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Habitat management survey for conservation of the great yellow bumblebee Bombus distinguendus in the Outer Hebrides

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INTRODUCTION

The great yellow bumblebee *Bombus distinguendus* is one of a range of species that has declined as a result of agricultural intensification (Western Isles LBAP, 2004). Prior to 1970 the bee was more widespread on mainland Britain; it is now restricted to the Outer Hebrides, Orkney Isles, Coll and Tiree and scattered locations on northern mainland Scotland (NBN Gateway website, 2008) (Fig. 1). The sites where the bee remains are priority habitats for conservation: machair and neutral grassland. The great yellow bumblebee has been designated a Nationally Scarce species and included in the UK Biodiversity Action Plan (UK Biodiversity Group, 1999). As the Outer Hebrides are the stronghold for this species investigations into what can be done to ensure its survival have been concentrated in this area. This study investigated farming operations and corncrake conservation sites in relation to the requirements of the great yellow bumblebee. Fieldwork was carried out in the Outer Hebrides in September 2005; whilst I was working as a volunteer for the Royal Society for the Protection for Birds. The work was supported by a grant from the Esmée Fairbairn Foundation, administered by the Glasgow Natural History Society.

Machair management survey

The aim of this study was to establish the machair management protocol that best suits the great yellow bumblebee. In South Uist, crofters or their agents were consulted to determine the management practices they employ in areas of machair where the great yellow bumblebee occurs. A list of 42 sites where the bee is known to occur was provided by the RSPB: data was gathered for 24 of these sites.

From Fig. 2 it can be seen that all sites used both the 'rotation system' and 'the regeneration method'. All sites have a rotation system based on one year of mixed cereals followed by one of fallow. During the fallow year no seed is added to sites allowing wild plants to regenerate naturally.

Fertiliser application differed between sites; some used seaweed alone, whereas others used seaweed in combination with manure. Seaweed alone was favoured on 63% of the 24 sites, probably because it is freely available. Manure is only used as an additional fertiliser on crofts where cattle are kept inside for part of the year (37% of sites). All sites are grazed throughout the winter and 42% are also cut for silage or hay at the end of the summer. This difference in site management seems to be traditional, having been used by generations of crofters.

The type of fertiliser used may have little effect on bee populations although less fertiliser input would tend to create greater wildflower diversity (Royal Horticultural Society, 2009). Similarly, whether the machair is cut or grazed at the end of the growing season may have little effect on subsequent bee use (a comparative study of bee use of these differently managed areas would ascertain this). However, cutting the machair for hay or silage and leaving the cuttings for a few days would allow the seeds to fall to the ground (Royal Horticultural Society, 2009); this would maintain a seed bank in situ.

The most important factors for the great yellow bumblebee are the availability of nesting sites in rank grassland, and a provision of forage plants throughout the flying season (SNH, 2008). As one of the few places in the UK where the bee is surviving, it is suggested that traditional practices (the level of fertiliser application, rotation and grazing) create the habitat requirements of the bee (Western Isles LBAP, 2004). Anecdotal evidence from one landowner suggested that it would be better to leave machair areas fallow for longer than one year, allowing the soil to "fix better". Further study would be required to assess any potential benefit to a longer fallow period.

The results of this survey can be used to advise site development elsewhere to create more favourable areas for bees. Further comparison of bee usage of sites with different management regimes will confirm the efficacy of traditional practices. More robust models for site management could then be established.

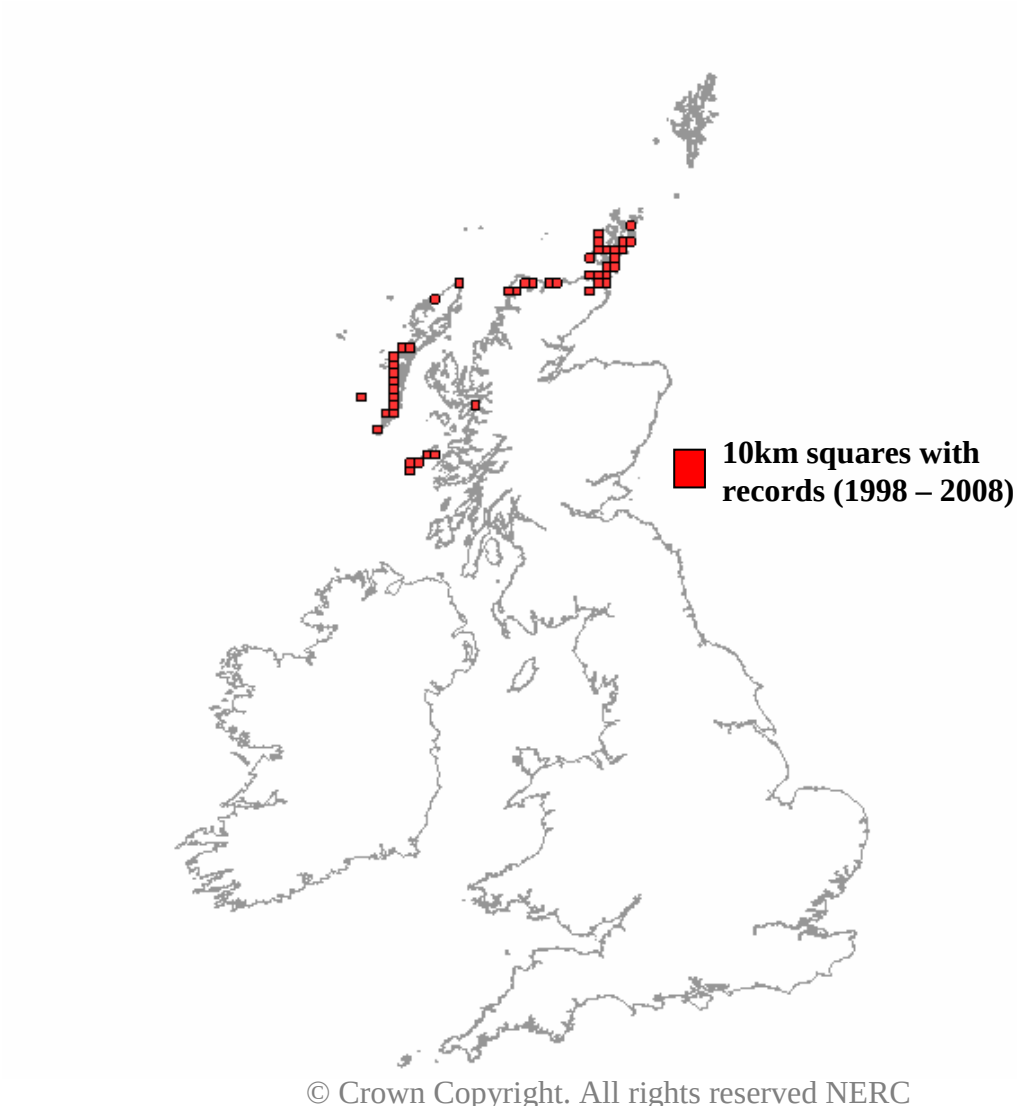

Fig. 1. 10km squares with records for great yellow bumblebee in Great Britain and Ireland for the ten years preceding this study (1998-2008). As can be seen the species is found in a few locations including the Orkney Isles, Outer Hebrides, Coll, Tiree and a few locations on the northern mainland of Scotland.

Habitat attribute	Target condition	Score by visual assessment of characteristic*				Max score
Floral diversity	>=3 species used by *B.distinguendus*	0 sp.	1 sp.	2 sp.	>=3 sp.	
		0	**1**	**2**	**3**	**3**
Cover and abundance of suitable flowering plants	>25% of area covered by 1 or more species of suitable flowering plant	0	1-10%	11-25%	>25%	
		0	**1**	**2**	**3**	**3**
Cover and abundance of suitable nest/hibernation habitat (rank grass/vegetation	Between 10 and 20% of area covered by lodged grass/vegetation	0	1-9%	10-20%	>20%	
		0	**1**	**2**	**1**	**2**
Cover and abundance of rye grass	Less than 25% of area covered by rye-grass	0	1-25%	>25%		
		2	**1**	**0**		**2**
Size of cover areas	>= 0.1ha each	<=0.1ha	0.2 – 0.5ha	0.6-1ha	>1ha	
		0	**1**	**2**	**3**	**3**
					total	**13**

* Score for each attribute shown in bold

Table 1. Scores given to attributes used to assess corncrake corners for bee suitability. Corncrake corners were visually assessed for factors shown in this table. The highest score given relates to the target condition: score decreases with habitat suitability. The maximum score of 13 denotes a very suitable habitat for bees.

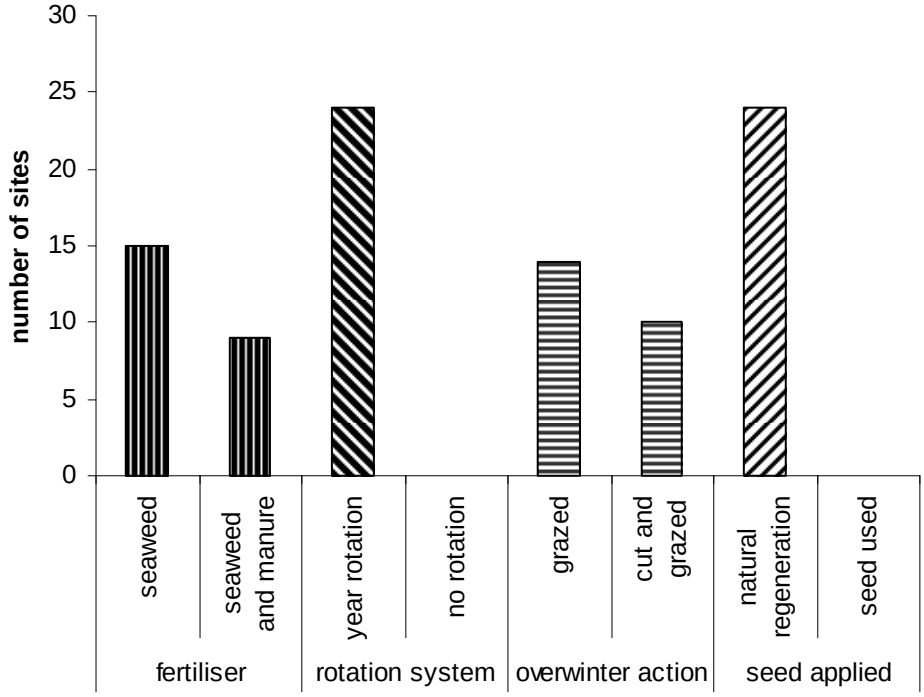

Fig. 2. Management prescriptions of 24 machair sites used by the great yellow bumblebee. Crofters were asked about the type of fertiliser used, the crop rotation system, what happens to plant material at the end of the growing season, and whether seed is applied to the land in fallow years. As can be seen, there is variation only in type of fertiliser and whether silage is gathered.

Fig. 3. Habitat score given to 44 corncrake corners in various parts of the Outer Hebrides. Sites were visually assessed and given a score based on the attributes shown in Table 1. The results show that the majority of sites are in the mid-range of scores with no site reaching the maximum possible.

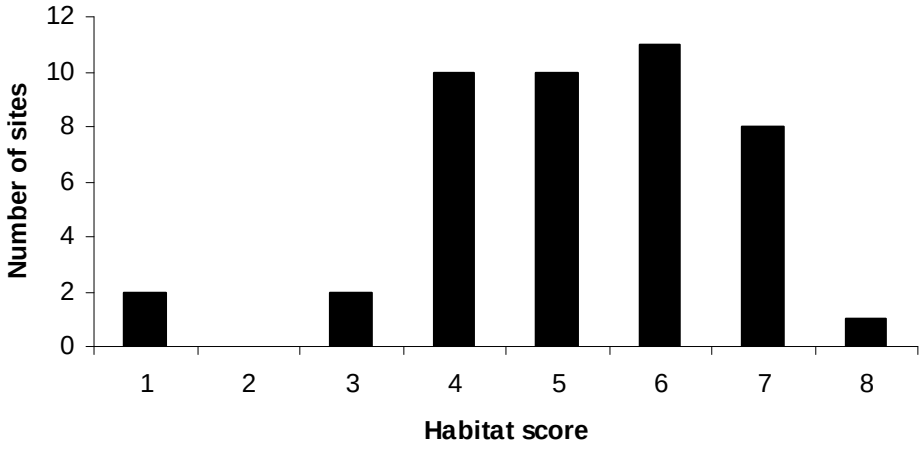

Fig. 4. Results of 44 corncrake corners assessed only for floral density, floral variety and bee nesting habitat. Table 1 shows the target condition for these factors and the score given for each. One site reached the maximum score with the majority of sites scoring relatively high.

Corncrake corners for bee conservation?

There is potential for directing a unified conservation effort to benefit both the great yellow bumblebee and the corncrake (*Crex crex*) as it is thought that loss of machair habitat is responsible for the decline of both species in the Western Isles (RSPB, 2007). Corncrake "corners" have been created in the Outer Hebrides to provide cover in the form of tall vegetation. These areas are located close to fields where hay or silage are grown and are used by the birds when the fields are cut, and when they arrive from Africa in the spring (Western Isles LBAP, 2005).

Forty four corncrake corners in North and South Uist were surveyed for their potential suitability for bees. Ideally, set-aside areas would provide everything bees need i.e. a constant supply of suitable flowering plants from April to September when the bees are active (RSPB, 2007) and suitable areas for nesting. The bees tend to nest underground in old rodent holes which are more abundant in uncut vegetation (RSPB, 2007). Table 1 shows the habitat attributes used for visually assessing corncrake corners and the target or 'best' condition for each of these in terms of suitability for bees. These criteria were provided by the RSPB based on bee habitat requirements. A score of 13 (the maximum possible) would indicate that the site was most suitable: as the score declines, so does potential suitability for bees. Fig. 3 shows that of the sites surveyed, none reach the maximum score. Two score 11 and six score 10. The majority of sites are in the mid-range of scores; none were completely unsuitable.

As bees forage relatively close (1-2km) to nesting sites (Macdonald, 2003) these attributes in close proximity would provide good habitat. Therefore the results from the corncrake corner survey were examined more closely for floral density, floral variety and nesting habitat suitable for bees. Of all corncrake corners assessed, only one site has the maximum score for this set of attributes; this suggests that this site is already suitable for bee use. As Fig. 4 shows, eight sites are missing one 'point' from the scoring system to reach the highest level – the majority of these sites (7) need improvements in nesting/hibernation habitat to boost their suitability. The provision of additional tall vegetation (herbs and grasses) would also be beneficial to corncrakes for cover (Western Isles LBAP, 2005); this may be a habitat feature that improves with time as the set aside areas become more established.

This study gives various options for the management of corncrake corners. As mentioned in the previous paragraph, enhancing nesting opportunities at the seven sites which are already relatively suitable for bees would be the easiest option and would quite quickly provide good sites. Conversely, improving sites that are currently inadequate for bees would increase opportunities for colonisation. This would primarily involve improving cover of suitable flowering plants, for example by adding plug plants or seeds of those flowers used by the bees.

Another option for the management of set-aside areas is to consider corners not used by corncrakes. Data provided by the RSPB shows the use of corners (bird present or within 100m) by corncrakes in 2004 and 2005. Of the 44 corners surveyed, six were not used by corncrakes in the two consecutive years. These sites are not wholly suitable for bee use, and all vary in the factors which are lacking. Further study would confirm the lack of corncrake use: following this the sites could be dedicated to bee conservation.

Improving corncrake corners alone will not ensure the continued survival of the great yellow bumblebee. The key factor is that land management continues to be sympathetic; machair maintained and, if possible, such practices expanded to create more sites for the bee and other species with similar requirements.

SUMMARY

Conservation of the great yellow bumblebee is dependent upon the provision of sites for both forage and nesting. Healthy populations are associated with machair habitat for foraging and nearby rank vegetation in sand dunes and banks for hibernation as well as nesting. The key aspects of machair management, which can be replicated on other sites to provide suitable habitat for the bees are:

- Seaweed and occasionally manure as fertiliser
- A crop rotation system including at least one year of fallow
- Natural regeneration in fallow year rather than seed application
- Machair cut in late summer and/or grazed over winter.

No corncrake corners are totally suitable for bee use. This does not mean that the bees do not use these sites, but it does give a number of options:

- Improve the 'best' sites to encourage more bee use.
- Concentrate on low scoring sites which are unsuitable for bees to increase the number of potential sites
- Focus on corners which are not used by corncrakes to create additional sites principally for bees.

ACKNOWLEDGEMENTS

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Map of great yellow bumblebee distribution: the information used here was sourced through the NBN Gateway website and included the following resources: BWARS, HBRG, SNH. data.nbn.org.uk Accessed 23/11/08. The data providers and NBN Trust bear no responsibility for the further analysis or interpretation of this material, data and/or information.

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