

## Report of project work

### Investigation into the foraging behaviour of bumblebees on varying flowering vegetation, across the habitats of the RSPB reserve, Dungeness, Kent.

#### The overall aims

Overall, this project aims to assess which habitats, on the RSPB reserve, Dungeness, in Kent, are most suitable for the soon to be re-introduced *Bombus subterraneus*, with a view to replicating and managing this habitat, for a successful re-introduction. Habitats include: grassland managed to provide a legume rich sward, semi-natural vegetated shingle, rank vegetation at margins of wetlands and a grazed field. *Bombus subterraneus* is a long-tongued species of bumblebee, which was last recorded in Dungeness, in 1988; it has been planned that queens from a successful New Zealand population will be re-introduced to Dungeness in spring 2010. The following research questions have been addressed:

#### Research Questions

With a view to the re-introduction of *Bombus subterraneus*:

1. How does each recorded species of current *Bombus* vary across the four habitats?
2. How does the total number of *Bombus* sightings vary across the four habitats?
3. Which habitat contains the greatest abundance of flowering vegetation preferred by *Bombus subterraneus*?
4. Which current *Bombus* species prefer to forage on which flowering vegetation family across the four habitats?

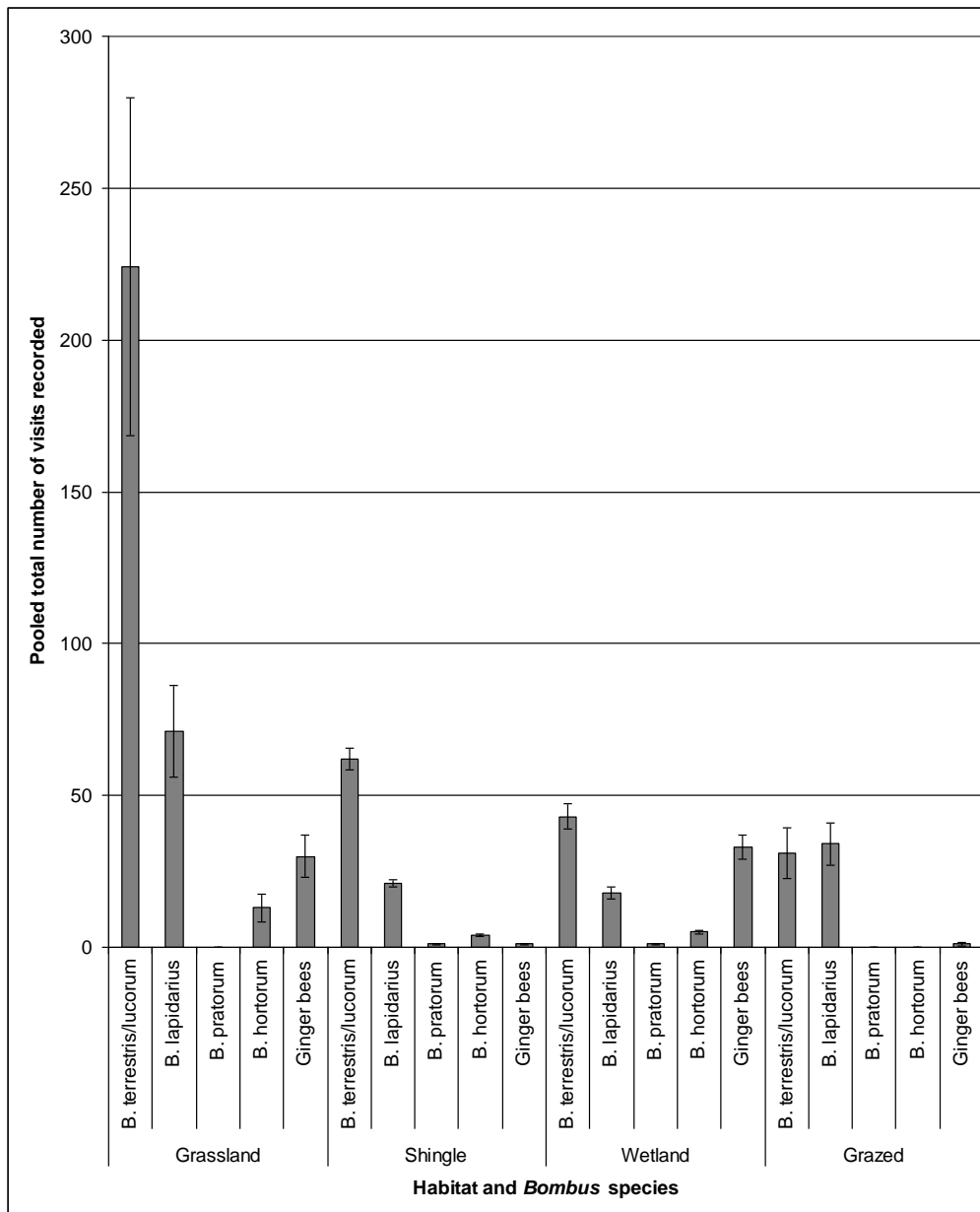
#### Study design (bit of methods but not detailed)

Data was collected between the 18<sup>th</sup> of July and 1<sup>st</sup> August 2009, across the four habitats of the RSPB reserve, Dungeness, South Eastern Kent. This time of year is ideal as the worker females are actively foraging for nectar and pollen. Data collection was always between 8.30am and 5.00pm, when bumble bees are most active. In each habitat, five 20x20m 'working quadrats' were marked out approximately 100m apart, except in the wetland habitat where space was a little limited. Separated in time across the five working quadrats, three bee walks were conducted in each. Each bee walk was timed for fifteen minutes and involved a steady walk from one end of the working quadrat to the other, covering the whole square. All *Bombus* species that were foraging on flowering vegetation were identified, in addition to the species of flowering plant. *Bombus* individuals that were unable to be identified were caught in the meshed sample pot and carefully inspected with a hand lens. By covering the entire area, certain areas are not treated more favourably. In each working quadrat 20 random small quadrats were thrown. All flowering vegetation within the quadrat was identified and recorded.

#### Results in graphs/significant findings

Here, some of the more interesting findings from the investigation are relayed.

#### **Addressing objective 1:**

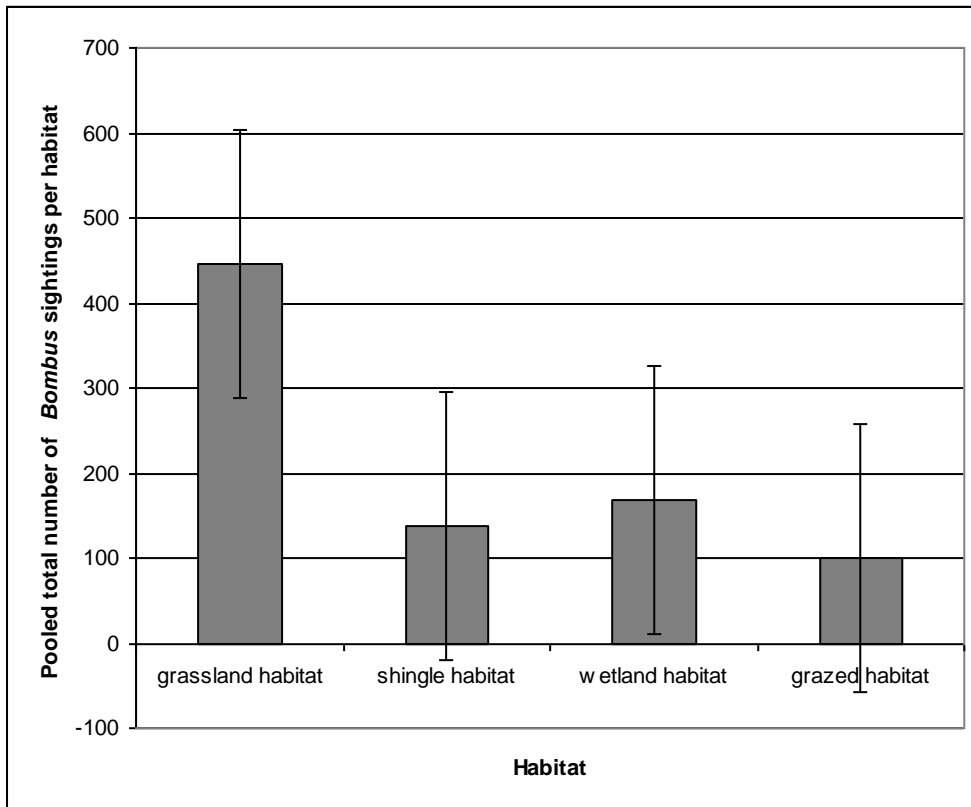


**Figure 1. Pooled total number of *Bombus* visits recorded across four habitats  $\pm$  standard deviation, collected July/August 2009, Dungeness, Kent, UK.**

Figure one displays the pooled total number of *Bombus* visits recorded across the four habitats. Results of ANOVAS calculate suggest that:

- Grassland had significantly greater *Bombus terrestris/lucorum* than other habitats. (F ratio > F critical value)
- Grassland had significantly greater *Bombus lapidarius* than other habitats (F ratio > F critical value).
- None of the habitats had significantly greater visits by *Bombus pratorum*.
- Grassland had significantly greater *Bombus hortorum* than other habitats (F ratio > F critical value).
- Wetland had significantly greater 'ginger bees' than other habitats (F ratio > F critical value).

**Addressing objective 2:**

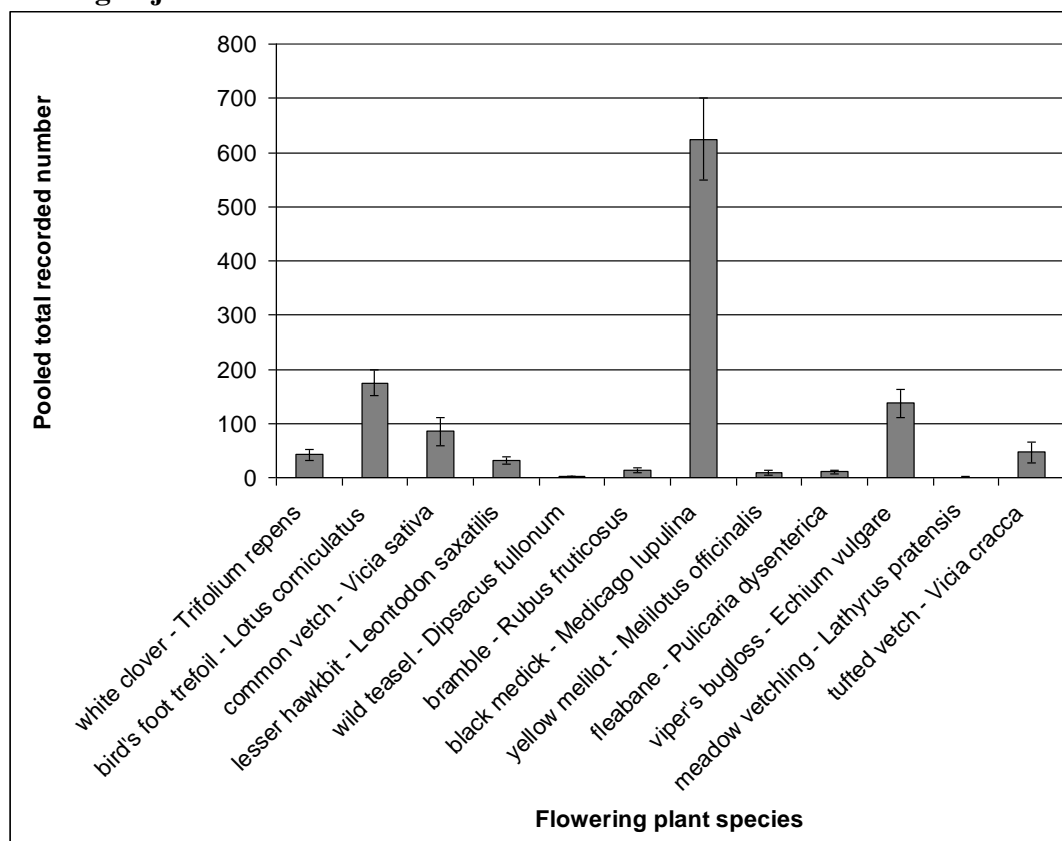


**Figure 2. Pooled total number of *Bombus* sightings recorded across four habitats  $\pm$  standard deviation, collected July/August 2009, Dungeness, Kent, UK.**

Figure 2 displays the pooled total number of *Bombus* sightings recorded across four habitats; this includes *Bombus* in flight and is not species specific.

Grassland had significantly greater *Bombus* sightings than other habitats ( $F$  ratio  $>$   $F$  critical value).

### Addressing objective 3:



**Figure 3. Pooled total number of flowering plant species recorded across the wetland habitat  $\pm$  standard deviation, collected July/August 2009, Dungeness, Kent, UK.**

When it came to investigating which habitat held the greatest abundance of *Bombus subterraneus* preferred plants, interestingly the only habitat that held the specific preferred species of flowering vegetation including viper's bugloss (*Echium vulgare*), yellow melilot (*Melilotus altissima*), common teasel (*Dipsacus fullonum*) was in fact the wetland habitat, displayed in figure 2.

**Addressing objective 4.**

Chi squared results suggest that:

- On the grazed habitat, *Bombus terrestris/lucorum* prefers the pooled recorded species of the Fabaceae family (including white clover/meadow vetchling/bird's foot trefoil/red clover/tufted vetch/black meddick) to the pooled recorded species of Asteraceae family (common ragwort/fleabane/creeping thistle).
- On the wetland habitat, *Bombus terrestris/lucorum* prefers the pooled recorded species of the Borage family (including viper's bugloss) to the pooled recorded species of the Fabaceae family (including white clover/meadow vetchling/bird's foot trefoil/tufted vetch/black meddick/common vetch/yellow melilot) and to the pooled recorded species in the category including pooled families (including Asteraceae: lesser hawk bit/fleabane/ + Teasel family: wild teasel + Rosaceae family: bramble).
- On the wetland habitat, the pooled 'Ginger Bees' prefer the pooled recorded species of the Borage family (including viper's bugloss) to the pooled recorded species of the Fabaceae family (including white clover/meadow vetchling/bird's foot trefoil/tufted vetch/black meddick/common vetch/yellow melilot) and to the pooled recorded species in the category including pooled families (including Asteraceae: lesser hawk bit/fleabane/ + Teasel family: wild teasel + Rosaceae family: bramble).
- On the grazed habitat, *Bombus terrestris/lucorum* prefers the pooled recorded species of the Asteraceae family (including lesser hawk bit/creeping thistle/daisy) to the pooled recorded species of the Fabaceae family (including bird's foot trefoil/white clover/red clover).

**Conclusions relating findings to wider context in this field**

**Importance of bumblebees**

Over the last 50 years, there has been a decline in British bumblebee abundance; causing concern because of the effects this has on associated the associated plants and also crops. A significant number of wild plants are pollinated exclusively by bumblebees, so loss of numbers can result in changes in plant communities, and therefore associated herbivore communities (Goulson *et al.*, 2005).

**Why has this decline occurred?**

Environmental change like intensified farming practices, and therefore loss of grassland habitats has resulted in this decline, particularly in southern UK (Osborne & Corbet, 1994) (Carvell, 2002). Intensive agricultural production has resulted in increased field size and loss of field margin habitat, which is important for foraging, reproduction and overwintering of bumblebees (Backman & Tiainen, 2002).

**Relating findings to the future**

To understand which habitats are important for the re-introduction of *Bombus subterraneus*, significant findings that show where bumblebees most similar to *Bombus subterraneus* are most abundant, which plants they prefer to forage on, and where these plants are abundant across the four habitats have been observed.

*Bombus hortorum* and the 'ginger bees' are both long-tongued species like *Bombus subterraneus*. As it was found that the grassland habitat has significantly greater *Bombus hortorum* than the other habitats, this should be a habitat that should perhaps be replicated and continued to be managed on the RSPB reserve, in a way that results in a high abundance of this species, with a view to the re-introduction of *Bombus subterraneus*.

Additionally, the wetland habitat had a significantly greater abundance of 'ginger bees', another long-tongued species like *Bombus subterraneus*, therefore effort should be allocated to perhaps replicate and continue to manage the vegetation at the edge of wetland habitats across the RSPB reserve, to allow for high a abundance of these species.

Also, the vegetation at the edge of the wetlands had the greatest abundance of plants preferred by *Bombus subterraneus*, including common teasel, viper's bugloss and yellow melilot. So these areas must be surveyed every year to ensure high numbers of these plants to encourage high bumblebee numbers, especially once *Bombus subterraneus* has been re-introduced. Invasive species should be managed effectively.

Furthermore, on the wetland habitat, viper's bugloss was proven to be favoured by 'ginger bees' over species from the daisy family and teasel family, therefore special effort should be made to ensure a high abundance of this species in the habitat, to allow for a high abundance of long tongued species of bumblebee, including *Bombus subterraneus*.

More information relating my findings to the wider context will be included in the discussion section of my write-up.