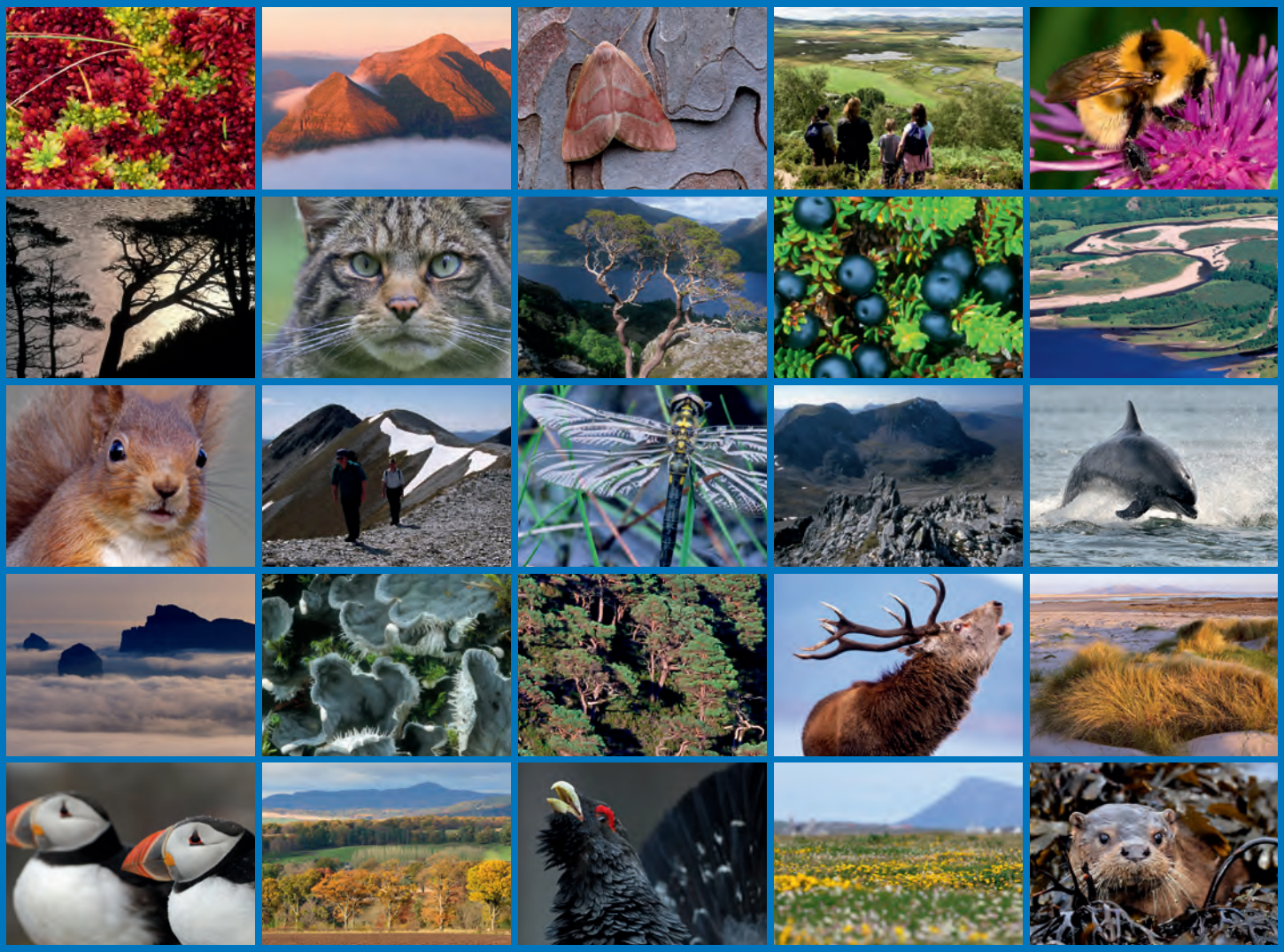
Scottish Natural Heritage
Commissioned Report No. 784

A survey of the mason bee *Osmia uncinata* in Caledonian pine woodlands and evaluation of its status in 2006-07



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COMMISSIONED REPORT

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A survey of the mason bee *Osmia uncinata* in Caledonian pine woodlands and evaluation of its status in 2006-07

For further information on this report please contact:

Athayde Tonhasca
Scottish Natural Heritage
Battleby
Perth
PH1 3EW
Telephone: 01738 458671
E-mail: athayde.tonhasca@snh.gov.uk

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COMMISSIONED REPORT

Summary

A survey of the mason bee *Osmia uncinata* in Caledonian pine woodlands and evaluation of its status in 2006-07

Commissioned Report No. 784
Project no: 582
Contractor: Royal Society for the Protection of Birds (RSPB)
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Keywords

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

Background

Osmia uncinata is a species associated with gaps and open edges in Caledonian pine woodland. This study aimed to survey potential habitats of *O. uncinata* to better understand the species' status and range, and to undertake an experimental investigation of trap-nests as monitoring tools.

Main findings

- *Osmia uncinata* is not confined to old-growth Caledonian pine woodland, but is extant in commercial plantations with suitable conditions. Its presence was confirmed for three formerly occupied 10-km squares and it was recorded in two new 10-km squares, bringing the total distribution to 15 10-km squares recorded since 2000.
- Although the bees did not use the trap-nests, the survey results confirmed the bees' requirements of open areas for foraging. Forest managers need to be made aware of the importance of track verges and entrances as forage areas and ensure that these are maintained to prevent overgrowth.
- Further research into the foraging and nesting requirements of the bee would help fine-tune management advice to forestry managers. Recommendations for further work are provided.

For further information on this project contact:
Athayde Tonhasca, Scottish Natural Heritage, Redgorton, Perth, PH1 3EW.
Tel: 01738 458671 or athayde.tonhasca@snh.gov.uk
For further information on the SNH Research & Technical Support Programme contact:
Knowledge & Information Unit, Scottish Natural Heritage, Great Glen House, Inverness, IV3 8NW.
Tel: 01463 725000 or research@snh.gov.uk

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Acknowledgements

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1. INTRODUCTION

Osmia uncinata is a RDB3 species with a UK distribution restricted to Scotland, and a BAP Priority Species for which RSPB is the Lead Partner. This bee nests in old beetle galleries on trees found in sunny locations, generally at the edge of tree stands and gaps in the forest. It forages in disturbed, open areas within and adjacent to the trees, particularly in meadows, along road-side verges and streams. *Osmia uncinata* represents a suite of species that are dependent on successional habitats in Caledonian pine forests.

The project comprised two parts:

1. A survey of open edges and gaps in Caledonian pine woodland to better understand *O.uncinata* status and range.

2. An experimental investigation of trap-nests as monitoring tools.

2. SURVEY OF OPEN EDGES AND GAPS IN CALEDONIAN PINE WOODLAND

2.1 Rationale

During the first comprehensive survey of *O. uncinata* in Scotland (Edwards, 2001), nests were found in old-growth pine woodland, but it now appears that burrows in plantation trees are used as well. Additionally, it was believed that in Scotland *O. uncinata* collects pollen almost entirely from bird's foot trefoil, *Lotus corniculatus* (Figure 1). However, subsequent pollen analysis indicated that 10 or more other plant species are also utilised (P. Westrich, pers. comm.), which implies that *O. uncinata* is not confined to bird's foot trefoil habitats and therefore may be more widely distributed than previously known. Edwards (2001) suggested that *O. uncinata* is under-recorded, and may use a wider range of locations for breeding and foraging. A survey of additional areas of potential habitat within the species' known range was undertaken to help clarify its status and range.

Figure 1. Osmia uncinata *foraging on* Lotus corniculatus *(photos by Murdo Macdonald).*

2.2 Methods

In the Highlands, *O. uncinata* is known from Strathspey, Glen Affric (1 site), Moray coast (2 sites), the Black Isle (1 site), Mid Ross (1 site), and SE Sutherland (1 site) (Figure 2).

Survey locations were selected to cover gaps in the current known distribution, working generally within the known distribution of historic records. All selected pine plantations were in open, sunny areas, had dead wood or beetle burrows and suitable forage plants (especially *L. corniculatus*). Visual searches were carried out by inspecting holes in trees made by *Rhagium inquisitor* and other beetles and then carrying out timed walks (30-40 min)

through nearby areas containing *L. corniculatus* and other Fabaceae species. Surveys were restricted to days forecast to be sunny, a necessary condition for the bee to forage, but some sites were in shade when visited. A total of 60 sites were surveyed during the two years; five in 2006 (Table 1) and 55 in 2007 (Table 2). The survey included three areas where the bee had previously been recorded: Monadh Mor (2004 and 2005), Abernethy (1982 and 1999) and Inshriach (1982).

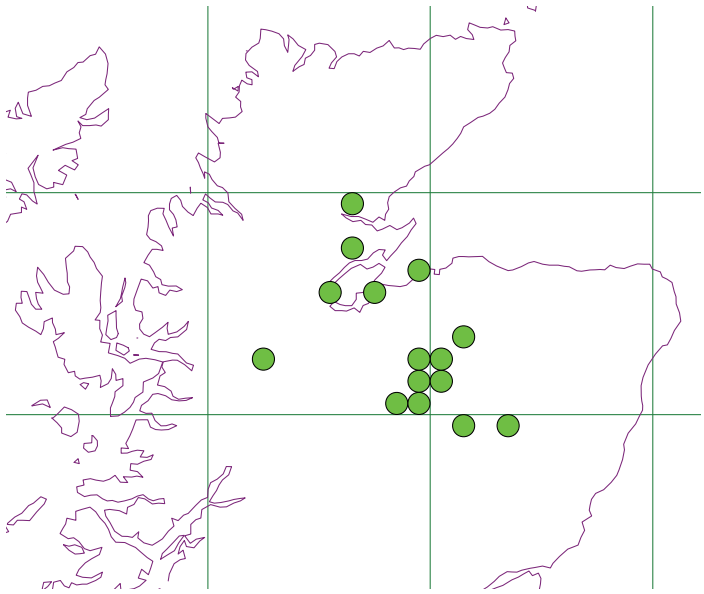


Figure 2. Osmia uncinata *known sites as at 15 July 2005, including historic records.*

2.3 Results

In 2006, the only sightings of *O. uncinata* were at four locations within the Mondhuie area of RSPB's Abernethy National Nature Reserve (Table 1), although suitable habitat existed at the four other sites.

In 2007, there were 11 sightings of *O. uncinata*, of which eight were within three previously recorded sites, Monadh Mor, Abernethy Forest and Inshriach, and the remainder were at three new sites: Dulnain Bridge (NH92), near Nether Port (NJ02) and Upper Tomvaich Wood (NJ03) (Table 2).

Five of the 11 sightings were within the Forestry Commission plantation woodland near Inshriach House, where the bee has not been recorded since a single record in 1982, and two were within two hectads within Abernethy Forest. Figure 3 shows the distribution of the sites visited and where the bee was recorded.

Most sightings of the bee were from open areas either alongside tracks or track entrances (five sites), on a roadside verge (two sites) and at a quarry (one site). There appears to be an association between *O. uncinata* and *L. corniculatus* but this is not always the case; one of the sites near Inshriach where *O. uncinata* was seen only had very small scattered patches of *L. corniculatus*.

Of the 48 locations where *O. uncinata* was not recorded, at least 19 had good amounts of *L. corniculatus* and are considered worth re-visiting. The weather was very poor in June 2007 and even on sunny days the temperature was below 15^0 C and the sun often had

disappeared at the time some sites were visited, which may account for the absence of sightings.

Table 1: Results of Osmia uncinata *survey in 2006. Surveyed in June by Murdo Macdonald (MM) and Stewart Taylor (ST)*

Location	**Grid Ref**	**Surveyor**	***O. uncinata* seen?**
Lairg	NC50	MM	no
Glen Aldie	NH77	MM	no
Glen Glass/Foulie	NH65	MM	no
Little Garve/Longart	NH46	MM	no
Abernethy Mondhuie	NH98031950	ST	yes
Abernethy Mondhuie	NH99602002	ST	yes
Abernethy Mondhuie	NH99531997	ST	yes
Abernethy Mondhuie	NJ03811399	ST	yes

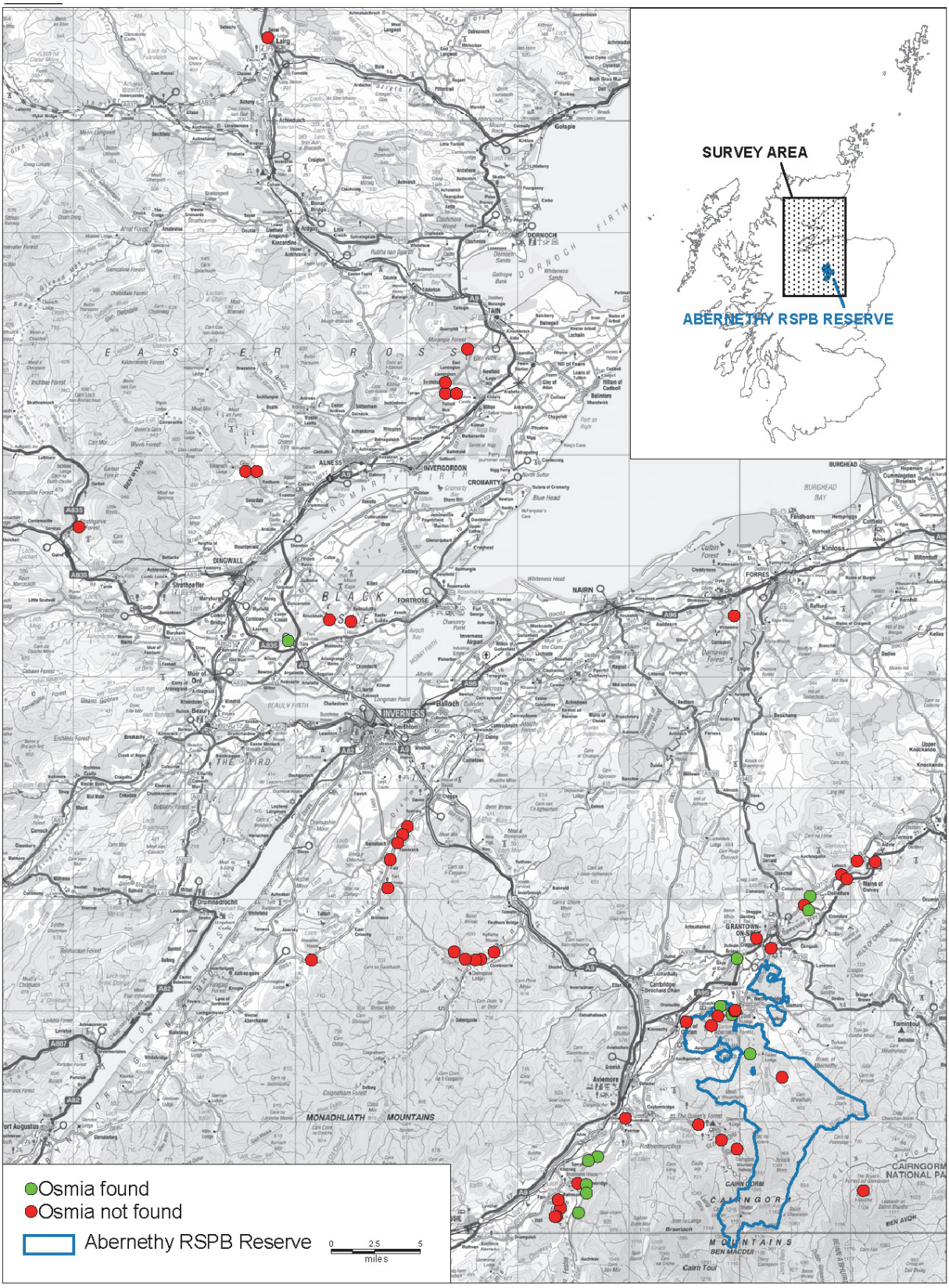
Table 2: Results of Osmia uncinata *survey in 2007. Surveyed by Murdo Macdonald (MM) and Stewart Taylor (ST)*

Date	Location	Grid Ref	Surveyor	*O. uncinata* seen?	Comments
2/5	Knockbain	NH630551	MM	no	Much *Lotus* in superficially suitable habitat but not in full flower.
27/5	Dunmaglass	NH614245	MM	no	Good weather for foraging, other solitary bees active on small amount *Lotus* but habitat unsuitable.
31/5	Knockbain	NH630552	MM	no	*Lotus* was in flower and good foraging conditions. Worth revisiting.
31/5	Monadh Mor	NH593532	MM	yes	One male seen in previously known location. Recent felling has involved stacking of timber on the *Lotus*-rich verges, with some temporary loss of forage. Increased shading by tree growth can be anticipated. FCS is aware of the presence of the bee on the site, but some direct approach should perhaps be made with a view to establishing management principles to accommodate the needs of *Osmia*.
1/6	Coneas/Glen Glass	NH5568	MM	no	Good weather for foraging and many other solitary bees active on plentiful *Lotus* but no evidence of *Osmia*. This site looks favourable, but has been visited several times in good conditions with no result. It should not be rated as a priority for survey in future.
1/6	Loch Morlich	NH96283 09730	ST	no	Walked right round loch, very few *Lotus* plants.
1/6	Allt Mor bridge	NH98353 08354	ST	no	Masses of *Lotus* close to road verge, a possible site for future checks.
1/6	Ex Council Yard	NH95191 18992	ST	no	Intermittent sun, good *Lotus* clumps with kidney vetch.
1/6	Coire na Ciste car park	NH997 075	ST	no	Too windy and probably too high, more *O. inermis* territory, lots of *Lotus* however.
2/6	Coneas/Glen Glass	NH5668	MM	no	As in 1/6 visit.
7/6	B970 opposite Boat	NH89714 10320	ST	no	Good clumps of *Lotus.*

	House entrance				
7/6	Forestry Commission track Inshriach	NH87205 06868	ST	yes	One *Osmia* seen on *Lotus* along track, a perfect location.
7/6	FC workshop entrance	NH86362 06504	ST	yes	One or two *Osmia* seen, large amount of *Lotus.*
7/6	FC track	NH85414 04457	ST	no	Scattered patches of *Lotus* along track side.
7/6	same FC track Inshriach	NH86187 04349	ST	yes	One to two *Osmia* seen despite there only being very small scattered patches of *Lotus.*
9/6	FC track Inshriach	NH86196 03591	ST	yes	One *Osmia* seen, good patches of *Lotus* along track side.
9/6	FC track entrance Inshriach	NH85488 01814	ST	yes	Big patches of *Lotus* in layby by road, *Osmia* found on small patch just by road nearby.
9/6	FC track	NH83667 02967	ST	no	A few good clumps of *Lotus*.
9/6	FC track entrance	NH83871 02233	ST	no	Many small clumps of *Lotus* by road and into track entrance.
9/6	FC track	NH83508 01485	ST	no	
9/6		NH83496 01484	ST	no	
9/6		NH83376 01470	ST	no	Huge patch of *Lotus*.
14/6	FC track	NH83667 02967	ST	no	Sun was out but a very cool breeze persisted.
14/6	FC track entrance	NH83871 02233	ST	no	
14/6	FC track	NH83508 01485	ST	no	
14/6		NH83496 01484	ST	no	
14/6		NH83376 01470	ST	no	
19/6	Roadside verge Dulnain Brg (west side)	NH99749 24675	ST	yes	One *Osmia* found.
19/6	Finlarig	NH9955	ST	no	Few *Lotus* plants.
19/6	Glenbeg	NJ0126	ST	no	Few *Lotus* plants.

19/6	road verge Upper Port Wood	NJ05819 29467	ST	no	Several small patches of *Lotus*.
19/6	Upper Tomvaich Wood quarry	NJ06346 30286	ST	yes	Quarry site, one *Osmia* seen, good patches of *Lotus.*
19/6	roadside verge B9102	NJ09156 32231	ST	no	Good patches of *Lotus*, mainly birch woodland adjacent.
19/6	track Tom na Laimh wood	NJ10569 33452	ST	no	Few *Lotus* plants, mainly birch wood adjacent.
19/6	Craigvarren Wood	NJ1114 33813	ST	no	Few *Lotus* plants.
19/6	Woods of Knockfrink	NJ12207 33374	ST	no	Managed Scots pine wood, few patches of *Lotus*.
19/6	Tom an Uird (west)	NJ09640 31844	ST	no	Reasonable amount of *Lotus,* possibly worth another visit.
19/6	Road verge nr Nether Port track entrance	NJ06203 29047	ST	yes	Good patches of *Lotus*, one *Osmia* seen at north verge of road.
19/6	Track entrance Craig Revack	NJ02834 25600	ST	no	Good patches of *Lotus*, sunshine intermittent, to re-visit.
22/6	Track entrance Craig Revack	NJ02834 25600	ST	no	Sunshine intermittent.
30/6	Forestry track nr Ardachy	NH77876 25252	ST	no	Few *Lotus*, not worth re-visiting.
30/6	Forestry track nr Dalarossie Cott	NH76691 24607	ST	no	Few *Lotus,* not worth re-visiting.
30/6	forestry track same wood as 31	NH76225 24556	ST	no	Track verges sprayed with herbicide, not worth re-visiting.
30/6	by Garbole to Farr single track road	NH75304 24617	ST	no	No sun, small patches of *Lotus*, not worth re-visiting.
30/6	same road further along	NH74296 25275	ST	no	As above.
30/6	FC car park Feyglass Wood	NH68310 31015	ST	no	No sun, worth re-visiting, walked track to NH68128 30558.

30/6	FC car park School Wood	NH68536 33576	ST	no	No sun, not worth re-visiting.
30/6	lay-by B851 nr Tombreck	NH69206 35075	ST	no	No sun, but worth a re-visit, plenty of *Lotus* on recently disturbed ground.
30/6	B851 council lay-by & FC loading bay	NH69647 35825	ST	no	No sun, good amounts *Lotus*, worth re-visiting.
30/6	FC Littlemill Wood entrance B851	NH70078 36559	ST	no	No sun, lots of *Lotus* and worth re-visiting.
30/6	Lamington	NH7375	MM	no	Little *Lotus* in evidence, and no obvious nesting habitat. Not worth revisiting.
30/6	Lamington	NH7376	MM	no	As above.
30/6	Lamington	NH7475	MM	no	As above.
30/6	Edge of Abernethy Forest	NH995199	ST	yes	
30/6	Abernethy Forest	NH9962002	ST	yes	



CDMU (RH)

Figure 3. Distribution map of areas surveyed in 2006 and 2007 with location of records.

3. AN EXPERIMENTAL INVESTIGATION OF TRAP-NESTS AS MONITORING TOOLS FOR *OSMIA UNCINATA*

3.1 Rationale

The availability of suitable nest and foraging sites in sunny locations appears to be a limiting factor for *O.uncinata.* Potentially this could become a severe problem if management practices do not maintain these features. For example, management advocated for capercaillie and other closed-forest species, such as continuous tree canopy through extended rotations and thinning rather than clear-felling, and reducing grazing levels to facilitate natural regeneration of woodland, may reduce the length of sunny stand edges and cause the loss of foraging sites. Clear fells and other open spaces (above a certain size) are considered to fragment woodland habitat for species such as capercaillie. Management prescriptions seeking to maximise woodland area and continuity of woodland cover, have the potential to conflict with the interests of invertebrates that require gaps within the forest, including *O. uncinata.*

3.2 Methods

Osmia uncinata occupies beetle galleries in the bark of pine trees. Trap-nests were used to test whether bees would accept them as nesting sites. The nests comprised larch blocks divided in six sections with 6-8 grooves bored into each section. When the sections were joined together, the grooves formed holes. Three hole sizes were used: 5, 6 and 10 mm diameter, with one size per block. The blocks were mounted in sets of three to form one trap nest. They were wrapped in black waterproof tape and the exposed surface with the holes was waterproofed with beeswax. The roof of the trap-nest was overhanging by 2 cm and the bottom edge was grooved to avoid water dripping into the holes (Figure 4).

Figure 4. Trap-nest on a Caledonian pine tree.

Trap-nests were erected in early May 2006 within the RSPB Abernethy Nature Reserve at five locations; four where the bee had been sighted during the last four years and one site (River Nethy South) in suitable habitat in the far south of the forest where the bee had not

been seen but not adequately searched (Table 4); three trap nests were placed at most locations. They were erected on trees in SE-SW facing positions at approximately 3 m above the ground, and were angled downwards to prevent water running into the holes. They were mounted about one week before the bee is known to be active and retrieved on 27 and 28 September 2006. The trap nests were opened and the contents examined by Murdo Macdonald during October 2006. It was planned to transfer any cells of *O. uncinata* into gelatine capsules (as used in the pharmaceutical trade) in order to rear them through the winter and release emerged adults back on site in the following spring.

Table 4: Location of trap-nests in 2006

SITE	GRID REF
Mondhuie power line	NH 9920 1948
near Nethy Bridge	NH 9954 2001 (2 nests) NH 9954 2041
River Nethy Ford	NJ 0216 1455 NJ 0217 1445 NJ 0219 1448
River Nethy South	NJ 0229 1272
Tomdhu gate	NH 9829 2039

A second pilot study was undertaken in 2007. To increase the likelihood of occupancy, more trap nests were placed at each of three sites: Mondhuie (four nests), River Nethy Ford (five nests) and Tomdhu gate (five nests). These were erected in late May, retrieved in February 2008, and opened and examined by Murdo Macdonald. Characteristics of sample sites are shown in the Appendix.

3.3 Results

No *O. uncinata* were found in the trap nests, and only one hymenopteran, an *Apis mellifera* worker occupied them, possibly attracted by the bee-wax on the structure. Spiders were the main occupants and they produced a lot of silk, which potentially could have deterred bees from using the holes. Some of the spiders and most of the dipterans found were alive.

Despite careful, positioning, several trap nests were very wet and three contained slugs. As the trap-nests were exposed to the SW, the rain may have been driven into them by the wind.

The spiders were retained for identification (by IK Dawson) and included:

Clubiona subsultans (Clubionidae), 3m, 10f: restricted to Caledonian pine forest in the UK where it lives on pine trees and juniper; a RDB2 species.

Moebelia penicillata (Linyphiidae), 1m: thinly but widely distributed across Britain, living typically in crevices on conifer trunks.

Cryphoeca silvicola (Dictynidae), 1f: a common species in dry litter and under loose tree bark in the north and west.

Amaurobius fenestralis (Amaurobiidae), 3f: widespread and very common under loose tree bark.

Philodromus aureolus (Philodromidae), 3f: widespread and common on shrubs, trees, etc.
All spiders were previously known from Abernethy.

4. DISCUSSION

The results of the survey have confirmed that *O. uncinata* is not confined to old-growth Caledonian pine woodland, but occurs in managed plantations, provided there are suitable conditions. A previous survey of mature pinewoods in Strathspey, Deeside, and areas around Inverness, where beetle galleries were examined for occupation, demonstrated that the bee only nests in trees standing in sunny sites (Edwards, 2001). All the sightings in this study were in open areas within the forests, alongside tracks, roadside verges and at a quarry site, confirming the value of such open sunny features.

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

a) Design of the trap nests, such as hole size: the ones used in the study were based on the requirements of a similar species, *O. bicornis.* Testing variations in design was outside the scope of this project.

b) Abundance of alternative natural sites.

c) Nest locations were based on where *O. uncinata* was sighted foraging, but bees may be nesting far away from these sites. Areas of *L. corniculatus* tend to be small, so bees have to use many foraging areas and may not nest near a particular one.

d) The bees may be site-faithful. Having emerged, it is possible that they prefer to nest in the same area.

Given the lack of success with trap nests, it was concluded that it was not feasible to continue with the experiment.

It is unknown where the bees were nesting, but it is possible to be in the vicinity of the areas of forage. It was common to see a bee coming back to the same patch of flowers every 5-10 min; assuming it was the same bee returning each time, this would suggest that the bee was nesting within a few hundred metres.

Our results have shown that *O. uncinata* is found in plantation as well as semi-natural Caledonian pine forest, therefore being more widespread than originally thought. As a result of this survey, its presence was confirmed in three formerly occupied 10-km squares and it was recorded in two new 10-km squares (NH92 and NJ03), bringing the total distribution to 15 10-km squares recorded since 2000.

Known populations are, however, highly localised and their sizes are unknown. Although management for species characteristic of larger contiguous woodland areas such as capercaillie may conflict with the interests of *O. uncinata* and other invertebrates that require gaps in forest cover, it is unlikely that all woodland within the bee's range will be managed in this way. In addition, *O. uncinata* is likely to be favoured by management for black grouse, which require a patchwork of young and widely spaced trees, and woodland edges with a

well-developed understorey. Management practices for black grouse include the widening of rides and creation of open ground plus the thinning of tree cover at the edge of compartments, all of which should benefit *O. uncinata* and the other invertebrates of open areas (http://www.blackgrouse.info/management/woodland.htm).

5. RECOMMENDATIONS FOR FURTHER WORK

It is recommended that continued effort is put into advocacy. In particular, forest managers need to be made aware of the importance of track verges and entrances as forage areas and ensure that these are maintained to prevent overgrowth. Forest managers should be made aware of the importance of sites where *O. uncinata* has been recorded, and provided with advice to avoid accidental destruction of forage areas, e.g. by inappropriate placement of log-stacks (as was noted at Monadh Mor in 2007) or the over-use of verges as turning places for vehicles (some degree of disturbance is essential to maintain these successional habitats, so occasional use by vehicles may be beneficial).

Further surveys should be considered to better establish the status of the bee. Several of the sites visited during 2007 were considered to have suitable conditions, although the bee was not seen, possibly due to bad weather at the time of the visits.

Further research into the foraging and nesting requirements of the bee would help fine-tune management advice to forestry managers. For example, it is unknown whether the bees can nest in high stumps produced by timber harvesting. It would be useful to know whether bees are faithful to patches of forage to ascertain the importance of retaining particular ones. Research into foraging distances using marked bees would help ascertain the minimum distance between nesting and foraging sites and the amount of suitable foraging plants needed.

Experimental management of track-side verges could be carried out to determine what is required to maintain the right conditions for *L. corniculatus.* Sites where no active woodland management is carried out are likely to become overgrown and some form of rotational ground disturbance may be required. In commercial plantations, this may be achieved through normal operations of timber extraction, provided the same areas are not disturbed too often.

6. REFERENCES

Edwards, M. 2001. Survey of three Biodiversity Action Plan bee species (*Colletes floralis, Osmia inermis and O. uncinata)* in Scotland, 2001. *Unpublished report to RSPB and SNH*.

7. APPENDIX

a. Sites used for the trap-nest study in 2006

Mondhuie power line

Near Nethy Bridge

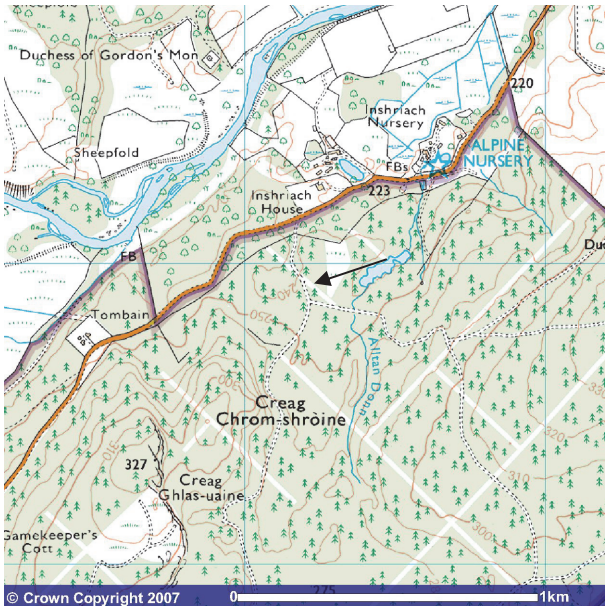
River Nethy Ford

River Nethy South

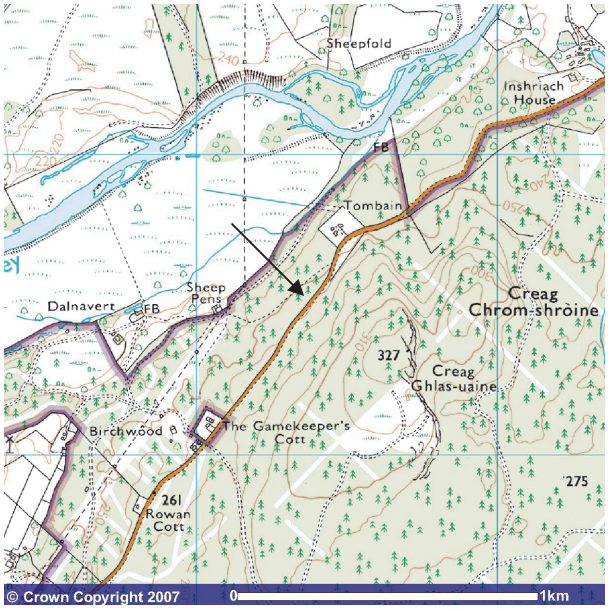
Tomdhu gate

b. Some sites used for the trap-nest study in 2007

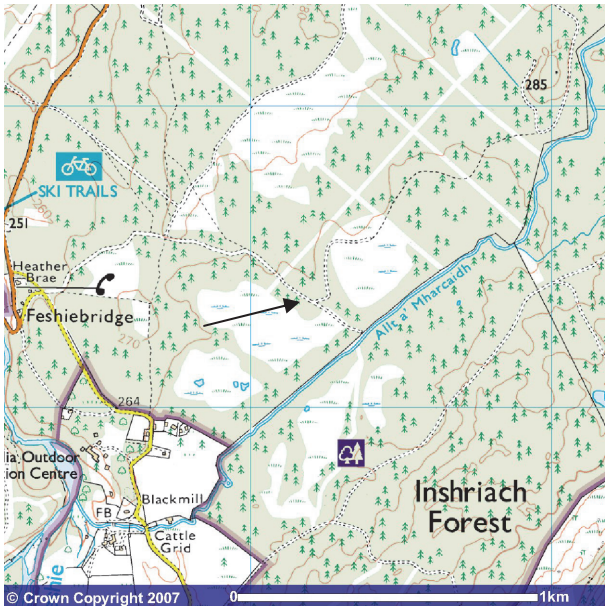
Forestry Commission track near Inshriach House NH87205 06868

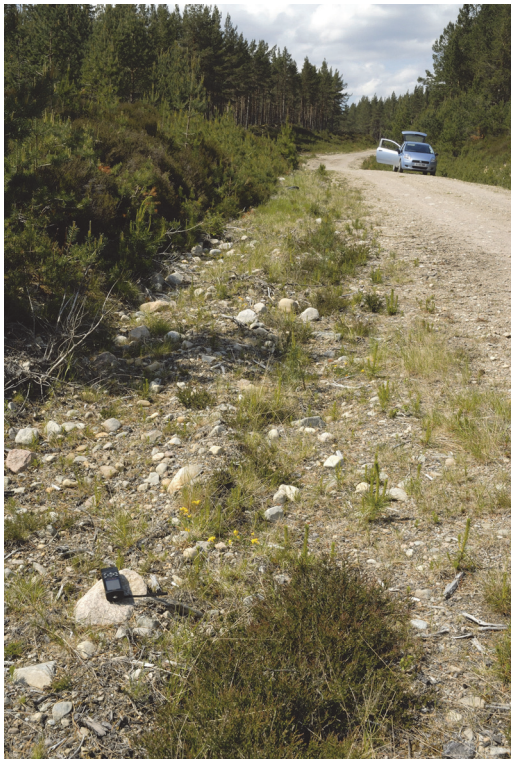


Forestry Commission Workshop site west side B970 NH86362 06504

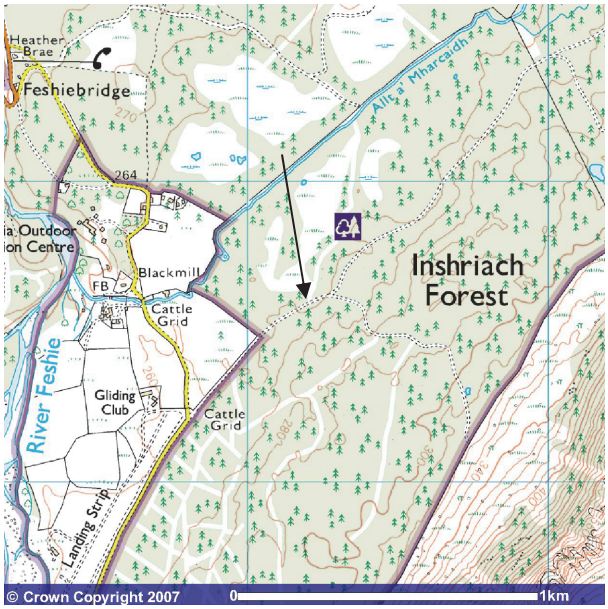


Forestry Commission track Inshriach Forest NH86187 04349

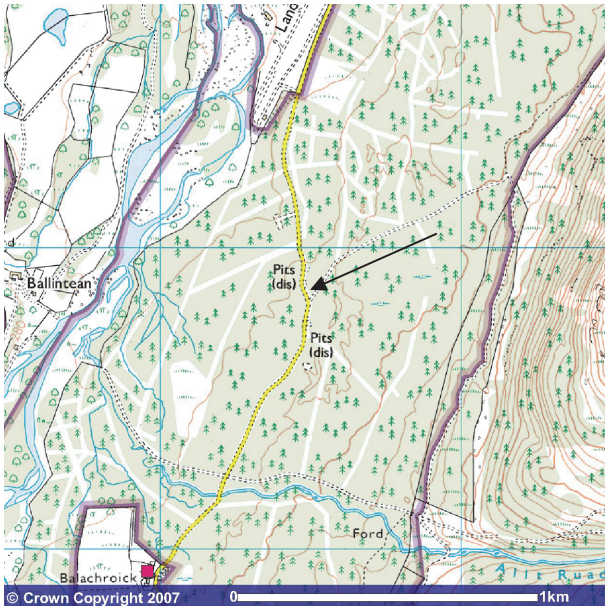




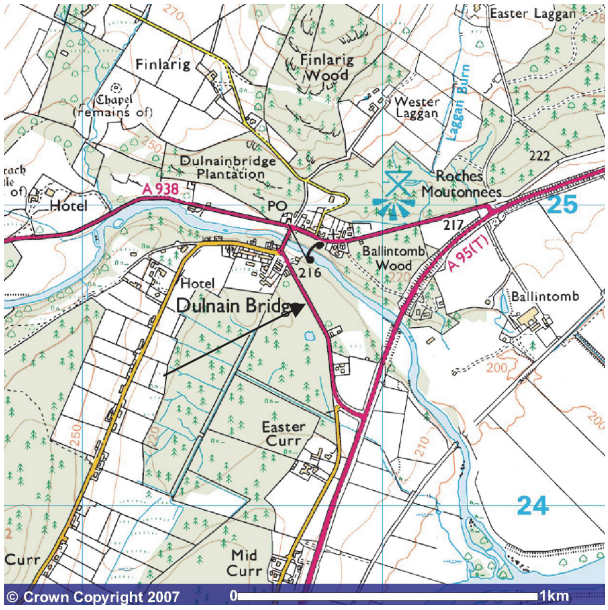
Forestry Commission track (north side) Inshriach Forest NH86196 03591



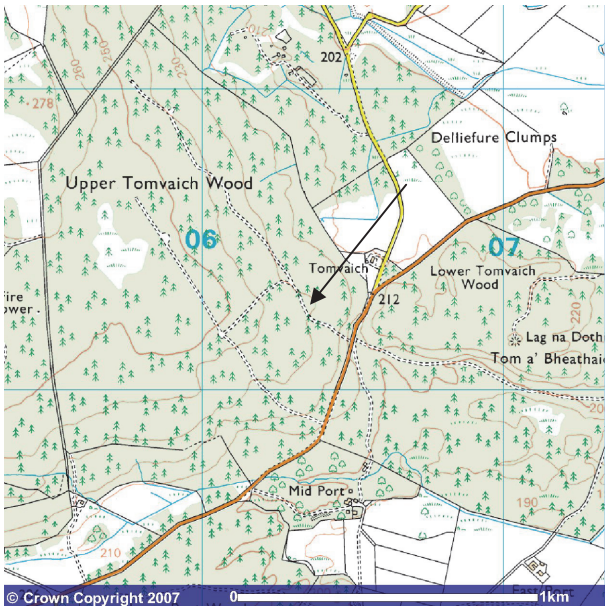
Roadside (east) - Forestry Commission track entrance NH85488 01814



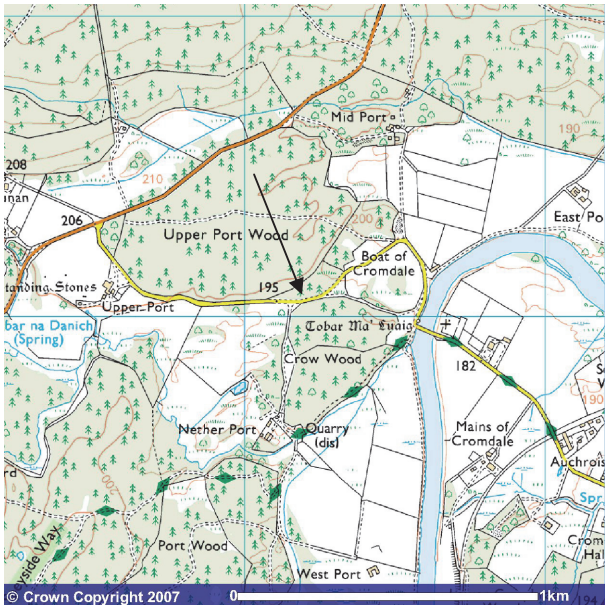
West roadside Dulnain Bridge NH99749 24675



Quarry in Upper Tomvaich Wood NJ06346 30286



Roadside verge (north) close to Nether Port track entrance NJ06203 29047



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Policy and Advice Directorate, Great Glen House,
Leachkin Road, Inverness IV3 8NW
T: 01463 725000

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