

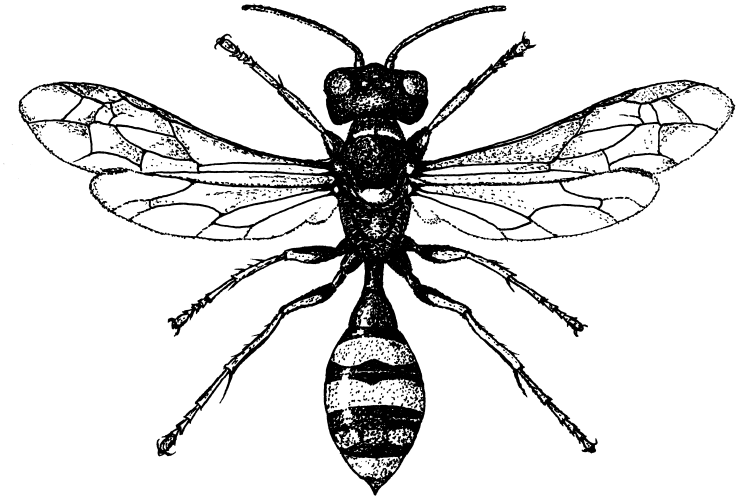
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Mellinus arvensis – a solitary wasp (4 × life size)

(David Clarke)

Contents

Reports on Field Meetings

'Wild Goose Chase': Solway coast and Loch Ken – Geoff Horne 1

Notes and Records

Recent Reports – Geoff Naylor 2

Great Tit targeting nymphalid butterflies – John Miles 3

Butterflies at Jockey Shield in 2003 – John Miles 3

Some notable beetles from the Rusland Valley – John Read 5

A first case of Red Squirrel Parapox disease in north Cumbria – J. P. Duff . . . 6

A previously unknown and apparently native occurrence of the Small-leaved
Lime in the Eden valley, Cumbria – David Clarke 8

Articles

Bryophytes of Acorn Bank – Peter Harris 11

Cumbrian Barklice (Psocoptera) – Bob Saville 17

The Wasps and Bees (Hymenoptera: Aculeata) of North Walney National
Nature Reserve – Michael E. Archer 21

Society Announcements – see end covers

From the Editor

As promised in the previous issue, we have included here two contributions that had to be held over for lack of space. It is particularly nice to be able to welcome unsolicited pieces as articles – both, as it happens, entomological in scope. One covers that rarely surveyed group, the Psocoptera (barklice, or booklice as they are also often known), and the other is a fine and detailed survey of the bees and wasps of one of the county's most important sites for them - Walney Island.

The Field Meetings programme (see back cover) offers the usual wide choice to see an interesting range of habitats and wildlife. Workshops on Ferns, and Ladybirds provide opportunities to get to know how to study and identify these groups, led as usual by experts from within our Society.

From the 2004 AGM:

We agreed there is a need to promote our activities more widely, and thereby to increase membership. This can only happen if more members are willing and able to help. The most obvious task is the production of regular write-ups of our meetings for publication in the local Press; another relates to creation and/or distribution of posters. There is therefore much scope for anyone who would like to put writing or DTP talents to good use, or to use this need as a skills development opportunity!

We also referred to the need to give more opportunities for more members to participate in running the Society's affairs: there will therefore be proposals to the next AGM for Council members have time-limited periods of office, and to give active encouragement for members to get involved.

David Clarke

Additions to the Society's Library

Jeremy Roberts has kindly donated the following titles:

Birds of the Mediterranean and Alps by Lars Jonsson, (Croom Helm, 1982);

A Field Guide to the Seabirds of Southern Africa and the World by G Tuck & H Heinzel (Collins, 1979).

Spadeadam surveys

The site Conservation Officer is encouraging planned visits to this MoD site by any naturalists who can add to the documentation of the flora and/or fauna of this for-long rather 'closed' area. There is a wide variety of bog and stream habitats, as well as the extensive forestry plantings over the years. Anyone wishing to take advantage of this opportunity is asked to contact David Clarke or Stephen Hewitt in the first instance.

National Insect Week

The Royal Entomological Society's *National Insect Week* is being launched at the Darwin Centre at the Natural History Museum in London on Monday 14 June. As part of the *Week*, RES will be launching a National Bumble Bee Nest Survey (in conjunction with Rothamsted Research) and Insect Watch. They will be asking members of the public to survey the insects in their gardens, school yards and local parks to get a better idea of insect life in the UK. Details should be available via Steve Hewitt at Tullie House.

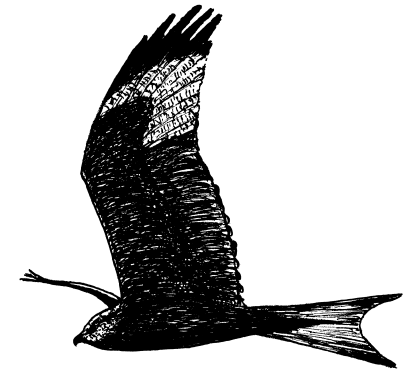
7th February 2004

Leader: Geoff Horne

'Wild Goose Chase': Solway coast and Loch Ken

On a fine, bright, but very cold morning five members of the society and four visitors set off on the annual wild goose chase along the North Solway coast and Loch Ken.

At our first stop at Newbie, west of Annan, we all had good views of waders and ducks feeding on the sand flats ahead of the incoming tide. These included Redshank, Knot, Turnstone, Dunlin, Oystercatcher and Lapwing, as well as Shoveler, Wigeon and Teal. We watched in awe as an adult female Peregrine came in



Red Kite (David Clarke)

on a power run from the sea and scattered everything. A heavy winter shower forced us back into the cars and we moved on alongside Priestside Flow where we had our first Buzzard of the day, as well as a large flock of Fieldfares and Redwings.

Continuing on past Bankend and Caerlaverock, we had good views of two flocks of around 200 Barnacle Geese and another flock of 30 plus Whooper Swans. At Glencaple the tide was at its peak and flocks of Golden Plover, Lapwing, Redshank and Dunlin were resting on the marsh, only to be rudely disturbed by an adult male Sparrowhawk. On the river the usual Goldeneye were showing well.

The weather continued to deteriorate as we travelled to Auchenroch Loch, where we watched a flock of Greylag Geese feeding in the fields. It was here that we decided to press on to Laurieston to see the Red Kites being fed at a local farm. This proved quite spectacular with up to 4 birds in the air at once and one in particular coming in very close to the hide, giving magnificent views. In addition there were up to 20 Ravens taking advantage of the free food supply.

We made our way round to Loch Ken where we came across a number of flocks of Greylag Geese, one of which contained 3 Greenland White-fronted Geese – allowing us to compare the differences in the plumage of the two species. Good views were also had of Pintail, Wigeon, Teal, Tufted Duck, Pochard and in the adjacent fields a number of Brown Hares. The day ended with probably the best views we have ever had of Greenland White-fronted Geese, about 150 of which were feeding in the field near the road.

Geoff Horne

Notes and Records

Recent Reports

These notes cover the period October 2003 to late February 2004 and are compiled from information gathered from members, either by record cards or word of mouth.

For birds, the winter period was relatively quiet. A late October **Richard's Pipit** near Tindale Tarn was an excellent find (John Miles). November highlights included a **Little Auk** and up to 3 **Mediterranean Gulls** at Flimby (Tristan Reid), a **Long-tailed Duck** at Anthorn (Mike and Anne Abbs) and a **Red Kite** at Penton. December produced 3 **Bean Geese** at Whitrigg (M. & A. Abbs), a **Bittern** at Siddick Pond, a single **Waxwing** on Warwick Road, Carlisle and a long-staying **Great Northern Diver** in Silloth harbour.

One of the more unusual records of the early part of 2004 was a singing **Chiffchaff** at Gilsland in mid February (Dorothy Iveson).

Talkin Tarn was also 'quieter' than usual. A very early 'redhead' **Smew** in October may have been the same bird that frequented the tarn on and off in December and January (last winter there were up to 6 Smew in that area). Few **Gadwall** were seen (maximum 3) in November and December after a promising record group of 9 in mid-October. A hybrid 'small' **Canada × Barnacle Goose** was of interest in October. **Goosanders** peaked at about 130 in December but were very scarce or absent in the New Year. Up to 7 **Whooper Swans** in November and December (unusual for Talkin Tarn) were presumably casual visitors from the larger flock at Tindale Tarn. 5 **Pintail** on 6th February were even more unusual.

Late moths were featured in the last issue but other late insects included **Common Darter** at Glasson Moss on 16th November and, also in late November, **Red Admiral**, **Peacock** and **Small Tortoiseshell**.

Despite some wintry weather in early 2004, by mid February, there were sightings of **Small Tortoiseshell** and **Peacock** in the local area and, most unusually, a **Painted Lady** at Grange-over-Sands (J. Curtis). The somewhat battered specimen may, despite the date, have been a migrant (this coincides with sightings elsewhere in the UK). Several moths were also seen earlier than usual; notable examples being **Dotted Border** and **Oak Beauty**. More seasonably, Steve Hewitt noted **Snow Fleas** (*Boreus hyemalis*) at Glencoyne Park on 2nd January and on Wetherlam summit, 5th March.

Cold weather perhaps explains the dearth of early **Frog spawn** records, but Jeremy and Margaret Roberts' pond at Wetheral, Carlisle, once again produced a very early date – 6th February; Wasdale on 22nd February (Tony Tipling) is the only other reported to me.

Geoff Naylor

Great Tit targeting nymphalid butterflies

2003 brought renewed signs of an enterprising female Great Tit in my garden attacking nymphalid butterflies. These colourful insects have colour patterns and behaviours which tend to deter bird predation, but one individual tit was not put off in 2002 - perhaps this was the same one again? The bird in question frequented certain bushes, catching what was available and removing the wings before eating the body under the same bushes, leaving tell-tale feeding signs. The first attack was noted on 11th August. Tortoiseshells and Peacocks were the first to suffer, and the latter had virtually disappeared by 18th August – though this may not have been entirely due to predation. After that it continued on the Tortoiseshells, followed by Red Admirals and later a scattering of Painted Ladies. Tits are well-known as canopy feeders, so *Buddleia* are perhaps just an extension of their normal feeding habitat. Interestingly, the butterflies were ignored when they were in the nearby herbaceous borders. 'Whites' were not as plentiful in the garden as the nymphalids, but the fact that none of their wings were amongst the feeding remains perhaps indicates they were deliberately avoided. My estimate of the total number of butterflies killed was around 50, with wings found especially under just two bushes – which I intend to cut down before next year to try and reduce the kills.

Other garden enthusiasts have yet to notice this sort of attack by Great Tits, although Rob Shaw (pers. comm.) once noted a Blue Tit with a deformed bill feeding on butterflies. Rob has been feeding birds for years and still does not get tits foraging in his *Buddleia* for butterflies. Even Spotted Flycatchers, which are well known for catching butterflies, have never taken numbers of them around my own garden - despite up to four of these birds being present this summer.

John Miles

Jockey Shield, Hynam Bridge, Brampton, CA8 9NF

Butterflies at Jockey Shield in 2003

For a number of years now I have been trying to manage the garden for insects and especially butterflies. The sheltered wooded valley hereabouts has proved productive over the years, despite an altitude of nearly 200 metres. 2003 was a magical summer but it was not always good news for the butterflies. I had record counts for Small Tortoiseshells and Painted Ladies, but was down on Red Admirals and Peacocks, though these were still in impressive numbers. There was also a repeat occurrence of predation on these insects by a Great Tit (see previous note in this issue).

With around 15 Tortoiseshells and one Peacock trying to hibernate in the house

through the winter, I had been hoping for an early spring. As the central heating often causes them to wake up, I have developed a strategy of removing them to the cold of the garage. Despite this a Small Tortoiseshell appeared in the house on 6th March, and another on 25th March.

Finding nectar sources in early spring for these butterflies is always hard, and wild plants like Dandelion (*Taraxacum officinale*) and willows (*Salix* spp.) are a mainstay at this time. In 2003, Peacocks were certainly on the wing in late March, with my first 'White' on 8th April, and Orange-tip on 16th. I used to have a large crop of Cuckoo-flower (*Cardamine pratensis*) growing in the lawn, but as that has since reduced to isolated plants, the Orange-tips now use the Dame's Violet (*Hesperis matronalis*) - which flowers along the border in May and later doubles up as a food source for their caterpillars.

June saw the first Painted Ladies and Red Admirals - presumably migrants. The resident Small Pearl-bordered Fritillary colony just beyond the garden seemed to have a poor year. There were some late Peacocks in June, with a rare visit from a Small Heath. The first Small Tortoiseshells of the 2003 generation were on the wing by 21st June, and a single butterfly was apparently looking for a hibernation site in the house by 13th July! (I once had one butterfly start hibernation in July and finish in December). The first Comma was seen by 19th July, but there were still no spring sightings despite five years of records. The *Buddleia* had begun flowering by 23rd July, a prime nectar source at this time. The first fresh Peacock appeared on 30th July - a week earlier than 2002, and there were up to 20 by 4th August. The Small Tortoiseshells had reached a count of up to 21 by 11th August. By this time the Great Tit predation mentioned above was under way.

The peak dates for the commoner species this year were: Peacocks: 40+ on 8th August (60+ in 2002); Small Tortoiseshells: 30+ on 23rd August; Painted Ladies: 11 on 14th September and Red Admirals: 38 on 15th September (100+ is my record). On 15th September there was only 1 Small Tortoiseshell active, with at least 12 already hibernating in the house.

As the season closed, there was a last Comma on 1st October and a great record of a Wall Butterfly on 16th October - there used to be a colony close by at Talkinhead Farm. As I write (18th January 2004), I have so far have counted 41 Small Tortoiseshells hibernating in the house - the best year ever. It will be interesting to see whether numbers in 2004 show the benefits of the fine season of 2003. Equally, will the Great Tit have passed on her skills to a new generation, or will the butterfly-eating habit just disappear when she does?

John Miles

Some notable beetles from the Rusland Valley

The following rare and notable beetles were found on 7th June 2003 during the course of survey work carried out in Rusland Woods in the Rusland Valley. These records are of species additional to those listed by Hewitt *et al.* (2003).

Two specimens of the small, Regionally Notable (Notable/Nr), rove beetle *Stenus tarsalis* (Ljungh) were found crawling on damp sand in Border Moss Wood, on the east bank of Rusland Pool (SD3486). This beetle tends to be localized in Britain, but is widely distributed and has been recorded from a large number of localities. It is associated with damp habitats and can be found around the edges of ponds and streams.

Two specimens of the Endangered (Red Data Book 1) click beetle *Synaptus filiformis* (Fabricius) were swept from long grass and mixed herbage by the edge of Border Moss Wood and near to the east bank of Rusland Pool (SD3486). *S. filiformis* is very rare in Britain and it is a Biodiversity Action Plan species. The distribution map provided by Mendel & Clarke (1996) shows the historical distribution of the beetle in this country. It is now restricted to just two sites in Britain. *S. filiformis* is associated with Reed Canary Grass (*Phalaris arundinacea*) and has been recorded from muddy banks of the River Parrett in South Somerset (VC5) (Duff 1993). This is a new record for Westmorland (VC69) and also the first for Cumbria.

One specimen of the large and dark, coppery coloured click beetle *Paraphotistus impressus* (Linnaeus) was found at the entrance to the mixed woodland at Skinner Pasture (SD3487). The beetle was swept from mixed herbage in a small open area and near to a small stream. *P. impressus* is a Nationally Scarce species (Notable/Nb) measuring just over 15 mm in length and the adults are characteristic in having quite a large deep longitudinal furrow on the prothorax. The beetle is associated mainly with woodland and the adults have been recorded from pine, birch and oak. Day (1923) remarks on the beetle as being local and scarce in the county and records it from Gilsland, Orton and Baron Wood.

One specimen of *Trachodes hispidus* (Linnaeus) was swept from short grass along an open ride in Skinner Pasture. This small, dark brown weevil is associated mainly with broad-leaved and pasture woodland and is regarded as being faintly indicative of ancient woodland sites. The adults can be found in moss and humus and in the decaying branches of various trees, which includes oak, hazel and hornbeam. The weevil is quite widely distributed in Britain, but tends to be local and is considered Nationally Scarce (Notable/Nb). It has been found in a number of woodland sites in Cumbria.

One specimen of the rather elongate weevil *Tanymecus palliatus* (Fabricius) was

tapped from one of its foodplants, Creeping Thistle, in Border Moss Wood on the east bank of Rusland Pool (SD3486). *T. palliatus* is a Nationally Scarce (Notable/Nb) beetle known from England, Wales and Scotland. It is polyphagous and feeds on a variety of plants, especially Compositae. It has previously been recorded from Skinburness and Burgh Marsh (Day, 1923) and from Humphrey Head (SD3974) in Cumbria.

Acknowledgements

I wish to thank Stephen Hewitt at Carlisle Museum for his help and advice while preparing these records and for allowing me access to the collections of local Coleoptera in the Museum. I would also like to thank Mr Howard Mendel for kindly confirming the identity of *Synaptus filiformis*.

The entomological survey of the Rusland Woods has been conducted on behalf of the Lake District National Park Authority.

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R.W. John Read, 43 Holly Terrace, Hensingham, Whitehaven, Cumbria CA28 8RF

A first case of Red Squirrel Parapox disease in north Cumbria

In examinations sponsored by the Cumbria Wildlife Trust, the first case of Red Squirrel Parapox disease was confirmed in a Red Squirrel (*Sciurus vulgaris*) in Cumbria north of the mountains of the central Lake District. Parapox Disease is known to be carried by Grey Squirrels, but does not appear to be a particularly harmful disease in that species (there has only been one confirmed case of disease (Duff *et al.* 1996) but many Greys have antibody to the virus). However Red Squirrels are extremely susceptible to the Parapox virus and once infected, the disease is generally fatal within 10 to 20 days. During the last century, the introduced Grey Squirrel (*S. carolinensis*) has extended its distribution steadily northward throughout most of England. It has been appreciated during the last 15

years that the area of Grey Squirrel extension in north-west England becomes a 'zone' of Parapox Disease in the Red Squirrel population, presumably as the two species intermingle for the first time and the Greys carrying the virus infect the Red Squirrels. Behind this wave of Grey extension and Red clinical Parapox there has been an almost complete extirpation of Red Squirrels in mainland England and Wales. It is now believed that Parapox disease may be a significant factor in this replacement of the Red Squirrel by the Grey, in addition to the competition for resources between the two species.

Grey Squirrels first appeared in numbers in the Keswick area two years ago despite the hope that the Lakeland Fells would present an effective physical barrier to their movements. There has been good evidence that they managed to cross the fells by way of the pass of Dunmail Raise between Grasmere and Thirlmere. When they appeared, squirrel Parapox in the local Red population was anticipated and it has now occurred. Although the course of the disease in the area may take several years to develop, and interspecies competition will probably play a part, history indicates that the significant Red Squirrel population in Cumbria is now under severe threat and will suffer the same fate as elsewhere in England.

[Squirrels may be a source of zoonotic disease, which is transmissible from animals to humans, and suitable hygiene precautions should be taken, including the wearing of gloves, to avoid these diseases (Duff *et al.* 2001).]

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J. P. Duff

*VLA: Diseases of Wildlife Project, Veterinary Laboratories Agency
Penrith CA11 9RR*

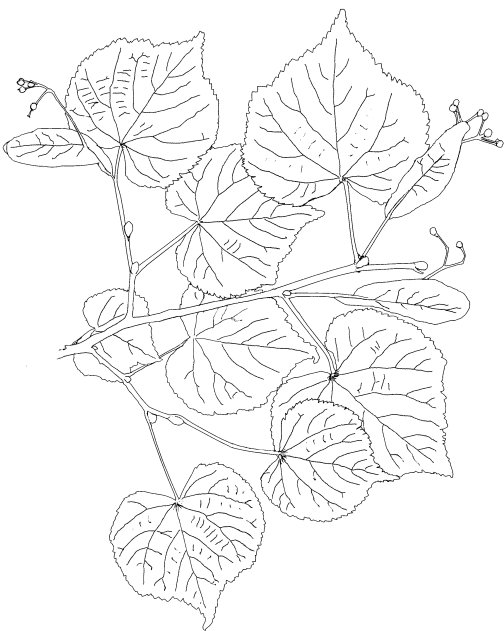
A previously unknown and apparently native occurrence of the Small-leaved Lime (*Tilia cordata* Miller) in the Eden valley, Cumbria

In the summer of 1994 whilst working the east bank of the River Eden in Fishgarth Wood (NY 4950), I had noticed a lime near the foot of a rather inaccessible cliff-like stretch - the tree being only easily viewed from the opposite bank. I finally re-visited the site in 2003, taking advantage of a long period of low water levels to re-locate it and collect samples of foliage, flowers and fruits. Its horizontally spreading roots are lodged into the bedding planes of outcropping Permian sandstone, at barely three metres above summer low water level - i.e. at or below extreme flood levels, as shown by river debris in the lowest branches. The narrow terraces of the slope hereabouts have variable soil cover and are not totally stable - a situation exacerbated by occasional wind-throw of large trees at this west-facing site.

By late May the developing flowers were noticeable above the foliage, at a distance giving the tree a characteristic 'variegated' appearance. Open flowers were present by early July, though the peak flowering was in mid month. Fruits were collected in late August. The characteristics of these, combined with small leaves with glaucous undersides and orange tufts of hairs in the vein axils, 'are all typical of the northern

form of *Tilia cordata*' (C. D. Pigott, pers. comm.).

The Fishgarth lime shows signs of a troubled life. The oldest timber, a stock with furrowed bark, projects almost horizontally from the cliff/bank but ends abruptly at about 2 metres above its base. The original leading shoot has been lost at some time in the past - presumably due to river action - yielding the 'elbowed' trunk so often a feature of riverside trees. From the tip of the now healed-over stump, two smooth-barked lateral limbs spring vertically, the more vigorous of these rising to some eight or nine metres. The girth of the basal stock is only c. 1.0 metres, which might ordinarily



Small-leaved Lime (Jeremy Roberts - from a specimen)

suggest an age of less than 100 years. However, loss of the crown is likely to have caused a set-back to normal growth, making age particularly difficult to assess, and competition from the contorted roots of an oak under which it closely nestles may be yet another constraint on its development. A thin shoot from near the rooting base bends down-slope and has itself rooted at the tip, from which point new sprouts spread out over the river, a mere 2 metres above the water at most. The main stock gives no indication of possible origin as a down-slope 'runner' from other limes, now lost.

The woodland above the slope is now 'coniferised', and there are no details of its former composition. Pigott (pers. comm.) states that 'survival on cliffs and rocks is very much a feature of [*T. cordata*] ecology. There is one ancient lime tree on a similar site above the Ribble near Ribchester'. Pigott & Huntley (1978) discuss the distribution and site characteristics of *T. cordata* in Cumbria: the species clearly survives well on a wide variety of substrates and they emphasise that steep topography is a feature of most of the known localities. Most of these are in the southern Lake District - with northern outliers at Ullswater, Haweswater and in Borrowdale.

Despite further searches at Fishgarth, this appears to be the only tree of its kind just here. It is amongst quite a rich assemblage of deciduous species, which include Ash, Hazel and Wych Elm. The ground flora is dominated by *Luzula sylvatica*, indicative of the mainly 'hungry' siliceous substrates of the slope. Standard colorimetric tests on surface soil collected near the base of the tree indicated a pH of 6.5-7.0 (i.e. almost neutral), but samples more obviously the product of recent weathering from just above base of the tree were distinctly more acidic (c. pH 5.0). However, the rocky nature of the substrate limited sampling opportunities.

Near the tree are examples of other species of richer ground, all within the flood range. These include Guelder-rose (*Viburnum opulus*) and Black Spleenwort (*Asplenium adiantum-nigrum*) - a plant of the latter is actually lodged at the base of the tree. These could both be river-distributed in origin, though occasional nutrient flushing may be the key to their survival here. Not too far away, the river flood-zone has Spindle (*Euonymus europaeus*), Northern Bedstraw (*Galium boreale*) and Bird's-foot Sedge (*Carex ornithopoda*), which are all likely to derive from sites quite distant. (Corner & Roberts (1989) give further discussion of the last-mentioned.) The Fishgarth lime can hardly have been planted where it grows, and it is tempting to regard it as yet another member of this rather fortuitous assemblage, even if not so clearly dependent on nutrient flushing. The presence of the sole Fishgarth example of Norway Maple (*Acer platanoides*) - rare in 'native situations' in Cumbria - just a few metres from the lime, makes yet a further case for water-borne dispersal.

Although potential upstream sources for *Tilia cordata* are not obvious, the

existence of undetected trees in the Eden gorge is not impossible. The nearest known possible native source, Wetheral, is of course some 4 km downstream. The last-mentioned site could be a source for seed carried by birds, or vectors unknown. Production of ripe seed is known to be a rare occurrence at this northern part of the species' range, and limited to only the warmest of summers (Pigott & Huntley, *op. cit.*). Whatever the dispersal mechanism, the possibility remains that the tree may be a rare example of the relatively recent spread of *Tilia cordata* at its northern limits. Equally, it cannot be discounted that even though not 'ancient', it may be the sole survivor of a former population at the site.

The Wetheral Woods site – close to a medieval Priory - has been known only since the 1970s (Halliday, 1997), just too late for evaluation and inclusion in Pigott & Huntley's 1978 account. The trees are mainly on the west bank, with most of the obviously ancient typical trees again on a river cliff, but others of less certain ancestry also occur. Jeremy Roberts (pers. comm.) has recently mapped this 'population'. Wetheral apart, Fishgarth Wood is the most northerly locality for apparently native *Tilia cordata* in Cumbria, and the only other site in the long course of the Eden. Its occurrence adds yet another element to the interest of the River Eden SSSI.

Identification of *Tilia* spp. is problematic, due to natural variation and frequent hybridisation (Pigott, 1998). The author cited is the BSBI referee for the genus and kindly confirmed the identity of the Fishgarth material. I am grateful for his valuable comments during the preparation of this note, and to Jeremy Roberts for many discussions of this topic.

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[Professor Pigott has supplied reprints of a series of four papers dealing with the Small-leaved Lime in NW England, one of which is cited above. They are held in the Museum's library. Ed.]

David Clarke

Bryophytes of Acorn Bank

Peter Harris

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Introduction

Acorn Bank, near Temple Sowerby, is a property of the National Trust 75 hectares in area lying on the Crowdundle Beck in the Eden Valley. The present study was intended to examine the diversity of mosses and liverworts growing in the gardens, woodland and farmland of the estate. The management of Acorn Bank provides for recreational, agricultural, horticultural and conservation interests. In the nineteenth and first half of the twentieth centuries the extraction of gypsum was of economic importance on the site. Thus natural features of the area have been modified or even transformed by varied human activities and habitats more or less favourable for bryophytes have been created incidentally. Some of the habitats can be expected to be relatively stable over time, others are subject to frequent disturbance.

Observations

Records were made during visits to the site at intervals of one to three months over three years (2000, 2002, and 2003). The area surveyed was all on the Westmorland (VC 69) side of the Crowdundle Beck; a small part of the property on the other side (VC70) was not included. The species recorded are conveniently considered in relation to their habitats; nomenclature follows Blockeel and Long (1998).

Species typical of rivers and mires grow in the water of the Crowdundle Beck (Table 1) and around the margin of a water-filled gypsum working in one of the conifer copses (Table 2). Of the four species watered by the beck, *Dichodontium pellucidum* grows in wet sand and gravel of the mill stream; the other three colonize river-washed stones. Plants of *Fontinalis antipyretica* are few and sparse in growth. Among the five species found at the margin of the old gypsum working, the combination of *Dicranella palustris* and *Philonotis fontana* is more characteristic of upland flushes and streams than stagnant lowland ponds (Porley, 1992).

Despite the name, 'Christie's Bog', a field to the south of the property comprises damp pasture rather than mire and bryophytes that occur there are not special to the site. The prevalence of *Calliergonella cuspidata* is consistent with relatively poor drainage and high nutrient levels (Hill, 1994).

Acorn Bank is notable for the variety of trees, native and exotic, in the mixed

woodland and carr that flank the Crowdundle Beck. Species of bryophyte found colonizing the trunks and branches of these trees or growing on tree stumps and logs are indicated in Table 3. Of the epiphytic mosses *Bryum capillare*, *Dicranoweisia cirrata*, *Dicranum montanum*, *Orthotrichum affine*, and *Ulota crispa* are present as small cushions or tufts on the bark while *Amblystegium serpens*, *Hypnum andoi* and *Hypnum cupressiforme* grow as patches or wefts covering larger areas of tree. With the exception of *Ulota crispa*, all of these mosses together with the liverwort, *Metzgeria furcata* occur on more than one genus of tree. *Ulota crispa* was found only on Wild Cherry (*Prunus avium*), but records of this moss were very few and conclusions concerning host preference cannot be made. *Brachythecium velutinum* grows as an epiphyte on the bark of Elder (*Sambucus nigra*), a host shrub that it is known to favour (Porley, 1994). The two species of *Lophocolea* and the moss *Brachythecium rutabulum* are common on rotting logs and stumps throughout. *Radula complanata* was observed on tree stumps and as an epiphyte on Ash (*Fraxinus excelsior*).

Trees growing isolated or in small stands in the open fields or parkland carry few species of bryophyte. *Hypnum cupressiforme* is often present, sometimes together with *Bryum capillare*.

The area surveyed includes many walls, some around areas of garden, others bordering roads through the property and guarding bridges over a drainage ditch (Birk Sike). Made largely of sandstone, they represent a potential ecological niche for bryophytes adapted to grow on stone and rock. It may be assumed that the widespread use of mortar in the walls has affected colonization through localised effects on pH and nutrients available. The mosses growing on the walls (Table 4) are all very common species although maps of bryophyte distribution (Hill, Preston, and Smith, 1991, 1992, 1994) suggest that two, *Bryum caespiticium* and *Pseudocrossidium revolutum*, have not been recorded very frequently in Cumbria.

The wooded areas that border the Crowdundle Beck, including the northerly facing slopes and the small alluvial flats, provide shaded, damp habitats that support prolific bryophyte growth. Records of the variety of mosses and liverworts growing on the ground under trees (Table 5) come largely from these areas. Species such as *Rhytidiadelphus triquetrus*, *Thuidium tamariscinum* and *Cirriphyllum piliferum* are present in profusion. They cover considerable areas of the slopes which they share with grasses, herbs and ferns of the field layer. *Fissidens taxifolius* colonizes sloping areas under trees where other vegetation is sparse. Other species, such as the liverwort, *Conocephalum conicum* and the mosses, *Rhizomnium punctatum*, *Plagiomnium undulatum*, *Plagiomnium affine*, *Thamnobryum alopecurum* and *Fissidens bryoides* grow on or close to the river bank. A small amount of *Polytrichum formosum* was found in one of the copses

under conifers but not in the woodland along the river.

Exposed soil appears to be a favoured site for several species of bryophyte found in the survey (Table 6). *Physcomitrium pyriforme* and *Didymodon insulanus* grow on shaded soil exposed on the river bank. Areas of drying carr subject to flooding in the winter and with sparse vegetation are colonized by the moss species *Pseudephemerum nitidum*, *Ditrichum cylindricum*, *Funaria hygrometrica* and *Dicranella heteromalla*. The moss *Didymodon fallax* and the liverwort *Marchantia polymorpha* subsp. *ruderalis* occur on soil in the gardens. The latter species is common as a weed of such 'artificial' sites (Paton, 1999). *Brachythecium rutabulum* and *Eurhynchium praelongum* occur widely on soil at shaded and unshaded sites and together with *Ceratodon purpureus* they colonize exposed ground along the drainage ditch (Birk Sike) that runs across the property.

Areas used for agricultural purposes were not subject to any systematic, detailed search. In superficial viewing of grassland to the south of the house, bryophytes were not observed. In rougher areas of pasture where a more varied flora occurs the mosses *Eurhynchium praelongum*, *Brachythecium rutabulum* and *Cirriphyllum piliferum* are present. In relatively damp parts, *Calliergonella cuspidata* is also found. Closer inspection of the farmland might well be justified.

Discussion

Acorn Bank is in a lowland area (altitude c. 108m) of relatively low annual rainfall (<1000 mm) compared with other parts of Cumbria. The main soil type is a surface water gley (John Hooson, pers. comm.) but soils on the property must have been subject to major modification by agricultural and horticultural practices, including drainage. With only one or two exceptions, the bryophyte species recorded on the ground are categorized in the literature as adapted to basic to slightly acidic conditions (Hill, Preston, and Smith, 1991, 1992, 1994). Some typical calcicoles grow on the stone walls.

None of the 66 species of bryophyte (56 mosses, 10 liverworts) recorded can be regarded as other than common in Britain. However, one of the epiphytic mosses, *Dicranum montanum*, has been described as rare outside south-east England (Smith 1978). Production of capsules has not been observed in Britain and the formation of small propaguliferous shoots with deciduous leaves has been noted by Smith (1978); the occurrence of deciduous leaves was readily observed in the specimens examined here. Alder (*Alnus glutinosa*), Wild Cherry and Ash are host trees for the moss at Acorn Bank.

The survey points to the value of the Crowdundle Beck with flanking carr and wooded slopes in providing an environment favourable to bryophyte diversity.

The importance of habitats where potential competition from higher, vascular, plants is minimal is also indicated. Such habitats include the surfaces of trees, living and dead, the many stone walls and the areas of disturbed soil, silt and sand of the river bed and banks. It is accepted that further species of bryophyte will be found as more detailed surveys are carried out. The present study should provide a starting point for these and also a reference point for detecting changes in the bryophyte flora over time.

Acknowledgements

I should like to express my appreciation to John Hooson for supplying information about Acorn Bank and to Chris Braithwaite for guidance to areas of interest on the property. During the period of my observations, Sara Braithwaite, Custodian of Acorn Bank, has welcomed visits from the Natural History Group of Penrith Branch of U3A (University of the Third Age). As a member of the Group, I am grateful to her for facilitating the survey.

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Table 1. In water of river

Mosses: Dichodontium pellucidum
Fontinalis antipyretica var. *antipyretica*
Leptodictyum riparium
Rhynchostegium riparioides

Table 2. Margin of water-filled mine working

Liverwort: Aneura pinguis

Mosses: Bryum pallens
*Calliargonella cuspidata**
Dicranella palustris
Philonotis fontana

* also in riverside carr and wet areas of pasture

Table 3. On trees, living and dead

Liverworts: Lepidozia reptans

*Lophocolea bidentata**
Lophocolea heterophylla
Metzgeria furcata
Radula complanata

Mosses: Amblystegium serpens var. *serpens*
*Brachythecium rutabulum***
Brachythecium velutinum
*Bryum capillare****
Dicranoweisia cirrata
Dicranum montanum
Hypnum andoi
*Hypnum cupressiforme****
Orthotrichum affine
Ulota crispa

* also in field layer of woodland

** also on walls, on ground in woodland and on exposed soil

*** also on walls

Table 4. On stone walls

Mosses: Bryum caespiticium
Didymodon rigidulus
Grimmia pulvinata var. *pulvinata*
Grimmia trichophylla
Homalothecium sericeum
Neckera complanata
Orthotrichum anomalum
Pseudocrossidium revolutum
Rhynchostegiella tenella
Schistidium apocarpum
Tortula muralis var. *muralis*
Zygodon viridissimus var. *viridissimus*

Table 5. On ground in woodland

Liverworts: *Conocephalum conicum*
Diplophyllum albicans
Plagiochila porelloides

Mosses: *Atrichum undulatum* var. *undulatum*
Cirriphyllum piliferum
Eurhynchium hians
Eurhynchium praelongum *
Eurhynchium striatum
Fissidens bryoides
Fissidens taxifolius var. *taxifolius*
Mnium hornum
Plagiomnium affine
Plagiomnium rostratum
Plagiomnium undulatum
Polytrichum formosum
Rhizomnium punctatum
Rhynchostegium confertum
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Thamnobryum alopecurum
Thuidium tamariscinum

* also on exposed soil at other sites.

Table 6. On exposed soil

Liverwort: *Marchantia polymorpha* subsp. *ruderalis*

Mosses: *Ceratodon purpureus*
Dicranella heteromalla
Didymodon fallax
Didymodon insulanus
Ditrichum cylindricum
Funaria hygrometrica
Physcomitrium pyriforme
Pseudephemerum nitidum

Cumbrian Barklice (Psocoptera)

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A holiday in Cumbria between 20th July and 1st August 2003 provided an opportunity to investigate the current distribution of outdoor Psocoptera (commonly called barklice) in the area. Before the visit, Stephen Hewitt from the Tullie House Museum, Carlisle kindly provided lists of known occurrences based on records held at the local Biological Records database and on specimens in the museum. These records (mainly 19th and early 20th century), combined with those of an unpublished study around Brathay (from the early 1980s) that had been given to me by John Sellick, indicated that both the Westmorland (VC 69) and Cumberland (VC 70) vice-county areas were under-recorded.

As their name suggests, barklice are most frequently found on trees and bushes and all of the specimens collected were either beaten from branches or brushed from tree trunks. In order to start building up a picture of which species are widespread and which have a more localised distribution, specimens were collected from a range of different locations. These locations (25 in all) included not only discrete sites such as the Aira Force woodland but also places like gardens, randomly selected sections of hedge and isolated mature trees on farmland. The findings are summarized in the table overleaf.

Twenty-nine barklice species were recorded during the visit compared to twenty-four species found previously. Four of these previously recorded species (*Loensia fasciata*, *Trichadenotecnum majus*, *Mesopsocus unipunctatus* and *Caecilius fuscopterus*) were not seen, so nine species new to Cumbria were found. These are: *Philotarsus parviceps*, *Ectopsocus petersi*, *Epicaecilius pilipennis*, *Lachesilla pedicularia*, *Peripsocus didymus*, *Elipsocus moebiusi*, *Trichopsocus dalii*, *Cuneopalpus cyanops* and *Stenopsocus stigmaticus*. Most of these species had a restricted distribution but, interestingly, two (*Philotarsus parviceps* and *Ectopsocus petersi*) were the most widespread species seen, both being found at two-thirds of the locations visited. These two species were also found in large numbers; for example, the *Philotarsus parviceps* specimens made up almost a quarter of the 750 specimens collected.

Many barklice species have preferences for specific types of tree and specific parts of the trees. The trees that had the greatest diversity and abundance of barklice species were Yew (*Taxus baccata*), oak (*Quercus* sp.), Hawthorn (*Crataegus monogyna*) and pine (*Pinus* sp.).

Table 1

Species	Vice-county		Tree sampling situations			% of visited locations
	69	70	Broad-leaved branches	Conifer branches	Trunks	
<i>Philotarsus parviceps</i>	+	+	+	+	+	64
<i>Ectopsocus petersi</i>	+	+	+	+	+	64
<i>Metylophorus nebulosus</i>	+	+	+	+		52
<i>Elipsocus pumilis</i>	+	+	+	+		44
<i>Cerobasis guestfallica</i>	+	+		+	+	40
<i>Caecilius flavidus</i>	+	+	+	+		40
<i>Peripsocus subfasciatus</i>	+	+	+	+	+	36
<i>Caecilius burmeisteri</i>	+	+		+		32
<i>Ectopsocus briggsi</i>	+	+	+	+	+	28
<i>Psococerastis gibbosa</i>	+	+	+			28
<i>Reuterella helvimacula</i>	+	+	+		+	24
<i>Loensia variegata</i>	+	+	+		+	24
<i>Elipsocus hyalinus</i>	+	+	+	+		24
<i>Trichadenotecnum sexpunctatum</i>		+	+		+	24
<i>Graphopsocus cruciatus</i>	+	+	+	+		20
<i>Peripsocus phaeopterus</i>	+	+	+	+		16
<i>Epicaecilius pilipennis</i>	+	+			+	16
<i>Stenopsocus immaculatus s.l.</i>	+	+	+			12
<i>Philotarsus picicornis</i>	+	+	+	+		12
<i>Enderleinella obsoleta</i>	+	+		+		12
<i>Lachesilla pedicularia</i>	+	+	+	+	+	8
<i>Amphigerontia bifasciata</i>	+	+	+			8
<i>Elipsocus abdominalis</i>	+	+			+	8
<i>Peripsocus didymus</i>	+	+	+			8
<i>Elipsocus moebiusi</i>	+		+			4
<i>Pteroxanium kelloggi</i>	+			+		4
<i>Trichopsocus dali</i>	+			+		4
<i>Cuneopalpus cyanops</i>		+		+		4
<i>Stenopsocus stigmaticus</i>		+	+			4

Notes on selected species

Philotarsus parviceps Roesler 1954

The first specimens with exact collecting data in Britain date from 1984 but the

species is known to occur from at least 1960 (Saville, 2001). All the previous Cumbrian records of *P. picicornis* may refer to either or both of the two *Philotarsus* species. The records made during the holiday suggest that *P. parviceps* is the most widespread and abundant Cumbrian barklouse species. Although not parthenogenetic, studies carried out in the Lothians indicated that the vast majority of the population in that area was female (Saville, 2001). All of the 170 specimens found in Cumbria were female.

Ectopsocus petersi Smithers 1978

In the report of his study of the Brathay area, Sellick (1983) mentioned that the newly discovered *E. petersi* might be encountered in the area, though he had not seen it. During the holiday I specifically visited one of his 41 sampling locations to check if *E. petersi* (and the related *E. briggsi*) was present. A search of three Yew trees in Brathay churchyard resulted in 9 specimens. The finding of the species at Brathay was not surprising since it has rapidly become one of the most widespread of all barklouse species (see table above).

Ectopsocus briggsi McLachlan 1899

Although not apparently as widespread as *E. petersi*, it seems that *E. briggsi* is also more abundant than formerly. Sellick (1983) found only five specimens during his studies of 41 locations in the Brathay area in 1981 and 1983 (see notes on *E. petersi* above). The three Yew trees that I searched in Brathay churchyard produced nine specimens. In the Lothians only two specimens had been found prior to 1935 whereas today the species is widespread (Saville, 1999).

Epicaecilius pilipennis (Lienhard) 1996

This species is only known from Madeira and Britain and is currently known in Britain from c. 20 locations in the Lothians, one from Fife and two from Glasgow (Saville, 2001). It has also recently been found in Sussex (Alexander, 2002). Consequently the finding of the species at four separate locations in Cumbria is particularly interesting. The species was found on the trunks of mature trees, as is the case for most of the Scottish specimens. It was found: on an oak on farmland near Beckbank (NY546357) on 20th July 2003, on deciduous trees in the Winderwath garden (NY598293) on 25th July 2003, on a conifer in the Aira Force woodland (NY400204) on 29th July 2003, and on an oak in the Brantwood grounds (SD312957) on 30th July. A total of 6 specimens was observed.

Further studies

Barklice are a convenient group to study because there are relatively few species (c. 50 in Britain) and these are generally not too difficult to identify. Straightforward identification keys are available in New (1974) though two widespread species, *Ectopsocus petersi* and *Philotarsus parviceps*, are not included. Comprehensive keys for all species are available in Lienhard (1998).

A total of 33 species has now been recorded in Cumbria, but further studies are likely to reveal a number of additional species (I would be surprised if *Amphigerontia contaminata* and *Mesopsocus immunis* were not found).

The occurrence frequencies of the species shown in the table are perhaps indicative of their true distributions but are unlikely to accurately reflect them, for a number of reasons. The number of sites visited was small and sampling did not include the full range of habitats where barklice may occur (e.g. no searching under stones). A few species only occur earlier in the year and will of necessity have been excluded. Some of the species that were found can have dramatic annual fluctuations in numbers (e.g. *Graphospocus cruciatus*) and the observed distribution of these species may to be anomalously restricted. Consequently further studies are required if the genuine local status of each of the species is to be determined.

Records

The detailed records of the findings including species names, locations, 6-figure grid references, species numbers, sampling details and dates have been given to Stephen Hewitt of the Tullie House Museum, Carlisle. Voucher specimens of each of the species found will be donated to the Museum.

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The Wasps and Bees (Hymenoptera: Aculeata) of North Walney National Nature Reserve

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North Walney NNR has been found to have 51 species of aculeate wasps and bees, of which six are of national importance. North Walney is located at the north end of Walney Island on the south side of the mouth of the Duddon Estuary (SD1772) in the West Cumbria Coastal Plain Natural Area. The site is leased to English Nature from Vickers Shipbuilding and Engineering Ltd and Broughton Estates and is managed by Cumbria Wildlife Trust. Radley (1994) considered that North Walney had been formed on an open coast to form a sandy promontory at the mouth of an estuary. The reserve has an area of 144ha and consists of sand dunes and dune slacks on the north and west sides, saltmarsh on the east side and dune heath with shrubs and pools in the centre. It is surrounded by mudflats, and sandy and shingle beaches. This study was mainly confined to the 68ha of the dunes and dune slacks. Some species of aculeate wasps and bees were found nesting in the bare stable sandy areas, usually on slopes but also on level ground. The flowers of Sea-holly (*Eryngium maritimum*) and other umbellifers, spurges (*Euphorbia* spp.), stonecrops (*Sedum* spp.) and Bird's-foot Trefoil (*Lotus corniculatus*) were important food sources for these insects.

Methods

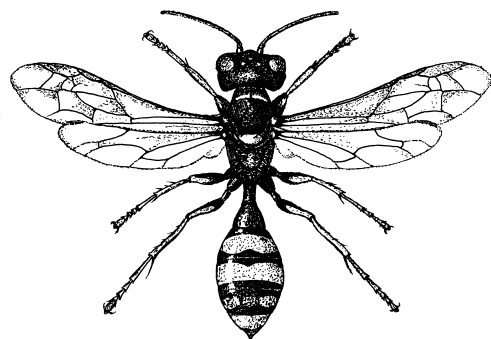
Between 1993 and 2003, the author made nine visits distributed throughout the year as follows: May (1 visit), June (3), July (3) and August (2). During each visit, which lasted about four to five hours, all species of aculeate wasps and bees were recorded and usually collected with a hand net for identification. N.A. Robinson (personal communication) made available additional information, particularly of his visit on 21st July 1996. Further records were found in Dean (1990). In the following account the nomenclature can be related to Kloet & Hincks (1978). An up-to-date checklist can be found on the Bees, Wasps and Ants Recording Society (BWARS) web pages at www.bwars.com.

Species present and the seasonal progression of species

A full list of recorded species is given in the Appendix. Table 1 shows the taxonomic distribution of species and records deriving from the author ['Archer sample'], and these in combination with Neil Robinson's data ['Archer+Robinson sample']. (Robinson listed nine species of which *Crossocerus tarsatus* and

Nomada rufipes were new to the Archer sample.) A 'record' here represents a specimen differing in one of the following three variables: name, sex and day of visit. Insufficient information is provided in Dean (1990) for inclusion in Table 1, and none of the species he listed were new to the Archer+Robinson sample except for *Lasioglossum laevigatum* (Kirby) – recorded during 1986. At present the breeding range of *L. laevigatum* is from Cornwall to Kent and north to Hereford and Worcester and Suffolk. This record, if confirmed, would be regarded as a vagrant species in Cumbria. Archer (2002) also recorded a vagrant specimen of *L. laevigatum* from Yorkshire. This species is not considered further in the analysis of the records.

There are about twice the number of species and records of solitary bees compared with solitary wasps. The family Sphecidae is the dominant taxonomic group among the solitary wasps, both in terms of number of species and records, although the Pompilidae are well represented in terms of records. No one solitary bee subfamily is dominant in terms of number of species but the Megachilinae are dominant in terms of number of records.



Mellinus arvensis, one of the 22 species of solitary wasp recorded at Walney

Based on the Archer sample, Table 2 shows the number of species recorded and when species were first recorded for each month. The most productive months for solitary wasp species were June, July and August, with June the most productive month for the first recording of species. The most frequently encountered species of solitary wasp were: *Crossocerus wesmaeli*; *Pompilus cinereus*, *Episyron rufipes* and *Oxybelus argentatus* as nesting aggregations on slopes of bare sand; *Crabro cribrarius* (usually on flowers of umbellifers), *Anoplius concinnus* and *Ancistrocerus scoticus*. All these species are subterranean nesters.

The most productive months for solitary bee species were June and July, with May and July the most productive months for the first recording of species. The most frequently encountered species were *Hoplitis claviventris* and *Osmia aurulenta* (usually on flowers of Bird's-foot Trefoil); *Sphecodes pellucidus* searching for the nesting aggregations of its host *Andrena barbilabris*; *Megachile circumcincta* with its cleptoparasite *Coelioxys elongata*; *Epeolus variegatus* searching for the burrows of its host *Colletes fodiens*, and *Hylaeus brevicornis*. These species are subterranean nesters except for *O. aurulenta*, which nests in empty snail shells,

and *H. claviventris* and *Hylaeus brevicornis*, which nest inside dead stems such as Bramble (*Rubus* sp.).

The numbers of species of solitary wasps and bees found per visit were: May: 16, June: 8, 13, 15; July: 12, 14, 18; August: 12, 12.

Estimating the potential number of solitary wasp and bee species

One of the problems in the study of any site is the difficulty of not knowing how many more species are present, but as yet unrecorded. Recent advances in non-parametric statistical procedures offer a way of addressing this problem. Chao and Bootstrap estimates (in Colwell & Coddington, 1994) and Jackknife estimates (Heltshe & Forrester, 1983) describe procedures to estimate the potential number of species (species-richness) likely to be found on a site after a number of samples have been taken. The presence/absence quantitative estimate of Chao is based on the number of species that are recorded in just one ('unique species') or two samples in the survey. The Jackknife procedure is based on the unique species only, while the Bootstrap procedure is based on the relative abundance of each species. Because some aculeate species are only active in the spring or summer it is advisable that samples be distributed throughout the months of adult activity. The software to carry out these statistical procedures was provided by Pisces Conservation Ltd. In practice the software takes one, two, etc samples at random, each time calculating a mean estimate of species-richness. The procedure is continuously repeated dependent on the number of samples. With a small number of samples the estimates are highly variable, but as more samples are selected these may stabilize, giving confidence in them.

The estimates based on the Archer+Robinson sample at different sample sizes are given in Figs 1, 2 and 3. The estimates are tending to stabilise. Table 3 shows the three species-diversity estimates after all samples have been considered, with 95% confidence limits (except for the Bootstrap estimate). The final species-diversity estimates are between 48 and 54 species, of which 79%–88% have actually been recorded.

Recorded species at any site could be resident, tourist or vagrant species. Resident species obtain all their resources, mainly nesting sites and food, from the site under study while tourist species, although living in the geographical area of the site, do not normally obtain their resources from the site. Vagrant species, normally occurring away from the geographical area of the site, were not found at North Walney, except for *Lasioglossum laevigatum*, if it is confirmed. It is often difficult to separate resident and tourist species. Probably tourist species will tend to be unique [i.e. single record] species, or found on few occasions, as only small

Figure 1: the Chao presence/absence estimate of species richness for N. Walney

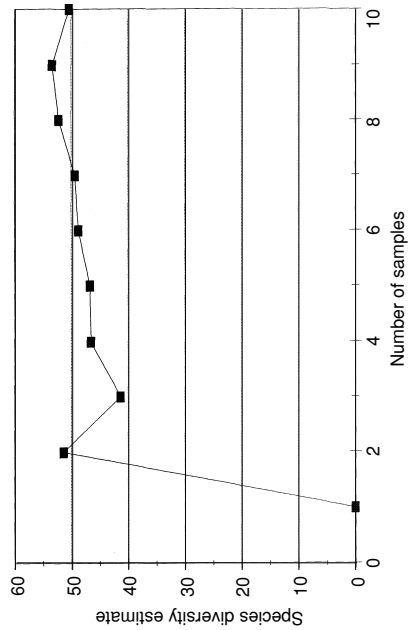


Figure 2: the Jackknife estimate of species richness for North Walney

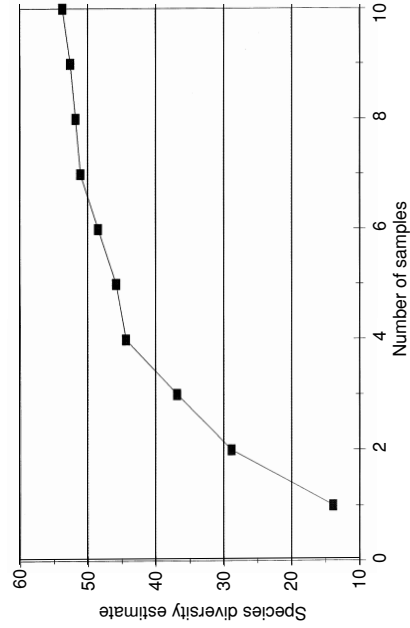


Figure 3: the Bootstrap estimate of species richness for North Walney

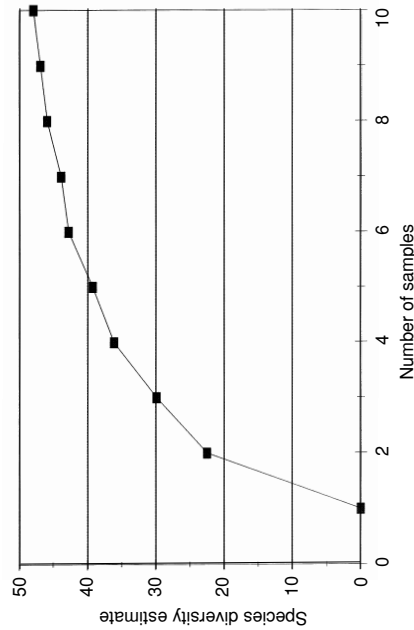
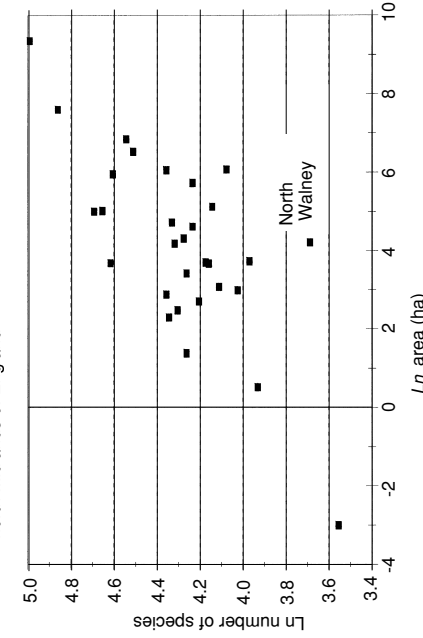


Figure 4: A species-area relationship of 30 sites from the north and north Midlands of England



numbers would be expected to be present on the site and hence unlikely to be found. Unfortunately unique species could also be rare resident species, which have small numbers on site and are hence again unlikely to be found. It is therefore necessary to generate more specific arguments to begin to separate the rare resident and tourist species. No specific arguments seem possible to separate resident and tourist species at North Walney so the estimates of 48-54 species can be accepted. Thus, on average, 6-12 more solitary species are predicted to be present at North Walney.

Species-area relationship

Another problem in the study of any site is the difficulty of knowing when the species list is sufficiently complete to enable reasonable comparison with other sites. The list from North Walney can be considered reasonably complete from the species-diversity analysis. As such, it would be interesting to compare the species-area relationship for North Walney with other sites from the north and north Midlands of England. Fig 4 compares North Walney with 29 other northern sites, and shows that it lies well outside the 'normal' range. The regression equation for the northern sites is: $\ln \text{ no. spp.} = 3.92 + (0.095 \times \ln \text{ area})$. Inserting the figure for Walney into this reveals that it would need to have some 75 species in order to approximate to the average of the other sites. This observation indicates the relatively unfavourable nature of North Walney, probably climatic, for aculeate wasps and bees. Archer (1990) showed that solitary wasps were more sensitive to summer weather than solitary bees. This may, at least in part, explain the relatively low proportion of solitary wasps on North Walney.

Quality assessment of the solitary species

According to Shirt (1987) *Colletes cunicularius* is a Red Data Book species and according to Falk (1991) *Oxybelus argentatus* and *O. mandibularis* are nationally notable species. Recent work by BWARS indicates that *Anoplius concinnus*, *Ceropales maculata* and *Tachysphex unicolor* are also of national importance.

Each of the 40 solitary species of the Archer sample can be given an Archer national status (Archer, 1999, 2002). Under the Archer scheme *C. cunicularius* is a very rare species, *C. maculata* a rare species and *A. concinnus*, *T. unicolor*, *O. argentatus* and *O. mandibularis* scarce species. With this information a national quality score of 128 and a species quality score (SQS) of 3.2 can be calculated (Table 4). The species quality score is a measure of the relative number of rare and scarce species present and is thus an indicator of the conservation value of a site.

Archer (1999) found that quality scores are influenced by the area of a site, while

SQSs are relatively independent of site area, and so can be used to compare sites. How does the SQS compare with other northern sand dune sites? SQSs from the east coast sites are: Gibraltar Point 1.7 (Archer, 2003), Saltfleetby-Theddlethorpe NNR 1.8 (Archer, 2000), Spurn Point 2.3 (Archer, unpublished) and Lindisfarne NNR 1.6 (Archer, unpublished) and for the west coast are: Ainsdale-Formby 3.8 (Archer, 1999) and North Walney NNR 3.2. The west coast sites have higher SQSs than the east coast sites, probably reflecting the warmer climate of the west coast.

Cleptoparasitic load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasite rates are higher in temperate regions as host populations are more synchronized in their life-history characteristics, except in hot deserts where the infrequent occurrence of rainfall would tend to synchronise life-history characteristics. From a review of the literature Wcislo (1987) found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%. As such, CLs for sites in Britain should have similar values. For the north Midlands and north England, the CLs for species of solitary bees vary from 21.7%-36.6% (range 14.9%) (Archer, 1999). The CL for North Walney (Table 5) falls within this range and therefore supports Wcislo's hypothesis.

Wcislo (1987) gives no CLs for wasps, but Archer (1999) found that CLs of solitary wasps for sites from north Midlands and north England varied between 10.3%-22.2%. The CL for North Walney (Table 5) falls within this range. Wcislo's hypothesis can therefore be applied to the solitary wasps.

Aerial nester frequency

The aerial-nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters use old beetle burrows in dead wood, central plant stem cavities (e.g. bramble), old snail shells, or crevices in old mortar or exposed on the surface of rock or other hard material. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered. The aerial nesters at North Walney are all stem nesters except for *Osmia aurulenta*, which uses empty snail shells.

The AFs for the solitary wasp and bee species are given in Table 6. The AF for all the British species of solitary wasps is 46.2% and for solitary bees is 17.9%. The

AF for the solitary wasps is much lower than the British AF, while the AF of the solitary bees is much higher than the British AF. Since North Walney is relatively unfavourable for solitary wasps and bees it would be expected that the AFs would be higher than the British AFs. This is because aerial sites are likely to benefit more from the relatively less warmth available both daily and seasonally than subterranean sites. Why then should the solitary wasp AF be so low? Perhaps the stem-nesting species of solitary wasps are yet to be found. Certainly the number of recorded aerial nesting wasps (Table 6) is very small and the discovery of four more species would make a large difference to the AF.

Summary

North Walney:

1. has 51 recorded species of aculeate wasps and bees with six species of national importance;
2. is predicted to have a species-diversity of about 48-54 solitary species of which, on average, about 6-12 species remain to be found. These species could be mainly aerial-nesting solitary wasps;
3. is relatively unfavourable for solitary wasps and bees compared with other northern English sites since it holds fewer species relative to its area;
4. has a higher species quality score than sand dune sites in northeast England;
5. has solitary wasps and bee cleptoparasitic loads similar to those from other sites as predicted by Wcislo (1987); and
6. has a higher aerial nester frequency for solitary bees and a lower aerial nester frequency for solitary wasps compared with British data.

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Illustration (p. 22): David Clarke

Appendix: species recorded

- Chrysididae: *Hedychridium ardens* (Latreille in Coquebert), *Chrysis ignita* (L.).
- Pompilidae: *Pompilus cinereus* (Fab.), *Episyron rufipes* (L.), *Anoplius concinnus* (Dahlbom), *Arachnospila anceps* (Wesmael), *Evagetes crassicornis* (Shuckard), *Ceropaes maculata* (Fab.).
- Eumeninae: *Ancistrocerus oviventris* (Wesmael), *A. scoticus* (Curtis).
- Vespininae: *Dolichovespula sylvestris* (Scopoli).
- Sphecidae: *Tachysphex pompiliformis* (Panzer), *T. unicolor* (Panzer), *Crabro cribrarius* (L.), *Crabro peltarius* (Schreber), *Crossocerus elongatulus* (Vander Linden), *C. wesmaeli* (Vander Linden), *Oxybelus argentatus* Curtis, *O. mandibularis* Dahlbom, *O. uniglumis* (L.), *Pemphredon lethifera* (Shuckard), *Mellinus arvensis* (L.).
- Colletinae: *Colletes fodiens* (Geoffroy in Fourcroy), *C. succinctus* (L.), *C. cunicularius* (L.), *Hylaeus brevicornis* Nylander, *H. hyalinatus* Smith.
- Andreninae: *Andrena haemorrhoea* (Fab.), *A. tarsata* Nylander, *A. barbilabris* (Kirby).
- Halictinae: *Lasioglossum leucozonium* (Schrank), *L. villosulum* (Kirby), *Sphecodes pellucidus* Smith, *S. puncticeps* Thomson.
- Megachilinae: *Osmia aurulenta* (Panzer), *Hoplitis claviventris* (Thomson), *Megachile circumcincta* (Kirby), *Coelioxys elongata* Lepeletier.
- Anthophorinae: *Epeolus cruciger* (Panzer), *E. variegatus* (L.), *Anthophora furcata* (Panzer).
- Apinae: *Bombus lucorum* (L.), *B. terrestris* (L.), *B. hortorum* (L.), *B. lapidarius* (L.), *Bombus pascuorum* (Scopoli), *B. bohemicus* (Seidl), *B. sylvestris* (Lepeletier), *Apis mellifera* L.

Table 1
Number of species and records from North Walney NNR based on the Archer and Robinson samples

	Species (Archer)	Species (Archer + Robinson)	Records (Archer)	Records (Archer + Robinson)
<i>Solitary wasps</i>				
Chrysididae	2	2	2	2
Pompilidae	6	6	26	29
Eumeninae	2	2	7	7
Sphecidae	11	12	36	40
Total solitary wasps	21	22	71	78
<i>Solitary bees</i>				
Colletinae	5	5	18	19
Andreninae	3	3	8	8
Halictinae	4	4	13	13
Megachilinae	4	4	30	31
Anthophorinae	3	4	7	8
Total solitary bees	19	20	76	79
Total solitary species	40	42	147	157
<i>Social wasps & bees</i>				
Vespininae	1	1		
Apinae	8	8		
Total social species	9	9		
Total wasps & bees	49	51		

Table 2
Number of solitary species and months when species were first recorded at North Walney NNR based on the Archer sample

	May	June	July	August
Number of species				
Wasps	7	14	13	12
Bees	9	11	14	7
Number of species first recorded				
Wasps	7	10	2	2
Bees	9	3	6	1

Table 3
Non-parametric estimates of species richness at North Walney NNR based on the Archer+Robinson sample

	Chao estimate	Jack-knife estimate	Bootstrap estimate
No. species recorded	42	42	42
No. species estimated	50	54	48
95% confidence limits	39-62	48-60	–
% of estimated spp. found	84.0	77.8	87.5

Table 4
The Archer national quality scores of the solitary species recorded from North Walney NNR based on the Archer sample

National Status	Status Value (A)	No. Species (B)	Quality Scores (A × B)
Universal	1	20	20
Widespread	2	14	28
Restricted	4	0	0
Scarce	8	4	32
Rare	16	1	16
Very rare	32	1	32
Total		40	128

Species Quality Score (SQS) = 128/40 = 3.2

Table 5

The relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species recorded from North Walney based on the Archer sample

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic Load CL = $100 \times C/(H+C)$
Solitary wasps	17	4	19.0
Solitary bees	14	5	26.3

Table 6

The nesting habits of the solitary species from North Walney NNR based on the Archer sample

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = $100 \times A/(A+S)$
Solitary wasps	2	15	11.8
Solitary bees	5	9	35.7

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BSBI: Botanical Society of the British Isles; SSSI: Site of Special Scientific Interest; VC: Vice-county.

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Summer Programme 2004

Field meetings start from Carlisle College, Victoria Place, Carlisle. (Leaders may cancel meetings at this rendezvous if they consider circumstances unsuitable.)

Members' own transport; places available for those without.

Bring packed lunches for all meetings beginning before midday.

May 21st (Friday) Natterjack Evening Leaders Mike Abbs & Frank Mawby. Depart 8:30pm. Meet 9pm at Anthorn (NY199584).

June 26th (Saturday) Dragonflies in Little Langdale Leader David Clarke. Depart 9.30am. Meet at car park at Hodge Close (NY317018), 10.30am.

July 10th (Saturday) Ferns Workshop Leader Jeremy Roberts. 10am Tullie House; local field visit in afternoon. Lunch not provided, numbers limited: please book via Tullie House Box Office, 01228 534664. Free to CNHS members.

August 7th (Saturday) Moth Night at Wreay Leaders Richard Little and Mike Clementson. Depart 8:30pm; meet at Sam's Wood, Wreay (NY439487), 9pm.

August 14th (Saturday) Solway: Birds & Dragonflies Leaders Mike and Ann Abbs. Depart 9:30am. Meet Anthorn (NY199584) at 10am; wellies advisable.

August 21st (Saturday) Ladybirds Workshop Leader Steve Hewitt. 10am at Tullie House; local field visit in afternoon. Lunch not provided, numbers limited: please book via Tullie House Box Office, 01228 534664. Free to CNHS members.

September 25th (Saturday) East Coast Birding Leader: Geoff Naylor. Depart 9:00am.

October 9th (Saturday) Red Deer Rut, Martindale Leader: Geoff Horne. Depart 12:30pm. Meet: Martindale church (NY434183), 1.30pm.