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BRIEF COMMUNICATION

First record of the invasive bumble bee *Bombus terrestris* (Hymenoptera: Apidae) on Navarino Island, southern Chile (55°S)

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Abstract. As the volume of global trade expands, so does the risk of alien species reaching new regions. *Bombus* (*Bombus*) *terrestris* (Linnaeus) (Hymenoptera: Apidae) is a bumble bee traded internationally for crop pollination and is now considered an invasive species in New Zealand, Japan, and throughout South America. We newly document its presence on Navarino Island, Cape Horn, Biosphere Reserve, Chile (55°S), the southernmost locality reached by this species to date.

The genus *Bombus* Latreille comprises around 250 species distributed almost worldwide (Michener, 2007; Williams *et al*., 2008). For Chile, two native species have been described, *Bombus* (*Cullumanobombus*) *funebris* Smith, 1854 and *B*. (*Thoracobombus*) *dahlbomii* Guérin-Méneville, 1835, in addition to the two recent introductions of *B*. (*Megabombus*) *ruderatus* (Fabricius, 1775) and *B*. (*Bombus*) *terrestris* (Linnaeus, 1758) (Montalva *et al*., 2011). The last of these species, *B*. *terrestris*, could become a serious threat to biodiversity globally (Sutherland *et al*., 2017; Geslin *et al*., 2017). This species was deliberately introduced in Chile in 1997 as a pollinator of tomato (*Solanum lycopersicum* L.) and avocado plants (*Persea americana* Mill.) (Montalva *et al*., 2008). *Bombus terrestris* was introduced to the Magellanes region in the summer seasons of 2011–2012,

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2012–2013, and 2013–2014 through an INIA (Instituto de Investigaciones Agropecuarias) project to assess its capability as a pollinator of red currant, *Ribes rubrum* L. (Pérez, 2013; Estay & McLeod, 2014). The first European bumble bee colonies were used in greenhouses at INIA Kampenaike, Punta Arenas (52°S) (Estay & McLeod, 2014). Since then, more colonies have been privately introduced for pollinating tomato plants (Díaz Tavie, pers. comm).

In the latest reports of this species' distribution from the citizen science program, 'Salvemos Nuestro Abejorro' (Save our Bumble Bee), *B. terrestris* is recorded from the Coquimbo region (30°S) to the Magellanes region (51°S), including Chiloé Island (Montalva *et al*., 2015), spanning 21 degrees of latitude. Recently, Simonetti *et al*. (2016) documented the presence of naturalized *B. terrestris* since 2013 on Riesco Island (52°51′S, 71°33′W).

The dispersal rate of *B. terrestris* is estimated to be around 200 km per year (Schmid-Hempel *et al*., 2014). It arrived in Argentina in 2006 (Lanín National Park, Neuquén Province), a country that had banned *B. terrestris* importation, from Chile (Torreta *et al*., 2006), probably through low elevation passes across the Andes, eventually reaching Río Gallegos (51°37′S, 69°12′W) in 2014 (Geslin & Morales, 2015).

The goal of this note is to document the presence of *B. terrestris* on Navarino Island (54°56′S, 67°36′W), Cape Horn Biosphere Reserve, Chile, through captures and multiple sightings. These records are concerning because they represent the southernmost localities for this fast-spreading invasive species in one of the last 24 pristine areas of the world.

The first sighting of *B. terrestris* on Navarino Island occurred in April of 2016, when an individual was observed flying around a shrub of *Chiliotrichum diffusum* (G.Forst.) Kuntze (Asteraceae). By October of the same year, eight sightings were made and one individual was collected. Later, on a survey through the northern coast of Navarino Island, three individuals were sighted and one of them was captured. Seven individuals were collected in a second survey at the same locations. All captured specimens are workers. Sighting and capture sites are given in figure 1. Specimens were identified following the descriptions of Abrahamovich *et al*. (2007) and Montalva *et al*. (2011), and are deposited in the Freshwater Ecology Laboratory Wankara in Puerto Williams, Chile.

EXAMINED MATERIAL: All from Chile, Magallanes region, Navarino Island: 1♀ (worker), Puerto Williams (54°56′4.2′′S, 67°36′1.7′′W), 11-10-2016 [11 October 2016], 10 m.a.s.l.; 1♀ (worker), Corrales viejos (54°56′7.93″S, 67°27′57.32″W), 05-02-2017 [5 February 2017], 4 m.a.s.l.; 1♀ (worker), Caleta Eugenia (54°56′1.23″S, 67°19′18.45″W), 21-02-2017 [21 February 2017], 13 m.a.s.l.; 2♀♀ (workers), Km 13 (54°55′40.84″S, 67°25′15.93″W), 22-02-2017 [22 February 2017], 8 m.a.s.l.; 1♀ (worker), Puerto Navarino (54°56′1.23″S, 67°19′18.45″W), 24-02-2017 [24 February 2017], 13 m.a.s.l.; 1♀ (worker), Puerto Toro (55°4′43.57″S, 67°4′37.33″W). 26-02-2017 [26 February 2017], 48 m.a.s.l.; 2♀♀ (workers), Bahía Honda (54°55′13.52″S, 68°13′0.26″W), 11-03-2017 [11 March 2017], 2 m.a.s.l., J. Rendoll leg.

The arrival of *B. terrestris* at Navarino Island, approximately 300 kilometers from Punta Arenas, is likely the result of hitchhiking. Bumble bee migrations can be facilitated by ships, likely coming on board while ships harbor, perhaps even arriving onboard while the ship is sailing nearshore (Mikkola, 1984). There are no known reports of *B. terrestris* from Ushuaia (South Tierra del Fuego, Argentina), the closest populated

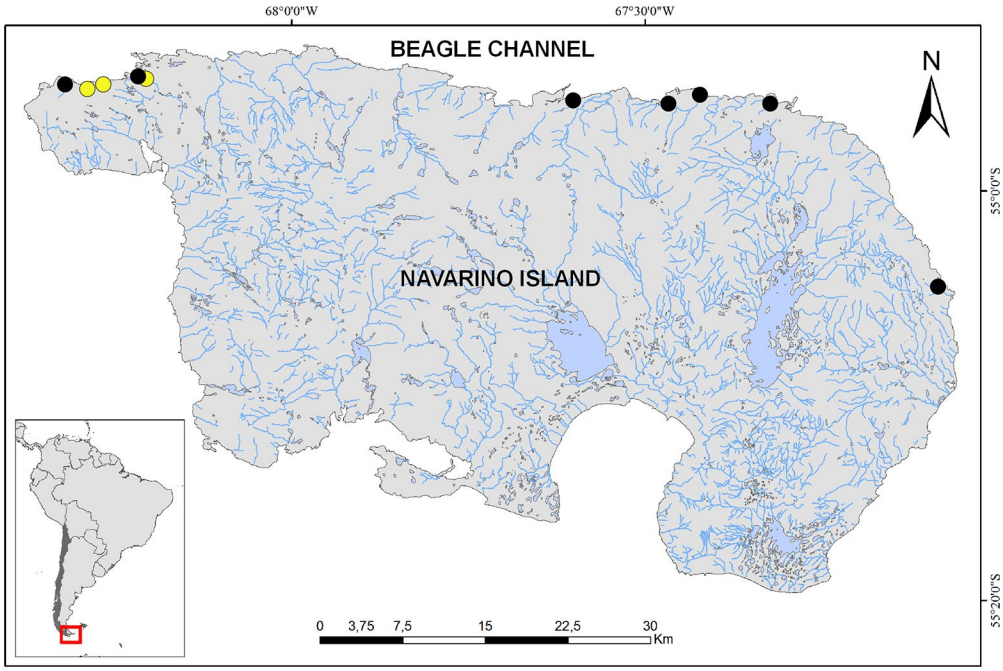

Figure 1. Map of Navarino Island (55°S) showing locations where *Bombus* (*Bombus*) *terrestris* (Linnaeus) has been captured (black circles) and sighted (yellow circles).

area; therefore, assisted transportation appears to be a plausible explanation for how *B. terrestris* arrived at Navarino Island. However, the species' natural dispersal capacity cannot be rejected as a reasonable hypothesis for how they reached Navarino Island (Ollerton, 2016). Although bumble bee island hopping is documented (Haeseler, 1974; Macfarlane & Gurr, 1995), the harsh environmental conditions on southern South American channels and fjords could represent a dispersal barrier for *B. terrestris*.

The presence of the non–native *B. terrestris* poses a risk for native Magellanic bees and other native pollinators (Pérez, 2013; Valdivia *et al*., 2016). These risks may include direct competition for floral resources and nesting sites (Goulson, 2003), transmission of pathogens to native species (Arbetman *et al*., 2012; Schmid-Hempel *et al*., 2014; Arizmendi *et al*., 2016), pollination of non-native plants (Montalva *et al*., 2011) and, therefore, a general threat to local native plant communities (Goulson, 2003; Valdivia *et al*., 2016). The potential ecological effects of *B. terrestris* require study in this southern archipelagic ecosystem. Furthermore, the Magallanes region is not listed as a producer of tomatoes and other vegetables in the annual agricultural report of the National Institute of Statistics, Chile (INE, 2014), so the first intentional introduction of *B. terrestris* seems to be an unjustified economic risk. We encourage no further non-native pollinator introductions in the region. Similar to Geslin & Morales (2015), we strongly recommend monitoring *B. terrestris* dispersal and additional surveys to check on the plight of the native *B. dahlbomii* in one of its last pristine habitats.

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