**Submission to the inquiry into the risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial purposes**

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To the members of the Environment and Communications Legislation Committee,

This submission addresses the following terms of reference regarding the risks and opportunities associated with the use of the bumblebee population in Tasmania for commercial purposes:

a. the existing distribution and population density of exotic bumblebees;
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. three other related matters.

a. the distribution and population density of exotic bumblebees;

The current distribution within Australia is limited to Tasmania. Breeding of bumblebees and use as greenhouse pollinators will enhance the feral population density of bumblebees on the island.

The population on Tasmania is inbred (Buttermore 1998; Schmidt-Hempel *et al.* 2007). If this legislation includes the introduction of new breeding stock to enhance the genetics of the inbred bumblebee population on Tasmania, this will further enhance feral population density (Hingston 2005a; Whitehorn *et al.* 2009). Experiences overseas have shown that the introduced bees will not remain contained and will escape (Kraus *et al.* 2011).

An increased feral population density will:

- increase the risk of successful colonisation of the mainland, as more hibernating queens will be produced, leading to an increase of stowaway queens in cargo;
- increase the environmental impact of this feral species on Tasmania (see below);

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

The Tasmanian greenhouse tomato industry will benefit from commercialisation. Bumblebees increase the quality and yield of greenhouse tomato by approximately 10% (Banda and Paxton 1991). In 2005, approximately 0.42 % of Australian greenhouse tomatoes were grown in Tasmania (RIRDC Pub. No. 10/081). Assuming this percentage has not changed in the past years, this production represents a farm gate value of the Tasmanian tomatoes of A$ 2.19 million (based on the total Australian farm gate price for tomatoes, 2013-2014, totalled A$ 350.6 million, ABARES). A 10% increase would thus represent a benefit of A$ 219,000 per annum for the Tasmanian tomato industry.

In addition, there will be a reduction in labour costs for pollination. However, it is likely that due to market mechanisms, the reduction in labour costs will be offset by the costs of procuring bumblebees. Additionally there will be associated costs of applying biological

control for pests and diseases in the greenhouses, as possibilities to spray are reduced when bumblebees are in use.

Certain other pollination dependent horticultural industries on Tasmania may benefit, as bumblebees are efficient pollinators of, e.g., blue-berries and raspberries and forage during inclement weather. Currently, these industries rely heavily on feral honeybees. In the case of an incursion of the Varroa mite in Tasmania, these growers are likely to benefit from feral bumblebees, as the mite will decimate feral honeybees and drive up prices for managed hives. However, too many bumblebees can damage production of raspberries (Saéz *et al*. 2014).

The honeybee industry may suffer negative impacts from increased feral bumblebee populations through competition for nectar and pollen (Stout *et al.* 2002) and through reduced demands for pollination services. Furthermore, if new genetic bumblebee material is introduced, the potential of introducing diseases would pose a real risk for the honeybee industry (see below).

Forestry may suffer negative impacts through delays in reforestation as a result of increased pollination of foxgloves and rhododendron when feral bumblebee densities increase.

Agriculture may be negatively impacted through proliferation of toxic (foxgloves, rhododendron) or otherwise inedible weeds some of which are of serious agricultural and/or environmental concern (e.g. bumblebees are the best pollinator of scotch broom; Stokes *et al.* 2006).

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;

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 (Hingston 2005b, 2007), a decrease in the nectar availability for the swift parrot (Hingston 2004, 2007), displacement of native Tasmanian bees from flowers through competition (Hingston and McQuillan 1999) and rob nectar without pollination (Hingston and McQuillan 1998b; Olsson *et al.* 2000; Hingston 2007; Johnson *et al.* 2010).

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

d. the implications for Australia's biosecurity regime of any approval to use bumblebees in Tasmania for commercial purposes;
An approval to breed and use the illegally introduced bumblebees in Tasmania for commercial purposes presents a fundamental risk to Australia's biosecurity system, because it could provide a countrywide incentive for illegal introductions of species that can benefit certain industries, but may be harmful to others, including the bumblebee. The invasive species council eloquently explains this risk (http://invasives.org.au/files/2015/01/fs-bumblebees-in-tasmania.pdf). Additionally, bumblebees are known to harbour honeybee viruses and other microbial diseases (see below) and any novel imports will require regulation and intense screening of breeding material.

e. With benefits for Tasmanian tomato growers and some fruit growers on the one hand and potential negative impacts for the honeybee industry, forestry, agriculture and the environment on the other hand, the potential economic outcomes are hard to predict. However, an earlier study has indicated that the Tasmanian population was too inbred for commercial rearing to be economically viable (Buttermore *et al.* 1998). The inbred status of the population has not changed. If the introduction of new breeding stock is considered in this context, there is a high risk of economic damage (see under g.2.b. below).

f. the effectiveness of alternative pollination options;
Hand pollination is very effective, achieving 90% of the efficiency of bumblebees. Native bees are as effective as bumblebees in pollinating tomatoes in greenhouses (Hogendoorn *et al.* 2000, 2006, 2007). Development of breeding systems for these bees is feasible (Hogendoorn *et al.* 2007), but requires solid industry support. So far, four large individual growers and one distributer of greenhouse tomato have invested a total of $44,000 into R & D of native bees for greenhouse tomato pollination, over a period of 6 years, i.e. about A$ 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.

g. Three other related matters.

1. Bumblebees, while not very aggressive, nest in the ground. By analogy to European wasp nests, nesting in the soil can increase the probability of eliciting stings, as soil nests can be stepped upon. Approximately 3% of the population is likely to be allergic (Hoffman *et al.* 2010). Between 2004 and 2005, 10 persons have been hospitalised for bumblebee stings, with a mean length of hospital stay of 1.4 days (Australian Institute of Health and Welfare 2008).
2. The current bumblebee population is the offspring of very few introduced queens and therefore inbred (Schmid-Hempel *et al.* 2007). Buttermore (1998) suggested the population was too inbred for rearing to be economically viable. If introduction of new breeding stock is considered as part of this enquiry, then this should be explicitly stated, because this dramatically changes the risks, for the following reasons:

a. Introduction of new breeding stock to enhance the genetics of the breeding population will also improve feral population density. Experiences overseas have shown that the introduced bees will not remain contained and will escape. An increased feral population density will:
- increase the risk of successful colonisation of the mainland, as more hibernating queens will be produced, leading to an increase of stowaway queens in cargo;
- increase the environmental impact of this introduced species;

b. Introduction of live bumblebee material increases the risk of inadvertent introduction of bee diseases, not only to the bumblebees present on Tasmania, but also to honeybees and native bees. The likelihood of this is high and the consequences can be far-reaching.
*Likelihood*
In a seminal paper titled "The Trojan hives: pollinator pathogens, imported and distributed in bumblebee colonies", Graystock *et al.* (2013) show that 77% of commercially produced bumblebee colonies imported into the UK *on the basis of being free of parasites* (from 3 producers), in fact carried a total of eight species of infectious microbial parasites, that pose a significant risk to other native and managed pollinators. Furthermore, bee viruses have been carried over the world by movement of honeybees, locally threatening honeybees and other bee species (Wilfert *et al.* 2016), and microsporidian diseases have been introduced with bumblebee hives in South America (Schmid-Hempel *et al.* 2014).
*Consequences*
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 (Schmid-Hempel *et al.* 2014). According to the authors, this major invasion event currently unfolding in southern South America has disastrous consequences for the native bumblebee species.
Australia can learn from these events, and should have learnt from its own past, that the introduction of any animal requires extreme diligence on the part of the legislators. This pertains in particular to pollinators, as they are involved in the production of 30% of our diet.
For Australia, viruses take a special position. Our country lacks a number of honeybee viruses (see below) and their inadvertent introduction can have a profound impact on bees and the bee-keeping industry. Global declines in bee populations overseas (honeybee, bumblebee and solitary bee species) have been linked to viruses that are transmitted by the Varroa mite and that, through association with the mite, have become more virulent. Of particular concern is Deformed Wing Virus (DWV), which affects both honeybees and bumblebees and probably also native bees (see Wilfert *et al.* 2016, and references therein). It is important to note that (a) DWV is not present in Australia (Roberts *et al.* 2015), (b) the virulent version of the virus is present in all regions from which populations of bumblebees can be sourced (New Zealand, Europe, USA, Africa) and (c) DWV, including the form modified by the mite, can be transmitted between bee species (Singh *et al.* 2010), independent of the Varroa mite (Wilfert *et al.* 2016). Similarly, Slow Bee Paralysis Virus is not as yet present in Australia (Roberts *et al.* 2015), but if transmitted to honeybees by imported bumblebees, could affect future export of honeybees to the USA, where the virus is also absent (Rose *et al.* 2014).
Thus, if importation of new bumblebee breeding stock is considered, the risks need to be thoroughly evaluated by specialists and the stock needs to be assessed for the presence of any known *and unknown* viruses and other diseases, as their presence can have serious negative implications for the health of honeybees and native bees, for crop pollination and for the export capabilities of the Tasmanian honeybee industry.

3. The committee should be very clear on whether legalisation of breeding of bumblebees on Tasmania (and/or importation of breeding stock) will have <u>implications for the legal status of bumblebees on the mainland</u> of Australia. If this is the case, then this changes

the premise of the current inquiry. Specifically, the far-reaching consequences of the decision would render the scope of this inquiry inadequate, as this scope currently relates only to Tasmania and the potential impacts of introduction to the mainland are far more serious.

Yours sincerely,

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