Department of Primary Industries, Parks, Water & Environment

Tasmanian Government

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

Attached is a submission from the Tasmanian Department of Primary Industries, Parks, Water and Environment to the above inquiry.

Other Tasmanian Government agencies have been consulted in the preparation of this submission.

Yours sincerely

John Whittington
SECRETARY

17 March 2016

Department of Primary Industries, Parks, Water and Environment Submission

Senate Standing Committee on Environment and Communications Inquiry into the risks and opportunities associated with the use of the bumblebee population for commercial pollination purposes

AgriGrowth Tasmania
9 March 2016

AgriGrowth Tasmania
Department of Primary Industries, Parks, Water and Environment

Tasmanian Government

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

A submission to the Environment and Communications References Committee, Australian Senate

Department of Primary Industries, Parks, Water and Environment, Tasmania (DPIPWE)

Introduction

The Tasmanian fruit, vegetable and seed industries are heavily reliant on the use of pollination services which are provided by commercial honey producers as part of their overall operations. Important agricultural crops using pollination services include; apricots, blueberries, strawberries, raspberries, cherries, apples, pears, brassicas, carrot seed, plum, lavender, clover, onions, red clover, lucerne and fennel.

Tasmania has a relatively small but vibrant honey industry, with producers of varying size and scale. There are currently over 200 registered bee keepers in Tasmania, with an estimated 17,000 hives. The cornerstone of the industry is leatherwood honey, which can only be produced in Tasmania and attracts premium prices.

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. Consequently, there are apiarists who are dedicated to providing pollination services only and they are increasingly in demand because of the growth across a range of sectors including cherries, berries, pasture and vegetable seed 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.

Both the Tasmanian Crop Pollination Association and a number of peak bodies in industries dependent on pollination services have expressed concern about the critical shortage of honey bee pollination hives available during the critical peak demand periods. The future of honey bee pollination is also under threat globally from pest and disease issues, such as varroa mite and colony collapse disorder.

For some Tasmanian crops, there is a potential alternative to honey bee pollination. Tasmania is the only State in Australia in which the European bumblebee *Bombus terrestris* has successfully established. After deliberate or accidental importation, bumblebees were first discovered in Tasmania in 1992. The species rapidly spread and established throughout the State.

The Tasmania Government does not condone the breach of biosecurity law that led to the introduction of the species into this State. However, it is 24 years since the introduction occurred, and there is no feasible opportunity to eradicate the species.

The Government is therefore 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.

This possibility is currently impeded by the fact that capture and utilisation of any existing bumblebee populations for greenhouse pollination is not permitted under Commonwealth law.

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. Research undertaken in 1997 concluded that the genetic limitations of the existing bumblebee population undermined the commercial case for rearing them for pollination. However, the technologies available to do so may now have significantly advanced.

To fully understand and quantify the costs and benefits of using the existing Tasmanian bumblebee population for pollination would require the conduct of commercial scale trials in Tasmania, with appropriate permission from the Commonwealth to proceed to such trials. The Tasmanian Government accordingly proposed such trials to the Commonwealth Government in early 2015. It remains the position of the Tasmanian Government that those trials would generate critical information to assist in the further consideration of this issue.

It is emphasised that the Tasmanian Government has not sought permission to introduce new bumblebees or genetic material into Tasmania. To do so could be viewed as setting a precedent and legitimising the original illegality of importation.

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. This assumes that the trials as proposed adequately demonstrate that there will be no further detriments caused from using bumblebees for commercial pollination.

Response to the Terms of Reference

a. the existing distribution and population density of exotic bumblebees

The European bumblebee *Bombus terrestris* is now found across the entire state of Tasmania, inhabiting all major vegetation communities from sea level to approximately 1,260 meters above sea level.

The density at which *B. terrestris* occurs has not been quantified, however observations in Tasmania suggest it is capable of becoming a major component of flower visitor faunas within climatically suitable areas.

A map of bumblebee distribution in Tasmania is included as Attachment A to this submission.

b. productivity and economic benefits of the commercial use of bumblebees for agricultural producers

Bumblebees are used commercially for the pollination of crops in more than thirty five countries around the world, including for tomatoes, melons, strawberries, raspberries, eggplants, zucchinis, apples, almonds, blueberries, avocados, kiwifruit and many others, including seed crops.

In comparison with other pollinating insects like honey bees, bumblebees are very effective pollinators. Bumblebees pollinate flowers through a method called "buzz pollination", a rapid vibrating motion which releases large amounts of pollen onto the bee. 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.

Bumblebees are active at low temperatures around 5°C, whilst honey bees become active at temperatures of 15-18°C. They are also active on cloudy, foggy, and rainy days, and can fly in winds of up to 64km/hr and subsequently work earlier in the mornings and later into the evening hours.

Unlike honey bees, bumblebees are attracted to flowers with long narrow corolla tubes, such as blueberries and tomatoes. Bumblebees are much more efficient pollinators than honey bees as they mainly forage for pollen rather than nectar, and transfer more pollen to the pistils with each visit.

One important advantage of bumblebees over honey bees is the absence of a communication system. Honey bees inform each other by means of the so-called "bees' dance" of the presence of an attractive

food source outside the crop in which their pollination activities are required, as a result of which the bees may leave collectively. Bumblebees do not have such a communication system. Should an individual bumblebee find an attractive food source elsewhere, it cannot inform its companions, so other bumblebees will continue to work in the crop in which their services are required.

Another advantage of bumblebees over honey bees, which manifests itself particularly in fruit crops, is the fact that they are not so much tied to a specific area in the crop. They change trees more often and more easily than honey bees. This benefits the cross-pollination which is often required in fruit (especially when it depends on pollen of special "pollinator trees").

Bumblebees are also non-swarming and much less aggressive than honey bees.

Bumblebees are now commonly used world-wide for the pollination of tomato crops. The use of bumblebees significantly reduced labour costs and has reportedly improved fruit quality and yield in some instances. 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.

c. the potential environmental impacts associated with the commercial use of bumblebees, including whether their use is likely to: impact the conservation status of a species or ecological community; impact biodiversity; cause unintended ecological impacts; and contribute to a wider distribution of bumblebees

While the proposed trials would use only the feral bumblebee population already present in Tasmania and would be limited to enclosed premises, researchers in Tasmania and in other jurisdictions have noted some negative impacts from the introduction of bumblebees. The following information therefore does relate primarily to the broader impacts of commercialization and the subsequent global distribution of bumblebees.

Bombus terrestris exhibits a range of characteristics enabling it to readily establish and maintain a range of negative impacts in naive ecosystems. These traits include having a generalist foraging strategy, high reproductive capacity, few natural predators, tolerance to a broad range of climatic and environmental conditions, a high dispersal rate and being an active vector of disease and pathogens.

Despite restricting the use of commercial bumblebees to contained greenhouse environments, escape, release and the establishment of introduced colonies has been documented throughout its commercial range including the United Kingdom, Chile, Japan, Mexico, Korea, Taiwan and Uruguay.

Increasingly, scientific evidence points to *B. terrestris* as having a range of negative ecological impacts in multiple regions around the world. Similar to Tasmania, negative interactions with indigenous bee

fauna has been detected in Japan, Israel and the United Kingdom with further competition over nest sites documented in Japan. Serious concerns have been raised on the potential impacts of *B. terrestris* on ecosystem function and agriculture in Tasmania, including competition for nectar with native and honey bee species, providing a potential vector of parasites and pathogens, negative interactions on the reproduction capacity of native flora, altered reproductive capacity of some weed species with the promotion of "sleeper" weed establishment and spread, and the potential for the Tasmanian *B. terrestris* population to provide a source population for incursions (both deliberate and accidental) into mainland Australia. Further, it has been documented in the United Kingdom and North and South America that the presence and spread of parasites and disease has been detected in all commercial *B. terrestris* operations, with the negative impacts associated with pathogen spillover into native bee populations. Similar impacts can be expected for Tasmania's (and potentially mainland Australia's) native bee populations.

There is now evidence for 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. 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 Tasmania has identified six possible sleeper weeds; the cost to control and/or eradicate these remains undefined. Currently many weeds in Tasmania originate from Europe where they have evolved complex mutualistic relationships with *B. terrestris* that 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 *B. terrestris* arrived.

The potential risks associated with the commercial use of bumblebees will undoubtedly increase significantly if permission to introduce new genetic material is again sought by the greenhouse industry. Introducing new genetic material into a population provides a species with a high adaptive potential allowing for the rapid selection of genotypes with higher competitive abilities and increased expansion and colonization success. With respect to *B. terrestris*, the altering or enhancing of its genetic vigor and pollination performance will simultaneously increase the species' invasive potential and negative ecological impacts in Tasmania, and the potential incursion of this species into mainland Australia. 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.

As currently evident across its introduced range, commercialized *B. terrestris* populations in Tasmania would result in escapes and releases from contained horticultural establishments. This would result in high density populations of the species which may further exacerbate the impacts at a local scale in proximity to commercial operations.

If introduced to the Australian mainland for pollination of greenhouse crops, *B. terrestris* poses a potential threat to national biodiversity because it (1) is highly likely to escape from captivity and form

feral populations in the wild across a large area (2) forages on many species of native and introduced plants and has spread rapidly throughout all major native vegetation types in Tasmania (3) is able to reduce the amounts of nectar available to other animals by foraging at lower temperatures than other bees and (4) it may displace more effective pollinators resulting in reduced seed production for some species of native plants.

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 discolour*) in spring, which may negatively impact the parrots' reproductive output.

For these reasons, the Tasmanian Government does not support the importation of new genetic bumblebee material into Tasmania.

It is noted that, while the aforementioned issues are important, they are not necessarily factors that should prevent a decision to proceed with controlled trials using the population that has been present in Tasmania for over 20 years. Rather, the trials would present a low risk opportunity to determine if there could potentially be benefits from an already present species.

d. the implications for Australia's biosecurity regime of any approval to use bumblebees in Tasmania for commercial purposes

Implications to Australia's biosecurity regime if bumblebees were approved for commercial use in Tasmania are very much dependent on the conditions or circumstances under which approval is granted and any subsequent developments.

DPIPWE is supportive of a trial using the existing wild population of bumblebees as the basis for a feasibility study placing the insects in protected environments. Approval to use existing wild-caught bumblebees present in Tasmania in greenhouse pollination trials would have no greater risk implication for Australia's biosecurity regime than the present situation where bumblebees now occur widely in the wild across the State.

The integrity of the national biosecurity system would be questioned however if such an arrangement became permanent, due to the illegal nature of introduction of an environmental pest such as the bumblebee. It could be viewed as setting a precedent and legitimising the original illegality of importation and thus tempt the smuggling of other potential pests with perceived commercial economic benefit into Australia.

DPIPWE is accordingly not supportive of the importation of new populations of bumblebees from overseas. If specifically-bred bumblebee stock was imported for a Tasmanian trial instead, the

introduction of new genetic material may inadvertently strengthen the entire Tasmanian bumblebee population, with unforeseen consequences for the environment and other bee populations. Tasmania is the only place in Australia in which bumblebees have managed to successfully establish, despite several deliberate but failed attempts to do so on the Australian mainland in the late nineteenth and early twentieth centuries. The accidental release of newly imported bumblebees in Tasmania would therefore pose greater risks to both Tasmania and to other Australian States.

e. the potential economic outcomes

The potential economic outcome of the successful commercialization of Tasmania's existing bumblebee population for pollination could be a significant expansion of the State's 'controlled environment agriculture' (CEA) sector, in which commercial agricultural crops are grown in fully enclosed secure greenhouses.

In Australia, growers currently pollinate their greenhouse tomato crops three times a week using mechanical hand-held vibrators touching each plant. Work by the Australian Hydroponic and Greenhouse Association in 2006 estimated that it costs Australian growers $25,000 to manually pollinate one hectare (10,000 square meters) of tomatoes, against $7,000 for bumblebee pollination, a saving of $18,000 per hectare. This is a 72 per cent saving or in excess of $8 million annually industry-wide. 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. (In 2008, the Association estimated that the economic benefit of bumblebee pollination would be A$40 million per year.)

In 2012, Marcus Brandsema (co-owner of Tasmanian company, Brandsema J&A and Chairman of Protected Cropping Australia – the successor organisation to the Australian Hydroponic and Greenhouse Association) stated that industry has found that use of bumblebees for pollination would cut pollination costs to 25 per cent of manual pollination, and increase productivity by about 15 per cent, especially in greenhouse tomato crops.

Apart from tomatoes, capsicums and cut-flowers, there are few commercial agricultural crops currently being grown in fully enclosed secure greenhouses in Tasmania. Whilst there has been a rapid expansion of the use of protective poly-tunnels, especially for the production of fresh berries, these structures are not always fully enclosed, often with ends and side walls being non-existent to allow adequate air circulation.

Therefore, the immediate benefit of using bumblebees within greenhouses would primarily be restricted to the relatively small tomato and capsicum sector. ABS figures suggest there are eight growers and about 8.2ha in greenhouse capsicum and tomato production in Tasmania. The estimated saving of

$18,000 per hectare would result in a direct saving to the Tasmanian industry of around $147,600 per annum if bumblebee pollination was allowed.

It is thereby noted that some parties suggest that Tasmania would see minimal benefits from the use of bumblebees in CEA, because of the small production area. However, given the competitive advantage that the use of bumblebees would offer, it is conceivable that the production area would be increased through investment. Tasmania could become a future hub for CEA, and a new business opportunity for apiarists providing bumblebee services could also result.

A report prepared by an independent agricultural economist on CEA, which was commissioned by the Department of Economic Development (now the Department of State Growth), found that the use of bumblebees as pollinators would create a major competitive advantage for Tasmanian producers by significantly reducing production costs.

A large grower with significant investment in Tasmania has informally indicated to the department that it would consider making a sizeable investment in CEA in Tasmania if it could access bumblebees for pollination. Other potential investors have also indicated their interest in being able to use bumblebees for pollination.

CEA businesses in Tasmania and interstate have suggested that access to bumblebees would make Tasmania a desirable investment location for large scale protected cropping investment, for crops including tomatoes, blueberries, raspberries and strawberries. While Tasmania has ideal climatic conditions for CEA, the cost of power and freight relative to other production areas affects Tasmania's competitive position, and therefore the state's CEA sector has remained relatively small. Access to bumblebees for pollination would offset those additional costs and make Tasmania a favourable investment proposition.

The use of bumblebees for pollination in CEA also underpins pesticide-free greenhouse production due to the bumblebee's low tolerance and requires the adoption of Integrated Pest Management strategies (involving the use of arthropod bio-control agents). Some international growers promote the fact that they use bumblebees as proof of their pesticide-free production practices when marketing their products. In fact, bumblebee images on produce tags are used overseas to signify "clean, green, pesticide-free" produce. The introduction of these systems would be in keeping with Tasmania's clean green image and branding.

Access to bumblebees for pollination would also enable Tasmania's CEA sector to compete more effectively with countries such as New Zealand and Chile, which already receive a productivity advantage from access to bumblebees.

f. the effectiveness of alternative pollination options

The effectiveness and other issues around honey bee pollination and the use of mechanical hand-held vibrators for pollination are discussed above.

It is DPIPWE's understanding that no species of bee native to Tasmania is suited to the same pollination tasks in which bumblebees offer specific advantages.

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ATTACHMENT A: Bumblebee Distribution in Tasmania