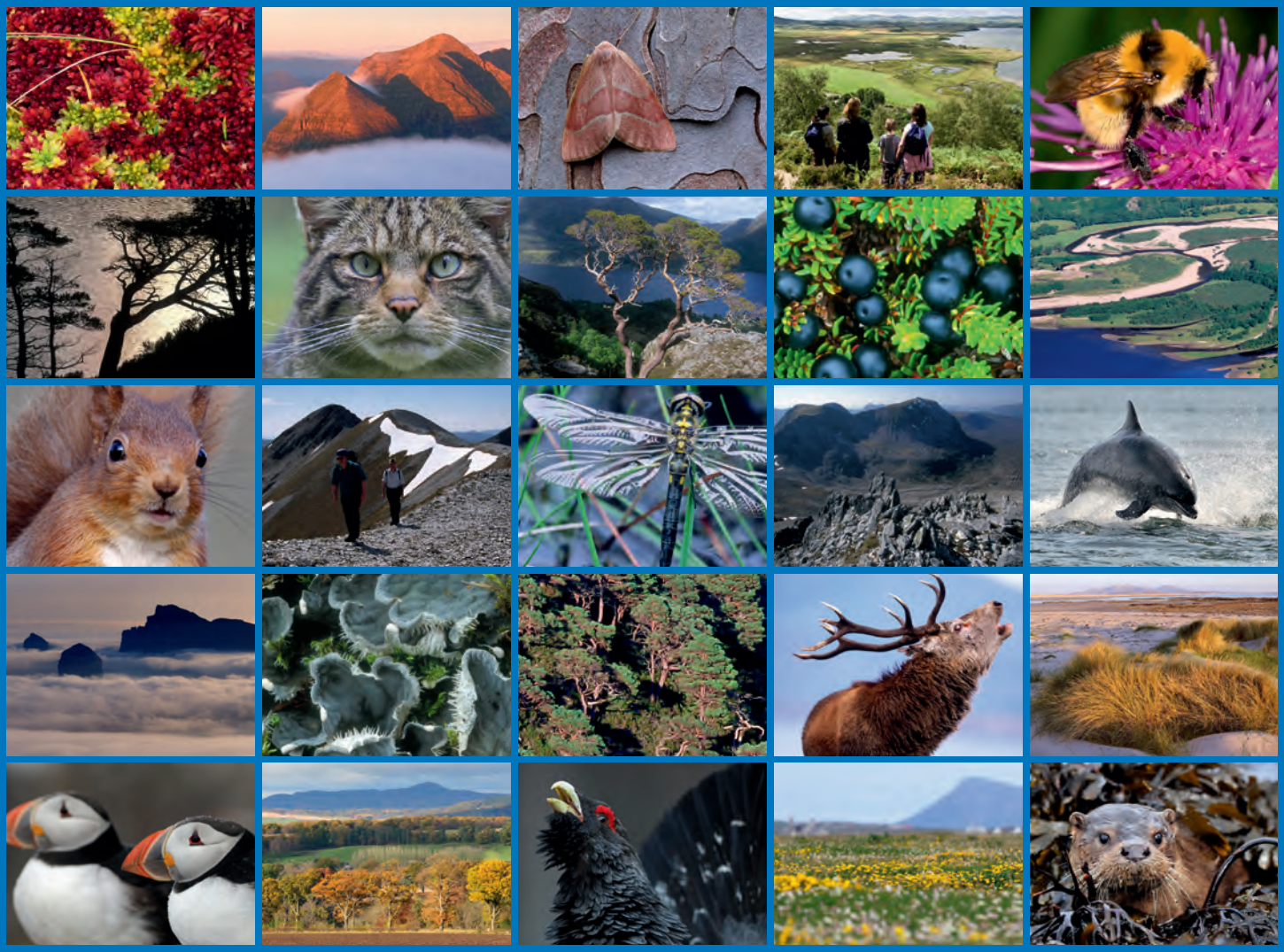
Scottish Natural Heritage
Commissioned Report No. 794

Evaluation of trap-nests for monitoring *Osmia uncinata* bees



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COMMISSIONED REPORT

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Evaluation of trap-nests for monitoring *Osmia uncinata* bees

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COMMISSIONED REPORT

Summary

Evaluation of trap-nests for monitoring *Osmia uncinata* bees

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Project no: 582
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Keywords

Osmia uncinata; mason bees; solitary bees; Caledonian pine; pollination; artificial nests; trap-nests.

Background

Osmia uncinata is a boreo-alpine, UK BAP priority bee species, and restricted to the Highlands in the UK. This bee is under threat from the loss of suitable habitat through agricultural intensification, commercial afforestation or insufficient grazing. As a boreo-alpine species, *O. uncinata* is likely to be negatively affected by warming of the UK climate. Artificial nests have been widely used a research tool for *Osmia* bees, but there is no information about their efficiency for *Osmia uncinata*. The objective of this project was to evaluate trap-nests as aids for monitoring and increasing populations of this species.

Main findings

- The bees did not use the trap-nests. Some minor problems were identified in the experimental design (trap deterioration and theft by birds), but their scale was too small to have influenced the results. Possible causes for trap failure are discussed.

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1. INTRODUCTION

Osmia spp. are cavity-nesting bees; they make use of existing cracks and crevices in rocks, trees, walls (hence the common name 'mason bee'), hollow plant stems, etc. Some species readily occupy artificial nests set up to attract them, a characteristic that has facilitated their rearing and promoted the development of methods for commercial pollination (Bosch & Kemp, 2001). Several nesting designs have been tested and proved to be acceptable, such as drilled wooden blocks, grooved boards, cardboard or plastic tubes, bundles of reed or bamboo stems and drinking straws (Free & Williams, 1970; Mader, 2010). Trap-nests have been used to enhance *Osmia* populations (Stubbs *et al*., 1997; Bosch & Kemp, 2001) and to successfully monitor their populations as well as of other cavity-nesting wasps and bees (Budrys *et al*., 2010).

Osmia uncinata is a UK BAP priority species, and in the UK is confined to Scotland. This bee is known to nest in holes in trees vacated by the larvae of the long-horn beetle *Rhagium inquisitor* (and perhaps other species). It forages in disturbed open areas within forests, particularly where *Lotus corniculatus* is present.

Sears *et al*. (2014) carried a pilot investigation on the efficiency of trap-nests as monitoring tools for *O. uncinata*. Although the traps were not successful in attracting bees, the group of investigators involved with the project believed that the principles of the method remained promising.

2. OBJECTIVES

The objective of this project was to improve on the methodology used by Sears *et al*. (2014) to test whether trap-nests are a useful tool for monitoring, and perhaps increasing, populations of *Osmia uncinata*. There is no published information on artificial nests for *O. uncinata*, but since the habits of other *Osmia* are comparable (Maeta, 1978; O'Toole & Raw, 1991; Banaszak & Romasenko, 1998), it was assumed that known requirements of reared species are applicable for the Scottish species.

3. METHODS

Trap-nest were constructed with 30-cm open-ended sections of PVC drain pipes filled with 6 and 8 mm diameter cardboard tubes (supplied by The Red Beehive Company, Oxford). Based on a sample (n = 21) of *O. parietina* and *O. pilicornis* specimens from the collection at the National Museums of Scotland, 6 mm was estimated to be the adequate diameter to accommodate a female *O. uncinata*. The 8-mm tubes were added in anticipation of possible larger bees, but they comprised only about 10% of all tubes in a pipe unit (Figure 1).

One hundred trap-nests where installed between 12 and 18 May 2001 in the vicinity of 17 sites where the bee had been recorded in 2007 (Table 1, Annex). To securely fix the drain pipes holding the cardboard tubes, they were encircled with a 300 mm length of Thorsman configuration 8 galvanised fixing band (TAG 12x0.7) and screwed to the trees through the holes in the banding (Figure 2).

The pipes were installed with their entrances pointing slightly down to minimise rain penetration. Two to three nests were fixed to each tree, each with a slightly different orientation towards the path of the sun (Figure 3).

Figure 1. Trap-nests comprising 80% of 6-mm diameter cardboard tubes and 10% of 8-mm tubes.

All trap-nests were visited between 2 and 28 June on days when sunshine was forecast, so that bees could be searched on flowering *L. corniculatus* patches. The nests were removed from all sites between 4 and 8 August, and stored.

Table 1. Details of Osmia uncinata *trap-nest locations*

Site	**Location**
FCS track near Inshriach House Inshriach Forest	NH87194 06956
FCS workshop west side B970 Inshriach Forest	NH86331 06517
FCS track Inshriach Forest	NH86192 04372
FCS track Inshriach Forest	NH86219 03691
FCS track Inshriach Forest	NH85482 01846
Roadside verge Dulnain Bridge (Seafield Estate)	NH99768 24670
Quarry in Upper Tomvaich Wood (Seafield Estate)	NJ06385 30284
Roadside verge by Nether Port entrance (Seafield Estate)	NJ06110 29074
FCS Culbin Forest - location Kintessack entrance area	NH99473 61450
FCS Monadh Mor Black Isle North of Inverness	NH58780 53016
RSPB clearing at track by Speyside	NH99530 19981
RSPB track under power-line	NH98045 19488
RSPB on track to power-line	NH98151 20028
FCS Monadh Mor Black Isle North of Inverness	NH59127 53226
FCS track Inshriach Forest	NH86102 03551
RSPB Bognacruie track	NJ03819 13994
Ex council lay-bye near Firwood	NH99581 20028

Figure 2. Installing trap-nests.

Figure 3. A typical group of installed nest-boxes in Inshriach Forest.

4. RESULTS

There was very little bee activity during the site visits; only about six bees were seen visiting *L. corniculatus* flowers on 3 June. Sunshine was intermittent on many days of inspection; July was a poor month for number of sunny hours (100.35) in relation to the average for the month, 122.60 h (Strathspey Weather, http://www.strathspeyweather.co.uk/comparison.htm). There were no obvious signs of bee occupation at any of the trap-nests when they were taken down in early August. Occupied tubes would have been clearly visible because bees seal them at the entrance, but nonetheless Murdo Macdonald inspected them just in case tubes had been sealed deep inside.

A problem developed with the cardboard tubes in 18 of the trap-nests, with layers of paper detaching from the centre, possibly due to moisture (Figure 4). Another problem that should be considered in similar further trials was that a few of the wood screws (22 out of the 200 used) securing the nests to the trees broke at the point where the screw entered the sap-wood of the tree. This could be overcome by the use of larger screws; in most cases the broken section of screw was recovered.

At several sites the tubes had been tampered with, and sometimes completely removed, probably by inquisitive tit species and great spotted woodpeckers (Figure 5).

Figure 4. Details of curled tubes.

Figure 5. Tubes removed by birds.

5. CONCLUSIONS

It is unknown why the trap nests were not used by *O. uncinata.* Some of the possible reasons are:

a) Abundance of alternative natural sites.
b) Low number of bees due to the weather.
c) Nest design: some features of the trap-nests (colour, texture, level of exposure, etc.) may not be attractive or even may repel the bees.
d) Nest location: placement of trap-nests was based on previous sightings of *O. uncinata* foraging, but they may nest far away from these sites.
e) The bees may be tree-specific: they may prefer to nest in the same tree from where they emerged.

Artificial nests have been shown to be efficient tools for conservation and for enhancing pollination services of several *Osmia* species and other bees (http://www.conservationevidence.com/actions/47), but the lack of success in trapping bees in this study and in Sears *et al*. (2014) survey suggest that the method is not appropriate for monitoring *O. uncinata*.

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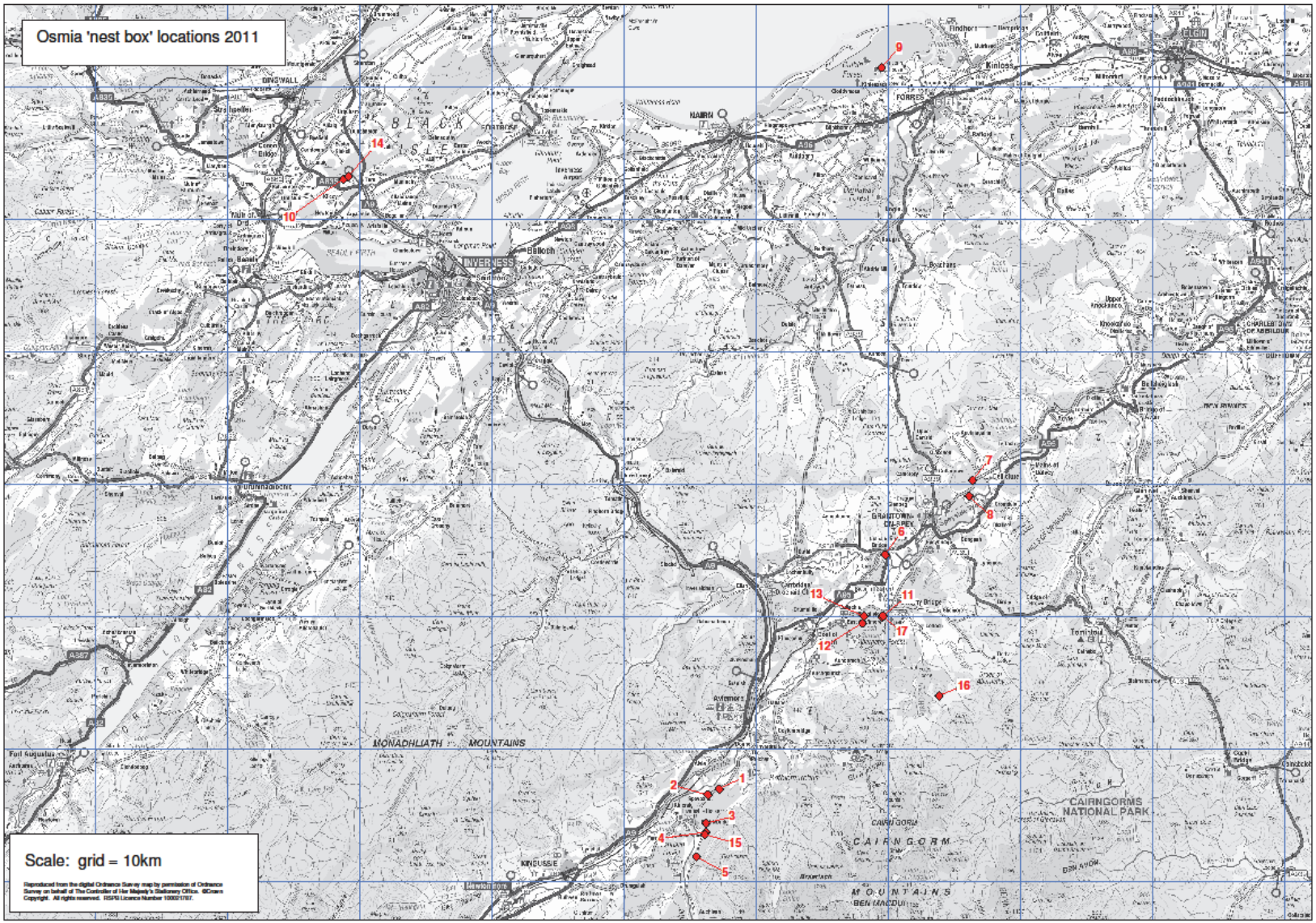
APPENDIX A: NEST BOX LOCATIONS



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