Australian Government
Department of Agriculture and Water Resources

Ref: 2016/003675E

Ms Christine McDonald
Committee Secretary
Senate References Committee on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600

Dear Ms McDonald

I write enclosing the department's submission to the committee's inquiry into the risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial pollination purposes. I appreciate the extensions to the due date for the department's submission.

The department's submission addresses the matters identified in the inquiry's Terms of Reference from a portfolio perspective. I trust the information in the submission will assist the committee with its inquiry.

If requested to attend, officers of the department will be available to appear before a hearing of the Senate Committee inquiry.

Yours sincerely

Paul Morris
Acting Deputy Secretary

16 March 2016

Enc.

Australian Government
Department of Agriculture and Water Resources

SUBMISSION

SENATE REFERENCES COMMITTEE ON ENVIRONMENT AND COMMUNICATIONS

Inquiry into the risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial pollination purposes.

March 2016

1. Introduction

The Department of Agriculture and Water Resources works to drive a stronger economy by building a more profitable, more resilient and more sustainable agriculture sector, and supporting the sustainable and productive management and use of rivers and water resources.

Relevant to the inquiry's Terms of Reference, the department provides advice to the Australian Government on how to help our primary industries remain competitive, productive and sustainable into the future. The department also regulates the import of animals, plants and skin products to ensure that Australia is safeguarded against exotic animals and plants and pests and diseases.

The department's submission addresses the role of bumblebees in crop pollination and the biosecurity arrangements that apply to bumblebees in Australia.

2. The use of bumblebees to pollinate crops

There are approximately 250 species of bumblebees (*Bombus* spp.) which naturally occur in Europe, North and South America and south and South-East Asia. They have also been introduced in New Zealand, Tasmania and Chile (Williams, 1994). The potential productivity and economic benefits for Tasmanian agricultural producers from the commercial use of bumblebees can be estimated from research conducted in other countries.

Glasshouse tomatoes

Bumblebees provide productivity and economic benefits to the production of glasshouse tomatoes. Pollination of glasshouse tomatoes is the most significant use of bumblebees internationally with Velthuis & van Doorn (2006) estimating that glasshouse tomato pollination accounted for 95 per cent of world bumblebee sales. *B. terrestris* (Europe, Asia, New Zealand, Chile; present in Tasmania, but not domesticated) and *B. impatiens* (United States, Mexico and Canada) are the two most commonly used species (Velthuis & van Doorn, 2006).

Bumblebees are the preferred method for glasshouse tomato pollination in other countries for three, interacting reasons:

1) Improved tomato yield and quality

   Tomato anthers release pollen when moved by external factors such as wind or insects. Pollen release is necessary for pollination and fruit set to occur. When grown in greenhouses supplementary pollination is provided to achieve the highest possible yields and quality. This can be achieved by insect pollination or various methods of manual pollination.

   Compared to manual pollination, bumblebee pollination gives at least equal tomato yields or, according to some studies, increased yields (Appendix 1), but at less cost. Bumblebee pollination has a further advantage because it improves tomato quality such as increased individual tomato weights and more seeds per tomato, which is a surrogate measure of firmness. Although European honey bees do pollinate glasshouse tomatoes (Appendix 1), they are not well suited to the pollination of glasshouse crops (Evans, 2010) and their effectiveness varies seasonally (van Ravestijn & van der Sande, 1991; Sabara et al., 2004). In

Australia, manual pollination is preferred to honey bees for the pollination of glasshouse tomatoes.

2) Reduced pollination costs

Bumblebees offer significant cost-savings when compared to manual pollination with an electric vibrating 'wand', which is how glasshouse grown tomatoes are currently pollinated in Tasmania. Although effective (Appendix 1), manual pollination, in which a person works through the glasshouse touching each plant with a vibrating wand every second or third day during the flowering period, is labour intensive requiring 40–60 hours of labour per hectare per week (van den Eijnde & De Ruijter, 1989; Bell, Spooner-Hart & Haigh, 2006). In Australia the costs (based on labour rates of $16 per hour and pollination three times a week) of manual pollination were estimated in 2004 at between $20 800 and $27 700 per hectare per annum[1] (Carruthers, 2004).

In comparison, based on 12 colonies a hectare, a cost of $160 AUD per colony and a colony life-span of two months, Carruthers (2004) estimated costs of bumblebee pollination in Australia would be $9 300 per hectare per annum.

3) Availability

The commercial use of bumblebees for glasshouse tomato pollination has depended on the establishment of methods to breed them in necessary quantities. There are more than 30 producers world-wide (Velthuis & Van Doorn, 2006). During the development of the industry, prices for bumblebee colonies have fallen considerably due to competition among suppliers, improved production methods and economies of scale. For example, in the Netherlands, which has extensive glasshouse tomato production, prices declined from approximately €200 per colony in 1988-90 to around €50-60 per colony in 2006 (Velthuis & Van Doorn, 2006).

In 2013–14, the Australian Bureau of Statistics estimated there were nine producers growing tomatoes under cover in Tasmania, producing 527 390 kilograms from 3.9 hectares. It is likely that the use of the bumblebees currently in Tasmania would deliver productivity benefits to these producers, subject to the cost of bumblebee colonies and the pollination performance of the Tasmanian population. It is uncertain what effect the ability to use bumblebees for pollination would have on the future growth of the Tasmanian glasshouse tomato industry.

Other crops

In addition to glasshouse tomatoes, bumblebees are used to pollinate a range of other crops[2]. Many of these crops can also be pollinated by honey bees. In other countries, the choice between the use of honey bees and bumblebees is determined by colony purchase / rental cost, crop type and environmental conditions (Velthuis & van Doorn, 2006). Honey bees are

[1] A form of automated, manual pollination, which could reduce the costs associated with manual pollination, is currently being trialled by d'Vine Ripe in South Australia (Sampson, 2015). The outcome of this trial is not yet known.

[2] Capsicum, cabbage seed, carrot seed, chillies, clover, cucumber, eggplant, melons, onion seed, zucchini, strawberry, raspberry, blackberry, currant, cranberry, blueberry, apple, pear, cherry, kiwifruit, peach, apricot, pear (Velthuis & Van Doorn, 2006; Spivak & Mader, 2010). See Appendix 2 for information on the production and value of these crops in Tasmania.

preferred to bumblebees for large-area field applications (Howlett & Donovan, 2010) because of the higher number of bees in each hive (a honey bee hive 20 000–30 000 bees; a bumblebee hive 50-800 bees) and their greater foraging distance (Spivak and Mader, 2010; Evans, 2010). Bumblebees withstand adverse weather conditions better than honey bees and are preferred in glasshouse crops due to their superior performance in enclosed environments (Evans, 2010). It is likely that having access to bumblebees for pollination purposes in Tasmania would deliver productivity and economic benefits for growers of crops other than glasshouse tomatoes. However, there is insufficient information to estimate the extent of such benefits.

3. Biosecurity matters

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and state and territory government legislation imposes conditions on the possession and movement of pest animals within Australia. The Department of the Environment and state and territory government agencies administer this legislation.

The entry of live species into Australia is regulated by the Department of Agriculture and Water Resources under the *Quarantine Act 1908* (which will be replaced by the *Biosecurity Act 2015* on 16 June 2016) and by the Department of the Environment under the EPBC Act. Mainland Australia is free of bumblebees. The Department of Agriculture and Water Resources undertakes a range of activities to prevent them entering Australia (including new species entering Tasmania) from international sources, including inspections of people, mail, baggage, ships, animals, plants and cargo containers. If bumblebees are detected at the border they are exterminated.

A species must be on the List of Specimens taken to be Suitable for Live Import under the EPBC Act before it can be imported into Australia. Currently bumblebees are not on this list. The Department of Agriculture and Water Resources would only develop quarantine conditions for bumblebee imports if they were added to the list for live imports under the EPBC Act. The process for developing quarantine conditions would include an Import Risk Analysis.

The relevant state or territory government biosecurity agency would lead the response to a bumblebee incursion on mainland Australia. A nationally cost-shared eradication programme to address a bumble bee incursion could be considered under either the Emergency Plant Pest Response Deed (EPPRD) or the National Environmental Biosecurity Response Agreement (NEBRA). Under these arrangements, an emergency response to a plant pest would be coordinated by a Consultative Committee. The Consultative Committee would advise the National Management Group (NMG) on technical aspects of a potential response. The NMG is the key decision making body and must agree to a response plan and the associated cost sharing in order for a national eradication programme to commence. Both the Consultative Committee and NMG comprise representatives from the Commonwealth and all state and territory governments. Under the EPPRD, affected industries and Plant Health Australia also participate in the Consultative Committee and the NMG.

4. Other matters

There is little empirical evidence about the extent of benefits from the commercial use of bumblebees for farmers in Tasmania and some of the risks this may create in Tasmania or mainland Australia. The department identified the following matters as possibly warranting further consideration:

1) the effectiveness of the bumblebee population in Tasmania at pollinating crops, which is uncertain because the population is in-bred (Schmid-Hempel et al., 2007)
2) the commercial viability of bumblebee production in Tasmania, given the small size of the market
3) the effect of the commercialisation of the bumblebee population in Tasmania on the likelihood of honey bee pests and diseases present in Tasmania (e.g. Braula fly) being transferred to mainland Australia or on the transfer of viruses present in bumblebees to European honey bees
4) the ability of control measures to mitigate any environmental and biosecurity risks from the use of the bumblebee population in Tasmania
5) the extent of any competitive advantage glasshouse tomato and other crop producers in Tasmania may gain from the commercial use of bumblebees and the possible incentive this may create for the illegal introduction of bumblebee to mainland Australia
6) the extent to which permission to use the bumblebee population in Tasmania would provoke requests for the broader use of bumblebees in Australia.

5. References

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APPENDIX 1

The results from research studies comparing the effect on pollination method on parameters of tomato yield and quality. Control treatments = 100 per cent.

Research study	No supplementary pollination†	Honey bee pollination	Manual Pollination	Bumblebee Pollination
		Total tomato yield (per cent)		
Banda & Paxton, 1991	100	149	162	215
van Ravestijn & van der Sande, 1991	100	na	124	127
Cribb, Hand & Edmonson, 1993	100	122	118	na
Pressman et al., 1999	na	na	100	100-120
Strange, 2015	100	na	na	113
		Individual tomato weight (per cent)		
Banda & Paxton, 1991	100	127	135	176
van Ravestijn & van der Sande, 1991	100	na	109	116
Kevan et al., 1991	na	na	100	98
Dogterom, Matteoni & Plowright, 1998	100	na	106	126
Pressman et al., 1999	na	na	100	100-124
Vergara & Fonseca-Buendia, 2012	100	na	105	108
Strange, 2015	100	na	na	105-118
		Number of seeds / tomato (per cent)		
Banda & Paxton, 1991	100	130	197	314
Kevan et al., 1991	na	na	100	118
Dogterom, Matteoni & Plowright, 1998	100	na	129	168
Vergara & Fonseca-Buendia, 2012	100	na	115	145
Strange, 2015	100	na	na	129

† The amount of incidental movement of plants due to ventilation and people in trials conducted in small scale experimental glasshouse is generally greater than that in large scale commercial glasshouses.

[na] This treatment was not included in the research study.

APPENDIX 2

The production and gross value of crops that respond to bumblebee pollination in Tasmania 2010-11 (ABS, 2012‡).

Crop	Number of agricultural businesses	Production (tonnes)	Gross Value ($m)
Vegetable seed	75	89	16.8
Capsicums	5	831	2.3
Melons	0	0	np
Tomatoes	15	712	2.7
Eggplants†	np	np	np
Cucumbers†	1	20	0.06
Blackcurrants	6	410	0.8
Blueberries	21	101	2.6
Raspberries	27	305	8.4
Strawberries	17	417	4.3
Cherries	109	3 416	28.4
Apricots	24	1 846	7.7
Peaches	5	135	0.5
Apples	99	27 254	30.7
Pears	33	845	1.5
Kiwifruit	0	0	np
Tasmanian agriculture (total)	4 085		1 152

‡ Although older, the 2010-11 ABS Agricultural Census statistics provide information on more crops than the more recent 2013-14 ABS Agricultural survey.

† ABS 2015 as data not reported in ABS 2012.

np not published