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Evidence for the decline of the western bumble bee (*Bombus occidentalis* Greene) in British Columbia

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Scientific Note

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The crucial ecosystem service provided by native pollinators has been recently regarded as threatened globally (e.g., Biesmeijer et al. 2006, Klein et al. 2007, NRC 2007). Bees (Hymenoptera: Apoidea) are a speciose taxon containing a large portion of native pollinating insects. As in many invertebrate groups, baseline data and natural history knowledge for most bee species is highly deficient. As a result, important pollinators may undergo drastic declines unnoticed (Buchmann & Nabhan 1996).

Bumble bees (*Bombus* spp.) are among the best studied bee taxa as they are large, colorful and relatively easy to identify (Kearns & Thomson 2001). The declines of some species have been documented globally (Williams & Osborne 2009) but the declines in western Canada have been largely anecdotal. In particular, North American members of the subgenus *Bombus sensu strictu* have declined rapidly throughout their native ranges (reviewed in Evans et al. 2008). While the decline of *B. franklini* in southwestern U.S.A. and *B. affinis* in eastern North America have been well documented and quantified (Thorp & Shepherd 2005, Colla & Packer 2008, Grixti et al. 2009), there are few baseline data for comparing previous and current abundances of *B. occidentalis*, the Western Bumblebee. Here we provide a comparison of the relative abundance of *B. occidentalis* after 20 years in the Fraser Valley of British Columbia, Canada.

In 2003 and 2004, a study on the abundance and diversity of wild bees in commercial highbush blueberry and cranberry fields was performed (Ratti et al. 2008, Ratti 2006). The study was located in the Fraser Valley of British Columbia where a total twelve sites were surveyed using sweep nets and pan traps (Ratti et al. 2008, Ratti 2006). Collected specimens were identified by C. Ratti with vouchers being confirmed by T. Griswold and deposited in the Packer Collection at York University, Toronto, Ontario, Canada and the USDA-ARS Bee Biology and Systematics Laboratory, Logan, Utah. Similar surveys were performed in various berry fields and natural vegetation in the same region in the early 1980s (Winston & Graf 1982, MacKenzie & Winston 1984). While the exact same sampling methods were not used for both time periods, the recent study (Ratti 2006) sampled more sites and used an additional sampling method (pan trapping in addition to sweep netting). This indicates that differences noted in *B. occidentalis* abundance are not the result of lower sampling effort during the more recent time period.

Bombus occidentalis was the second most abundant bumble bee in blueberry fields in 1981 (27% of collected bumble bees) (Winston & Graf 1982), and it was the second most common *Bombus* species, overall, collected in berry fields and natural vegetation (approx 22%) in 1982 (MacKenzie & Winston 1984). In 2003–2004, this species represented less than 1% of the *Bombus* collected (26 individuals of the 2738 total). Likewise *B. occidentalis* was the most abundant bee (55% of bumble bees, 312 individuals) in cranberry fields in 1982 and second most abundant bee in 1981 (41% of bumble bees, 104 individuals) (MacKenzie & Winston 1984, Winston & Graf

1982), but was represented by 2 individuals (0.3% of bumble bees) in cranberry fields in 2003 and was absent from cranberry fields in 2004. *Bombus occidentalis* was also very low in abundance in urban habitats adjacent to this region in a survey performed during the same time period (2 individuals, 0.1% of bumble bees) (Tommasi et al. 2004).

These results provide quantitative evidence that wild populations of *B. occidentalis* have declined in western Canada. While there are various suspected reasons for declines among the members of the subgenus *Bombus s.s.* (reviewed in NRC 2007), the introduction and amplification of diseases from managed bumble bee populations is a likely threat. The management of *B. occidentalis* colonies for commercial pollination collapsed after an apparent outbreak of disease (Whittington & Winston 2004, Evans et al. 2008). Wild populations are likely also particularly susceptible to disease, but are less easily observed. Since pathogens have been found to transfer from managed to wild populations (Colla et al. 2006, Otterstatter & Thomson 2008), it is of utmost importance that the use and screening of managed bees is highly regulated. Without increased control, the loss of native bumble bee species could result in devastating impacts on native fauna and flora as well as inadequate pollination of agricultural crops.

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