fly (*Braula coeca*), to the mainland[48] CSIRO commented that Braula fly, which is a significant honey bee pest, is found in honey bees in Tasmania but not on the mainland. Accidental transfer of Tasmanian bumblebee queens on to mainland Australia would present a significant risk of introducing this pest. CSIRO explained that:

> Bumblebees are not a natural host for this fly, but they may act as a carrier. *Braula coeca* is listed in the AUSVETPLAN as a Category 4 emerging animal disease (except Tasmania), with potential to cause international trade losses and local market disruptions.[49]

3.42 CSIRO also highlighted that the Tasmanian bumblebee population is yet to be tested for viruses common to bumblebees, but not present on the mainland:

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46 Dr Andrew Hingston, *Submission 11*, p. 6.

47 Dr Jonathon Taylor, Department of Agriculture and Water Resources, *Committee Hansard*, 29 February 2017, p. 5.

48 Department of Agriculture and Water Resources, *Submission 19*, p. 4.

49 CSIRO, *Submission 7*, p. 6.

> Should these viruses be present in bumblebees, and then transfer to honeybees this would compound detrimental effects of Varroa should it arrive in future.[50]

Biosecurity risks to the mainland

3.43 The possible introduction of bumblebees to the mainland was seen as a significant risk. As noted above, studies indicate that bumblebees could colonise large areas of mainland Australia. CSIRO commented that:

> Some of the more highly favourable areas of suitable environment [for bumblebees] overlap with significant parts of the conservation estate, including the Australian Alps National Parks. Following any introduction of *Bombus terrestris* to the Australian environment, the nexus between the bee and introduced plant species would make many habitats vulnerable to invasion.[51]

3.44 CSIRO summarised the concerns shared by many submitters that the commercial use of bumblebees for pollination in Tasmania would increase the possibility of bumblebees, along with the associated risks outlined above, being transferred to the mainland. One issue noted by CSIRO was that the use of bumblebees in greenhouses would increase risk of accidental transfer to the mainland. CSIRO explained:

> Greenhouse use will bring *Bombus terrestris* into closer association with people and products that are transported to the mainland. This greatly increases the risk of an accidental transfer. For example, a single mated queen bee could be transferred to the mainland in a container, or a boxed bumblebee colony could be mistakenly stacked in among produce that is being shipped to the mainland, and there establish a new colony.[52]

3.45 CSIRO highlighted the need to increase biosecurity controls to prevent the inadvertent spread of the bumblebee to the mainland should the proposed trial proceed. CSIRO stated that pest insects and bee diseases are already among the targets for internal biosecurity controls in Australia, however, preventing a bumblebee incursion on to the mainland could become a new target. This would require new strategies from biosecurity agencies. CSIRO also noted that due to the small size and cryptic nature of the bumblebee, it can easily 'hide' in greenhouse materials which would suggest the need for significant biosecurity controls.[53]

3.46 In addition to inadvertent transportation risks to the mainland, the potential for bumblebees in greenhouses to escape was noted by several submitters.[54] As stated

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50 CSIRO, *Submission 7,* p. 6.

51 CSIRO, *Submission 7,* p. 4.

52 CSIRO, *Submission 7,* p. 4.

53 CSIRO, *Submission 7,* p. 6.

54 Dr Katja Hogendoorn et al, *Submission 16,* p. 1.

above, the industry has indicated that measures such as queen gates fitted to hives can be employed to minimise the risks of escapes.

Incentives for illegal introductions of bumblebees and other invasive species

3.47 Submitters were particularly concerned that the commercial use of the feral bumblebees in Tasmania for pollination would create a strong incentive to introduce bumblebees (and other invasive species that may have a commercial value) to the mainland and to introduce new varieties of bumblebees. The Invasive Species Council described this as a 'foot in the door' strategy to remove impediments to introducing and using bumblebees on mainland Australia. The Invasive Species Council went on to state:

> If the ban on using illegally imported species is removed, this will create a strong incentive to shift them illegally to the mainland and to introduce new varieties of bumblebees.[55]

3.48 Many submitters argued that the commercial use of bumblebees in Tasmania would create an incentive for their illegal introduction to the mainland particularly if their use resulted in commercial advantages for crop growers.[56] CSIRO observed that:

> If greenhouse growers in Tasmania gain an economic advantage by use of bumblebees, growers on the mainland will have a stronger incentive to access the same benefit. An unscrupulous person might then be motivated to illegally import bees to the mainland in the hope that the invasion will be followed by legitimate commercial adoption (i.e. history of the species in the species in Tasmania would then be repeated on the mainland).[57]

3.49 Dr Hingston expounded on this point and stated:

> If the commercial use of bumblebees is permitted in Tasmania on the grounds that a feral population is already established, and a feral population then becomes established in another Australian State, that State could then argue for permission to use bumblebees commercially otherwise it would be at a competitive disadvantage to the State of Tasmania.[58]

3.50 Similarly, the Geelong Beekeepers Club indicated that the successful use of bumblebees in Tasmania would create pressure to use them on the mainland:

> If this demand for the use of the bumblebees in Tasmania for commercial pollination purposes is successful, it is quite easy to envisage future demands by the industry, especially as one of the country's largest producers of glasshouse tomatoes has a facility in Tasmania. Through the

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55 Invasive Species Council, *Submission 4,* p. 2.

56 Tasmanian Farmers and Graziers Association, *Submission* 13, p. 1; Dr Tobias Smith, *Submission 17,* p. 2.

57 CSIRO, *Submission 7,* p. 4.

58 Dr Andrew Hingston, *Submission 11,* p. 5.

> "foot in the door" argument, one can readily extrapolate their claim for the introduction and use of bumblebees (*Bombus terrestris*) throughout the rest of the glasshouse vegetable growing industry in Australia based on the "success" of the bumblebees…in Tasmania! All the research and scientific evidence currently available indicate it would be extremely detrimental to allow yet another "invasive species" into Australia with untold consequences![59]

3.51 The Geelong Beekeepers Club noted that despite best efforts to contain the bumblebees, potential economic benefits would make transfer to the mainland attractive:

> One can easily also foresee the "illegal" or "accidental" transfer of bumblebees onto mainland Australia, as the "economic benefit" envisaged from bumblebees…may prove to alluring to resist for some.[60]

3.52 Submitters also noted that approval of the commercial use of bumblebees may be used seen as a precedent which will encourage the illegal import of other species.[61] Dr Halcroft, for example, argued that:

> Allowing the commercialisation of *B. terrestris* for use in Tasmania for commercial pollination purposes would function as an incentive to illegally introduce any organism that conveys a benefit to an industry.[62]

Pressure to allow the importation of new genetic material

3.53 The committee received evidence that should the proposed trial of bumblebees prove successful and their commercial use were to be approved, there would eventually be pressure to import new genetic material to improve the feral bee stock. The AHBIC stated that this would result in 'a great biosecurity risk to the current honey bee industry in Tasmania and maybe Australia'.[63]

3.54 Alternatively, it was argued should the proposed trial prove unsuccessful due to the poor genetic quality of the feral bumblebee population, there would be pressure to import new genetic material. According to Dr Hingston, it is likely that new genetic material would be needed for commercial breeding success:

> …use of the Tasmanian population of bumblebees appears unlikely to be able to provide economic benefits because analysis of the population in

59 Geelong Beekeepers Club, *Submission 18,* p. 4.

60 Geelong Beekeepers Club, *Submission 18,* p. 4.

61 Invasive Species Council, *Submission* 4, p. 1; Dr Andrew Hingston, *Submission 11,* p. 5; Dr Katja Hogendoorn et al, *Submission 16,* p. 3.

62 Dr Megan Halcroft, *Submission 2,* p. 3.

63 Australian Honey Bee Industry Council, *Submission 8,* p. 2.

> 1996 found that it was too inbred for commercial rearing to be economically viable.[64]

3.55 The department also commented that allowing the commercial use of bumblebees in Tasmania could create an incentive to improve the genetics of the bumblebees to make them more efficient pollinators. The present population may have limited viability compared to other population which some have suggested may result in an expectation that improved genetic stock would be sought by tomato growers to lift productivity and reduce costs. The department noted that the proposed trial aims to determine whether the current feral population is a viable pollinator of glasshouse tomatoes.[65]

3.56 The department also stated, in relation to the import of new genetic material, that there would need to be an application under the existing provisions for the inclusion of that new genetic material on the live import list if it was viable genetic material. The amendment of the live import list would be for the whole of Australia and could not be restricted to Tasmania.[66]

3.57 The pressure to improve commercial stock by importing new genetic material was also discussed by Dr McQuillan. He commented:

> If the trial is successful, there will be incentives to make it even better by having the bees living longer, being more active and all those sorts of things—being more resistant to disease and perhaps being more fecund. So I think we have to acknowledge that, if the trial is successful, it will put pressure on the government to allow extra genetic stock to come into the country. That raises questions about whether they would become even more invasive or more likely to succeed in the environment if they escape. It becomes a complicated question.[67]

Risks to primary industries

3.58 Submitters were concerned about the possible effects of a commercially reared colony of feral bumblebees or imported bumblebees on Tasmania's honey industry and live bee export industry, as well as the possible link between bumblebees and increasing numbers of introduced weeds.

Reduced honey production

3.59 One of the major concerns put to the committee regarding the greater density or increased vigour of bumblebees is based on the competition with honey bees for

64 Dr Andrew Hingston, *Submission 11*, p. 3.

65 Department of the Environment, *Submission 22*, p. 10.

66 Mr Paul Murphy, Department of the Environment and Energy, *Committee Hansard*, 29 February 2017, p. 3.

67 Dr Peter McQuillan, University of Tasmania, *Committee Hansard*, 21 February 2017, p. 23.

resources and subsequent impact on the lucrative Tasmanian honey industry. The Invasive Species Council commented that commercial quantities of bumblebees in Tasmania would enhance the bumblebee's competitive advantage in the environment which would have consequences for the honey industry:

> It could compete for nectar and pollen with the honeybee, and because it can forage at lower temperatures and start foraging earlier in the morning, it would have a competitive advantage over managed honeybees.[68]

3.60 This view was supported by the Geelong Beekeepers Club which submitted that there is competition for nectar between the bumblebee and honey bees.[69] Dr Hingston also pointed to a study which suggested that bumblebees are competitively excluding honeybees in some situations in Tasmania.[70]

3.61 The South Australian Government raised concerns that should bumblebees be introduced to the mainland, their greater ability to forage could have a negative effect on the mainland honey bees.[71]

3.62 The Tasmanian Beekeepers' Association raised concerns that increased numbers of bumblebees could affect the Manuka and Leatherwood honey industry in Tasmania. The Association noted that bumblebees operate at lower temperatures and carry more nectar than honey bees. The Association warned that competition from feral bumblebees could have a devastating effect on the honey industry should they roam to the Leatherwood and Manuka areas in Tasmania.[72]

3.63 The Geelong Beekeepers Club pointed out that the possibility of introduced diseases through imported bumblebees could put the European honey industry at risk, and industry which 'currently provides pollination services to agriculture estimated at $3.2 billion' annually.[73]

Live bee exports

3.64 The introduction of diseases and pests through importation of bumblebee genetic material was seen as a threat to the live bee export industry. It was noted that Tasmania exports its disease-free bees to countries where diseases such as the varroa mite have destroyed hives. The Costa Group noted that Tasmanian beekeepers exported 14 pallets of bees—9.8 tonnes of live insects—to Canada in 2014.[74]

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68 Invasive Species Council, *Submission 4,* p. 3. This evidence is based on information attributed to the AHBIC.

69 Geelong Beekeepers Club, *Submission 18,* p. 3.

70 Dr Andrew Hingston, *submission 11,* p. 5.

71 South Australian Government, *Submission 21,* p. 4.

72 Tasmanian Beekeepers' Association, *Submission 3,* p. 2.

73 Geelong Beekeepers Club, *Submission 18,* p. 2.

74 Costa Group, *Submission 12,* Attachment 3, p. 1.

The Tasmanian Beekeepers' Association also pointed to the importance of the live bee export market and commented that 'any biosecurity issue could shut down this market causing financial hardship to our beekeepers'.[75]

3.65 Similarly, the AHBIC also outlined concerns about the impact of new diseases and pests on live bee exports. The council stated:

> Tasmanian beekeepers currently have a market for package bees into Canada. Whilst this involves transhipping through Melbourne, there have been concerns raised about the possible introduction of *Braula coeca* to mainland Australia during transhipping. *Braula coeca* does not have the same devastating effect on honey bees as does the varroa mite. So it would be envisaged that there will be much disquiet about allowing the transhipping of package bees through Melbourne if the varroa mite was inadvertently introduced to Tasmania through the introduction of bumble bees from outside Tasmania. This would lead to the loss of this important source of revenue for beekeepers in Tasmania.[76]

Increased weeds

3.66 As noted above, research indicates that the introduction of bumblebees is likely to lead to increased seed production of some agricultural weeds. Of particular concern is the possible increased prevalence of weeds that currently lack an efficient pollinator. The department commented that:

> Weeds have major economic, environmental and social impacts in Australia, causing damage to natural landscapes, agricultural lands, waterways and coastal areas. Weeds impact severely on agriculture by competing with production, contaminating produce and poisoning livestock.[77]

3.67 The South Australian Government commented that bumblebees could be an ideal pollinator for weeds that currently occur in low densities or have not yet escaped gardens.[78] Any increase in weed density would result in significant costs to agricultural sector through weed eradication costs and lost production. The Tasmanian Government commented that:

> Sleeper weeds are a significant national issue with the Australian government estimating that if nine currently recognized sleeper weeds were not controlled or eradicated, they could eventually cost $100 million annually in lost agricultural production. Recent assessment of weeds in

75 Tasmanian Beekeepers' Association, *Submission 3,* p. 2.

76 Australian Honey Bee Industry Council, *Submission 8,* p. 2.

77 Department of the Environment, *Submission 22*, p. 9.

78 South Australian Government, *Submission 21,* p. 4.

> Tasmania has identified six possible sleeper weeds; the cost to control and/or eradicate these remains undefined.[79]

3.68 The Tasmanian Government recognised the increased risks for weed control associated with the introduction of new genetic material:

> For example, a genetically enhanced *B. terrestris* population has the potential to hinder control programs for gorse in Tasmania, a species that today costs woolgrowers alone about $1 million annually in lost production.[80]

3.69 This view was supported by Mr Robert Bell who noted the increased costs of controlling noxious weeds spread by bumblebees. Mr Bell stated:

> Currently Australia spends in the region of $3.5 billion controlling weeds. Any commercial gain for Tasmanian Glasshouse Producers is likely to be totally subsumed by the inevitable increase in the weed control budget.[81]

3.70 The Geelong Beekeepers Club also highlighted the consequences of accelerated weed spread for other industries:

> Other weeds likely to benefit are poisonous or prickly, and problematic for the dairy and grazing industries in Tasmania. More research needs to be carried out in these areas. [82]

Alternative pollination options

3.71 Submitters opposed to the commercial use of bumblebees argued that there are alternative pollination options available to producers. Bumblebees are valued in horticulture due to their buzz pollination. As outlined in chapter 2, wand pollination of greenhouse crops, such as tomatoes, mimics buzz pollination and results in improved yield and quality compared to pollination by honey bee. However, growers note that this method is labour intensive and therefore increases costs of production.

3.72 The committee also received evidence that native bees are a potential alternative to bumblebees. The department noted that some native bees, such as blue banded bees and green Carpenter bees have been shown to be effective buzz pollinators.[83]

3.73 Both the department and the Invasive Species Council noted that research has shown that two species of blue banded bee, *Amegillia holnesi* and *A. cholorocyanea*

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79 Tasmanian Government, *Submission 20,* p. 8. See also Dr Megan Halcroft, *Submission 2,* p. 1.

80 Tasmanian Government, *Submission 20,* p. 8.

81 Mr Robert Bell, *Submission 9,* p. 2.

82 Geelong Beekeepers Club, *Submission 18,* p. 2

83 Department of Environment, *Submission 22,* p. 2.

are effective pollinators of greenhouse tomatoes.[84] A blue banded bee, *A. murrayensis*, was shown to be a potential glasshouse pollinator due to its high buzzing frequency and reduced flower visit duration when compared to a common bumblebee species used in North America for pollination services.[85]

3.74 Two species of Carpenter bees, *Xylocopa aeratus* and *X. bombylans*, have also been shown to be efficient pollinators of tomatoes with about a 14 per cent increase in fruit weight compared to wand pollination.[86]

3.75 While these native bees may have potential for effective crop pollination, it was noted that there are no species of bee native to Tasmania suited to the same pollination tasks in which bumblebees offer specific advantages.[87] In addition, while some research has been undertaken into the use of native bees for pollination services, this research is limited and has not progressed in recent years.[88] CSIRO commented that commercial use of native bees will not be possible until methods have been developed to rear and supply them in sufficient number. CSIRO went on to comment that 'the problem is not that rearing the bees is necessarily infeasible, but rather that there has been very limited research in this area to date'.[89]

3.76 In their joint submission, Dr Katja Hogendoorn et al outlined the research invested in the use of native bee for greenhouse tomato pollination up to 2009. It was stated that:

> So far, four large individual growers and one distributer of greenhouse tomato have invested a total of $44,000 into [research and development] of native bees for greenhouse tomato pollination, over a period of 6 years, i.e. about A$7,300 per annum, between 2003 and 2009. The commercial development of bumblebees for tomato pollination took 20 years and involved 3 research groups. This demonstrates that the Australian greenhouse tomato industry has not made a concerted effort to research native alternatives.[90]

3.77 CSIRO argued that the limited investment into research and development of native bees is because:

> …there has been ongoing hope (among growers) that a *Bombus* system will one day become available in Australia. In other words, the possibility of

84 Invasive Species Council, *Submission* 4, Attachment p. 2; Department of Environment, *Submission 22*, p. 10. See also Geelong Beekeepers Club, *Submission 18*, p. 3.

85 Department of Environment, *Submission 22*, p. 10.

86 Department of Environment, *Submission 22*, p. 10.

87 University of Tasmania and Tasmanian Institute of Agriculture, *Submission* 6, p. 5; Tasmanian Government, *Submission 20*, p. 9.

88 Geelong Beekeepers Club, *Submission 18*, p. 3.

89 CSIRO, *Submission 7*, p. 7.

90 Dr Katja Hogendoorn et al, *Submission 16*, p. 3.

> adopting the imported technology (greenhouse *Bombus* pollination) may have suppressed investigation of other options.[91]

Calls for further research

3.78 Further research into the use of native bees rather than trialling bumblebees was supported by a range of submitters.[92] Dr Anne Dollin, for example, stated that:

> Focus and funding should be directed towards continuing to develop safe native pollinators for Australian agriculture, rather than importing an exotic bee species with known invasive characteristics.[93]

3.79 The South Australian Government submitted that research into the use of native bees 'should be encouraged with funding contributed by industry'.[94]

3.80 However, Costa Group submitted that the blue banded bee, while an effective pollinator, 'is not a social bee and has no commercial value or use except on a limited scale as a pollinator for seed crops in greenhouses'. Costa Group added that research was funded for several years will little result.[95]

Conclusion

3.81 The committee has carefully considered the issues canvassed during the inquiry and concludes that, on the evidence provided, a trial of the use of the population of feral bumblebees in Tasmania for pollination purposes should be supported. In coming to this conclusion, the committee is mindful of the possible environmental and biosecurity risks arising from the commercial use of bumblebees. However, the committee has taken into account significant mitigating factors outlined in the evidence.

3.82 First, the committee notes that before a trial of the commercial use of bumblebees can be undertaken, amendments to the EPBC Act would be required. In the previous Parliament, the Commonwealth Government proposed amendments to the EPBC Act which would have established a new part (Part 3) to the live import list and a mechanism to allow a trial in Tasmania into the use of bumblebees for crop pollination. These amendments were introduced in September 2015 as part of the debate on the Environment Protection and Biodiversity Conservation Amendment (Bilateral Agreement Implementation) Bill 2014 (the bill) after the Environment and Communications Legislation Committee's inquiry into the bill had concluded. The bill lapsed at the end of the Parliament and has not been re-introduced.

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91 CSIRO, *Submission 7,* p. 7.

92 Invasive Species Council, *Submission 4,* Attachment, p. 2; Dr Katja Hogendoorn et al, *Submission 16*, p. 3.

93 Dr Anne Dollin, *Submission 15,* p. 2.

94 South Australian Government, *Submission 21,* p. 5.

95 Costa Group, *Submission 12*, p. 7.

3.83 The committee acknowledges that the proposed amendments sought to establish a process requiring an environmental impact assessment, including consultation with the public and state Ministers, before the live import list is amended to allow possession of an existing feral population. In part, the assessment would require the applicant seeking an amendment of the live import list to demonstrate that the use the existing feral population would not threaten other species or biodiversity in Australia. The applicant would also have to demonstrate that the feral species would not become invasive and there would not be adverse impacts on threatened species or ecological communities.[96] The proposed amendments also contained an 'opt in' provision whereby state and territory governments would be required to consent to the exemption.

3.84 Based on the evidence received during this inquiry, the committee considers that the amendments proposed in 2015 appear to provide an adequate mechanism to ensure that the environment, threatened species and biodiversity are protected before a decision is made to allow the possession of an existing feral species. However, the committee is mindful that the proposed amendments have not been subject to review by the Legislation Committee.

3.85 As the proposed amendments have implications for the Australian environment generally, the committee considers that a thorough examination is required so that the views of interested stakeholders can be sought, to ensure that there are no unintended consequences, and that the mechanism proposed is sufficiently robust to apply to a broad range of existing feral populations. In addition, the committee considers that any proposal to amend the live import list to provide for a Part 3, also include a review mechanism to identify whether the arrangements put in place are effective in protecting the environment.

3.86 Secondly, before feral bumblebees in Tasmania can be used for any commercial purpose, a trial of their commercial viability would be undertaken. The committee notes that the minister may permit for a trial for up to two years. The committee considers that is an appropriate period and recognises the need to undertake research into the commercial viability of bumblebees.

3.87 Further, the committee notes the Tasmanian Government's evidence that only wild caught bumblebees would be used in a trial. If feral bumblebees prove not to be viable, particularly because of poor genetic diversity, the Tasmanian Government indicated that the trial would not continue. The Tasmanian Government also clearly stated that it would not support the importation of new genetic material to improve the feral bumblebee population for pollination purposes.

3.88 The possible need for new genetic material was a significant matter taken into consideration during the committee's deliberations. The committee only supports the

96 Department of the Environment, *Submission 22*, p. 3; Senator the Hon Simon Birmingham, Assistant Minister for Education and Training, *Senate Hansard*, 14 September 2015, p. 6731.

trialling of the existing population of bumblebees for pollination in fully enclosed facilities. It does not support the importation of any new bumblebee genetic material as it believes this constitutes an unacceptable risk to Australia's environment and biodiversity.

3.89 In addition, the committee notes that the proposed trial will also test containment procedures. The committee considers that ensuring there are no escapes of queen bumblebees and no establishment of new colonies is crucial to maintaining the existing density of bumblebees in the environment. The committee notes that to date there appears to have been few adverse environmental impacts in Tasmania from feral bumblebees. However, this may not continue to be the case should the density of bumblebees in the wild increase. Moreover, the committee considers that adequate containment of bumblebees will address some of the concerns raised by the honey bee sector.

3.90 The committee considers that any trial of the commercial use of bumblebees in Tasmania should also ensure that adequate biosecurity mechanisms are in place so that bumblebees are not accidentally, or otherwise, introduced to the mainland.

3.91 The committee has considered the environmental concerns raised in evidence. As noted above, there appears to be limited evidence of adverse environmental impacts from the existing Tasmanian feral bumblebee population. At the same time, the potential economic benefits for Tasmania from the commercial use of bumblebees in greenhouses may be significant. Bumblebees are well suited for pollination of certain greenhouse crops resulting in improved crop yields and quality. Production costs for Tasmanian greenhouse producers would also decrease as bumblebee pollination would replace labour-intensive wand pollination. The committee considers that these benefits will lead to increased production and thus employment opportunities in Tasmania.

3.92 The committee has also considered carefully the arguments related to the use of bumblebees should *Varroa destructor* establish in Australia. As bumblebees are resistant to varroa, their use for commercial pollination could provide significant advantages. However, in light of the potential for damage to the honey bee colonies from *V. destructor*, the committee also sees significant value in further research into alternative pollination options, particularly the use of native bees.

Recommendation 1

3.93 The committee recommends that the Commonwealth introduce amendments to the *Environment Protection and Biodiversity Conservation Act 1999* to amend the live import list to allow for the use of existing feral populations and that the proposed amendments be referred to the Environment and Communications Legislation Committee for inquiry and report.

Recommendation 2

3.94 The committee recommends that any proposed amendment of the live import list to allow the use of existing feral populations provide for a review mechanism after two years of operation. The committee further recommends that, should any adverse environmental impacts be identified in the review, the *Environment Protection and Biodiversity Conservation Act 1999* be amended to omit Part 3 of the live import list.

Recommendation 3

3.95 The committee recommends that the Commonwealth Government work with state governments to fund further research into the use of native bees as pollinators.

Senator Peter Whish-Wilson
Chair

Appendix 1

Submissions and additional information

Submissions

1	Fruit Growers Tasmania
2	Dr Megan Halcroft
3	Tasmanian Beekeepers' Association Inc.
4	Invasive Species Council
5	Raspberries & Blackberries Australia Inc.
6	University of Tasmania and Tasmanian Institute of Agriculture
7	CSIRO
8	Australian Honey Bee Industry Coucil Inc.
9	Mr Robert J Bell
10	Mr Marcus Brandsema
11	Dr Andrew Hingston
12	Costa Group
13	Tasmanian Farmers & Graziers Association
14	Mr Peter Franklin
15	Dr Anne Dollin
16	Dr Katja Hogendoorn, Ms Elisabeth Fung, Dr Remko Leijs and Dr Richard Glatz
17	Dr Tobias Smith
18	Geelong Beekeepers Club
19	Department of Agriculture and Water Resources
20	Tasmanian Government
21	Government of South Australia
22	Department of the Environment

Form letters

Form letter type 1: received from 9 individuals

Additional information

Mr Phil Pyke – Briefing points presented at public hearing, Hobart 21 February 2017

Oz Honey, Mr Lindsay Bourke – Journal article: E. Genersch, C. Yue, I. Fries and J.R. de Miranda, 'Detection of Deformed wing virus, a honey bee viral pathogen, in bumblebees (*Bombus terrestries* and *Bombus pascuorum*) with wing deformities', *Journal of Invertebrate Pathology*, 91, (2006), received 12 April 2017

Oz Honey, Mr Lindsay Bourke – Media Article: R Morelle, 'Bumblebees infected with honeybee diseases', *BBC World Service,* 19 February 2014, received 12 April 2017

Appendix 2

Public hearings

Tuesday, 21 February 2017 – Hobart

Fruit Growers Tasmania

Mr Trevor Monson, Pollination Specialist
Mr Phil Pyke, Business Development Manager

Costa Group

Mr Michael Toby, Corporate Affairs Manager

Protected Cropping Australia

Mr Marcus Brandsema, Board Member

Tasmanian Beekeepers' Association

Mr Lindsay Bourke, President

University of Tasmania

Associate Professor Geoff Allen, Senior Lecturer
Dr Stephen Quarrell, Research Fellow in Entomology
Dr Peter McQuillan, Senior Lecturer

Department of Primary Industries, Parks, Water and Environment

Dr Lloyd Klumpp, General Manager, Biosecurity Tasmania
Ms Carole Rodger, Director, AgriGrowth Tasmania

Wednesday, 29 March 2017 – Canberra

Department of the Environment and Energy

Mr Stephen Oxley, First Assistant Secretary
Mr Paul Murphy, Assistant Secretary

Department of Agriculture and Water

Dr Jonathan Taylor, Acting Assistant Secretary
Mr Andrew O'Sullivan, Director
Dr Penny Linnett, Principal Veterinary Officer