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TRANSACTIONS of the NORFOLK & NORWICH NATURALISTS' SOCIETY

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TRANSACTIONS OF THE NORFOLK & NORWICH NATURALISTS' SOCIETY

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Figure 2. Deer-park and Castle Rising village 1588. See Presidential Address p. 3.

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Presidential Address delivered to the Society on 11 January 2011

A thousand years of birding in Castle Rising

Fred Cooke

This presentation is a journey back through time and stems from my two main passions: 1) a long-term professional interest in bird populations and their changes over time; 2) my recently acquired interest in local history. By examining evidence from documentary sources and landscape history, it may be possible to know what changes have occurred in bird populations, not just in the recent past but over the last thousand years or more, and I do this through a detailed examination of the history of a well-documented small village in West Norfolk, the ancient Borough of Castle Rising.

At present, Castle Rising is a village with a population of around 200 people. It has a variety of habitats, with some arable farming and much land set aside, predominantly for pheasant and partridge. In addition to the game-birds introduced there, some other traditional farmland birds such as Barn Owl, Yellowhammer, Linnet and Skylark can be found. It has two ancient woodlands, Mill Wood and Alder Carr. Because much of the underlying geology of the area consists of Sandringham Sands, heaths were common – the nature reserves of Dersingham Bog and Roydon Common are examples of ancient West Norfolk heaths. These locations are the breeding grounds of Stonechats, Woodlarks, Tree Pipits and occasionally Short-eared Owls. Heaths were once more common in the area and were used by local residents for grazing their livestock, but after commoners were excluded by the local Lords of the Manor, many of the heaths have reverted to mixed woodland, mostly within the past 150 years. Goldcrests, Great Spotted Woodpeckers, Blackcaps and Tawny Owls can be found there. The ancient woodlands are no longer managed for timber as they were in the past and are no longer the haunts of Nightingales, although this species could be found nesting in the area as little as six years ago. In the neighbouring parish of North Wootton, an extensive but degraded saltmarsh stretches to the Wash and is the breeding ground of Marsh Harriers, Shelducks, Avocets, Redshanks, Reed Buntings and Meadow Pipits. In the winter it is visited by large flocks of Brent Geese, Wigeon, Teal, Pintail, Lapwings, Curlew and Golden Plover. A recent regular visitor is the Little Egret. The River Babingley flows through the northern part of the parish and is home to Kingfishers, Grey Wagtails and, until recently, Mandarin Ducks. In the village itself, typical village birds such as Jackdaws, Swifts, Swallows and House Martins make their nests, and there are declining populations of House Sparrows and Starlings.

If we want to examine the bird life of the past in the area, we can: 1) talk to elderly residents, 2) look at written records from the past, or 3) examine local landscapes to infer what birds might have been here in earlier times. I use all these approaches and below I present some of my conclusions. They may in some cases be speculative but are based on a reasonable knowledge of present and past distributions and known habitat preferences.

Because there are many early Cretaceous Sandringham Sand deposits in the area, sand-pits are common and have been worked from the thirteenth century until the middle of the twentieth century. Older residents remember the nesting Sand Martins in the sand-pit opposite the golf-course, but they no longer nest there.

Other local records can be found in the various books written about Norfolk's birds – books such as the mid-nineteenth century three volume series *Birds of Norfolk* by Henry Stevenson; B.B. Riviere's book *A History of the Birds of Norfolk* (1930) and the more recent *The Birds of Norfolk* by Moss Taylor, Michael Seago, Peter Allard and Don Dorling (1999). Other useful references are *The Historical Atlas of the Breeding Birds of Britain and Ireland 1875-1900* produced by Simon Holloway (1996) and *The History of British Birds* by Yalden and Albarella (2009). Also invaluable were the Accounts Books of the L'Estrange Estate which record the birds and other objects brought into the estate kitchens from 1520 onwards; these are currently stored in the Norfolk Records Office.

For the rest of this presentation, I intend to go back in time and infer what changes in the bird populations of Castle Rising have occurred and give you the evidence for my conclusions.

One of the major changes, which has occurred within the life-time of many Norfolk naturalists, is that brought on by the massive changes in agricultural practice since the second world war. This is documented in the graph (Figure 1) which illustrates the decline in farmland birds since 1975.

A film taken in the late 1960s and donated to the Castle Rising History Group shows a very different village from that of today. Farm animals were common in the fields surrounding the village and the farm in the village was probably still active. Now the barn is used to sell bric-a-brac. Pasture land surrounded the parish and in the early years of the twentieth century Corncrakes would still have been common.

In 1861 an important event occurred in West Norfolk. Sandringham was acquired by the Royal family and for both Edward VII (Bertie) and George V, it was widely used for its potential for shooting game. Its use by both these kings is documented in two books – *King Edward VII as a Sportsman* by A.R.T. Watson (1911) and *King George V as a Sportsman* by J. Wentworth Day (1935). In one of these books, a historian of 1781 said 'The woods of Babingley and Wolferton adjoining to it [Babingley Church] are very valuable and **abound in game**.' [my emphasis]. The area already had a reputation for its game and the eighteenth century Lords of the Manor of Castle Rising used to visit the area from their estates in Surrey to participate in the sport.

Several interesting bird species were introduced into the area by the royal family in an attempt to diversify their shooting oppor-

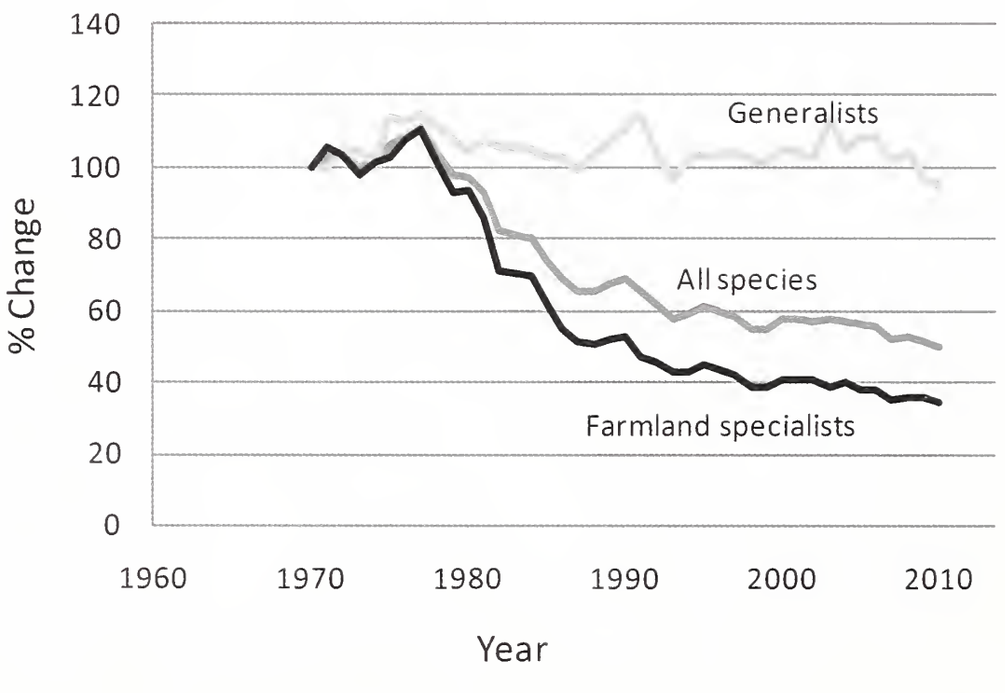

Figure 1. Changes in farmland and other birds 1970 -2010. Nineteen species are included of which twelve are farmland specialists. Data from the British Trust for Ornithology.

tunities. Red Grouse were introduced and successfully bred on at least one occasion at Dersingham Bog. Quail, Black Grouse and Wild Turkeys were also introduced with a notable lack of success. Perhaps Golden Pheasant which, although declining, still survive in the area, was introduced at this time. Pheasant pens, where young birds were reared and released, increased the pheasant population and Red-legged Partridges were increasingly replacing Grey Partridges in many of the shoots, though not those of the Sandringham estate. The whole area was widely keepered and raptors and other predators had declined to extinction by the latter part of the nineteenth century. Kites and Marsh Harriers were already extinct, and Hen Harriers, Buzzards and Ravens had disappeared by the end of the century. Happily, we are now seeing a return of most of these species and Ravens are likely to be a regular Norfolk sight before too long.

Another gamebird which was recorded in the area but had disappeared before Sandringham was acquired by the royal family was the Great Bustard. Around 1800 Lord Coke of Holkham sent a letter to Hammond of West Acre, thanking him for the bustard which Hammond had sent him and saying it was 'the best I ever eat'. Mrs Herbert Jones, author in 1883 of *Sandringham Past and Present*, refers to Rev. A. Jessop who describes in 1803 'seeing a flock of 11 rise up together from the heath almost under your horse's feet'.

Another unusual bird which appeared in our area in the late nineteenth century was the Pallas's Sandgrouse. Day (1935) reports a large influx into Norfolk in 1888. 'Many were seen round about Sandringham, the sandy dunes and shingle beaches being exactly the sort of country to appeal to them.'

If we go further back in time, we can examine the Castle Rising area in Tudor times. The magnificent map (Figure 2; see inside front cover), produced in 1588, shows the area at that time (a copy is preserved in the Norfolk Record Office). It was a Royal Chase and had been widely used for falconry and for hunting deer by the Black Prince and Edward III in the fourteenth century during their visits to Castle Rising to see Queen Isabella (see below).

The outline of the deer-park can still be detected on the present-day OS map of the village. The landscape must, however, have been very different in those days and we know that large oak trees were cut down there during the Civil War, for the protection of King's Lynn. It is likely that the area would have been a little like the deer-park at Holkham and would also have contained Fallow Deer. It would probably be the home of birds such as Wryneck and Lesser-spotted Woodpecker, both absent from the area today.

The park was abandoned in the mid-seventeenth century and because of the sandy soil became a rabbit warren, with two warreners being responsible for managing the rabbits there. However the rabbits bred profusely and it was reported that 'the warrener has killed the last year 17,000 ..... their breeding in the castle ditches and banks, and the walls are..... in danger of overthrowing' (Bradfer-Lawrence 1932). Perhaps at that time the area resembled Weeting Heath and together with the nearby heathland was probably an ideal place to find such birds as Stone-curlews, Wheatears, Whinchats and Red-backed Shrikes.

We have little documentary evidence of life in Castle Rising itself in the sixteenth century, but the L'Estrange family 'Household Book' from nearby Hunstanton gives a good record of local birds:

pd at Lynne whan ye went on hawkying to Woolferton wood for fyer and drynke ....viiid

a fesant kyllyd wt ye goshawke

xii larks kyllyd with the hobbye

vi rabetts and ii ptriches kylled wt ye sper-

hawke

*viii mallards, a bustard and i hernsewe** [killed with a crossbow]

a watter hen kylled wt the gonne

a cranne kylled wt the gonne

Itm a wjdgyn kylled wt the gonne.

* A hernsewe is a Heron.

There are also several records of wading birds killed, mainly in the winter months, during the early part of the seventeenth century:

Reynolds his man for bringing a dosen and a half of **Pewetts** *2s.*

Oct 21. Given to one that brought **Stints** *from Holly.*

Nov 4 To Bastard for a **Curlew** *8d and 2* **Spowe** *and 2* **dotterel** *6d.*

Dec 11 Given to Holly his boy for bringing **stints**.

Jan 2 Given to one for bringing of **Knottes** *from Bloy 4d.*

Dec 31 To Armigers man for bringing of **Knottes** *1s.*

May 20 To one that brought **Dotterels** *from Bloy.*

Sept 29 For a dozen **Stintes** *4d.*

May ? Sent by Noris 4 **dotterell** *given by rewards.*

May ? Sent by Mr Peapes 6 **dotterell** *given as rewards*

Oct 17 4 Partridges and 5 **Woodcocks**

Nov 4 Given by S. Giles a **plover** *and 5 other small fowle.*

Nov 4 sent from Segon, a **Curlew**, *a teal and other little birds given as reward.*

....2 partridges, 3 Rabbits, 4 **Plover**, *a* **Curlew**, *a teal, a* **Spowe** *and 2* **Redshanks**

Stints were presumably any small wader, Dunlin, Sanderling or Stint. But what were Spowes? The Hunstanton Household books are the only known written source of this word and Gurney (1921) and most early ornithologists have come to the conclusion that it refers to Whimbrel, largely on the basis that it is close to the Icelandic name for that species. However, this is almost certainly incorrect for two reasons: firstly, most Spowes were shot during the November – January period; secondly, they were sold at a much lower price than Curlews (averaging 2d rather than 6d for the larger bird). Most other common waders are mentioned in the Household Book. There is an occasional reference to a Fedoa, probably a godwit, and most other likely species, including Sparrows are recorded in the book. My suggestion is that the wildfowlers were aware of *two* types of godwit. Perhaps Fedoa was the Black-tailed and Spowe was the Bar-tailed?

Another place where there is information of the birds of Castle Rising is the middens of the castle itself. An account of an excavation of Castle Rising is given by Morley & Gurney (1997). We can also gain some knowledge of life in the fourteenth century from the records of the Royal Accounts from King's Lynn. Queen Isabella resided in the castle at that time and was often visited by her son, King Edward III, who was very keen on falconry. Figure 3 shows

Figure 3. King Edward III with Gyr-falcon.

an early drawing of Edward III with a Gyr Falcon, this type of falcon being restricted to the King's use.

Below are two entries from the Chamberlains' Accounts from King's Lynn for 1338 which suggest that Gyr Falcons may have entered the port of King's Lynn for the king's use, perhaps from Scandinavia.

ixli. vis. Viiid (£9.6s 8d). given for two gerfalks bought for the use of the Lord King. 1338

xxxviiis given to Andrew de Biri for keeping of same gerfalke. 1338

The commonest bird in the middens was the domestic chicken, but of the wild birds there was evidence of falconry with bones of Peregrine, Goshawk, Buzzard and Sparrowhawk, while bones of Red Kite suggest that this species may have been a common scavenger at that time. There were also the bones of many quarry species: Grey Heron, Spoonbill, Teal, Wigeon, Mallard, Crane, Golden Plover, Curlew, Woodcock and Oystercatcher. The Spoonbill is interesting and there is evidence that young birds of this species were also harvested at Hunstanton from a local nest site. Clearly the Spoonbills which have recently bred on the North coast of Norfolk are returning after a very long absence from the region.

There is strong evidence of major habitat changes at Castle Rising since the borough was first established some time in the Saxon period. There is an old piece of doggerel which is quoted in every account of the history of the village. It states that:

Rising was a seaport town when Lynn was but a marsh.

Now Lynn it is a seaport town, and Rising fares the worse.

Evidence from the landscape shows that Rising was indeed a 'seaport town' and that there was an inlet of the Wash which stretched to within 500 metres of the village on the north side. Aerial photos show that an extensive saltmarsh was situated in the present valley of the Babingley River and even as late as the twentieth century the sea occasionally broke though the sea-defences. Before the building of sea walls in the tenth and seventeenth centuries, boats would regularly sail up the river to the village, bringing much of the stone for the building of the castle and Norman church. Earlier the river had been used by the Romans for shipping Silver Carr for the building of Branodunum and Reedham.

This proximity of the sea and the salt marshes would have meant that Castle Rising would resemble some of the ports on the North Norfolk coast in earlier times. Perhaps terns, Ruffs and Black-tailed Godwits would have nested in the grazing marshes. There would also have been greater expanses of freshwater marshes and greater areas of reedbeds. Perhaps Bitterns and Bearded Tits would have nested there.

I want to end with two more exotic species that were certainly in the area in earlier centuries. One is the White-tailed or Sea Eagle. Sir Thomas Browne (1605-1682), one of Norfolk's earliest and most eminent naturalists speaks of the not unusual appearance of the *'Haliæëtus* or Fen Eagles' in Norfolk but adds *'the great and noble kind of eagle called Aquila gesneri* [Golden Eagle] *I have not seen in this country.'* The similarity of the ecological requirements of the Sea Eagle to the closely related North American Bald Eagle, a lowland bird that likes wetlands and woodlands, suggests that it would have been widespread in the Castle Rising area in earlier centuries. It is almost certain that this bird was a spectacular member of Norfolk's avifauna in the past and played an important role in the ecosystem. It was probably wiped out from Norfolk by human persecution soon after Browne had written of its presence in the county. I was surprised that some prominent Norfolk naturalists opposed the recent attempt to reintroduce this magnificent species back into the county. It may arrive under its own

steam in future years but I feel that a great opportunity to assist its reintroduction was missed.

The other species is the Dalmatian Pelican. This is a species which now nests no closer to the UK than the Danube Delta but in Roman times nested in the Rhine Delta. It needs extensive areas of reedbeds such as occurred in the Fens, parts of Somerset and the Humber estuary in earlier times. A bone of this species was found at King's Lynn and several more were found in other former fen areas such as Glastonbury. These included bones of juvenile birds. The heraldic Pelican can still be seen in some of the medieval doorways of Lynn and is represented on the Lynn coat of arms.

Much of what I have written, particularly of the earlier periods must of necessity be speculative, but in general I have used what evidence I have found. The combining of local history with an interest in changing bird populations has uncovered some interesting findings. I hope they stimulate others to investigate the rich local history of Norfolk.

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Professor F. Cooke 6 Lynn Road, Castle Rising, Norfolk PE31 6AB

f.cooke1@btopenworld.com

Swanton Novers Wood NNR, Norfolk, and its Coleoptera: Supplement No.4

Bryan Sage

Introduction

This is the fourth supplement to the paper by Sage (2006) and follows on from Supplements 1, 2, and 3 (Sage 2007, Sage 2008a and Sage 2010), and covers the year 2010. Also included are any data of interest for 2011 that are to hand at the time of writing. The ride and compartment numbers referred to in the text can be found in Figure 1 in Sage (2006). Some of the data referred to in this paper have been taken from Baker (2010). This may be the last supplement for some time since it has been decided to scale down research on the Coleoptera for reasons discussed below.

On 19 June Dr R. Colin Welch (RCW) visited the Great Wood by invitation of the author. Dr Welch's speciality are the more 'difficult' groups of the Coleoptera, especially the Latridiidae, Ptilidae and Staphylinidae. During the course of the day he recorded 85 species of which 30 are additions to the reserve list (see below).

Publication of this supplement at this point was prompted by several factors. With the total number of beetles recorded now standing at 667 species, finding additional species becomes ever more difficult. There have also been changes to the list of species that qualify as saproxylic that have resulted in changes to the SQI Index. Finally, the management regime implemented by Natural England in recent years has resulted in a decrease in habitat diversity, and this has had a negative impact in terms of finding beetles. Further discussion on these points will be found below.

Precipitation

Since the rain gauge was choked with snow at one point, it is possible that the rainfall totals are too low. The rainfall in the Great Wood for the period September 2009 to August 2010 was 647 mm (an average of 53.9 mm per month), compared with 639.5 mm (an average of 53.3 mm per month) for the same period in 2009-2009. The recent trend of dry springs was continued. February 2010, with 165 mm, was exceptionally wet, and August 2010, with 121 mm, was the wettest of the summer months.

Woodland management

Management during the winters of 2009/2010 and 2010/2011 continued much along the lines of 2008/2009.

Coppicing

Compartment 8 is unusual in that it comprises oak standards over oak coppice (see photograph). Opinions vary as to when this compartment was last coppiced: 1947 (i.e. 64 years ago) has been suggested, but others think that it was about 80 years ago. In October 2010 work began on part of this compartment and continued until December. Instead of re-coppicing, the trees were pollarded, and several standard trees were cut down in the process.

In January and February 2011 Compartment 17a was re-coppiced and completely cleared of undergrowth and marginal scrub, with the brash being burnt. At its western end this compartment is within a few metres of the site where the rare scolytid beetle *Ernoporicus caucasicus* RDB1 (Endangered) was first discovered in the wood in May 1997. The burning of the dead and dying twigs may have reduced the scope for its dispersal. This species is known from only one other site in Norfolk.

Ride Management

In Sage (2010) mention was made of the ride or track running along the north side of Compartment 20 that had been surfaced with carstone, a material alien to this site (see photograph in Sage 2010). This has developed into a linear bed dominated by ruderal species such as Creeping Thistle *Cirsium arvense*, Common Knapweed *Centaurea nigra*, bramble *Rubus fruticosus* agg., Ragwort *Senecio jacobaea*, Broad-leaved Dock *Rumex obtusifolius*, Common Sorrel *R.acetosa*, Ribwort Plantain *Plantago lanceolata*, Greater Plantain *P. major*, Silverweed *Potentilla anserina*, Creeping Cinquefoil *P. reptans*, dandelion *Taraxacum* agg., Yarrow *Achillea millefolium*, Rosebay Willowherb *Chamerion angustifolium*, Scentless Mayweed *Tripleurospermum inodorum* and Creeping Soft-grass *Holcus mollis*.

Ponds

During a total of six visits to the ponds by the author from February to May the Compartment 4, and the north and south ponds were all full, with just one exception. On 18 February the south pond was only half-full, but all three ponds were frozen. No further checks were made until 10 July at which time the Compartment 4 pond was half-full, the north pond three-quarters full, and the south pond was very low. Throughout the rest of the summer and early autumn all three ponds were dry (RB). The next check by the author was not until 24 October; the Compartment 4 and south ponds were very low, but the north pond was three-quarters full. By 10 November the Compartment 4 and north ponds were half-full, whilst the south pond was only 20 per cent full. A final check on 12 December found all three ponds at maximum water level.

Biodiversity

Flora

In May 2010 the Norfolk Flora Group and the Norfolk Bryophyte Group both visited Great and Little Woods, and on 12 February 2011 the British Lichen Society did likewise. As a result of these visits the vascular plant list was increased to 349 species (excluding 16 microspecies of bramble), the number of mosses and liverworts was increased to 93 species, and lichens from 35 to 62 species.

Birds

There was one addition to the bird list for Great and Little Woods, and that was a Raven perched in a tree in Compartment 17 on 26 May. Other records of interest were the presence of a pair of Goshawks from late April until August. They were seen carrying sticks into the Larch trees in Compartment 9, but there was no evidence of breeding. There was no evidence that the Hobby bred in the Swanton Novers area this year, and the Turtle Dove now appears to have been lost as a breeding species. Two pairs of Common Redstarts bred in the Great Wood, but a Nightingale singing in Little Wood on 28 April only stayed for a day. All records are from Baker (2010).

Moths

A total of 4306 macro-moths of 226 species were recorded (Baker 2010).

Beetles (Coleoptera)

Appendix 5 in Sage (2010) listed the 616 species that had been recorded in Great and Little Woods up to the end of December 2009. However, one species, *Philonthus mannerheimi* (Staphylinidae) should now be deleted from the list, thus reducing the total to 615.

During 2010 a further 42 species (all collected in the Great Wood) were added to the list and these are detailed in Appendix 1. These additions bring the total recorded up to the end of December 2010 to 657 species. There were two species new to Norfolk – *Acrotrichis* (*s.str.*) *rugulosa* (Ptilidae) and *Microdota boreella* (Staphylinidae). Two further species in the latter family – *Datomicra dadopora* and *Dimetrota cinnamoptera* – are only the second records for Norfolk. The first record for *Datomicra dadopora* was from

the STANTA military training area on 24 March 1991 by Martin Collier. The second species, *Dimetrota cinnamoptera*, was found at Thompson Common on 12 May 1985 by the late Derek Lott and/or Tony Drane. Dr. Colin Welch has pointed out that *Microdota boreella* is a boreo-alpine species which he had not taken previously. It has no Nationally Notable status, probably due to poor distribution records.

Twelve additional species were added in 2011. On 6 May an example of *Zeugophora subspinosa* (Megalopodidae) was swept from vegetation in Ride 38. On 1 September two Staphylinid beetles sieved from a wood chip pile in Ride 72 proved to be *Pseudomedon obscurellus*, a Notable species, and *Coproporus immigrans* both of which are also new to Norfolk. The latter species is of particular interest since details of its occurrence in the British Isles have not yet been published, so at the time of writing it is not on the official British list. The first record would appear to be specimens taken by Peter Hammond from a woodchip pile in West London in January 2009. A visit by Andrew Duff, Martin Collier and the author on 16 October produced a further 10 new species. Small puffball fungi provided *Cryptophagus lycoperdi* (Cryptophagidae). Searching under bark, mostly of Scots Pine, yielded *Rhizophagus ferrugineus* (Monotomidae), and two Scolytids (Curculionidae): *Hylastes ater* and *Tomicus piniperda*. Three species of Staphylinidae (*Nudobius lentus*, *Omalium caesum* and *Phloeonomus pusillus*) were found in the same habitat. Another staphylinid, *Sepedophilus testaceus* (a Notable B species), was taken by sieving soft, rotten wood with small bracket fungi. Finally, *Aphodius prodromus* (Scarabaeidae) was found on vegetation. These 12 additions increase the total site list to 667 species.

Another species of interest, although it is not new to Norfolk, is *Uleiota planata* (Silvanidae) found by RCW on 26 June 2010 and by BS at the same site on 29 April 2011. It was listed by Hyman & Parsons (1992) under the family Cucujidae as a Notable A species found in ancient broad-leaved woodland. It had earlier been listed by Harding & Rose (1986) in the list of saproxylic beetles of pasture-woodlands, and later by Fowles *et.al.* (1999) who gave it a Rarity Score of 16, so it was accepted as a species useful in calculating both the Index of Ecological Continuity (IEC) and the Saproxylic Quality Index (SQI). However, Alexander (2009) mapped all records known to him and concluded that it is an established importation via the timber trade which is spreading rapidly, but does not warrant IEC or SQI status, or indeed any conservation status at all in Britain. The habitats in which the species has been found since it was first recorded in the 19th century have been pretty general but have included only very few classic old-growth sites, such as Windsor Great Park where it was not reported until 1962. Swanton Novers Great Wood is undoubtedly a classic old-growth site and *Uleiota planata* is certainly breeding there. This raises the question as to the source of this population since timber is not imported into the wood, in fact the reverse is the case. We shall probably never know the answer.

There were a few records of the Green Tiger Beetle *Cicindela campestris*, with three in May and five in June, and Baker (2010) states that there has been a run of poor years with the 2010 index being 80% below the long-term average. The larvae of this beetle excavate cylindrical burrows in the earth to depths of up to 30 centimetres or more. The most favoured habitat for this beetle in the Great Wood is the southern stretch of Ride 34 adjacent to Compartment 8 where it joins Ride 61 and the heather area. In May 2003 over 40 were seen there. It may be relevant to the decline of this species that in the winters of 2008/2009. 2009/2010 and 2010/2011 this section of the ride was deeply churned and rutted by the movement of heavy vehicles which may have destroyed many lar-

vae, and has left the ground surface heavily compacted. Recently extensive sweep-netting in Rides 61, 64 and 65 produced, other than ladybirds, only two beetles. This was on 26 June 2011 when there was very little wind and the temperature was 27° C, conditions that were ideal for beetles. Again, it may be relevant that during the winter of 2009/2010 all these rides were close-cut across their entire width, and subsequently most of the marginal scrub was removed leaving no interface between the edge of the rides and the woodland proper.

The number of rare or scarce species, using Hyman & Parsons (1992 & 1994) as the reference point, was 52 at the end of 2009, as shown in Table 1 in Sage (2010). In 2010 there were two additions to the list – *Tillus elongatus* (Cleridae) and *Ischnomera cyanea* (Oedemeridae) – both Nationally Notable (Scarce) Category B. This increases the number of species in that category to 39, and the overall total to 54. The addition of *Pseudomedon obscurellus* and *Sepedophilus* testaceus in 2011 brings the number of Nationally Notable B species to 41, and the overall total to 56.

Saproxylic beetles

In Sage (2010) the total number of saproxylix species listed in Appendix 3 was 93 with a total score of 393, giving a Saproxylic Quality Index (SQI) of 422.6. Four further species were added in 2010 – *Atrecus affinis* (Staphylinidae), *Ischnomera cyanea*, *Mordellochroa abdominalis* (Mordellidae) and *Tillus elongatus* – with scores of 1, 4, 4 and 8 respectively. These increase the total number of species to 97 with a total score of 410, giving an SQI of 422.7. The ecological details for these five species are as follows:

Atrecus affinis – under bark and in rotten wood of various trees, including conifers.

Ischnomera cyanea – larva develop in relatively soft white-rotting heartwood of a variety of broad-leaved trees.

Mordellochroa abdominalis – larva develop in dry sapwood of dead broad-leaved trees.

Pseudomedon obscurellus – a wide range of habitats.

Tillus elongatus – a predator of other beetles on old broad-leaved trees, and usually in dead heartwood of beech.

Index of Ecological Continuity

A minor correction needs to be made to Appendix 4 in Sage (2010) in that the heading for column 2 should read 'Group' and not 'Score', Both *Ischnomera cyanea* and *Tillus elongatus* , both Group 3 species, should be added to the list bringing the total number of qualifying species to 27, the IEC to 34, and the RIEC to 32.

Summary

Various aspects of the woodland management and their effect on habitat diversity are discussed. Visits to the Great Wood by specialist groups in 2010 and 2011 resulted in the list of vascular plants being increased to 349 species, bryophytes to 93 species and lichens to 62 species. A Raven seen on 26 May was an addition to the bird list. The list of beetles (Coleoptera) now stands at 667 species. The total of Nationally Notable B species is now 41, and the overall total of rare or scarce species is 56. The number of sapropxylic species known from the site is now 97. The Saproxylic Quality Index (SQI) increases from 422.6 to 422.7. Insofar as the Index of Ecological Continuity (IEC) is concerned the number of qualifying species is now 27, the IEC is 34 and the RIEC is 32.

Acknowledgements

I owe particular thanks to Dr R.Colin Welch for finding time to visit the wood thereby boosting the species list, and also for identifying several difficult species of Staphylinidae for me, especially *Coproporus immigrans*. Martin Collier kindly provided details of past records for several species. Thanks are also due to Bob Ellis and Frances Schumann for providing the list of vascular plants recorded by the Norfolk

Flora Goup on their May 2010 visit. Peter Lambley likewise provided the list produced by the British Lichen Society following their visit in February 2011, and Robin Stevenson provided the list of mosses and liverworts resulting from the visit by the Norfolk Bryophyte Group in May 2010. Last but not least I must thank the Natural England staff, Robert Baker (Summer Warden) and Ash Murray (Site Manager) for their cooperation.

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B Sage Waveney House, Waveney Close, Wells-next-the-Sea, Norfolk NR23 1HU

APPENDIX 1: Additional Species of Coleoptera Recorded at Swanton Novers NNR 2010

Species	Date	Capture
Anobiidae		
Anobium fulvicorne (Sturm)*	19.6.10	swept from under oak
Anthicidae		
Omonadus floralis (L.)*	19.6.10	by sieving wood chips in Ride 72
Stricticomus tobias (Marseul)*	19.6.10	by sieving wood chips in Ride 72
Carabidae		
Acupalpus parvulus (Sturm)	6.9.10	in litter heap in Ride 60
Badister bullatus (Schrank)	11.10.10	sieved from moss in Ride 68
Badister sodalis (Duft.)	2.3.10	sieved from litter heap in Ride 68
Bradycellus sharpi Joy	6.9.10	in litter heap in Ride 60
Perigona nigriceps (DeJean)	6.9.10	by sieving wood chips in Ride 62
Chrysomelidae		
Derocrepis rufipes (L.)	10.7.10	at base of Bush Vetch in Ride 69
Cleridae		
Tillus elongatus (L.)	15.7.10	under bark of oak in Ride 48
Cryptophagidae		
Atomaria (Anchicera) fuscata (Schon.)*	19.6.10	by sieving cut grass in Ride 60
Atomaria (Anchicera) nitidula (Marsh)*	19.6.10	by sieving cut grass in Ride 60

continued

Species	Date	Capture
Geotrupidae		
Geotrupes stercorarius (L.)	21.7.10	crawling on grass
Kateretidae		
Kateretes rufilabris (Lat.)	19.6.10	by sweeping marshy area in ride 57
Latridiidae		
Enicmus transversus (Ol.)*	19.6.10	by sieving cut grass in Ride 60
Mordellidae		
Mordellochroa abdominalis (F.)*	19.6.10	swept from figwort by N pond
Oedemeridae		
Ischnomera cyanea (Fab.)	19.6.10	by sweeping in Ride 71
Ptiliidae		
Acrotrichis (s.str.) *atomaria* (DeG.)*	19.6.10	by sieving litter heap in Ride 60
Acrotrichis (s.str.) *cognata* (Matth.)*	19.6.10	in Badger dung by Ride 70
Acrotrichis (s.str.) *rugulosa* Rossk.*	19.6.10	by sieving litter heap in Ride 60
Acrotrichis (s.str.) *sitkaensis* (Mots.)*	19.6.10	by sieving litter heap in Ride 60
Acrotrichis (Ctenopteryx) grandicollis	19.6.10	by sieving litter heap in Ride 60
Silvanidae		
Uleiota planata (L.)*	19.6.10	under bark of *Tilia* logs in Ride 71
Staphylinidae		
Acrotona muscorum (Bris.)*	19.6.10	by sieving wood chips in Ride 72
Atheta aeneicollis (Shp.)*	19.6.10	in Badger dung by Ride 70
Atheta crassicornis (Fab.)*	19.6.10	in Badger dung by Ride 70
Atrecus affinis (Payk.)	19.6.10	larva under bark of burnt larch log, Ride 61
Autalia rivularis (Grav.)*	19.6.10	in Badger dung by Ride 70
Bisnius fimetarius (Grav.)*	19.6.10	by sieving wood chips in Ride 72, and
Brachygluta fossulata (Reich.)*	19.6.10	by sieving cut grass in Ride 60
Datomicra dadopora (Thunb.)*	19.6.10	in Badger dung by Ride 70
Dimetrota cinnamoptera (Thunb.)*	19.6.10	in Badger dung by Ride 70
Gabrius trossulus (Nordmann)	6.9.10	wood chips in Ride 72
Gauropterus fulgidus (Fab.)*	19.6.10	wood chips in Ride 72
Microdota boreella (Brundin)*	19.6.10	wood chips in Ride 72
Phacophallus parumpunctatus (Gyll.)*	19.6.10	by sieving wood chips in Ride 72
Philhygra palustris (Kies.)*	19.6.10	by sieving cut grass in Ride 60
Philonthus debilis (Grav.)*	19.6.10	by sieving wood chips in Ride 72
Phloeonomus punctipennis Th.*	19.6.10	under bark of *Tilia* log
Quedius (Distichalius) cinctus (Payk.)*	19.6.10	by sieving litter heap in Ride 60
Quedius (Raphirus) picipes (Man.)*	19.6.10	by sieving litter heap in Ride 60
Rugilus orbiculatus (Payk.)*	19.6.10	in Badger dung by Ride 70

Total 42 species

* Identified by Dr Colin Welch

A biographical memoir of Richard Hamond – a unique Norfolk naturalist

R. B. Williams

Introduction

Until the Second World War, it was customary for the Norfolk and Norwich Naturalists' Society to publish in its *Transactions* memoirs of deceased members who had been notable scientists or were otherwise distinguished. Although more recently this has become less common, it has been thought appropriate to remember in this way the marine zoologist Dr Richard Hamond (1930–2010), a remarkable character in many respects. Dick, as he was always known to friends and scientific colleagues, died suddenly of heart failure on 22 July 2010 at his home, Scaldbeck House, Morston. His family has long been associated with the Norfolk and Norwich Naturalists' Society, and he was a well known and greatly valued member, having joined in 1949, and serving as President for 2001–2002.

Nobody who met Dick Hamond ('It's Hamond with *one* 'm'!') could ever forget him. Friends could be assured of an effusive greeting delivered in his distinctively loud, fruity voice with his echoing laugh, head thrown back to reveal a couple of gold tooth-fillings. It might be said of Dick that he lived two centuries too late – he certainly had many of the characteristics and attitudes of an archetypal eighteenth-century squire. A somewhat overwhelmed young lady, having just met him for the first time, was afterwards heard to remark 'I didn't think anybody spoke like that any more!' A broad, open face with pale skin, penetrating blue eyes and blond, almost white, hair made him so sensitive to the sun that even on relatively overcast days, he almost always wore one of his wide selection of protective sou'westers and other headgear. The rest of his imposing frame – about 5' 10" and 17 stone – was usually attired in a stained and tattered fisherman's smock or, on more formal occasions, in a shabby mackintosh. Even when he lived in Australia, he invariably dressed in his Norfolk smock and a battered straw hat, repeatedly mended with masking tape.

However, this somewhat down-at-heel appearance belied a distinguished ancestry, of which Dick was enormously proud. The key to fully understanding his personality and the pivotal events in his life is to be aware of his carelessness of convention, his single-mindedness in pursuing only the things that really interested him and his eccentric mischievousness. As his sister Mary has observed (Athill 2010), he held steadfastly to some amazingly provocative beliefs, much too controversial for the sensitivities of many. However, Dick was perfectly well aware of the effect, whether amusing or irritating, that he had on people, and would often play on this. He was essentially a loner, lived much of his life in genteel poverty, and never married. Although he always had an eye for a pretty woman, marriage, as he explained to a friend, would have been incompatible with his unconventional lifestyle. Typically, he once wrote, 'I simply play it very cool, which has the added advantage of being inexpensive!'

This memoir provides insights, by those who knew him well, into the eccentric life, work and legacy of this immensely likeable and intelligent, if sometimes exasperating and outrageously irreverent, man.

Family background

The Hamonds have lived in Norfolk for more than 500 years, producing a number

of eminent churchmen, soldiers and naval officers. Hamond's Grammar School at Swaffham was founded in 1736, endowed by the 1724 bequest of Nicholas Hamond, Lord of the Manor of Swaffham. The family is related to the Viscounts Templewood and Buxton and the Barons Walpole, and has other Norfolk connections including the Packe-Drury-Lowes of Prestwold, and many other prominent families such as the Barclays, Birkbecks, Frys, Gurneys, Hoares and Nelsons (yes, *that* Nelson!). Up to the seventeenth century, the family was mainly concentrated in South Wootton, but during the eighteenth and nineteenth centuries had migrated to West Acre, and many Hamond memorials are to be seen in the respective churches.

Dick's father (1883–1953) was a highly decorated soldier, Major Philip Hamond DSO and bar, MC. His first DSO (in 1902, the youngest ever recipient up to that time) was gained as a lieutenant of the Mounted Infantry, when he was wounded at Rooiwal in the Second Boer War (1899–1902). He was then commissioned in the Norfolk Regiment, retiring in 1909. He was the first Hamond to settle in Morston, renting Morston Hall in 1914, when on the outbreak of the First World War he re-enlisted with the Royal Norfolk Regiment. In 1916, he was awarded the MC while a temporary major of the Motor Machine Gun Service; his second DSO was gained in the Tank Corps in 1918. By July 1918 he had been seconded to Camp Colt, Pennsylvania, where, alongside a certain Major Eisenhower (later to become President of the USA), he helped to train the American military in tank warfare. Having returned to Morston, in 1921 he bought the parcel of land known as Scaldbeck from a Colonel Groom of Stiffkey; here he installed a First World War barrack hut, where he first lived, building a cottage and a barn in 1922 and Scaldbeck House during 1924–1928. Much of the timber for the house came from a grounded ship, the *Guenowle* which, complete with cargo, he bought outright from the captain for £60. Scaldbeck House was to become hugely influential in Dick Hamond's life, being his first and last home.

Early years

Dick was born in Norwich on 26 January 1930 to Emily Diana (1899–1982), Philip's second wife; his younger siblings from that marriage are Mary and Edmund (Ned). He also had four older half-brothers and sisters from Philip's first marriage, to Rita Gladys. Although he did not use the name among friends and colleagues, he was known by family and Morston locals as Dickon (an old English form of Richard). His early childhood, roaming around Scaldbeck and the Morston marshes and beyond, was idyllic. Something of a child prodigy, in due course he attended St George's Preparatory School (the choir school for St George's Chapel at Windsor Castle), where he was sent in anticipation of great developments in his musical abilities. Here, his notable talent as a pianist and organist was nurtured, and his love of classical music began to develop. From an early age, he became fluent in German, learnt from his governess whose family had been helped by Philip to flee 1930s Germany. Later, he became equally fluent in French. When aged 13 years, Dick left St George's to enter Radley College, Abingdon, where he took an active part in the intellectual activities of the school, joining the Natural History, Scientific, Musical and Art Societies. Although he did some rowing, he generally managed to avoid any other kind of games.

In common with many small boys growing up during the Second World War, young Dick found this a rather exciting experience and he was fanatical about warplanes. Demonstrating early taxonomic skills, he could recognize any allied or enemy aircraft not only on sight, but also by engine sound. His sketch books contain drawings, almost of a technical standard, of different aircraft, as well as depictions of dogfights in

which a Hurricane or Spitfire was naturally always victorious. He also drew impressive seascapes with flotillas of warships. Needless to say, these depictions of British air- and sea-power were regarded with little enthusiasm by his soldier father! Dick was doted on by his mother, but this apparently burdened him with perhaps unreasonably high expectations that, later in life, did not always coincide with his own objectives. The long-continued isolation from parental influence during his formative years, first as a boarder at his preparatory and public schools, continuing into his National Service, and then at Cambridge University, may well have given rise to his rather egocentric personality and stubborn independence.

In 1945, Dick became the proud owner of his first monocular microscope, a gift from his parents for having passed his School Certificate one year early. By June 1946, his incipient skills as a naturalist and artist, with a talent for public speaking were already evident, when he delivered a lecture on newts to the Radley College Natural History Society; a beautiful pencil drawing of great crested and smooth newts, made even earlier when he was just 14 years old, still survives (Figure 1). Although his sketch books contain many more newt drawings, it is nevertheless clear that his life-long love of marine zoology was by then already well established. During the war he would journey by train with his mother to the marine biological station at Millport on the Isle of Cumbrae, and in the immediate post-war years, he travelled even more widely with his younger sister Mary. During 1946 and 1947, they travelled on their own to France, ostensibly to improve their French, when Dick took the opportunity to visit the Roscoff marine station, returning home by way of Jersey and the Plymouth Laboratory of the Marine Biological Association of the United Kingdom. For Dick's sixteenth birthday, his parents' present was the composition fee of 15 guineas for life membership of the association. The budding marine zoologist immediately wrote to the secretary, F.S. (later Sir Frederick) Russell:

> I am greatly looking forward to seeing Plymouth Laboratory at the end of term. I do hope that it is all right for me to bring a couple or so of drawing books, & painting outfit generally, which I propose to fill with coloured sketches (!) of the animals in the Laboratory tanks. I have been to Millport twice: but I understand that Plymouth is on a far larger scale. [RH to FSR, 16 July 1946.]

Clearly Dick created a very favourable impression at Millport, since it was the Director, Richard Elmhirst, who recommended his election to life membership of the Marine Biological Association. In June 1948, Dick delivered his last lecture to the Natural History Society at Radley, this time on 'Crabs and their relatives' ('bountifully supplied with photographs and bottled specimens'), describing the British species, their adaptations, life histories, parasites and commensals; all in all, an impressive performance for one so young. It seems certain that this knowledge was acquired entirely by his own efforts, facilitated by the opportunities presented by the proximity of his home to the sea. His frequent visits to famous British marine biological stations provided many opportunities to become acquainted with influential scientists who were to assist him greatly in later life.

Even during his schooldays, Dick's notorious eccentricity was emerging; Wordsworth's famous epigram, 'The child is father of the man' seems particularly apt. In 1947 the mother of one of his school friends took her three children for a summer holiday to Blakeney. Since the family knew the Hamonds, Dick was invited to dinner one evening at the Blakeney Hotel (even then a rather exclusive establishment). Dick arrived straight off the marshes where he had been conducting some muddy investigation or other. His clothes fully reflected this activity, causing the maître d'hôtel to comment sniffily 'Before the war, gentlemen always dressed for dinner'. Dick's hostess promptly rose from her seat to retort 'Before the war, hotel staff would not have

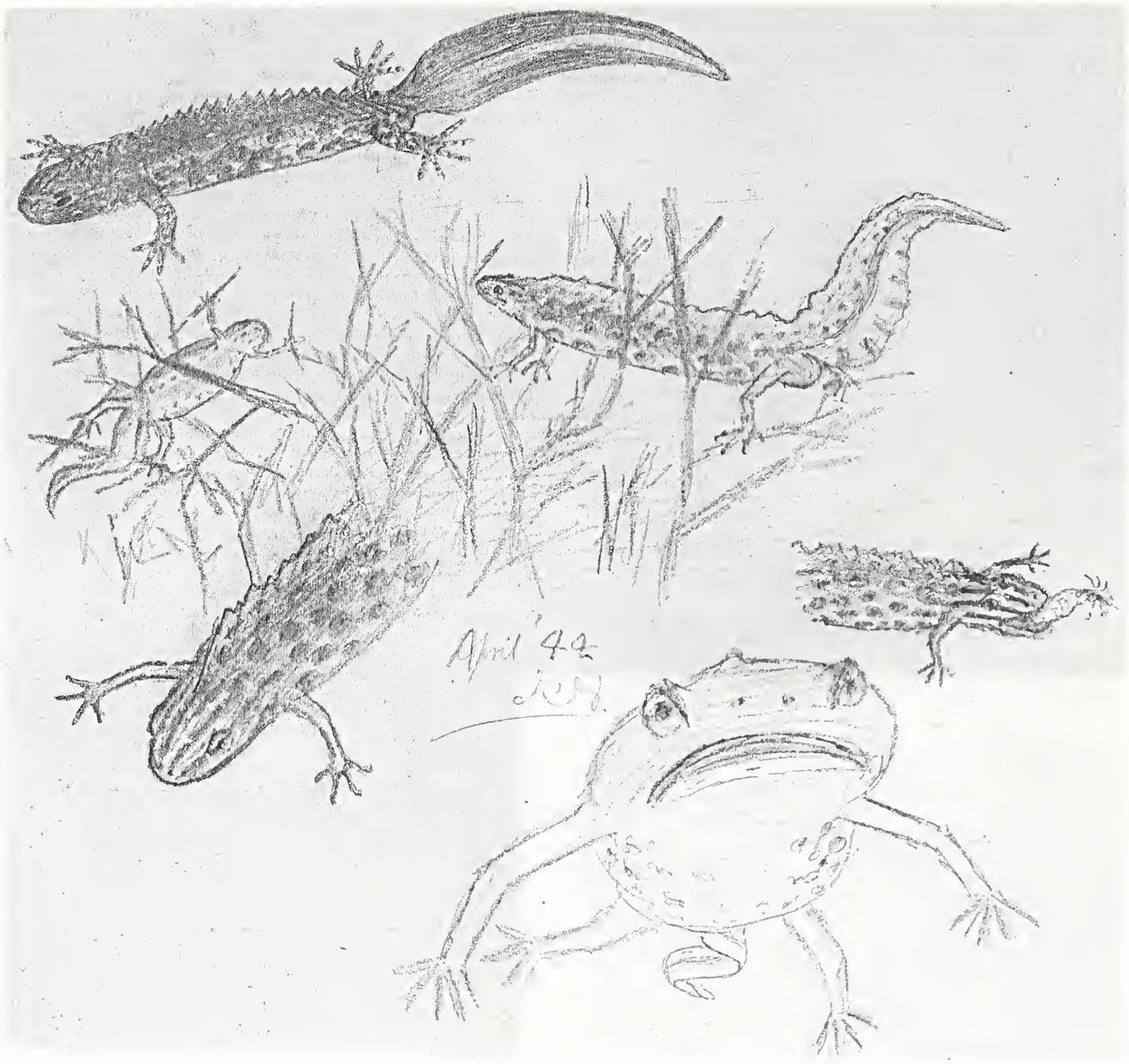

Figure 1. Great Crested and Smooth Newts: unpublished drawing by RH, April 1944.

dared to be so impertinent to any guest of mine in this establishment!' Dick, of course, was not at all put out, and clearly revelled in the attention this had attracted.

Army and university life

Immediately after leaving Radley, in July 1948 Dick's life was rudely interrupted by two years' conscription into the Royal Electrical and Mechanical Engineers. Nevertheless, 22052571 Pte Hamond was to write with surprising enthusiasm to Radley College from Lydd Camp, Kent:

> I am enjoying the Army very much as a whole and am now doing an elementary course at this camp which is to train me as a skilled (!) operator of A/A [anti-aircraft] equipment, predictors and searchlights. [RH, 15 October 1948.]

He was doubtless pleased that his skills in aircraft recognition could now be put to practical use, and he was duly transferred, owing to his father's influence, to Weybourne. It was during this period, so the story goes, that Dick was once lowered by his ankles into the pit below an anti-aircraft gun emplacement to make some electrical adjustments. Perhaps confused by the reversal of left and right due to his inversion, his reconnections resulted in the guns consistently pointing 180° away from the intended target! The enforced hiatus in his life did, however, enable him in 1950 to buy

his first stereobinocular microscope with his army pay accumulated at the end of his National Service.

In the early 1950s, Dick discovered motor cycles, owning several in succession, one of which was a Norton International, the model favoured by the famous TT racer Geoff Duke. However, an obsession with speed was Dick's undoing on more than one occasion, leading to crashes from which he nevertheless always miraculously escaped without serious injury. One can very easily envisage him in a leather flying helmet, a two-wheeled version of Kenneth Grahame's 'Mr Toad of Toad Hall'! Indeed, Dick and Mr Toad seem to have shared a number of personality traits, as will be seen.

In 1950, his National Service completed, Dick took up his place, deferred from 1948, at Peterhouse, University of Cambridge. He read botany, geology and zoology for Part I of the Natural Sciences Tripos, but gained only a third class in the Preliminary Examination in 1951. In the Part I examinations of 1952 he failed to obtain honours at all; he sat no further examinations and did not graduate. This unexpectedly poor performance most certainly did not do justice to Dick's recognized intellect and talent. But whatever the reasons for this setback, it did not discourage him from commencing his private marine research project at Morston. After a further three years, during which his father died in 1953, Dick determined to try university life again, this time in London. He entered Queen Mary College as a mature student in 1955, joining the Quekett Microscopical Club in the same year, serving as secretary of the student Biological Society 1957–1958, and finally graduating in 1959 with an upper second class honours BSc in zoology. In London, Dick owed much to his mother's financial support, as previously at Cambridge.

Now at last with a respectable degree, Dick embarked on a PhD programme at Newcastle University's Dove Marine Laboratory at Cullercoats. But away from his mother's steadying influence, things again went awry. It seems that the Director, Professor A.D. Hobson, and the Assistant Director, Dr H.O. Bull soon took against Dick, apparently because of his undisciplined approach to his work and cavalier use of aquarium facilities. Dick kept (and slept at) very odd hours, which greatly irritated Bull. On one occasion he was leaving the laboratory in the early afternoon when Bull met him on the steps and asked him where he was going to. At Dick's reply that he was off to a piano lesson, the Assistant Director was less than pleased! Before too long, Dick was sent down from the university, having completed only the 1959–1960 academic year there. Although Dr J.E. (later Sir Eric) Smith of the Plymouth Marine Laboratory, and also then on the Strategy Committee overseeing the running of the Dove Laboratory, wanted to challenge Dick's dismissal, this ultimately came to nothing. Dick always blamed Bull in particular for his downfall, and never forgave him.

But what to do now? Needing an income, Dick tried school-teaching, becoming Assistant Biology Teacher, January to August 1961, at King's Lynn High School. This was followed by a longer spell as Senior Science Master at Runton Hill School, Cromer, from 1961 to 1964. During all that time Dick was carrying out a study of the planktonic polychaete worms in Blakeney Harbour, and by 1961 he had become the Recorder of Marine Biology for the Norfolk and Norwich Naturalists' Society (see Appendix, item 2). But his heart was not in school-teaching, and in 1963 he registered as an external PhD student with London University to continue his research on polychaetes. This he pursued from home in the old barrack hut on Scaldbeck, already fitted out as a laboratory, that his father had first lived in. Curiously, his thesis does not record that he had a supervisor. Whilst it would have been quite typical of Dick to decide

that he did not need one, how he avoided this normally mandatory requirement for an external student is something of a mystery. Since his research was carried out at Morston, supervision from London would certainly have been difficult. Nevertheless, he obtained grants from the Royal Society of London and the Norfolk Research Committee, enabling him to supplement his work in Norfolk with visits to renowned marine laboratories at Roscoff, Naples and Kristineberg, as well as Plymouth, Millport, Cullercoats, Menai Bridge and Lowestoft. To Dick's alarm, the future of his research was threatened almost immediately after registration when he discovered that Lennart Gidholm of Uppsala University was working along very similar lines, but all was amicably resolved after an 11-day visit to Kristineberg with Gidholm in September 1963. Finally, after four years' work in relative isolation Dick submitted his thesis, entitled *Aspects of the Biology of Autolytoids*, which was examined by R.P. Dales of Bedford College, University of London, and Professor R.B. Clark of the University of Newcastle. The PhD was conferred on 23 October 1967.

Dick's wildly fluctuating results at Cambridge, Queen Mary College and Newcastle might have been inexplicable unless one understands that whilst he was always extremely successful at things that interested him, he could be an abysmal failure if pushed in directions that he did not like. Thus, Cambridge perhaps did not suit him because he was required to study a range of natural sciences that he was probably not particularly interested in; whilst at Newcastle he was expected to conform to behaviour that did not fit with his own priorities. Between those episodes, it is quite likely that he did so well at Queen Mary College because the bachelor's degree course concentrated on his beloved marine zoology. And finally, he was able to choose his own project for his PhD, undertaken at home where he no doubt delighted in the freedom to run his life how he wished. There, where his egoistic behaviour was not reined in by university teachers, he might again have gone astray, but the presence of his mother was crucial. There seems little doubt that he would not have finally obtained his PhD were it not for his mother's controlling influence keeping him focused on his work. Unfortunately, her well-intentioned cajoling became what Dick ultimately regarded as constant and unwelcome harassment. This issue became a major deciding factor in his emigrating to Australia.

Australia

Commonwealth Scientific and Industrial Research Organization

Two unrelated factors influenced Dick's next move. Firstly, on the brink of becoming a fully qualified marine zoologist, it was time to seek employment with a respected institution; and secondly, by now Dick had seriously fallen out with his mother, a sad situation in view of her natural maternal support and encouragement. His opportunity to escape (as he saw it) the family home was presented by an opening for a Research Scientist in Australia with the Commonwealth Scientific and Industrial Research Organization (CSIRO) at Cronulla, New South Wales. Dick was interviewed in London by the Chief of Division early in February 1967, and was appointed in April, conditionally on approval of his PhD thesis.

Three eminent referees provided frank and revealing assessments of Dick's personality and scientific skills – and all mentioned his musical talent. Incredibly widely read and with an enviable memory, he was described as having 'a mind like blotting paper'. The italics in the following extracts from referees' letters are mine, emphasizing passages reflecting Dick's character and talents, some aspects of which have already been observed. His referees clearly had his measure, and Professor G.E. New-

ell of Queen Mary College wrote:

> Hamond got a good upper 2nd class degree with us in 1959 ... *He came to us as a somewhat older man having had a rather chequered career at Cambridge.* The real key of Hamond's character is that he is a *dedicated naturalist and even as an under-graduate I reckon that he had a wider and more detailed knowledge of marine invertebrates than practically anyone else in the country.* Since leaving us he has been able, by virtue of having a small private income, to carry on with his studies on the Norfolk coast. As a result, he is about to submit a thesis for his Ph.D. degree on the life histories of the local polychaetes, and contributes a lot towards our knowledge of *Autolytus*.
>
> *Hamond does not fit easily into any category. He is supremely good at the things which interest him ... but he is not a good experimental zoologist. He is essentially a one-track minded man* but I think that he might be a very good person for this job.
>
> He is also an extremely good and gifted pianist, and is *well read in a variety of subjects. As regards his character he is a rather breezy extrovert* and would I think get on well with everybody ... *he would work immensely hard and I think be very productive.* [Professor G.E. Newell, 21 February 1967.]

Dick's long-term acquaintances with eminent Plymouth Laboratory scientists now paid off. For instance, F.S. Russell wrote:

> I have seen Richard Hamond at intervals *ever since as a boy he used to come into the laboratory to study marine biology in which he has always been keenly interested.* He should be very suited for research on ecology of larval plankton.
>
> I cannot speak much on his ability to work in a group of scientists. I have only met him from time to time, and *always found him a very likeable person, but I think he has been much on his own.* He is a very talented pianist. [F.S. Russell, 28 February 1967.]

Russell was clearly very perceptive regarding Dick's long isolation, which eventually left him a rather lonely man. But it was J.E. Smith who seemed to understand him the best:

> *Hamond is a very gifted taxonomist.* He is interested in the systematics of marine animals both from the plankton and the benthos for a number of years and *he has shown great initiative in carrying on his work of identification in surveys of the North Sea plankton while holding a teaching post in a school.*
>
> I regard him as fully capable of carrying out independent research for *he is no mere lister of species.* His papers always contain *good discussions of the implications of his taxonomic findings.* I think he is fully capable of opening up problems when he is provided with good material to observe.
>
> *Hamond is a most unusual character. He has the capacity to talk himself out of any job* which is a very great pity for *he is basically a very sound scientist,* but however *still finds it rather difficult to reserve his judgement of people.* I personally find this rather refreshing, but *I would want to have it in small doses.* Of one thing I can be sure, Hamond's peculiarities of personality are more likely to make an impact during the first few weeks of his taking up a new job than when people get to know him.
>
> To be brief, he is a very good scientist, *a man of considerable culture,* he is for instance a remarkably good pianist, but *one must exercise a little patience with him at the beginning of an acquaintance.* [J.E. Smith, 21 February 1967.]

If anything, Smith rather understated Dick's 'judgement of people'. For instance, on learning of some perceived mismanagement of Titchwell Lagoon in 1971, he railed against 'the halfbaked Philistines, who squat on Councils and other bodies'. He was even more scathing about the error-infested proofs of one of his papers containing 'various blemishes sedulously left unaccounted for by the printers (that race of somnolent morons)'.

Of these eminent referees, it was perhaps Newell who exercised the most influence, as Dick recognized in an old *curriculum vitae*: 'Through the good offices of the late Professor G. E. Newell, [I was] recruited as a Research Scientist by the CSIRO even before my PhD had been submitted'. G.F. Humphrey, chief of the CSIRO Division of Fisheries and Oceanography, having considered the referees' reports and recommending Dick's appointment, summarized well his key characteristics:

> I think Hamond's personality will fit in well with those with whom he will come in contact. *Hamond must have worked very hard to accomplish what he has. He is a person without guile and lives only for his work and his music. He is an Englishman to the core* but seems well able to look after himself in the life we lead at Cronulla. [G.F. Humphrey, 13 April 1967.]

Having landed the job, Dick's journey to Australia very nearly ended in his demise. Although originally allocated a first-class sea passage to Australia, at the instigation of his chief this was changed to an economy

air-fare to facilitate visits to India and Japan *en route*. The ill-fated BOAC flight BA 712 (call-sign Whisky-Echo) from Heathrow on 8 April 1968 lasted only three and a half minutes, during which a disastrous fire caused an engine to fall off. This and the subsequent emergency landing (Figure 2; see p. 34) were all coolly photographed by Dick from seat 19A, over the wing with the burning engine. Evacuation was achieved in a mere 90 seconds, during which Dick and a young sailor had the presence of mind to rush two dazed women away from the burning plane to safety. Sadly, five lives were lost, including a stewardess, Barbara Harrison, who was posthumously awarded the George Cross.

Once Dick had composed himself, he characteristically volunteered to be interviewed by an ITV news team. Later, resting in a hotel at Heathrow, he saw the interview on television, which to his satisfaction saved him the trouble of contacting family and friends to let them know he was safe. Returning to Morston the day afterwards his fishermen friends at the local hostelry told him that they had not been worried at all, as they knew it would take more than an air crash to get rid of him! Dick subsequently sold his story and photographs (cannily retaining the copyright) to a number of national and international newspapers and magazines, including *Paris-Match, Reader's Digest, Quick, Illustrated London News* and *Australasian Post*, the rich proceeds of which formed a useful financial buffer during his extended residence in Australia. On 23 April, Dick was on his way again to Sydney by air, this time in first-class, via the Indian Ocean Biological Centre at Cochin, India; the Marine Biological Stations at Misaki and Seto, and the Tokyo Museum, in Japan; and finally the Agriculture and Fisheries Department in Hong Kong. At last arriving in Sydney, he described again the fate of BA 712, this time in an interview on Australian television (Figure 3). Forty years on, the tragedy was commemorated by a

Figure 3. Dr Richard Hamond, 2 June 1968: photographer unknown.

book (Ottaway 2008); Dick had previously written two personal accounts (Appendix, items 28, 52).

Although the CSIRO Division of Fisheries and Oceanography was involved much more in ecological than in taxonomic work, Dick had managed to persuade his new chief to allow him to work initially on identifying collections of planktonic polychaete worms, following on nicely from his PhD research. He settled comfortably into that role, and completed his year's probation on 14 May 1969.

In 1970, Dick was assigned to CSIRO's major Northern Prawn Project. All continued satisfactorily until mid-1971, when problems began to arise after his chief was transferred:

> At the moment life here is a bit tiresome; following a 'palace revolution' (actually, administrative changes from higher up, including the transfer of my boss to another part of CSIRO), it appears that

> the work he gave me to do, rearing larval prawns from known mothers in order to afford a taxonomic basis for work on planktonic larvae, was not wanted; consequently, all this has been shelved, and my disappointment is acute; but apparently that is always the way – no sooner does anyone threaten to do some real marine biology then it gets squashed, whereas so long as one docilely does b- all but is connected in some way with a commercial-sounding project, then one is all right. All that I have left is to sort endless plankton samples from the Gulf of Carpentaria ... On the other hand, the pay here is much better than at home, and I am very fond of my colleagues; but I don't mind saying that, for the first time since I got here, I am looking about for another job. Goodness knows what I will get, or where, or even when; but this does not matter, so long as I am free to do the sort of research I really want. [RH to RBW, 7 July 1971.]

Again Dick's determination to do only what really interested him clearly emerges. During August to October 1971, he took leave to visit the UK, and it seems very likely that the objective was to attend an interview for some job opportunity. If that were so, it must have been unsuccessful; and to Dick's dismay, immediately after his return to Cronulla in November, he was dispatched to Karumba on the Gulf of Carpentaria.

There, it seems that he saw a chance to turn events to his advantage, for after only two days, he returned on his own initiative to Cronulla, complaining of an inability to tolerate the tropical conditions. If Dick had hoped that his precipitate action would force a transfer to some taxonomically based project elsewhere in the CSIRO, he was to be disappointed because no such post was available and he was subsequently retrenched (the Australian euphemism for 'made redundant'). He was, in fact, lucky not to have been dismissed instead. Nevertheless, the CSIRO, accepting the fact that they had employed him with full knowledge of his predilection for taxonomic work and lack of experience as an ecologist, treated him as generously as the terms and conditions of the post would allow. He was accordingly granted six months to find alternative employment, enabling him to benefit from certain pension and holiday rights. Even after his departure, the CSIRO kindly lent him a phase-contrast microscope to facilitate his further private work.

Ultimately, it was Dick's ejection from the CSIRO post that tested his mother's patience to the limit and resulted in the final breakdown of their relationship. After a subsequent visit to the UK in 1975, he never saw his mother again.

University of Melbourne

Finding a new post was not easy. As Dick complained,

> You may find it incredible, but I am sorry to say that it is true, that I find myself one of 300 for every job I go in for, and am getting so sick of it that I am considering earning my living at something else and keeping marine zoology as a hobby. [RH to P.G. Moore, 25 March 1973.]

Indeed, he was always optimistic about amassing great riches as a result of some masterly financial coup or selling the rights to his innovative microscope designs. From the 1970s right up to his death, he would drop tantalizing hints in letters or telephone conversations about the existence of a 'Master Plan' or a 'Grand Design' or a 'Masterplan for Success', with the stern warning that this must remain absolutely top-secret, although that was what he told everyone! Nevertheless, it would have been impossible for these plans to have been anything other than top-secret, since, loquacious as he usually was, this was the one project that Dick never revealed to anybody! A typically obscure example was:

> The Grand Design is now starting to look hopeful, so copepod and all other natural history-type work is having to take a back seat. [RH to RBW, 15 November 1973.]

Two years later, in 1975, there was a guarded reference to some business partner, which may have had some connection with his UK visit that year, but it was never mentioned again. Sadly, whatever plans Dick may have been working on at various times, none ever came to fruition.

Fortunately, after a frustrating struggle, Dick eventually found a safe haven in late

1973 with the University of Melbourne, where he became a Demonstrator and an Associate Research Fellow. From 1974 to 1979, he taught microscopy to final-year honours students in the Department of Zoology, and by this time was increasingly concentrating on microscopical techniques to improve the speed and accuracy of drawing copepods. An active member of the Field Naturalists' Club of Victoria, he also lectured to members on the same subject. Since he was largely dependent on short-term grants supplemented by some teaching, there were several times when the money almost dried up, but Dick managed to survive despite the setbacks, and continued with his beloved harpacticoid copepod research.

Immediately after leaving the CSIRO in 1972, he began the enormous task of revising the taxonomy of marine and freshwater members of this difficult group on a worldwide basis, beginning with New Zealand and Australia. He travelled widely, including the coasts and interiors of Victoria and Tasmania; the Great Barrier Reef; and New Zealand and the Chatham Islands. Colleagues also sent specimens from the UK, the USA, and various tropical islands around Australia and New Zealand. But Dick was becoming increasingly homesick, although he knew that the UK could not offer opportunities for research that matched those that he had in Australia:

> I still feel rather lonely sometimes, and of course long to get back, but goodness knows how I will make a living if I do! And at the moment I am on such a good thing here that it would be criminally silly to do anything to hinder it in the slightest. [RH to RBW, 11 August 1977.]

Nevertheless, his employment at Melbourne was at times rather precarious:

> Everything here is being dedicated to the final great write-up of all my harpacticoid work for the last five years – a mighty task! And after that I don't know what I will do, because Melbourne University cannot pay me anything after New Year's Day 1979 ... [RH to RBW, 20 October 1978.]

However, Dick was apparently reprieved, and his persistence began to pay increasing dividends:

> My immense revision of the Harpacticidae is dragging slowly to a close and I have put in for a grant to work up all the non-marine harpacticoids of Australia, being one of a gang of workers on freshwater entomostracans that we have here at the moment ... my share of this work will probably take three years from next July ... I long to get home, but goodness knows when this will be! [RH to RBW, 4 October 1979.]

> Needless to say, Melbourne University collapses with the giggles whenever it even thinks about me, so they have never got around to chucking me out, and in fact the money is still coming in (my next grant has just been announced.) ... All this in a rather cramped flat ... [RH to RBW, 14 February 1980.]

> After turning up here 8 years ago as a waif on the doorstep, I have now got them fighting to keep me!! [RH to RBW, 12 March 1980.]

His confidence now reasserting itself, Dick's academic ambitions began to grow:

> At the moment I have just over the minimum for a D.Sc. ... whereas the present attempt is upon the Melbourne D.Sc., the later stuff will be launched at one from my alma mater London; i.e. I am after a double! [RH to RBW, 12 March 1980.]

But a higher doctorate submission, being far more demanding than a PhD thesis, requires a great deal of preparation, and it was not until 1985 that Dick was able to complete his documentation for the Melbourne DSc assessment, by which time his permanent return to the UK was imminent. He submitted eleven published papers on harpacticoids (Appendix, items 18, 23, 29, 32, 39–44, 48), plus two massive unpublished typescripts. The first of those typescripts, on the non-marine harpacticoids of Australia and New Caledonia, comprised 152 pages of text and 934 drawings and was eventually published in 1988; it is still a benchmark paper (Appendix, item 55). The other, on the Harpacticidae, amounted to 149 pages of text and 672 drawings. Although submitted in 1983 to the journal *Marine Invertebrates of Scandinavia*, it was in fact a complete revision of all the European species based on the experience of 20 years. Regrettably, Dick withdrew that typescript after on learning from the editor that it did

not conform to the format of the journal. A later idea to publish it as one of the Linnean Society synopses also came to naught. It is unfortunate that the included descriptions of two new genera and three new species will never be seen in print. Perhaps discouraged, he never resubmitted this monograph anywhere but some parts relevant to north-western Europe were later incorporated in the Linnean Society synopsis of *Marine and Brackish-water Harpacticoid Copepods* (Appendix, item 59). The vast number of detailed drawings contained in these papers and typescripts demonstrates vividly why Dick worked so hard on the development of microscopical and drawing techniques for copepod taxonomy.

Despite the huge volume of work submitted, Dick was not awarded the DSc he coveted. He was still awaiting the examiners' decision when he had to return to the UK to attend to his recently deceased mother's estate, and therefore mischievously decided to hold a jokey 'mock ceremony' in hopeful anticipation of his obtaining the degree, because he knew that he would not be returning to Australia. The surviving photographs show Dick, wearing the full academical robes of a Melbourne DSc, cavorting in an extremely bizarre manner on the steps of the Department of Zoology in front of an astounded throng of onlookers. This certainly did not go down well with the senior members of the department, who felt that it was entirely inappropriate and declined to attend the photo session. The whole affair was, as a mutual friend later commented, 'both hilarious and tragic. So typical of Dick!'

Despite the vicissitudes, Dick described his residence in Melbourne as the best years of his life, and in 1979 he surprisingly became an Australian citizen. Although his motive seems unclear, it may be more than coincidence that at the time he was looking for a new post; perhaps he only saw citizenship as a potential advantage when seeking employment, since he never mentioned it to friends or family. Dick finally returned to Norfolk after seventeen years in Australia, moving into Scaldbeck House, his childhood home, in October 1985 (his mother having died in 1982).

Reminiscences

Friends of Dick who have visited Scaldbeck House never fail to recall the Spartan conditions there. Typically, on arrival guests were directed to a sparsely furnished room containing old-fashioned iron bedsteads, and presented with a huge pile of sheets and blankets (it was bitterly cold in winter) to make up their own beds. That ritual completed, they were usually ushered into the untidy, overcrowded kitchen, where a choice of innumerable varieties of tea would have been offered. Victualling was always a haphazard affair. Guests would sometimes have to go into Blakeney to buy provisions and cook for themselves, because Dick would be too busy elsewhere in the house. Nevertheless, if they chose to eat elsewhere (which they usually did), Dick was never known to refuse an offer of a free dinner. He was extremely enthusiastic about Asian cuisine, and he knew every Chinese, Thai and Indian restaurant for miles around. The guests' car would always be commandeered, and Dick would shout directions from the passenger's seat, often just too late to take a crucial turning, when a hazardous reverse might then be needed! Often, unexpected detours were sprung on the driver in order to view various local sights and monuments to eminent Norfolk personages, about whom Dick would always have some historical fact or anecdote to relate.

Usually, if a guest was unfortunate enough to be without a car, meals at Scaldbeck House could consist of little more than multiple cups of herbal tea accompanied by a few elderly biscuits. Once, a fellow copepod enthusiast from Belgium had spent an exhausting day without a lunch-break examining specimens, and at nine o'clock

that evening, desperately hungry, he diplomatically enquired when they might be having dinner. Dick had clearly not considered this possibility, but casually asking his guest if he liked Brussels sprouts and receiving a positive reply, he simply took an unwashed stalk of sprouts, dropped it into a pan of water, and 'dinner' was ready in six minutes! Inevitably, it was rounded off with Dick's home-made nettle tea. On one rare occasion, however, my wife and I were treated to one of his own Thai curries, which took some hours to prepare and cook. Our abiding memory is that of Dick, in his heavy smock, constantly stirring pans on his ancient Aga cooker, using the ragged grey cloth hanging on its front rail variously to move hot items around, wipe up spills and mop his heavily perspiring brow!

Dick's general domestic practices could be quite puzzling or even alarming to visitors, especially when they stumbled on one of his collections of bottles of marine specimens in the bath, or a bucket of live whelks under the scullery sink. One inquisitive guest, quietly peeking into a dingy ground-floor room with closed curtains, was astonished to see a large dining table neatly laid out with several place-settings, apparently untouched for years, somewhat redolent of Dickens's description of Miss Havisham's fictional abode. On the first floor were Dick's office, library and specimen store, to which few were granted access. On his desk sat an ancient manual typewriter, which had travelled with him to Australia and back. Anything that Dick produced, whether a letter or scientific paper, is immediately recognizable since his habit was to continue typing each line as far towards the right-hand edge of the page as possible before hitting the carriage return, occasionally inserting a hyphen in a broken word if he noticed in time. Letters and typescripts of scientific papers were usually on the back of previously used sheets, old bills or opened-up envelopes. Ever economical, when he returned from Australia Dick shipped large quantities of similar salvaged paper and empty Vegemite jars (to hold specimens) to the UK. The huge piles of empty cereal boxes in his kitchen, which many visitors must have puzzled over, were intended for cutting up to use in his card index system or for making folders and dividers for specimen containers.

A well-known aspect of Dick's single-minded impatience was his tendency to arrive without warning at one's home or workplace for a chat; when he had an idea, it had to be addressed immediately! It is common knowledge both in the UK and Australia that Dick could clear whole museum departments of staff as news of his arrival spread like an advancing tsunami. It was not that he was particularly difficult, only that he could be so time-consuming with his often impractical ideas and personal focus on copepods. He also could never resist proffering his advice on almost any topic, which irritated some people. Few of Dick's zoological associates can not have been treated to his detailed description (he eventually published it – Appendix, item 58) of how to sit correctly at the microscope.

As one Australian museum curator recalled, he was usually keen to report on his progress with the two enormous typescripts on harpacticoids for his DSc submission, carried in an ancient brown leather briefcase that he would open with a flourish to reveal bundles of the usual recycled paper: 'I remember his visits as being entertaining for a while, but after a time I wondered if he would ever leave!' It must be admitted that Dick's loud, loquacious nature was not to everybody's liking, and that was no doubt what Sir Eric Smith alluded to when he commented that Dick could talk himself out of any job! Another example of his single-mindedness was recounted by one of his weekend guests at Scaldbeck House. Answering a knock at his bedroom door one evening, he found Dick standing there

dripping wet, with only a towel clutched around his ample pink abdomen, wanting to discuss an interesting thought that had occurred to him during his ablutions.

A notable element of Dick's eccentricity was his child-like delight in scurrilous jokes and scandalous stories. There can be few who knew him well and had not been regaled with his colourful anecdotes and limericks, many being decidedly towards the blue end of the spectrum! This predilection for shocking his listeners took some getting used to, since it was a characteristic quite at variance with his more cultured attributes. He had a marked tendency to the theatrical, and one could not help but be impressed by an astounding memory that enabled him to recite for minutes on end his favourite Shakespearian speeches, or poems by Hilaire Belloc, replete with appropriate male or female voices and regional accents when called for. In fact, Dick was a great mimic, and his anecdotes of life in Morston or his time in Australia were invariably delivered in the Norfolk dialect (which his father could also imitate well) or a colonial accent. However, his lack of respect for authority and iconoclastic tendencies did not endear him to some of his acquaintances. This may well have been a contributory factor in his failures to stay the courses at Cambridge and Newcastle Universities. Nevertheless, some older zoologists seemed to be willing to overlook these personality traits, and as already mentioned Dick enjoyed considerable support in his early research from certain influential personages. In due course, he came to know many of the eminent marine zoologists of his time, both at home and abroad.

Dick listed his hobbies as marine biology, classical music, exotic cooking, microscopy, heraldry, astronomy and shooting. He owned hundreds of tape recordings of classical music (his 'catalogue' consisting of hand-written lists of titles on recycled paper) and had a particular love of Chopin's work. It was a great pity that Dick never played the piano again after his return from Australia, the family Steinway having been sold some years before. In Australia, he had developed a taste for Asian food and at one time intended to write a book on oriental cooking (another potential money-making plan that never materialized). Complementing his interest in heraldry, he had an amazing memory for the ancestries of the gentry and titled families of Norfolk. As might have been expected, Dick's approach to some hobbies was decidedly unconventional. He used to keep a 12-bore shotgun at the ready, so that when any unsuspecting pheasant or woodpigeon appeared in the wood behind his house, he would blast it from an upstairs window. A personally memorable occasion was the arrival in the post of a shoe-box containing a brace of half-decomposed pheasants, with the hurried note 'Eat immediately – hung for 15 days'.

Scientific work

Dick Hamond's work on his beloved Norfolk is distinguished not only for its scholarship, but also its remarkable thoroughness and historical context. From the extensive saltmarshes and their creeks, over the sandy and rocky shores, to the offshore depths, he employed every available means to discover their many zoological treasures. He was fortunate in 1950 to take part in a two-week cruise over the Dogger Bank on Captain C.A.W. Chapple's Grimsby trawler *Romilly*; he wrote an account of this that was never published. Offshore waters were subsequently sampled from his father's clinker-built crab-boat, named *Chunk Harvey* after a notorious eighteenth-century pirate, which was built to order by Johnson's of Sheringham. Further help was obtained from fishermen of Wells-next-the Sea, Stiffkey, Blakeney and Cley-next-the-Sea, who would bring him the 'rubbish' from their trawl nets and crab-pots. After his return from Australia, Dick acquired a larger more seaworthy crab-boat, the *Orion* which enabled him to work up to 32 km offshore, as

described in his Presidential Address to the Society in 2001 (see Appendix, item 61; and for another photograph of *Orion*, see Williams 2011a). No doubt his boat was named after a favourite constellation, a sketch of which, as seen from Melbourne, was found in Dick's papers.

Dick's life's work began by defining, describing and surveying the Norfolk marine area (Appendix, items 2, 4, 12, 20), providing accounts of his collecting methods (Appendix, items 7–9, 13) and laboratory techniques (Appendix, items 16, 22), in which he was greatly assisted by loans of instruments from the National Institute of Oceanography. As this labour of love developed, wide though his coverage was, he became especially expert on several particular groups. His first publication was in 1957 on the Norfolk Hydrozoa, with a supplement in 1963 (Appendix, items 1, 5). As always, he not only listed the species, but also unravelled their various taxonomic complications and geographical distributions. Thirty-two years after his last work on British Hydrozoa, his expertise in the group had not waned, as Dr Paul Cornelius's 733-page long Linnean Society synopsis of the *North-west European Thecate Hydroids and their Medusae* of 1995 records: 'Dr. Richard Hamond bravely read the entire typescript at least four times. He added numerous comments from his long and detailed experience, and lent dozens of important specimens.' This was typically generous of Dick, who would never fail to expend considerable time and effort in reviewing draft papers sent to him for criticism. His detailed letters would often include long sections beginning SRW (= suggested re-wording)!

Gradually, the phyla of Norfolk marine invertebrates were treated one by one from the 1950s right up to 1997 (Appendix). By September 1966 Dick had already recorded about 1,050 species in Norfolk. 'Of the species I have listed, three or four – possibly more are completely new to science.

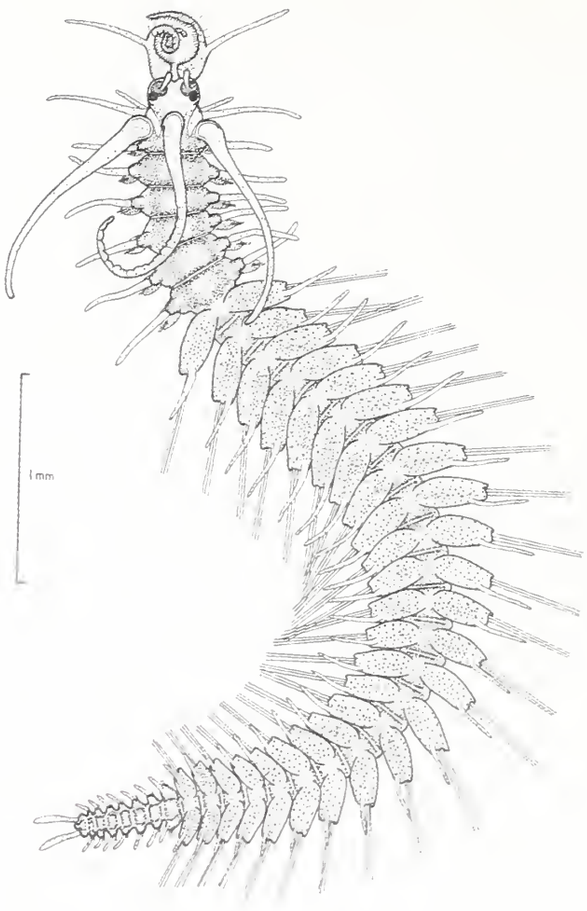

Figure 4. The syllid polychaete *Proceraea cornuta*: drawing by RH from Zooplankton Sheet 113, Fig. 2a (1967), reproduced with permission of the International Council for the Exploration of the Sea.

Between 20 and 30 species are new to the British Isles and at least 700 are new to Norfolk' (Pollitt 2010). By 2001, he could claim to know of 1,358 Norfolk species of marine invertebrate (Appendix, item 61). Along the way, Dick's work on the faunistics and biology of polychaete worms led to a series of papers (Appendix, items 3, 10, 15, 24–26, 38, 49) between 1963 and 1974, mostly culled from his 1967 PhD thesis. From 1968 a preponderance of papers on copepods, particularly harpacticoids, began to emerge (Appendix, items 17, 18, 21, 23, 29, 32, 36, 39–44, 47, 48, 54), culminating in his 225-page monograph on the non-marine canthocamptid copepods of Australia (Appendix, item 55) and his contribution of the text and illustrations for the family Harpacticidae to the Linnean Society synopsis of *Marine and Brackish Water Harpacticoid*

Copepods (Appendix, item 59). Incidentally, during the planning of that volume in 1987, Dick was apparently still carrying about his two still-unpublished *magna opera* in his ancient briefcase. His considerable artistic skills were employed in illustrating his own papers with fine drawings of protozoans, hydroids, medusae, brittle-stars, polychaetes, mysids, amphipods and copepods (e.g., Figures 4 and 5). He was also an accomplished macrophotographer and photomicrographer.

Although after Dick permanently returned to Norfolk in 1985 he still made offshore plankton-netting and dredging trips, he did very little work on his catches unless they happened to be copepods. Perhaps it was because of his disappointment at failing to secure a DSc, or perhaps because he was always trying to solve his more pressing domestic problems, that Dick seemed to lose enthusiasm for zoological research after his return to the UK. He published only seven items (Appendix, items 55–61) in the 25 years following his return from Australia, and most of that material had been accumulated before 1985. During 1986, he attempted to secure a taxonomic post in the UK, narrowly missing out at Edinburgh University, but after that he seemed to give up. However, in response to a survey of members of the Marine Biological Association just three months before he died, he registered an interest in marine pheromones, no doubt derived from his PhD research, over 43 years earlier. He had published one paper touching on polychaete sex-attractants (Appendix, item 49), and at the time of his death had three more in draft.

From 1985, however, he still hosted occasional visits of Norfolk & Norwich Naturalists' Society members to the rocky shore at West Runton and took up his place again as the Society's Marine Life Recorder, which he occupied until only a few months before his death. He could always be called upon to identify and record marine invertebrates and fish for naturalists in East Anglia and way beyond. In 1987, Dick joined the Royal Microscopical Society, and in 1998, the Porcupine Marine Natural History Society (named after a research vessel, not the mammal). He would attend Porcupine meetings

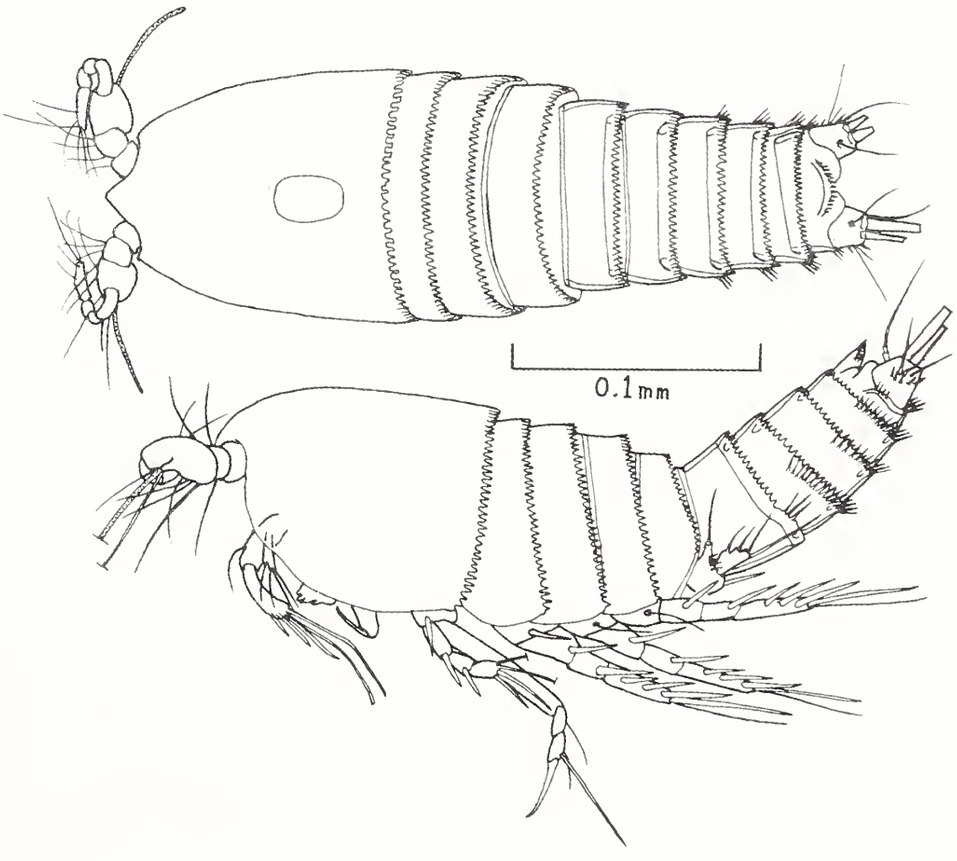

Figure 5. The harpacticoid copepod *Canthocamptus longipes:* drawing by RH from Invertebrate Taxonomy, vol. 1, no. 8, Fig. 66A & B (1988), reproduced with permission of CSIRO Publishing (http://www.publish.csiro.au/nid/121/issue/1759.htm).

if conveniently close enough in East Anglia, but would often fall asleep in his car while others were collecting specimens – he had probably seen them all before. Nevertheless, during the evening's socializing in some local public house he would always come alive when entertainment was called for – dull, he never was! The last such meeting he attended was in 2005.

Continuing the work begun in Australia, Dick's attention turned more and more towards the development of low-cost techniques for improving the performance of microscopes and methods for the rapid production of accurate drawings of his favourite animals, the amazingly complex copepods. His great skills and experience in this field were essential to his papers on harpacticoid taxonomy, but also contributed enormously to the success of the Norfolk & Norwich Naturalists' Society's Microscopy Group. He would attend all their meetings, despite the long drive from Morston to Norwich and back, invariably taking his favourite Olympus microscope fitted with phase contrast and Nomarski interference contrast. Dick owned an impressive collection of stereomicroscopes and compound microscopes. Using an optical bridge, he built a comparison microscope, which facilitates examination of specimens in pairs. Two microscopes connected by the optical bridge facilitate a split-view window enabling separate individuals or dissected appendages to be viewed simultaneously. As usual, Dick had a relevant anecdote, and would relate how the invention of the comparison microscope was a significant advance in forensic ballistics in the late 1920s, enabling the identification of bullets fired from the same gun.

This was just one of several methods adapted by Dick for identification and drawing of his favourite harpacticoid copepods. When living in Melbourne, he had set up in his cramped flat a typically Heath Robinson (but perfectly efficient) apparatus whereby he sat within a huge cardboard box that excluded light, facilitating the drawing of large projected images on the wall. Of course, another major reason for Dick's continuing his microscope work so enthusiastically was that he always hoped that his innovative methods would be financially rewarding. Sadly they were not, and so, when he realized this in the early 1990s, he decided he would lose nothing by publishing some of his results (Appendix, items 57, 58). By then, Dick's magic touch in attracting grant-money must have been failing, for he rather ironically observed, 'In view of the reluctance of the official grant-giving bodies to fund a project of this kind, it is a great pleasure to record that the costs of the present investigation were met from private resources' (Acknowledgements in tem 57). According to some personal notes that he left, he must have had enough data for several more papers on the Norfolk marine biota, including the Tunicata, Platyhelminthes, Nematoda, Protochordata, Nemertea and Ostracoda, as well as two on Diatomaceae.

Dick was one of the last of the old-school morphological taxonomists, and had never been exposed to the methodologies, which he did not really understand, of molecular biology. However, he was certainly aware of the potential benefits of DNA analysis for morphological taxonomy, and several times exhorted me to set up a home laboratory for that purpose, little realizing that the equipment would cost tens of thousands of pounds and would need to be housed in a sterile room. In such matters, Dick could be surprisingly naïve. He never abandoned the bizarre idea that one could construct any item of laboratory equipment with some glass and metal scraps and imagination. However, this was something that, up to a point, Dick was fairly adept at, despite Professor Newell's comment that he was not a very good experimental zoologist – his PhD involved, after all, much experimental work rather than pure taxonomy. Furthermore, he had mastered

the complexities of running a motor boat and the necessary navigational skills for his sea-going expeditions.

Dick's crowning achievement was to serve as President of the Norfolk & Norwich Naturalists' Society for 2001-2002, an honour previously afforded to his grandfather, Charles Annesley Hamond in 1906–1907. Dick's presidential address was a masterly historical synthesis of the marine habitats, oceanographic conditions and fauna of Norfolk (Appendix, item 61), delivered in his grandest theatrical style. This address was also notable for being the only occasion on which I ever saw him wear a suit and polished leather shoes! His last field trip was in 2007, when I persuaded him to join me in a survey of Half-Moon Pond at Cley-next-the-Sea (see photograph on front cover, 10 August 2007.

A lasting legacy

During the Australia years, Dick had discovered many previously unknown marine invertebrates, including a new genus and a new family of copepods that he generously donated to another taxonomist for description and naming. Also, it is thanks to him that the Natural History Museum in London now holds a fine collection of specimens representative of the Norfolk harpacticoid fauna. The high regard in which Dick will always be held by fellow zoologists is borne out by the taxa named in his honour, including nine species (*Entobius hamondi* Gotto, 1966; *Impexus hamondi* Kabata, 1972; *Heterolaophonte hamondi* Hicks, 1975; *Brianola hamondi* Wells & Rao, 1987; *Ceradocopsis hamondi* Moore, 1988; *Entomolepis hamondi* McKinnon, 1988; *Archesola hamondi* Huys & Lee, 2000; *Australocamptus hamondi* Karanovic, 2004; and *Inermiphonte hamondi* Huys & Lee, 2009), one genus (*Hamondia* Huys, 1990), and one family (Hamondiidae Huys, 1990). All are copepods except *Ceradocopsis hamondi*, an amphipod.

Dick himself discovered and named four new genera and forty new species of animals, also mostly copepods (see Appendix) from the UK, the USA and Australia. It seems not to be generally appreciated just how much Dick Hamond contributed to world copepodology, particularly while he was in Australia, and moreover, how he managed to achieve all that under the most difficult conditions. From the late 1960s, he laboured under the difficulties of precarious employment conditions, or sometimes no employment at all, while having to design and develop, or adapt, his own optical equipment in order to produce his exquisitely detailed drawings. As he wrote to Professor Geoff Moore (11 June 1980), 'Otherwise I just sit here drawing – sometimes I feel like Michelangelo lying on his back for umpteen years painting the roof of the Sistine Chapel!' The copepod expert, Professor Rony Huys, appraised Dick's work thus: 'Richard Hamond has made a significant impact on harpacticoid systematics in general, and on our knowledge of the Australian fauna in particular', (pers. comm. 11 October 2011).

Dick's friendship, talents and generosity have been valued highly and his eccentricity remembered with affection by many colleagues, who have written:

> I remember him as large, enthusiastic and kindly. [Eve Southward, pers. comm. 17 August 2010]
>
> Dick was a fine marine biologist. He was always supposedly short of cash and his mannerisms were slightly odd but I had a great affection for him. [Frank Evans, pers. comm., 30 August 2010]
>
> He was very talented and generous. His comments were kindly made and mostly well aimed. [Paul Cornelius, pers. comm. 20 January 2011]
>
> He was a genuine enthusiast. I have always regarded him as the last remaining eccentric naturalist in Britain. [Romy Huys, pers. comm., 11 October 2011]
>
> He was the kindest and most thoughtful and supportive of friends.

He will be especially remembered, not only in Norfolk but all over the world, for his unstinting willingness to share his wide knowledge of marine life and microscope technology, and for his great sense of fun

that made him the focus of attention at any gathering of scientists or friends.

But most importantly from the scientific point of view, Dick Hamond could write with authority on almost any marine invertebrate phylum, and probably had a wider knowledge of the systematics and identification of UK species than any other zoologist that I have known, an achievement recognized by his professor even during his undergraduate days. Moreover, he was always assiduous in ferreting out all the previous publications pertaining to Norfolk for each phylum that he tackled. It is to be hoped that future writers on the Norfolk marine fauna will do likewise; and that they will thus not overlook the rich legacy of Dick's seminal publications, listed in the Appendix herein.

Acknowledgements

Much of this account has been gleaned from the archives of All Saints' church of West Acre, Cambridge University Library, the CSIRO, the Marine Biological Association of the United Kingdom, the Quekett Microscopical Club, Radley College, and the Royal Microscopical Society, as well as from the published sources listed. For further information, copies of letters or personal reminiscences, I am grateful to Mary Athill (Morston); Rob Birtles, Carla Flores and Joel MacKeen (CSIRO); Geoff Boxshall, Rony Huys and Paul Cornelius (Natural History Museum, London); John Cooper (Radleian Society); Frances Dipper and Séamus Whyte (Porcupine Marine Natural History Society); Frank Evans (North Shields); Ned, Roberta and Nick Hamond (Morston); Eric Hollowday (Aylesbury); Tony Irwin (Castle Museum, Norwich); Tony Leech (Holt); Stephen Livermore (Norwich); David Macmillan (Melbourne University); Geoff Moore and John Allen (Millport); Kathy Moss (Royal Microscopical Society); Jock Mullard (Radley College); Bill Noblett and Jacqueline Cox (Cambridge University Library); Gary Poore (Museum Victoria, Melbourne); Richard Rutter (Peerage News); Eve Southward and Alexander Street (Marine Biological Association UK); Lewis Woolnough (Quekett Microscopical Club).

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Professor R.B. Williams Norfolk House, Western Road, Tring HP23 4BN

ray.coxitec@tesco.net

See page 34 for Figure 2, the ill-fated Whisky-Echo ablaze.

APPENDIX: Publication list of Dr Richard Hamond

Publications listed without authorship are by R. Hamond alone. Those with joint authorship are shown with all co-authors in the correct order. The day or month within a given year are noted if ascertainable, with any peculiarities of dating (for instance, if different from that given in the article). Names of new taxa, together with the institutions in which type specimens (usually holotypes or allotypes) are deposited, are noted in bold type immediately after the relevant articles; most of the specimens originally retained in RH's personal collection are paratypes and will ultimately be deposited with the Natural History Museum in London.

1 1957. Notes on the Hydrozoa of the Norfolk Coast. *Journal of the Linnean Society (Zoology)*, **43:** 294–324. [March]

2 1961. Marine fauna. Pp. 75–77 in *Norwich and its Region*. Norwich: Jarrold and Sons. [September]

3 1963. On some Polychaeta from the coast of Norfolk. *Annals and Magazine of Natural History (series 13)*, **5:** 567–576. [Dated September 1962, but published 18 April 1963]

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6 1965. On some amphipods from the coast of Norfolk. *Journal of the Marine Biological Association of the United Kingdom*, **45:** 153–160. [March]
[New species (Crustacea, Amphipoda): *Melita reidi*. RH's personal collection.]

7 1965. Hunting for marine animals. Part one: plankton and nekton. *Journal of the Quekett Microscopical Club*, **30:** 83–94. [November]

8 1966. Hunting for marine animals. Part two: benthos. *Journal of the Quekett Microscopical Club*, **30:** 137–142. [May]

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[New species (Crustacea, Copepoda): *Asterocheres ellisi* and *Agnathaner freemani*. Natural History Museum, London.]

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[New species (Crustacea, Copepoda): *Pseudonychocamptus carthyi*. Natural History Museum, London.]

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[New species (Crustacea, Copepoda): *Mesochra baylyi*. RH's personal collection and National Museum of Natural History, Washington DC.]

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[New species (Crustacea, Copepoda): *Cletodes millerorum*. Queensland Museum, Brisbane and RH's personal collection.]

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[New species (Crustacea, Copepoda): *Robertgurneya smithi*. Australian Museum, Sydney.]

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[New genera (Crustacea, Copepoda): *Coullia* and *Hoplolaophonte* with new species, respectively, *C. heteropus* and *H. aculeata*. Also new species (Crustacea, Copepoda): *Paralaophonte sculpta*. National Museum of Natural History, Washington DC.]

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[New genus (Crustacea, Copepoda): *Fibulacamptus* with new species *F. bisetosus*, *F. gracilior*, *F. tasmanicus*, *F. victorianus*. Other new species (Crustacea, Copepoda): *Canthocamptus ablatifurcatus*, *C. billwilliamsi*, *C. caecosetosus*, *C. clavifurcatus*, *C. dedeckkeri*, *C. dumonti*, *C. echinopyge*, *C. globulisetosus*, *C. henryae*, *C. howardorum*, *C. lacinulatus*, *C. longifurca*, *C. longipes*, *C. mammillifurca*, *C. mortoni*, *C. sublaevis* and *C. timmsi*. Museum Victoria, Melbourne and RH's personal collection.]

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Figure 2. See p. 20. Whisky-Echo ablaze minutes after its emergency landing, 8 April 1968: photo by R. Hamond.

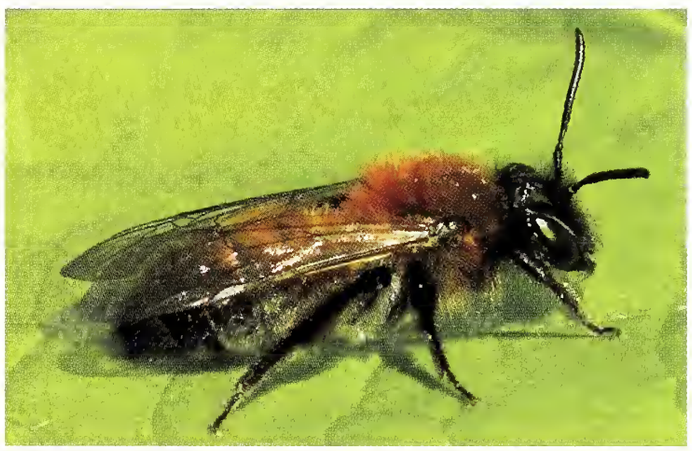
The Bees of Norfolk (see p.36)

Left: ***Colletes halophilus*** (male and females, NWO); below left: ***Andrena cineraria*** (female, NWO); below: ***Hylaeus hyalinatus*** (male, TS); below right ***Andrena fulva*** (female, NWO).

Photographers: NWO, Nick Owens;TS, Tim Strudwick, here and throughout.

Andrena clarkella (female, TS)

Andrena bicolor (female, NWO)



Andrena varians (female, NWO)

Andrena nigroaenea (female, TS)

Halictus tumulorum (female, TS)

Andrena clarkella (male, TS)

Andrena praecox (female, TS)

Andrena hattorfiana (female, NWO)

Panurgus banksianus (male, TS)

Lasioglossum parvulum (female, TS)

The bees of Norfolk: a provisional county list

Tim Strudwick

Introduction

Bees are currently enjoying a surge of public and scientific interest amid concerns over the declines of both the domestic honeybee and wild bee species and the potential impacts of the loss of pollinators on our food crop production. Bumblebees are well served by recent publications (Edwards & Jenner 2009; Benton 2006; Prys-Jones & Corbet 2011) and even have their own conservation charity. In contrast, solitary bees, which represent more than 90% of the UK bee fauna, remain obscure, with identification literature very hard to find. Very little recording of solitary bees has taken place in Norfolk for most of the last century and the last full list of Norfolk's bees was published more than 100 years ago (Barrett 1905), and this drew largely on a series of papers published in *Transactions* by John Bridgman in the late 1800s (Bridgman 1879, 1881, 1889). This paper aims to provide an up-to-date summary of our current knowledge of the status of all bee species in Norfolk. The word 'provisional' in the title reflects the expectation that the picture presented here is far from complete. It is hoped the publication of this baseline may encourage new recorders to develop an interest in this group and stimulate further recording.

The Norfolk bee fauna

The status of bumblebees in Norfolk has been well documented in recent years by David Richmond (2001, 2009). At least 18 of the 24 species of bumblebee currently found in the UK are known to be in the county. There is far less known or published about solitary bees. The distribution maps on the National Biodiversity Network website (www.nbn.org), which at the time of writing do not yet include the last five years' records, show an almost complete absence of solitary bees in Norfolk. The inevitable focus of the most active recorders on areas close to their homes and of professional entomological surveys on protected sites has resulted in the Brecks, the Norwich area, the Broads and the north and east coasts receiving most of the recent recording effort. This geographical bias has to be considered in interpreting the distribution of records. Many species are probably more widespread than we know and there are likely to be more species waiting to be discovered (or rediscovered).

Despite the limited information available, we know that at least 166 bee species, or 69% of the UK bee fauna, have occurred in Norfolk since 1969 (Table 1). Comparing this with published totals for other counties (Baldock 2008), Norfolk sits in the top six or seven counties in the UK for recorded bee diversity. The species that are absent from Norfolk are largely those associated with upland habitats or calcareous grassland, and those restricted to north and west Britain or the very south of England.

Bee identification

This paper does not attempt to tackle bee identification, but some context, and some cautionary words on the subject, might be helpful for prospective recorders. Good identification keys for bumblebees are readily available, and many species can be recognised in the field or from photos. However, there are many pitfalls, with some very similar species, sexual dimorphism, interspecific variation and the effects of wear and tear to take into account. Caution should be exercised, and an expert opinion

Table 1 The sub-families and genera of British bees, based on Archer (2005), with the number of species recorded in the UK (excluding the Channel Islands) and Norfolk from 1970 onwards.

Family	Subfamily	Genus	No. of species in UK	No. of species in Norfolk
Apidae	Colletinae	*Colletes*	9	6
		Hylaeus	11	8
	Andreninae	*Andrena*	62	38
		Panurgus	2	2
	Halictinae	*Duforea*	1	0
		Halictus	4	3
		Lasioglossum	32	22
		Sphecodes	16	13
	Melittinae	*Melitta*	4	3
		Macropis	1	1
		Dasypoda	1	1
	Megachilinae	*Anthidium*	1	1
		Stelis	4	3
		Heriades	1	0
		Chelostoma	2	2
		Osmia	12	6
		Hoplitis	1	1
		Megachile	7	7
		Coelioxys	6	4
	Anthophorinae	*Nomada*	28	19
		Epeolus	2	2
		Eucera	2	0
		Anthophora	5	4
		Melecta	1	1
		Ceratina	1	0
		Xylocopa	1	0
	Apinae	*Apis*	1	1
		Bombus	24	18
		Total spp.	**240**	**166**

sought, before submitting records of the less common species.

Solitary bees are more difficult. While a number of solitary species can be recognised in the field, collection of specimens and microscopic examination is required to confirm the identity of many. Up-to-date keys for many genera are not readily available, though this situation should be improved in the near future when a new handbook of British bees is published (Else, in prep.). Despite the limitations of photography, it is a good way to get started with solitary and bumblebees. The author is very happy to identify, where possible, species from emailed photos, or from specimens (addresses below).

Lasioglossum morio (female, NWO)

Lassioglossum calceatum (female, TS)

Lassioglossum calceatum (male, TS)

Macropis europea (female, TS)

Chelostoma campanularum (female, TS)

Lasioglossum leucozonium (male, NWO)

Sphecodes ephippius (female, NWO)

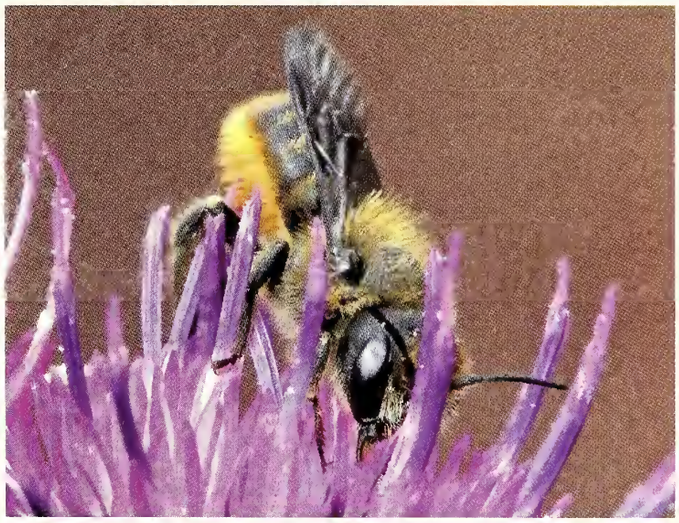
Dasypoda hirtipes (female, TS)

Anthidium manicatum (male, Sally Rix)

Coelioxys elongata (male, TS)

Megachile centuncularis (female, NWO)

Osmia rufa (female, NWO)



Osmia leaiana (female, TS)

Osmia caerulescens (female, TS)

Megachile dorsalis (female, NWO)

Osmia rufa (male, NWO)

Anthophora plumipes (female, NWO)

Anthophora plumipes (male, NWO)

Sociality and solitary lifestyles

It is well known that honey bees and bumblebees nest co-operatively, whereby fertile females (queens) rear infertile females (workers) that then help the queen to rear more workers, new queens and males. These are termed *social* or *eusocial*. It is less well known that some predominantly solitary bee genera include a few species that are also social. In the UK these are all in the sub-family Halictinae. In truly *solitary* bees every female is fertile and provisions her nest alone. However, some species may share a nest entrance, and hundreds or even thousands of nests may occur close together, so their solitary nature may not be obvious.

Notes on the systematic list

Sources of records

The species accounts below draw upon records from the databases of the Norfolk Biodiversity Information Service (NBIS), National Biodiversity Network (NBN) and the Bees, Wasps and Ants Recording Society (BWARS), the collections held at the Castle Museum, various published sources, an unpublished list by G.M.Spooner (*c.* 1980) and records supplied by individual recorders. The bumblebee accounts draw heavily on Richmond (2009). Inevitably records will exist that were overlooked, and hopefully this publication will help to draw these out.

Verification of records

All species reliably recorded in Norfolk are included in the list, but names of species only recorded before 1970 are in square brackets. In the preparation of this list, a few records were judged to be doubtful or erroneous and have been disregarded. These were either records of species which have since been subject to taxonomic revision, in unlikely locations, very difficult species where it seems unlikely that the recorder had access to up-to-date identification keys or reference specimens, or where a voucher specimen was found to have been misnamed. It is acknowledged that some of these may yet prove to be good records.

County boundaries

Biological recording tradition favours the use of Watsonian vice-counties, but with the importance of biodiversity data in the planning process and the role of local government in biodiversity, modern county boundaries are arguably now more useful for a county list. For the purposes of this work, Norfolk is defined as the post 1976 administrative area. Where species have occurred only in VC27 (East Norfolk) or VC28 (West Norfolk) this is noted.

Nomenclature

Scientific nomenclature follows Archer (2005), although in a few cases, where a revised or alternative name is also in current use, this is given in brackets. English names are given only where these are in general use.

Status

UK conservation status follows Falk (1991). Norfolk status is based on available records and the author's own experience. Details of records are given for the rarer species, including recorders where known.

Recorders mentioned in the species accounts:

AGI	Tony Irwin
EAA	EA Atmore
GN	Geoff Nobes
JBB	John Bridgman
JF	Jeremy Field
KD	Ken Durrant
MEA	Michael Archer
NWO	Nick Owens
RSB	R. Stuart Browne
SP	Stuart Paston
TS	Tim Strudwick

A systematic list of the bees of Norfolk

COLLETINAE – *believed to represent the most primitive group of bees; two very different genera.*

Colletes - *a rather distinctive genus of ground-nesting bees, having a blackish abdomen with clearly defined white or yellowish bands on the hind margins of each segment. The species require microscopic examination to separate them, although habitat is often a good pointer.*

Colletes daviesanus Probably the most widely distributed and least specialised UK *Colletes* species. It nests in vertical banks and the soft mortar of walls, and is active late June to mid-August. Norfolk status: recorded from widely scattered sites including gardens, and is most likely to be seen on Tansy *Tanacetum vulgare*, ragwort *Senecio* spp. and other Asteraceae flowers.

Colletes fodiens Nationally this is one of the commoner species, active from mid-June to late August, and associated with yellow Asteraceae, especially ragwort. Norfolk status: frequent in the Brecks and the Norwich area with scattered records elsewhere, on dunes, heaths and sandy grassland.

Colletes halophilus Nationally Scarce; BAP Priority. This species is endemic to western Europe, and in the UK is found from Dorset to Humberside. It is almost identical to *C. succinctus*, but usually distinguished by its very different habitat. *C. halophilus* flies from early August to early October, when its forage plant, Sea Aster *Aster tripolium*, is in flower. It nests in exposed sand or clay close to saltmarsh, often in large aggregations. Norfolk status: found locally around The Wash, more widely along the North coast from Holme to Weybourne and also at Breydon Water. Photo p.34.

Colletes marginatus Nationally Scarce. The smallest UK *Colletes* species, largely confined to the coast of England and Wales, but occasionally found inland. Active from early July to late August. Norfolk status: recorded on sandy grassland at several Breckland sites, and also on coastal dunes at Holme and Winterton.

Colletes similis This species is very similar to *C. fodiens*, with which it shares similar habits and phenology, but is rather scarcer than that species. Norfolk status: very local, with records from about 12 sites, most in the Brecks and the Norwich area.

Colletes succinctus A very widely distributed species, flying late July to mid-September when Heather *Calluna vulgaris*, its pollen source, is in flower. Norfolk status: found everywhere where Heather grows in quantity, even on isolated fragments of heathland or dune heath.

Hylaeus - *the white-faced bees are a genus of small, black, almost hairless bees (pollen being carried in the crop). Males usually have a white or yellowish face, and females have two pale spots between the eyes. Most nest in dead plant stems or holes in dead wood, but some also nest in the ground. They are often encountered on umbellifer flowers, and the species are very similar.*

Hylaeus annularis Confined to south-eastern Britain and usually found at disturbed, grassy sites. The females can be distinguished by the small, round white spots on the face, and the males by the swollen white basal antennal segments. Active mid-June to early September. Norfolk status: local, with records mainly from the Brecks and the Norwich area.

Hylaeus brevicornis A very small species, with a strong association with brambles *Rubus fruticosus* agg., often nesting in the stems. Active late June to early

September. Norfolk status: recorded fairly sparsely in Norfolk but probably overlooked.

Hylaeus communis Probably the most common and widespread species of the genus, found in a range of habitats, and flying from mid-June to early October. The male can be identified by the shape of the pale face markings. Norfolk status: common and widespread with a preference for damp and wooded habitats.

Hylaeus confusus A widespread species of wooded habitats. Norfolk status: apparently local, with most records from the Broads and Brecks.

Hylaeus cornutus Nationally Scarce. The only species in the genus with no white on the face in either sex, it is associated with warm, dry, disturbed habitats. Norfolk status: local, recorded from a handful of sites in the Brecks and around Norwich.

Hylaeus hyalinatus Found in a wide range of habitats, including gardens, and possibly the most frequent *Hylaeus* species in urban areas. Norfolk status: recorded frequently throughout Norfolk. Photo p.34.

Hylaeus pectoralis A rather localised species, flying from June to August and nesting in old galls of the chloropid fly *Lipara lucens* in the stems of Common Reed *Phragmites australis*. Norfolk status: common in Broadland, but apparently rare elsewhere with records only from Foulden Common 1979, Dersingham Bog 1982 (both AGI) and Boughton Fen in 2010 (GN).

[Hylaeus pictipes] Nationally Scarce. Now restricted to Kent and adjacent counties. Norfolk status: presumed extinct. Recorded at Eaton in the late 1800s (JBB).

Hylaeus signatus Nationally Scarce. This species collects pollen from Weld *Reseda lutea* and Wild Mignionette *Reseda luteola* and both sexes can be found around these plants. Norfolk status: widespread, and fairly common on sandy soils, especially around Norwich and the Brecks.

ANDRENINAE – *pollen carried on hairs on the hind legs and, sometimes, the rear thorax; all species are ground-nesting.*

Andrena – *a large genus with about 60 species known in the UK, some with a spring and a summer brood. Some species are recognisable in the field (at least the fresh females) but most cannot reliably be separated without microscopic examination.*

Andrena alfkenella RDB3. A small species, associated with umbellifers on calcareous grassland. Flies April to August in two broods. Norfolk status: rare, with four Breckland records: Middle Harling Heath in 2009 (TS), and South Acre, Cranwich and Weeting in 2011(GN).

[Andrena angustior] A small species. Norfolk status: presumed extinct. Recorded at Mousehold Heath in 1873 (JBB), but not since. It is widespread across England except the very north so may be expected in Norfolk.

[Andrena argentata] A small species associated with heathland and dunes in SE England, often foraging on Heather. Norfolk status: presumed extinct. Atmore (1909) reported 'large colonies' near Kings Lynn around 1900 but there have been no subsequent records.

Andrena barbilabris This species nests in bare sandy soils and flies from late April to late June. Norfolk Status: widespread, recorded from heathland, dunes, quarries, etc. throughout the county.

Andrena bicolor This small, double-brooded bee is active from early March to late August, and is one of very few *Andrena* species in which the female

has entirely black facial hair. It is found in most habitats and is particularly common in gardens. Norfolk status: widespread and common. Photo p.35.

Andrena bimaculata Nationally Scarce. A double-brooded species of heath, scrub and grassland. Norfolk status: local, found mainly on sandy soils.

Andrena chrysosceles This small dark species with red legs is frequently found in churchyards. Pollen is collected from a range of plants including Germander Speedwell *Veronica chamaedrys* and Hogweed *Heracleum sphondylium*. Norfolk status: very few records, but frequent in the Norwich area and probably overlooked and common throughout the county.

Andrena cineraria A beautiful and unmistakable bee, active from early April to early July. Pollen is collected from a range of species but gorse seems popular at Norfolk sites. Norfolk status: almost unknown until the last ten years, but now widespread in VC27 and the Brecks. Photo p.34.

Andrena clarkella One of the largest and earliest *Andrena* species, active from late February to mid-May, collecting pollen from the catkins of sallows and other willows and often nesting in conspicuous aggregations. Norfolk status: widespread. Photo p.35.

Andrena coitana A small, shiny, black bee, possibly associated with bramble, and active in July and August. Norfolk status: apparently very local in the county, with just 12 records from the Brecks and the Holt-Cromer ridge and not seen since 1986.

Andrena denticulata A late summer species, active early July to early September, and associated with yellow Asteraceae and sandy soils. Norfolk status: local and never numerous.

Andrena dorsata A very common double-brooded species, found in most habitats including gardens, and flying from late March to late August. Males often gather on tree foliage. The second brood is partial to bramble flowers. Norfolk status: very common throughout, and often the most common *Andrena* species in the summer.

Andrena falsifica Nationally Scarce. Another small, black species, extremely similar to more common species. There are just two records: Foulden Common (1979) and Holt (1986).

Andrena flavipes The female of this double-brooded species can be recognised by the well-defined whitish terminal hair bands on the abdominal segments. It flies from late March to early June and late June to late August, and appears to have greatly increased in recent years. Norfolk status: common in sandy habitats, including urban areas

Andrena fucata A woodland species, active from mid-May to late June. Norfolk status: rare, with just three post-1900 records: Aylmerton in 1974, Sheringham in 1982 (both KD) and most recently at Thompson Common in 1985 (AGI).

Andrena fulva The female Tawny Mining Bee is easily recognised by the long orange hairs covering her upper abdomen and thorax. This is a common spring species, often nesting on lawns, making a conical spoil heap around the nest entrance. Norfolk status: widespread and locally common. Photo p.34.

Andrena fuscipes This dull, greyish bee flies from late July to September, collecting pollen from Heather. Norfolk status: widespread, at most heathland sites including the dune heath at Winterton.

Andrena haemorrhoa A common woodland and garden species, with one brood, flying from March to June. Pollen is often collected from hawthorn *Crataegus* spp. and other shrubs of the Rosaceae. The female has a unique

combination of rufous thorax and glossy black abdomen with red hairs at the tip. Norfolk status: common and widespread.

Andrena hattorfiana RDB3. A large and distinctive species, with a glossy black or red and black abdomen. Flies late June to mid-August, collecting pollen from Field Scabious *Knautia arvensis* and sometimes Small Scabious *Scabiosa columbaria.* Norfolk status: local, recorded widely in the Brecks, with outlying records at Norwich Earlham Cemetery since 2004 (SP), Weybourne in 2010/11 (NWO) and Mundesley in 2011 (TS). The coastal records represent the northern limit of this species in the UK. Photo p.35.

Andrena helvola A species of woodlands and hedgerows, possibly with a preference for clay soils. Norfolk status: local, with recent records widely scattered, including, in 2011, Caudlesprings, Rosary Cemetery (Norwich), Strumpshaw and Morningthorpe.

Andrena humilis Nationally Scarce. A dark brownish bee, active from May to July, collecting pollen from yellow composites. Norfolk status: scarce, with recent records from three Breckland sites, four sites around Norwich and Overstrand.

[Andrena labialis] This species collects pollen from various legumes. Its range contracted in the twentieth century but it still occurs in the Midlands and is locally common in south Essex. Norfolk status: extinct. Regarded by JBB as 'uncommon' in the late 1800s, referring to records from Norwich, Yarmouth and King's Lynn.

Andrena labiata Nationally Scarce. A distinctive red and black species, the male with a white face, associated with Germander Speedwell. Norfolk status: widespread but local, mostly found on grassy commons, woodland rides and churchyards.

Andrena marginata Notable A. A summer species, active from early July to late August. Both sexes show varying amounts of red on the abdomen, and pollen is collected from scabious species, most often Small Scabious but also Devil's-bit Scabious *Succisa pratensis*. Norfolk status: scarce, with recent records from a few chalky sites in the Brecks, at Narborough and, in 2010, Weybourne (NWO).

Andrena minutula The sub-genus *Microandrena* is a group of very similar small, blackish bees. This is by far the commonest species, found in most habitats and active from early March to early September in two or possibly three broods. Norfolk status: very common throughout.

[Andrena minutuloides] Nationally Scarce. Almost identical to *A. minutula*. Norfolk status: two females were collected at Norwich in the 1870s (JBB). Though possibly now extinct, it is present in the Suffolk Brecks and is likely to be also present on the Norfolk side.

[Andrena nanula] Norfolk status: extinct. The sole British record relates to a female specimen attributed to JBB in the late 1800s and assumed to be from Norwich.

Andrena nigroaenea A large and very common species, active from late March to June, and occasionally July to August, and often seen in gardens. Norfolk status: common throughout. Photo p.35.

Andrena nitida (A. pubescens) Another common, large spring species in gardens. Norfolk status: common throughout.

Andrena nigriceps Nationally Scarce. A late summer species, often found on ragwort. Norfolk status: very local, with records only from the Sheringham/ Cromer area and the Brecks.

Andrena nigrospina RDB3. A very rare, large, black species, only recently separated from *A. pilipes*. Norfolk status: rare. JBB recorded *A. pilipes* in Norwich in the 1870s, and the dates of these suggest they were in fact this species. The only record since was of two females at Bowthorpe in June 2011 (TS).

[Andrena niveata] RDB2. A rare species associated with Cruciferae. Norfolk status: extinct. Recorded at King's Lynn by EAA *c.* 1900, but not since.

Andrena ovatula This double-brooded bee is very similar to *A. wilkella*, though habitat and phenology differ. This species flies April to May and July to August, Norfolk status: local, on heaths and rough grassland throughout the county.

Andrena pilipes s.s RDB3. A rare species with a southern and mainly coastal distribution. Norfolk status: presumed extinct. A female collected at Wymondham in April 1942 (RSB) was almost certainly this species, and there is a record for TL78 in July 2003 (NBN) which may have been *A. nigrospina*.

Andrena praecox An early spring bee, active from mid-March to mid-May, collecting pollen from willows. Norfolk status: common in the Norwich area and the Brecks, with few records elsewhere but probably overlooked. Photo p.35.

[Andrena proxima] RDB3. Norfolk status: presumed extinct; Saunders (1896) refers to a Norwich record by Bridgman.

Andrena scotica (A. carantonica) A large, rather nondescript species in which females share a common nest entrance though each tends its own nest within. Flies April to June. Norfolk status: widely distributed across the county and common in gardens, scrub, etc.

Andrena semilaevis One of the three commoner *Microandrena* species in the subgenus, this one usually found on umbellifers (Apiaceae) in May and June. Norfolk status: fairly common throughout.

[Andrena simillima] RDB3. Norfolk status: extinct. One old record from West Runton in 1900.

Andrena subopaca The third common *Microandrena* species, active from April to August and probably double-brooded. Commoner on clay soils and often in woodlands. Norfolk status: widespread and common.

Andrena synadelpha This species was first described in 1900, previously being confused with *A. helvola*. Flies from late April to June in gardens, hedgerows and coastal cliffs, possibly showing a preference for sandy soils. Norfolk status: locally common.

Andrena tarsata BAP Priority. A small dark species, the male with a white face, associated with Tormentil *Potentilla erecta* on heaths and moors, and active June to August. Norfolk status: rare, with just two recent records: Buxton Heath in 1979 (KD) and Upgate Common in 2010 (GN).

Andrena thoracica A distinctive large, dark species with a very shiny abdomen, active late March to mid-May and late June to mid-August. Norfolk status: local, with records from the coast between Weybourne and Mundesley, and from heaths, sand quarries and brownfield sites at Cranwich, Hockham, East Ruston and the Norwich area.

Andrena tibialis Nationally Scarce. A large spring species, active early April to late May. Norfolk status: rather local, with records only from the Brecks, Norwich area and East Dereham.

[Andrena tridentata] RDB1. Always very rare in the UK, and now probably

extinct. Norfolk status: presumed extinct; the only confirmed county record is one collected by F. Smith at Cromer in 1850, with several others now considered errors (Falk 1991).

Andrena varians Nationally Scarce. Norfolk status: rare, with just one recent record, Sheringham Park in April 2011 (NWO). Historically, Bridgman found this species uncommonly around Norwich in the 1870s, otherwise there is an unverified record from Wheatfen in 1938. Photo p.35.

Andrena wilkella A single-brooded species of neutral or calcareous grasslands. Females are very similar to some *A.ovatula* but mainly found mid-May to June when that species is rarely active. Norfolk status: recorded widely but infrequently in the county.

Panurgus *– rather shiny, black medium-sized, ground-nesting bees*

Panurgus banksianus Active from mid-June to mid-August, and visiting yellow-flowered Asteraceae, the males often conspicuously resting on such flowers in cool weather. Norfolk status: widespread but local in sandy habitats including heathland, coastal grassland and brownfield sites. Photo p.35.

Panurgus calcaratus A smaller species than *P. banksianus*, with a more southerly distribution, but with similar habitat choice and phenology. Norfolk status: rare, the only record near Grimes Graves in 2009 (GN).

HALICTINAE *– pollen is carried on the hind legs and, sometimes, the underside of the abdomen; mated females overwinter and emerge to nest in the spring; males and new females appear from June onwards and are often active well into October; some species are social, the spring females rearing a number of sterile workers which then help her rear the new queens and males.*

Halictus *– small to medium-sized ground-nesting bees with pale terminal bands on the abdominal segments; some are metallic green or bronze; all Norfolk species are social.*

Halictus confusus RDB3. Very hard to separate from *H. tumulorum*, especially females. Active April to September. Norfolk status: rare, only known from three Breckland sites and Roydon Common (MEA).

Halictus rubicundus A fairly large and distinctive species with pale hind tibia and narrow white abdominal bands, though superficially resembling some *Andrena* species. Active April to October. Norfolk status: widespread and fairly common in open habitats, usually on sandy soils.

Halictus tumulorum A metallic green-bronze bee with broad pale bands on the abdominal segments. Active March to October. Norfolk status: very common and widespread in most habitats, including gardens. Photo p.35.

Lasioglossum *– a large genus of small to medium-sized ground-nesting bees; mainly small, dark and plain; some have white bands or patches on the front of the abdominal segments (rear in* Halictus*); a few species are social; identification of most species requires microscopic examination.*

Lasioglossum albipes Very similar to *L. calceatum*, but much less frequently encountered. Active late April to late September. Seems to avoid urban areas and arable farmland. Norfolk status: widespread but not common.

Lasioglossum brevicorne RDB3. A small black species with very pale wing venation, restricted to sandy habitats in SE England. Active May to September. Norfolk status: rare, with records only from Santon Downham, Thetford Warren and Roydon Common, all in VC28.

Lasioglossum calceatum One of the larger *Lasioglossum* species, active from March to October, and commonly found in most habitats including gardens and

arable farmland. Norfolk status: very common throughout. Photo p.38.

Lasioglossum cupromicans A species with a mainly northern distribution in the UK. Norfolk status: by far the rarest of the four small metallic greenish *Lasioglossum* species in Norfolk, with records from seven widely scattered locations, all on dry sandy soils.

Lasioglossum fratellum Nationally, largely a species of heathland and moorland, though most Norfolk records are from calcareous grassland. It is very similar to *L. fulvicorne*, so there may have been some confusion. Active May to September. Norfolk status: rare, with just five records, at Santon Warren, East Walton and Foulden Commons, Narborough and Ringstead Downs (all VC28).

Lasioglossum fulvicorne A species of calcareous grassland, active April to September. Norfolk status: very local, recorded at a number of Breckland sites and at Narborough, Ringstead Downs and Flordon Common.

Lasioglossum lativentre Very similar in appearance to *L. quadrinotatum*. Active April to October, mainly in woodland edge and heathland. Norfolk status: very local, recorded at three Breckland sites, and four widely scattered sites in East Norfolk.

Lasioglossum leucopus The smallest of the four small metallic greenish species. Norfolk status: widespread, though less common than *L. morio*, and always in sandy habitats.

Lasioglossum leucozonium A common species with complete white bands on the abdominal segments. Active early April to mid-October. Norfolk status: common on sandy soils. Photo p.38.

Lasioglossum malachurum Nationally Scarce. Once a rarity, it has become much more widespread in the past 100 years. Active April to September. Norfolk status: widespread but local, often on clay soils.

Lasioglossum minutissimum A very small species, easily overlooked. Active April to October. Norfolk status: widespread in a range of habitats but usually on sandy soils.

Lasioglossum morio By far the commonst of the four small metallic greenish species, and probably the most common and widespread species of the genus. Active March to October. Norfolk status: very common throughout in most habitats, including gardens. Photo p.38.

Lasioglossum nitidiusculum A species that has become much less common during the last 100 years. Active from April to September. Norfolk status: rare, with records only from West Runton, Cromer, Strumpshaw and TG33, all in VC27.

Lasioglossum parvulum A small, black bee, almost identical to the previous species but much more numerous. Active from March to October. Norfolk status: widespread on sandy soils. Photo p.35.

Lasioglossum pauperatum RDB3. A very small species of sandy habitats. Active May to September. Norfolk status: rare, only known from Caister Chalk Quarry in 2008 and 2010 (TS).

Lasioglossum pauxillum Nationally Scarce. This small bee is found in a range of habitats on sandy and clay soils and has become much more common in recent years. Active April to October. Norfolk status: apparently a recent colonist, first recorded in 1998. Now widespread in VC27, and though only recorded from two sites in VC28, probably equally widespread there.

Lasioglossum prasinum Nationally Scarce. A species very much tied to heathland in SE England. Norfolk status: rare, with just three records, Santon Downam in 1985 (JF) and Grimes Graves in 2009 and 2011 (GN).

Lasioglossum punctatissimum Active May to October on heathland and other sandy habitats. Norfolk status: widespread.

Lasioglossum quadrinotatum Notable A. Very difficult to separate from *L. lativentre*, and with similar habits and phenology, but possibly more restricted to dry, sandy habitats. Norfolk status: very local, with records from about nine widely scattered sites, all since 1983.

Lasioglossum sexnotatum RDB1. A very rare species with only a handful of UK records, mainly from Norfolk and Suffolk. Norfolk status: very rare, with just a single recent record at Buckenham Tofts (VC28), by Andy Foster in 1985.

Lasioglossum smeathmanellum One of the four small metallic greenish species, with similar habitas and phenology to *L. morio* though much less common. Norfolk status: widespread, nesting in sandy soil or, more frequently, in the soft mortar of old walls, so frequently found in churchyards and gardens.

Lasioglossum villosulum Another small, dark species, active May to October. Norfolk status: common on sandy soils, but possibly avoiding urban areas.

[Lasioglossum xanthopus] Nationally Scarce. A large and distinctive species of calcareous grassland. Active April to October. Norfolk status: presumed extinct, with just a single record from Caister in 1902 (OHL). It occurs on the chalk in the Newmarket area and has been found in the Suffolk Brecks, so may yet be rediscovered in Norfolk.

[Lasioglossum zonulum] A fairly large species similar to *L. leucozonium.* Norfolk status: extinct, the first and only record being at West Runton in 1900.

Sphecodes *– a genus of red and black cleptoparasitic bees, similar in appearance to some solitary wasps; the hosts are mainly* Lasioglossum *and* Halictus*; the species can only be separated by microscopic examination, and even then only with some difficulty*

Sphecodes crassus Notable B. A probable cleptoparasite of *L. parvulum* and possibly other *Lasioglossum* species. Active March to September. Norfolk status: local, most records being from VC27.

Sphecodes ephippius A cleptoparasite of *Halictus tumulorum* and probably some *Lasioglossum* species. Active March to October. Norfolk status: common. Photo p.38.

[Sphecodes ferruginatus] Nationally Scarce. A probable cleptoparasite of *L. fulvicorne* and *L. fratellum.* Norfolk status: presumed extinct, the sole record from Brundall in the 1880s (JBB).

Sphecodes geoffrellus A cleptoparasite of several *Lasioglossum* species. Active April to October. Norfolk status: common.

Sphecodes gibbus A cleptoparasite of *Halictus rubicundus.* Active April to October. Norfolk status: local, with most records from the Brecks; the only VC27 sites are at Weybourne and Beeston.

Sphecodes hyalinatus A cleptoparasite of *Lasioglossum fulvicorne* and *L. fratellum.* Active May to September. Norfolk status: rare, recorded from Foulden Common 2003, Narborough 2002 (KD), TG32 1996 and Cranwich Camp 2011 (GN).

Sphecodes longulus Notable A. A cleptoparasite of small *Lasioglossum* species. Active May to September. Norfolk status: scarce, recorded from six Breckland sites, Caister Chalk Quarry in 2008 (TS) and Weybourne in 2011 (NWO).

Sphecodes miniatus Notable B. A cleptoparasite of small *Lasioglossum* species. Active April to September. Norfolk status: scarce, with records

from Santon Warren in 1987 (JF), Sheringham in 1984 (KD) and a few sites in the Norwich area 2008-10 (TS).

Sphecodes monilicornis A cleptoparasite of *Lasioglossum calceatum* and related species. Active March to October. Norfolk status: common.

Sphecodes niger RDB3. A cleptoparasite of *Lasioglossum morio*, the male of which is entirely black. Active April to October. Norfolk status: local, but increasing.

Sphecodes pellucidus A cleptoparasite of *Andrena barbilabris*. Active April to October. Norfolk status: widespread in sandy habitats where the host is present.

Sphecodes puncticeps A cleptoparasite of *Lasioglossum villosulum* and related species. Active May to September. Norfolk status: widespread in sandy habitats.

Sphecodes reticulatus Notable A. The hosts of this species have not been confirmed, though various *Lasioglossum* and *Andrena* species have been suggested. Active May to October. Norfolk status: common in the Brecks, and occurs locally at heathland and coastal sites throughout the county.

Sphecodes rubicundus Notable A. A cleptoparasite of *Andrena labialis*. Norfolk status: probably vagrant. JBB found it common in the Norwich area in the 1870s. It was then unrecorded until one was found at Hickling in 1988. This was probably a vagrant since the host appears to be extinct in the county.

MELITTINAE – *medium-large sized ground-nesting bees; pollen is carried on the hind legs.*

Melitta – *ground nesting bees, rather similar in general appearance to* Andrena *or* Colletes.

Melitta haemorrhoidalis Collects pollen from Campanulaceae, especially Harebell *Campanula rotundifolia*. Norfolk status: very local, all recent records coming from the Brecks.

Melitta leporina A rather scarce species of flower-rich grassland, collecting pollen from White Clover *Trifolium repens* and other Fabaceae. Norfolk status: scarce, recorded from several Breckland sites, Bowthorpe, Trimingham, Wheatfen and Sutton Fen.

Melitta tricincta Notable B. Very similar to the previous species, but collects pollen only from Red Bartsia *Odontites vernus*. Norfolk status: rare, with just three records: Thetford Warren in 2009 (TS), Weeting in 2011 (GN) and Thompson Common.

Macropis – *a medium-sized black and white ground nesting bee*

Macropis europea Notable A. The Yellow Loosestrife Bee flies June to August and is a fenland species. Both sexes are black and white, the male with a white face, and can be recognised in the field. They are usually seen around flowers of Yellow Loosestrife *Lysimachia vulgaris* or taking nectar on thistles (*Cirsium* spp.). Norfolk status: local, found at most Broadland fens, with records elsewhere from Caudlesprings, Boughton Fen and Downham Market. Photo p.38.

Dasypoda – *a large and distinctive ground-nesting bee, the female with very long pollen-collecting hairs on the hind legs.*

Dasypoda hirtipes Notable B. This species flies from June to August, foraging on Common Ragwort *Senecio jacobaea* and other yellow-flowered Asteraceae on heathland, dunes and other sandy habitats. Norfolk status: local, found in the Brecks and at most coastal dune sites. Photo p.38.

MEGACHILINAE – *females carry pollen on a brush of hairs under the abdomen.*

Anthidium – *a large dark bee with yellow spots on the abdomen; nests in dead wood, walls, etc.*

Anthidium manicatum The Wool Carder Bee flies from May to August, and is fairly common in southern England, particularly in gardens. It nests in aerial cavities (walls, dead wood, etc), lining its nest with hairs scraped from plants like Foxglove *Digitalis purpurea* and Lambs'-ears *Stachys byzantina*. Norfolk status: widely distributed but not numerous. Photo p.38.

Stelis – *medium-large cleptoparasitic bees; all species are scarce or rare.*

Stelis ornatula RDB3. A rare cleptoparasite of *Hoplitis claviventris*. Norfolk status: very local, with recent records from Grimes Graves, Santon Downham and Cranwich Camp in 2011(GN).

Stelis phaeoptera RDB2. A cleptoparasite of *Osmia* spp. Norfolk status: rare, only recorded from a garden in Carbrooke in 2008 and 2011 (GN).

Stelis punctulatissima Notable B. A cleptoparasite of *Anthidium manicatum*. Norfolk status: apparently rare, with recent records from Brundall in 2006 and 2007 (TS) and TG04 in 1997.

Chelostoma – *small bees with elongate bodies, nesting in dead wood and hollow stems.*

Chelostoma campanularum The Harebell Carpenter Bee is very small and slender, nesting in beetle holes in dead wood. It collects pollen from wild and cultivated *Campanula* spp., and flies from late June to mid-August. Norfolk status: fairly common in the Norwich area and Brecks and probably elsewhere. Easily overlooked. Photo p.38.

Chelostoma florisomne The Sleepy Carpenter Bee is much larger than the previous species and generally less common. It is active from early June to late August. Males sleep inside flowers. Norfolk status: scarce, with just six recent records, all since 2007: Alderford Common, Strumpshaw, Blakeney, Bacton Wood, Caudlesprings, Cranwich Camp.

Osmia – *medium-sized bees, nesting in holes in deadwood, walls, snails shells or vertical banks.*

Osmia aurulenta A snail-shell nester, typically found on coastal and chalk grasslands. Active March to August. Norfolk status: rare, with just three records, at Gun Hill, Holkham in July 2001 and Caudlesprings (GN) in March 2010 and 2011.

Osmia bicolor Notable A. The distinctive females are black with an orange abdomen, like a small bumblebee. Another snail-shell nester, active from late March to early August. Norfolk status: locally abundant on calcareous grassland in the Brecks. Elsewhere it has been recorded at Narborough and Alderford Common.

Osmia caerulescens The Blue Mason Bee is active late April to mid-July, nesting in holes in deadwood, and will use bee boxes, plugging the holes with chewed-up leaves. The females are dark with a bluish tinge, with a white pollen brush, and the males are gingery. Norfolk status: widespread, often in gardens, but never numerous. Photo p.39.

Osmia leaiana Similar in habits to *O.c aerulescens*, the females being larger, browner and with an orange pollen brush. Active May to August, collecting pollen mainly from Asteraceae. Norfolk status: widespread throughout. Photo p.39.

[Osmia pilicornis] Notable A. Norfolk status: extinct. There is an old record from King's Lynn in 1899 (EAA).

Osmia rufa The Red Mason Bee flies from April to July, nesting in aerial cavities, and readily uses bee boxes, often in numbers. The female has a pair of 'horns' on the face with which she packs in mud to seal the nest, leaving a characteristic rough finish. Norfolk status: common throughout, often in gardens. Photo p.39.

Osmia spinulosa A small dark species, nesting in snail-shells. Active mid-May to early September, and often found on ragwort and other yellow Asteraceae. Norfolk status: locally common, recorded widely in the Brecks, several coastal sites and the Norwich area.

Hoplitis *– a medium-sized black bee, nesting in holes above ground.*

Hoplitis claviventris A species of heath or meadow close to woodland, nesting in deadwood. Forages on yellow Asteraceae and peas (Fabaceae). Active late May to mid-August. Norfolk status: scarce, restricted to Breckland, where it is frequent along forest rides.

Megachile *–the leaf-cutter bees are medium-large; nest in holes in dead wood, hollow stems or in soil. Else (1999) provides a good identification key.*

Megachile centuncularis The Rose Leaf-cutter Bee, active from mid-May to early September, is the most common species, often using bee boxes. Norfolk status: widespread and common throughout, especially in gardens. Photo p.39.

Megachile circumcincta Nationally Scarce. A declining species of heath and sand dunes, active mid-June to late August. Norfolk status: rare, with just three recent records: Caister and Great Yarmouth in 2007 (TS) and the Brecks TL78 in 1998.

Megachile dorsalis (M. leachella) Nationally Scarce. The smallest of the genus, and the easiest to recognise, the female having a white pollen brush and the male green eyes. Active late May to early September, nesting colonially in the ground and largely a coastal species in the UK. Norfolk status: locally common in the Brecks, and at most coastal dune and soft cliff sites. Photo p.39.

Megachile ligniseca The largest species of the genus, found in well-wooded habitats, nesting in deadwood, sometimes excavating its own hole. Active late May to early September, often visiting thistles, knapweed and burdock for pollen. Norfolk status: fairly common throughout.

Megachile maritima A large ground-nesting species of heath, dunes and coastal grassland. Active early June to late August. Norfolk status: local, found all round the coast and in the Brecks.

Megachile versicolor A medium-sized species associated with wooded habitats. Active late May to mid-August. Norfolk status: widespread but scarce.

Megachile willughbiella A large and common species, found in most habitats, often collecting pollen from flowers of the pea family (Fabaceae). Norfolk status: common throughout.

Coelioxys *– cleptoparasites of* Megachile *and* Anthophora*; very distinctive appearance with a long abdomen lacking long hairs and tapering to a point in females, but the species are difficult to separate.*

Coelioxys conoidea Nationally Scarce. A parasite of *Megachile maritima*, and, like its host, restricted to coastal dunes and the Brecks. Active mid-June to late August. Norfolk status: local, but at most Breckland and coastal sites where the host occurs. Also a recent record from Norwich.

Coelioxys elongata A parasite of *Megachile willughbiella*. Active early June to mid-August. Norfolk status: widespread but not common. Photo p.38.

Coelioxys inermis A parasite of *Megachile centuncularis, M. versicolor* and *M. ligniseca*. Almost identical to the last species. Active late June to late August. Norfolk status: widespread but not common.

[Coelioxys quadridentata] RDB3. A parasite of *Anthophora furcata, A. quadrimaculata* and possibly other species. Norfolk

status: presumed extinct. JBB mentions records from Eaton, Postwick, Yarmouth and King's Lynn.

Coelioxys rufescens A parasite of *Anthophora bimaculata* and possibly other species. Norfolk status: rare, with only four recent records: Winterton in 1993, TF71 in 1999, TL79 in 2003 and Cranwich Heath in 2008 (GN).

***ANTHOPHORINAE** – a very varied sub-family; pollen is carried on the hind legs (except cleptoparasitic species).*

***Nomada** – the wasp bees are cleptoparasites, mainly targeting* Andrena *species; most have a striking black/yellow or black/red pattern; some can be recognised in the field.*

Nomada argentata RDB3. A cleptoparasite of *Andrena marginata,* active late July to late August. Norfolk status: rare, the only recent records from Foulden Common in 1983 (AGI), TL88 in 1986 and Weeting in 2009 (GN).

[Nomada armata] RDB1. A cleptoparasite of *Andrena hattorfiana,* now restricted in the UK to Salisbury Plain. Norfolk status: extinct. Bridgman collected this species at Eaton in 1876 and 1878.

Nomada fabriciana A cleptoparasite of *Andrena bicolor,* active from late March to early September, in two broods. Norfolk status: widespread and common throughout.

Nomada ferruginata RDB1. A cleptoparasite of *Andrena praecox,* active from early April to early May. Norfolk status: widespread. In the 100 years up to 2009 there had been just one county record. In the last two years there have been records from at least 12 sites in the Norwich area, Brecks and Downham Market. It may have been overlooked but it has certainly increased in abundance very recently.

Nomada flava A cleptoparasite of *Andrena carantonica* and probably other species. Active early April to mid-June. Norfolk status: widespread and common throughout.

Nomada flavoguttata A cleptoparasite of *Andrena minutula* and other related species. Active late March to late July, in two broods. Norfolk status: widespread and common throughout.

Nomada flavopicta Nationally Scarce. A cleptoparasite of *Melitta* spp., flying from mid-July to mid-August. Norfolk status: scarce, with about ten Breckland records and two from Sutton Fen.

Nomada fucata Nationally Scarce. A cleptoparasite of *Andrena flavipes,* active from late March to early September in two broods. Norfolk status: first recorded in 2003 in the Brecks and now fairly common and locally abundant on sandy soils throughout the county.

Nomada fulvicornis Nationally Scarce. A cleptoparasite, mainly of *Andrena tibialis* and *A. bimaculata,* active from early April to early August. Norfolk status: widespread on sandy soils where either host is numerous. Appears to have increased in the past five years.

Nomada goodeniana A cleptoparasite of *Andrena nitida* and *A. thoracica,* and probably other *Andrena* species, active early April to late June. Norfolk status: widespread and common throughout. Photo p.52.

Nomada integra A cleptoparasite of *Andrena humilis.* Active late May to late June. Norfolk status: very rare, with just one record, from Santon Downham (VC28) in July 1987.

Nomada lathburiana RDB3. A cleptoparasite of *Andrena cineraria,* and one of the more easily recognisable *Nomada* species. Active late April to late June. Norfolk status: unknown in 2009, but in the last two years found at ten sites in E. Norfolk, and at Cranwich Heath and Caudlesprings in VC28.

Nomada leucophthalma A cleptoparasite of *Andrena clarkella,* active late March to

early May. Norfolk status: widespread, probably occurring at most nesting aggregations of the host. Photo p.52.

Nomada marshamella A cleptoparasite of *Andrena scotica.* Active late March to early June. Norfolk status: widespread and common throughout.

[Nomada obtusifrons] Nationally scarce. A cleptoparasite of *Andrena coitana.* Norfolk status: presumed extinct. Recorded at West Runton and Brundall in the late 1800s.

Nomada panzeri A cleptoparasite of *Andrena synadelpha* and related species, active late April to early June. Norfolk status: widespread and common throughout. Photo p.52.

[Nomada roberjeotiana] RDB3. A cleptoparasite of *Andrena tarsata.* Norfolk status: extinct. Recorded from the King's Lynn area in 1902 (EAA).

Nomada ruficornis A cleptoparasite of *Andrena haemorrhoa,* active mid-April to early June. Norfolk status: widespread and common, usually near woodland or scrub.

Nomada rufipes A cleptoparasite of *Andrena fuscipes* and *A. denticulata,* active late June to late September. Norfolk status: widespread on sandy soils, especially *Calluna* heath.

[Nomada sexfasciata] RDB1. A cleptoparasite of *Eucera longicornis* and a UK rarity, now only known from Dorset. Norfolk status: extinct; collected by JBB from a colony of *Eucera* on a roadside bank near Postwick in the 1870s.

Nomada sheppardana A very small species, a cleptoparasite of several *Lasioglossum spp.,* active late June to mid-August. Norfolk status: scarce, recorded from four Breckland sites and Caistor St.Edmunds, though probably overlooked.

Nomada signata RDB2. A cleptoparasite of *Andrena fulva,* strangely much rarer than the host. Norfolk status: scarce, with just nine recent records, from Cranwich Heath, Weeting, Grimes Graves and Caudlesprings.

Nomada striata A cleptoparasite of *Andrena wilkella* and *A. ovatula,* active late May to mid-July. Norfolk status: scarce, with records from Santon Warren in 1986 (JF), Hoe Rough in 2007 (TS), Sutton Fen and Marsham Heath in 2010 (TS), and Cranwich and Weeting in 2011 (GN). Photo p.52.

Epeolus *– cleptoparasites of Colletes, of very distinctive appearance.*

Epeolus cruciger A cleptoparasite mainly of *Colletes succinctus,* active early July to early September. Norfolk status: widespread on heathland where the host occurs. Photo p.52.

Epeolus variegatus A cleptoparasite of *Colletes similis, C .fodiens* and *C. halophilus,* active late June to early September. Norfolk status: widespread, mainly on sandy grasslands and along the coast, where the hosts occur.

Eucera *– the long-horned bees, the males of which possess extremely long antennae*

[Eucera longicornis] The Long-horned Bee has declined alarmingly in the past 50 years and is now found sparingly only in the south and west of England. Norfolk status: presumed extinct; described as 'not uncommon' around Norwich by Bridgman in 1879, there have been no verified records since.

Anthophora *– rather rotund medium-large bees with a very long tongue, easily mistaken for bumblebee workers, but flight is fast and darting; males have a white face.*

Anthophora bimaculata A small, ground-nesting species, found in sandy habitats. Active June-August, both sexes are recognisable by white face and pale green eyes. Norfolk status:

frequent in the Brecks (where it favours Viper's Bugloss *Echium vulgare)*, but otherwise only recorded at Holt in 1981, Roydon Common in 1996 (MEA) and Sheringham 2001 (KD).

Anthophora furcata A rather dull, brown bee, active late May to mid-August, visiting flowers of woundworts *Stachys* spp., dead-nettles *Lamium* spp. and other Lamiaceae. Usually found in well-wooded habitats where it nests in deadwood. Norfolk status: widespread, but sparsely recorded; probably overlooked and common throughout.

Anthophora plumipes The Hairy-footed Flower Bee is one of the earliest spring bees, being seen from late February to mid-May. It is found in open woodland, scrub and gardens, nesting in dry bare soil or soft mortar in walls, and forages on a range of spring flowers, especially lungwort *Pulmonaria* spp., Cowslip *Primula veris* and currants *Ribes* spp. Norfolk status: widespread and common throughout. Photo p.39.

Anthophora quadrimaculata Nationally scarce. A species associated with lavenders *Lavendula* spp., *Nepeta* and other labiates commonly found in gardens, active July to August. Norfolk status: rare, with just one record from a Norwich garden in 1982 (AGI).

[Anthophora retusa] Another species that has declined dramatically in the UK, now only known from a few sites on the south coast. Norfolk status: presumed extinct; JBB found it 'plentiful' at Mousehold Heath in the 1870s, but the last record was in SE Norfolk in 1930.

Melecta *– rather distinctive greyish bees, cleptoparasitic on Anthophora spp.*

Melecta albifrons A cleptoparasite of the common *Anthophora plumipes*, active late March to late May and most likely to be seen around the nests of its host. Norfolk status: widespread, but rarely recorded. Photo p.52.

APININAE *– social bees and social parasites; pollen carried on hind legs.*

Apis *– honey bees.*

Apis mellifera The domestic Honeybee is active mainly February to November, but may appear in any month. Norfolk status: frequently encountered, often in large numbers despite recent declines. Temporary feral colonies are occasionally established in buildings or hollow trees. Photo p.52.

Bombus *– the social bumblebees and their social parasites (cuckoos); the latter were formerly treated as a separate genus, Psithyrus. English names are given but not all are in popular use, and many are not very apt; a number of colour phases occur in some species, including melanic forms.*

Bombus barbutellus Barbut's Cuckoo Bumblebee is a parasite of *B. hortorum.* Norfolk status: scarce, with most records from north Norfolk, but possibly overlooked.

Bombus bohemicus The Gipsy Cuckoo Bumblebee is a parasite of *B. lucorum*, and has a largely northern UK distribution. Norfolk status: scarce, with records widely scattered about the county.

Bombus campestris The Field Cuckoo Bumblebee is a parasite of *B .pascuorum.* Norfolk status: apparently scarce, but probably overlooked.

Bombus hortorum The Garden Bumblebee. Norfolk status: widespread and fairly common.

[Bombus humilis] Notable A. BAP Priority. The Brown-banded Carder Bumblebee, one of three species (with *B. muscorum* and *B. pascuorum*) with mainly ginger hairs all over, and a predominantly southern species. Norfolk status: probably extinct. Though fairly widespread in the 1960s, it seems to have disappeared. There have been a number of unconfirmed reports since.

Bombus hypnorum The Tree Bumblebee is a recent UK colonist, fond of gardens and well-wooded habitats. Norfolk status: widespread and locally common, having expanded rapidly since the first record at Earlham Cemetery in 2008 (SP). Photo p.52.

Bombus jonellus The Heath Bumblebee is usually regarded a species of heath and moorland. Norfolk status: very local, with recent records only from five N Norfolk sites, Catfield and Santon Downham. Photo p.52.

Bombus lapidarius The Red-tailed Bumblebee. Norfolk status: very common and widespread throughout the county.

Bombus lucorum The White-tailed Bumblebee. Norfolk status: widespread and common. Recent molecular studies have shown that there are three very similar species in the UK currently 'lumped' under this species. Two of these, *B. lucorum sensu stricto* and *B. cryptarum*, seem likely to occur in Norfolk.

Bombus monticola The Bilberry Bumblebee is an upland species associated with bilberry *Vaccinium* spp. Norfolk status: rare, possibly a vagrant, with records from Scolt Head and Kelling in 2007.

Bombus muscorum The Moss Carder Bumblebee has declined dramatically in the south of the UK in recent decades. Norfolk Status: very scarce, with recent records confined to the coast between Scolt Head and Weybourne. Photo p.52.

Bombus pascuorum The Common Carder Bumblebee. Norfolk status: widespread and common throughout.

Bombus pratorum The Early Bumblebee is sometimes double-brooded. Norfolk status: widespread and common throughout.

Bombus ruderarius The Red-shanked Carder Bumblebee is easily overlooked due to its similarity to *B. lapidarius*. Norfolk status: now very scarce with recent records only from Norwich, Wolferton and Hunstanton. Historically it was widespread over much of the county.

Bombus ruderatus The Large Garden Bumblebee is another species that has suffered a significant contraction in range. Norfolk status: rare, with recent records only from Holkham, and near Downham Market in 2007 (NWO).

Bombus rupestris The Hill Cuckoo Bumblebee is a parasite of *B. lapidarius*. Norfolk status: scarce in the east but locally common in the north and west. After no records for 40 years, this species appears to have re-colonised the county since 2000.

[Bombus subterraneus] The Short-haired Bumblebee is now considered extinct in the UK, though a reintroduction attempt in Kent is currently underway. Norfolk status: extinct. There are three records from the N coast, the last in 1961.

[Bombus sylvarum] Notable A. BAP Priority. The Shrill Carder Bumblebee was once widespread in the southern half of England and Wales but declined dramatically in the second half of the twentieth century. Norfolk status: extinct. Recorded at a number of central and south Norfolk sites in the 1960s, but not since.

Bombus sylvestris The Four-coloured Cuckoo Bumblebee is a parasite of *Bombus pratorum*. Norfolk status: widespread, and fairly common.

Bombus terrestris The Buff-tailed Bumblebee. Norfolk status: very common everywhere.

Bombus vestalis The Vestal Cuckoo Bumblebee is a parasite of *Bombus terrestris*. Norfolk status: widespread and common.

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The author is indebted to the recorders who have devoted time to recording of bees in Norfolk over the past 150 years. The late Ken Durrant deserves special mention for his records spanning a remarkable 72 years. David Richmond has done sterling work documenting and recording bumblebees for two decades, and the information on bumblebees herein was mostly drawn from his works. Tony Irwin provided access to collections at the Castle Museum as well as contributing more than 100 records (over 36 years). Pat Lorber and Martin Horlock (NBIS) and Mike Edwards (BWARS) provided access to records. Steven Falk provided a copy of Spooner's handwritten list. Geoff Nobes and, more recently, Nick Owens have both courageously tackled solitary bees, and are filling in some important gaps. They have also both provided helpful comments on drafts and the majority of the photographs.

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T. Strudwick 16, Beech Way, Brundall, Norwich, NR13 5ND

timstrud@tiscali.co.uk

Epeolus cruciger (female, NWO)

Nomada goodeniana (female, NWO)

Nomada leucopthalma (female, TS)

Apis mellifera (worker, NWO)

Melecta albifrons (female, NWO)

Nomada panzeri (female, NWO)

Nomada striata (female, TS)

Bombus hypnorum (male); ***Bombus muscorum*** (male); ***Bombus jonellus*** (queen, all NWO)

Poronia erici, a small nail fungus, recently recorded in Norfolk and Suffolk, and notes on the distribution of Nail Fungus *Poronia punctata*

Tony Leech, Sheila Francis, Neil Mahler & Ray Purser

On 3 October 2010, Ray Purser was photographing fungi on the dunes at Holme, West Norfolk, when he noticed a rabbit pellet bearing buff-coloured discs that he recognised as a nail fungus *Poronia* sp. Initially suspecting that they were *Poronia punctata*, a species of considerable conservation interest that usually occurs on horse dung, he sent specimens to Kew. There, Brian Spooner identified them as *Poronia erici*, a species not seen in Britain since the one and only previous record in 1933 (see below). Ray's remarkable photograph (p.60) shows eleven of the disc-shaped fruiting bodies (stromata) on a single pellet (two are fused). This is all the more remarkable when it is realised that the visible 'head' is only part of a conical fungus, most of which is buried within the pellet. Brian Spooner (2011) has recently given an account of this species, which is a 'pyrenomycete' and thus bears its spores in small chambers (perithecia) embedded in the buff-coloured stroma. The perithecia, seen as black dots, open to the surface via small pores or ostioles.

On a visit made on 7 November 2010, members of the Dersingham Mushroom Club were directed by warden Gary Hibberd to the site of the original find, a north-facing mossy bank on fixed dunes to the east of the visitor centre at Holme. About ten pellets with *Poronia* stromata were gathered from both sides of the track, none bearing more than four stromata. The following details were determined from these specimens:

Diameter of stromata: 1.0-2.2 mm with 1-10 ostioles each.

Spore dimensions: Average and range of ten spores from a single specimen: 32.7 (30-34) x 18 (17-20) µm, all pigmented, although many spores from the same perithecium were not (immature). These dimensions are at the top end of the published range (Lohmeyer 1994).

Although small *Poronia* fruit bodies had been observed on rabbit dung on occasions, it was not until 1988 that *P. erici* was described as a distinct species (Lohmeyer & Benkert 1988). Lohmeyer described *P. erici* from specimens found on rabbit dung on an island in the Baltic Sea off the coast of Germany (formerly GDR), noting other records from coastal sites in West Germany, Netherlands, Belgium and, possibly, Britain. Subsequent study of herbarium material revealed that *P. erici* had been collected from five states in Australia (where it is known as Dung Buttons), almost always on kangaroo dung at (mostly) non-coastal sites, and on one occasion from central Spain. The main differences between the two species are summarised in Table 1.

The single British record (before the colledtions in 2010) is referred to by Lohmeyer (1994) as 'apparently collected (in 1933) on the British Island of Scolt Head off the Norfolk coast.' This record does not appear on the Norfolk Fungus Database (held by the Norfolk Biodiversity Information Service, NBIS) nor on the national database (Fungus Record Database of Britain and Ireland, FRDBI). Despite this, the latter notes that the species is designated 'Extinct since 1933 in the Red Data Book 2nd edn. Brian Spooner has shed light on this (pers. comm.). At the request of Lohmeyer

Table 1 Distinguishing *Poronia erici* and *P. punctata*

	Poronia erici	*Poronia punctata*
Spore size	(22)25-32(33.5) x (12)14-18(19.5) µm (Lohmeyer 1994).	18-26 x 7-12 µm (Dennis 1978). 17-26 x 8.5-13 µm (Hansen & Knudsen 2000).
Substrate	Rabbit, hare, sheep, goat, horse (Europe). Kangaroo, wallaby, wombat, sheep , cow, horse (Australia).	Horse, cow (Europe).
Shape and size of stromata	Up to 6 mm diameter; cylindrical head, tapered downwards into a short stalk buried in dung.	5-15 mm diameter; flat head with long stalk in dung.

he had located the Scolt Head material in the Kew Herbarium as the only British *Poronia* specimen on rabbit dung. It was immature and had spores slightly smaller than the type material, so was referred only tentatively to *P. erici* but, in view of subsequent records, it is now considered to be that species.

Only after the above exchanges did it come to light that, in August 2010, Sheila Francis had collected what she also presumed was *P. punctata* from the dung of Exmoor Ponies at Snape Warren in Suffolk. She passed this information to Neil Mahler (Suffolk County Fungus Recorder) who collected further specimens and determined that the spores were very large for *P. punctata* –(29)30-32 x 17-18 µm. Neil was aware of the existence of *P.erici*, but only knew of it growing on rabbit dung and naturally assumed that it would therefore be smaller, with smaller spores to match. In the spring of 2011, further examination by Liz Holden established, however, that the Suffolk fungus was in fact *P. erici*.

Lohmeyer (1994) speculates that *P. erici* has been introduced to Europe from Australia but it would seem equally likely that movement was in the opposite direction. In support of this, the many coprophilous fungi from New Zealand described by Bell (1983) must have been introduced as that country has no indigenous herbivorous mammals.

Nail Fungus *Poronia punctata* in Britain

All sources indicate that the Nail Fungus *P. punctata* was formerly widespread in Britain but is now very uncommon. It is listed as 'Endangered' in Red Data Book edn.2, and is a Biodiversity Action Plan species. There are few pre-1970 records on the FRDBI but since then almost all have been from the New Forest area. Exceptions are: Dorset (1984, 2006); Surrey (1985, 2006); Oxfordshire (manure in garden 1995, 1996); North Hampshire(1998); Anglesey (2001); West Kent (2001); Berkshire (2005) and Herefordshire (2006). At least some of these records could be from the dung of ponies which came from the New Forest.

The only records for *P. punctata* on the Norfolk Fungus Database are:

1873 near Hunstanton , seashore. TF6740. CB Plowright, 1 December.

1874 Great Yarmouth TG5207.

1941 Wacton Common TM1890. EA Ellis, 4 May.

1944 Horsford Heath (Woods) TG1818. EA Ellis, 30 July.

1982 Holme, Broad Water TF714504 [should be TF7144]. PC (Peter) Holland, 5 June.

This last record is intriguing for a number of reasons. First, it is likely to be within one km (and possibly much less) of Ray Purser's 2010 discovery. Although a 6-figure grid reference is given for the 1982 record, this must be incorrect as it specifies a point five km north of Holme beach. The name Broad Water, however, and the easting suggest its proximity to the 2010 collection. The record is annotated 'on horse droppings; reliable record.' It was, however, made before *P. erici* had been described. In view of the fact that in Australia *P. erici* has been recorded from horse dung (and now on that substrate from Suffolk) it is probable that the 1982 record is actually of this species.

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Dr A.R. Leech 3 Eccles Road, Holt, Norfolk NR25 6HJ

leech@dialstart.net

***Poronia erici* on rabbit pellets at Holme.** Photo: Ray Purser.

Galeruca laticollis (Sahlberg): some notes on the life cycle

Tim Kemp

Galeruca laticollis (Salhberg) is a very rare skeletonising leaf beetle previously known in the 19th century at Wicken Fen and Whittlesea Mere (Cambridgeshire), Westward Ho! (Devon), Sherborne (Dorset), and Wheatley (Oxfordshire). It was considered to be possibly extinct in the UK by Shirt (1987) as there had been no UK records since 1919. It was re-discovered by Martin Collier in 1996 at Wheatfen Broad in East Norfolk, a site formerly owned by the nat-uralist Ted Ellis (Collier 1997). It has been recorded at Wheatfen every year since 1996, but very little has been found out about it in the intervening years. Wheatfen is still the only current site in the UK (Figure 1).

Figure 1. Pair of *Galeruca laticollis* mating.

At Wheatfen the female (Figure 2) lays her eggs on the food plant, Common Meadow-rue *Thalictrum flavum*, and the larvae hatch around the last week in May/first week in June. The emerging larvae (Figure 3) feed in the growing point of the plant and then disappear towards the end of June to pupate. The adults are not normally recorded until the very end of July/beginning of August. Adult beetles feed on the leaves of Creeping Thistle *Cirsium arvense*. At this time any females recorded have already been fertilised and have a swollen abdomen and egg case.

Figure 2. Female *Galeruca laticollis*.

Beetles of the genus *Galeruca* are generally assumed to be unable to fly as not all have fully developed wings and those that do

Figure 3. Larvae of *Galeruca laticollis*.

often have little or no flight muscles. The European *Galeruca tanaceti* is an example of a *Galeruca* with fully developed wings but there are no published observations of it flying. (Intriguingly, *Galeruca tanaceti* was recorded by Ted Ellis at Wheatfen in 1939, from the stomach of a Corncrake *Crex crex*.) In fact, only one observation of any *Galeruca* species flying exists, from Sherborne (Dorset) in 1919 by E.J. Pearce, (as *Galeruca laticollis*, Beenen 2005). To date no evidence of the beetle flying has been observed at Wheatfen.

U.K. & European status

Shirt (1987) described *Galeruca laticollis* (misidentifed as *Galeruca interrupta* Illiger) as being possibly extinct in the UK. *Galeruca laticollis* is distributed in the northern part of Palaearctic Region from eastern France to the Amur region of the Russian Far East. It has been recorded in Sweden, Finland, a few sites in northwest Germany, Lithuania and Russia, and it is listed in Denmark's Red Data Book as of 'Least concern' (Cox 2007).

Survey Data

A survey of the Wheatfen Broad Reserve to establish the location of Common Meadow-rue showed food plants in varying numbers along the side of all paths beside dykes and open fen that are brush cut on an annual rotation. Some grow weakly, others much more strongly with a thick, almost bulbous growth point. The latter are the ones favoured by *Galeruca laticollis*.

Individual larval food plants were examined to see if there were any similarities between ones that were used by adult females for egg-laying, and whether there has to be a minimum number of plants growing in the immediate vicinity in order for eggs to be laid. At the same time, the proximity of the adult food plant, Creeping Thistle, was noted.

No larvae were recorded on plants already coming into flower; no larvae were seen on plants under 22 cm in height; no larvae were found on taller, weaker plants where they were overshadowed by other path-side vegetation, and finally, at least two of the sites that held particularly high numbers of larvae were less than 2 m distant from reed spoil-heaps.

Quadrat (4 m x 4 m) surveying of Common Meadow-rue for larvae showed no consistency regarding distance to the nearest Creeping Thistles, ranging from less than 1 m to more than 20 m. One site did have Creeping Thistle actually within the same quadrat as Common Meadow-rue but this did not appear to have much influence, as the mean number of larvae per plant was 3.95, whilst the overall mean for all quadrats with larvae was 3.67. The maximum number of larvae on an individual plant was twenty. In some instances the distance to Creeping Thistles was greater than 20 m.

When the larval stages were well developed a small number were removed, along with fen soil and Common Meadow-rue growing points, from the plants the larvae were feeding on. The purpose of this was to see if they would develop into adults away from the site and to gain an understanding of the length of the pupal stage. On 16 June 2009 a total of eight large larvae were taken from plants with strong growing points. Additional growth points were taken as extra food and the plants and larvae were kept in three large glass containers, half-filled with soil from the sites where the larvae were taken from and sealed with cling-film which was liberally pierced to allow air-flow. These containers were placed on a north facing window sill. By 20 June only two (smaller) larvae had not disappeared into the soil to pupate and by the following day all the larvae had gone into the pupal stage. The first beetle to emerge did so on the morning of 3 July and by the end of the day a total of four had emerged. Over the next few days a total of six beetles emerged.

These observations show an approximate pupation stage length of only 14 days when removed from the wild.

Emergence on site

From 22 July, weekly visits to the larval sites were made in order to monitor the number of adult beetles. There was abundant evidence all over the reserve of the presence of adults on thistles, with characteristic holes in the leaves. All the plants of Creeping Thistle in the area of stands of Common Meadow-rue that had held larvae were closely searched on both the upper- and the underside of each leaf for either male or female adult beetles. The reason for this was to make sure none were missed, however a consequence of this was that it was difficult to cover more than two sites at any one visit. Few adult beetles were recorded

Galeruca laticollis has one generation each year and there is no evidence that adults overwinter. Eggs are laid within a brownish oothecae attached to low vegetation.

Conclusion

It appears that the *Galeruca lallicolis* population is thriving at Wheatfen, with very many larvae and much evidence of adult foraging on Creeping Thistles. This suggests that the current management regime is at least maintaining the numbers on site.

Galeruca lallicolis like, or need, sturdy, strong growing Common Meadow-rue plants that are preferably going to grow to at least one metre in height before flowering. They also need many Creeping Thistles in the vicinity of the meadow-rue. The management strategy of maintaining open pathways encourages growth of Common Meadow-rue and Creeping Thistle by restricting reed encroachment.

Further research suggestions

Unfortunately, much future research is likely to have to be invasive. For example, do the adult beetles fly? Are their flight muscles sufficiently developed? Less invasive might be to radio-tag adult beetles in order to discover what happens to them when they cannot be found (although this, of course, awaits an appropriately small technology!). Do they feed on other plants? Do some adults overwinter on Grey Willow *Salix cinerea*, on Aspen *Populus tremula*, or are they non-specific? Is the length of pupation the same in the field as it is in laboratory conditions?

Acknowledgements

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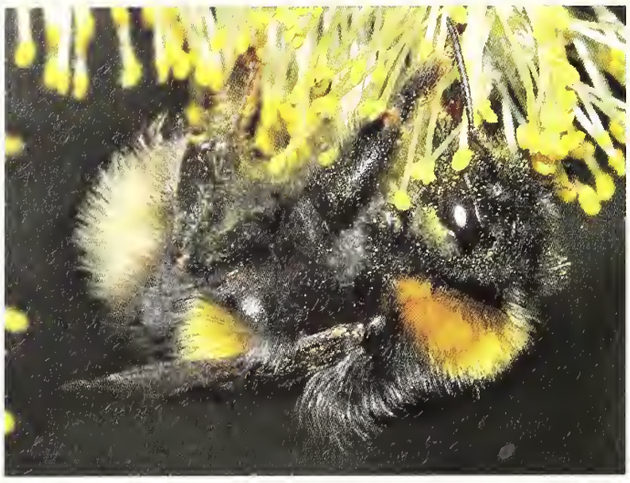
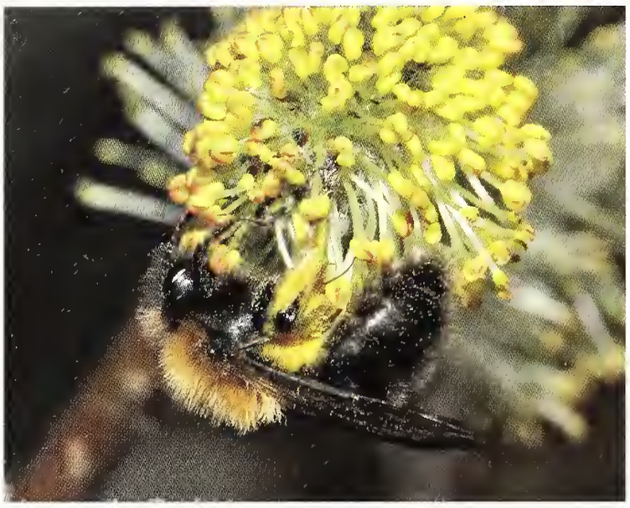
T. Kemp 6 Wingfield Court, Old Chapel, Norwich Road, Mulbarton, Norwich NR14 8JP

tombotim@live.co.uk



White-tailed Bumblebee *Bombus lucorum*: queen taking nectar on male sallow catkin, March.



Solitary bee *Andrena clarkella:* female taking nectar from male catkin, April.

Hoverfly *Eristalis intricarius*: taking nectar from female sallow catkin.

Honeybee *Apils mellifera*: on male catkin.

White-tailed Bumblebee *Bombus lucorum:* queen taking nectar on female sallow catkin, March. Note pollen on head and thorax.

Solitary bee *Andrena clarkella:* female taking nectar from female catkin, April. Note stigma touching pollen on bee's hair.

Buff-tailed Bumblebee *Bombus terrestris:* queen taking nectar from male sallow catkin, April.

Tachinid fly: taking nectar from male catkin, March.

Some observations on sallow catkin visitors

Nick Owens

The yellow crowns of sallows herald the start of spring in Norfolk's young woodlands and hedgerows. Goat Willow *Salix caprea*, Grey Willow *Salix cinerea* and similar species provide an abundance of nectar and pollen to insects emerging from hib-ernation. Male and female sallow catkins occur on separate trees (i.e. they are dioecious) and both contain nectaries. This article describes insect and other visitors to sallow catkins in Norfolk in March and April 2011. Particular attention was paid to bees. It was hoped to provide some evidence about how sallows are adapted for pollin-ation and their benefit to insects.

Observations

Observations were made in habitats such as pond edges, hedgerows, heathland and woodland. Bumblebees and butterflies were identified by sight using binoculars. Photographs or specimens of smaller insects were taken for identification. Sites visited included Beeston Common, Foxley Wood, Holkham Meals, Kelling Heath, Sandringham woods, the Stanford Training Area and Weybourne. Table 1 lists fauna recorded visiting two sallow species, Goat Willow and Grey Willow (note that Goat Willow flowers slightly earlier than Grey Willow). Some other willow species or hybrids may have been included in the observations as identification of willows is very complex (Hall 2011).

Aculeates

Ten species of bumblebee queens were recorded on sallow catkins, including the newly-arrived Tree Bumblebee *Bombus hypnorum*, seen at Sandringham and Holkham, and the local Heath Bumblebee *B. jonellus*, seen in Weybourne. In the first three weeks of March, bumblebees were observed to feed largely on nectar from both male and female sallows (see photos p.64). By the end of March they began filling their pollen baskets, marking the stage when nests had been established and pollen was being stored for egg laying. Honeybees *Apis mellifera* also took mostly nectar in the early weeks.

The close clustering of male catkins on the sallow stems caused bumblebees and honeybees to become covered in pollen on their backs as well as their undersides, and this presumably enhanced the effectiveness of pollen transfer (see photo p.64).

Seven species of solitary bee in the genus *Andrena* were identified: *A. clarkella* was seen taking pollen from male catkins and then flying to an adjacent female tree to take nectar on Kelling Heath (see photos p.64). *A. praecox* and *A. haemorrhoa* males were observed gathering around the trunk of a sallow in March, probably seeking unmated females. The scarce A. *tibialis* was recorded on sallow catkins in the Brecks, as were males of its scarce brood parasite, *Nomada fulvicornis*, both in the Brecks and at Beeston Common. These male nomad bees also appeared to be patrolling and searching for females as well as feeding on the sallows.

The large solitary bee *Anthophora plumipes* was a common visitor to sallows, as were Honeybees.

Weather conditions played an important role in pollen transfer, with little pollen available when the catkins were soggy and wet. Bumblebees did visit under these conditions but probably took only nectar.

Table 1. Animals observed feeding from sallow catkins

			Goat willow *Salix caprea*		Grey willow *Salix cinerea*	
		Sex/caste	Male	Female	Male	Female
Aculeata						
Andrena bicolor	solitary bee	female	x			
Andrena bimaculata	solitary bee	male				x
Andrena clarkella	solitary bee	female			x	x
Andrena dorsata	solitary bee	male				x
Andrena haemorrhoa	solitary bee	male	x			
Andrena haemorrhoa	solitary bee	female				x
Andrena praecox	solitary bee	male	x			
Andrena praecox	solitary bee	female			x	
Andrena tibialis	solitary bee	female	x			
Anthophora plumipes	Hairy-Footed Flower Bee	male	x			
Anthophora plumipes	Hairy-footed Flower Bee	female			x	
Apis mellifera	Honeybee	worker	x	x	x	x
Bombus pascuorum	Common Carder Bumblebee	queen	x		x	
Bombus hortorum	Garden Bumblebee	queen	x			
Bombus hypnorum	Tree Bumblebee	queen	x		x	
Bombus jonellus	Heath Bumblebee	queen	x			
Bombus lapidarius	Red-tailed Bumblebee	queen	x		x	x
Bombus lucorum	White-tailed Bumblebee	queen	x	x	x	x
Bombus pratorum	Early Bumblebee	queen	x	x	x	x
Bombus terrestris	Buff-tailed Bumblebee	queen	x	x	x	x
Bombus sylvestris	Four-coloured Cuckoo Bumblebee	female			x	
Bombus vestalis	Vestal Cuckoo Bumblebee	female				x
Lasioglossum calceatum	solitary bee	female				x
Nomada fulvicornis	nomad cuckoo bee	male				x
Vespula vulgaris	common wasp	queen	x			
Diptera						
Egle sp.	anthomyiid fly		x			
Eristalis tenax	drone fly		x	x	x	x
Eristalis intricarius	drone fly					
Melangyna sp.	hoverfly					
Scathophagid sp.	dung fly		x			
Tachina ursina	tachinid fly		x			
Syrphus ribesii	hoverfly				x	
Lepidoptera						
Polygonia c-album	Comma		x	x		
Vanessa atalanta	Red Admiral		x			
Inachis io	Peacock		x			
Aglais urticae	Tortoiseshell				x	
Aves						
Parus caerulus	Blue Tit				x	
Parus major	Great Tit				x	
Fringilla coelebs	Chaffinch				x	

Diptera

Nectar attracted many diptera species to sallows, but not all were identified. One of the earliest spring visitors were flies of the genus *Egle*, which used unopened parts of sallow catkins as a platform for courtship. Four species of hoverfly were observed. Hoverflies of the genera *Merodon* and *Eristalis* were abundant and seemed largely to take nectar (see photo p.64). There were very large numbers of *Eristalis* spp. on the sallow flowers at Beeston Common in April.

Birds

Blue Tits *Parus caerulus*, Great Tits *P. major* and Chaffinches *Fringilla coelebs* were seen plucking (and probably eating) nectaries from male 1.5kins at Sandringham woods. Whether they subsequently repeated the behaviour on female catkins, allowing pollination, was not seen. Willow Warblers *Phylloscopus trochlus*, Chiffchaffs *P. collybita* and Blackcaps *Sylvia atricapilla* were observed seeking insects amongst sallow catkins.

Mammals

Grey Squirrels *Sciurus carolinensis* were seen in Cambridge eating Crack Willow *Salix fragilis* catkins. This behaviour was not seen on sallows, but may occur.

Pollen size

Microscopic observation of sallow pollen showed it to have a diameter of about one tenth of that of primrose, a spring insect-pollinated flower. This indicates a pollen mass about one thousandth that of primrose.

Discussion

Goat Willows appear to be closely adapted to bumblebee pollination, having large, closely spaced catkins which apply pollen liberally to emerging queens between late February and early April. In the early weeks it was the provision of nectar that attracted queen bumblebees and worker honeybees to male and female catkins. Bumblebees regularly moved between adjacent male and female trees, giving the potential for pollen transfer from male anthers to female stigmas. Goat Willows were also a significant food source for butterflies that winter as adults, such as Peacocks (*Inachis io*) and Commas (*Polygonia c-album*), and these butterflies probably also transfer some pollen.

Grey Willows flowered slightly later than Goat Willows, and their catkins were smaller. They attracted a similar range of bumblebees and also two species of cuckoo bumblebees, which emerge slightly later than their hosts. Cuckoo bumblebees do not collect pollen from the sallows.

Hoverflies, especially drone flies *Eristalis* spp., were common visitors to sallow catkins and probably played a role in pollination. They eat but do not collect pollen (Stubbs and Falk 2002) and so are unlikely to be as effective in pollen transfer as similarly-sized solitary bees such as *Andrena clarkella*. *A. clarkella* and *A. praecox* collect pollen almost entirely from sallows (oligolectic) (Edwards and Roy 2001, 2002). Records of *A. tibialis* collecting pollen have so far also been confined to sallows (Baldock 2008). This specificity may be one factor restricting these three species to one brood per year (i.e they are univoltine). *A. haemorrhoa* feeds largely from sallows in early spring but then moves to other species (Baldock 2008), but is also univoltine.

Andrew Cannon (2011) reports up to fifty bumblebee queens on one small Goat Willow at Bayfield, Norfolk in March 2011. In the same month he trapped 240 moths of three sallow-associated species (Hebrew Character *Orthosia gothica*, Twin-spotted Quaker *Orthosia munda* and Common Quaker *Orthosia cerasi*) beside the flowering sallow in one night. These moth species are reported to feed on sallow catkins (Waring and Townsend 2003). It seems likely that moths play a part in sallow pollination.

Tim Strudwick (pers.comm.) photographed a Clouded Drab *Orthosia incera* taking nec-

tar from a sallow during the day. He reports finding a similar range of bees on sallows to those listed here, with the additional observations of *Andrena minutula* feeding on Goat Willow catkins at Mousehold Heath and *Nomada leucophthalma*, *N. flava* and *N. fulvicornis* as frequent visitors to willows, including females taking nectar.

Three species of bird were seen plucking nectaries from male Grey Willow catkins and warblers were seen taking insects from among sallow blossoms. Blue Tits have previously been reported taking nectar from sallows and it has been suggested that tits and warblers could act as pollinating agents (Kay 1985; Campbell,1963).

Sallow catkins have many features of wind-pollinated flowers: the anthers are exposed to the wind rather than being surrounded by petals and there is an abundance of very small pollen grains. As with the wind-pollinated Hazel *Corylus avellana*, catkins appear before the leaves, allowing access to the wind, and large quantities of sallow pollen are found in air samples (Proctor and Yeo 1973). Other members of the Salicaceae, such as poplars, are wind-pollinated and it has been suggested that willows are secondarily insect-pollinated i.e. willow ancestors were wind-pollinated but they are now insect-pollinated, retaining some features of wind-pollinated flowers (Sacchi and Price 1988). Despite the wide range of potential animal vectors of sallow pollen, it is possible that wind transfer still plays a part, and this needs further study.

Acknowledgements

Thanks to Tony Irwin and Stuart Paston for help with identification of diptera, to Tim Strudwick for assistance with the identification of solitary bees and to Martin Preston for access to his sallows in Weybourne.

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Dr N.W. Owens 22 Springfield Close, Weybourne, Holt, Norfolk NR25 7TB

Nick@nickowens.wanadoo.co.uk

The mosses and liverworts of Bawsey Country Park

C. Robin Stevenson

Bawsey Country Park, which lies just to the east of King's Lynn in West Norfolk (Figure 1), is an area of old sand workings belonging to Sibelco UK. It is an area of open public access, although a few areas within the Park remain fenced off for safety reasons.

Mosses and liverworts usually form part of the pioneer vegetation communities that establish themselves on bare surfaces, growing attached to rock or similar hard surfaces, on soils of various types, or attached to trees, as epiphytes. Some species grow in very dry places, tolerating considerable drought, whilst others are moisture demanding. Similarly, some can tolerate, acidic conditions with a very low pH whilst others are more nutrient demanding.

Because of its history as a mineral extraction site the range of habitats present within the Country Park is particularly wide.

The Park is varied both topographically and geologically. The underlying bedrock consists of Lower Cretaceous sands, belonging to the Leziate Sands Member of the Sandringham Sands Formation (Gallois 1994). This material is overlain in places by tills belonging to the Anglian Lowestoft Formation (*till* is the term now used to describe what some readers may remember as 'Boulder Clay'). Where the tills were thicker they constrained exploitation of the underlying sands, presumably because of the expense of removing the overburden. The Leziate Sands themselves are variable, with iron pyrite (FeS_2) and glauconitic clay-rich horizons having no commercial value (glauconite is an iron-rich silicate mineral). Where these were encountered they were moved, when feasible, in order to get at the underlying good quality sands. The resulting spoil heaps add much to the topographic variety of the site. The overall result is that the substrates available to plants, including the bryophytes, are somewhat more complex than the geological map of the area indicates. In undisturbed places heavily leached podsols, resting on Leziate Sands and coversands, provide acid substrates. Elsewhere soils are forming

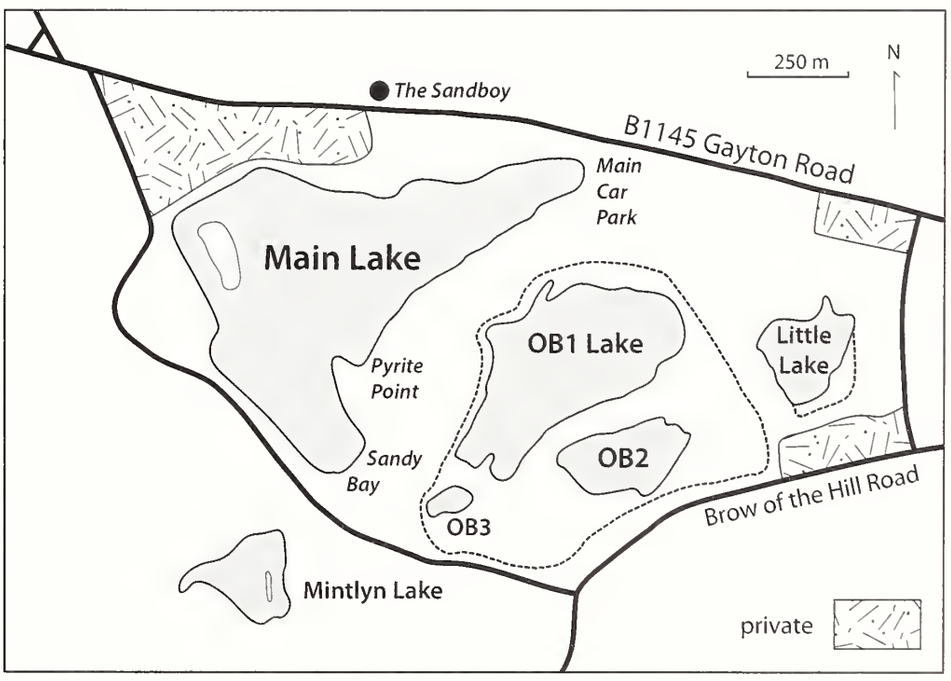

Figure 1. The area of the Bawsey Country Park. The majority of the names allocated to various features on the map were invented for convenience.

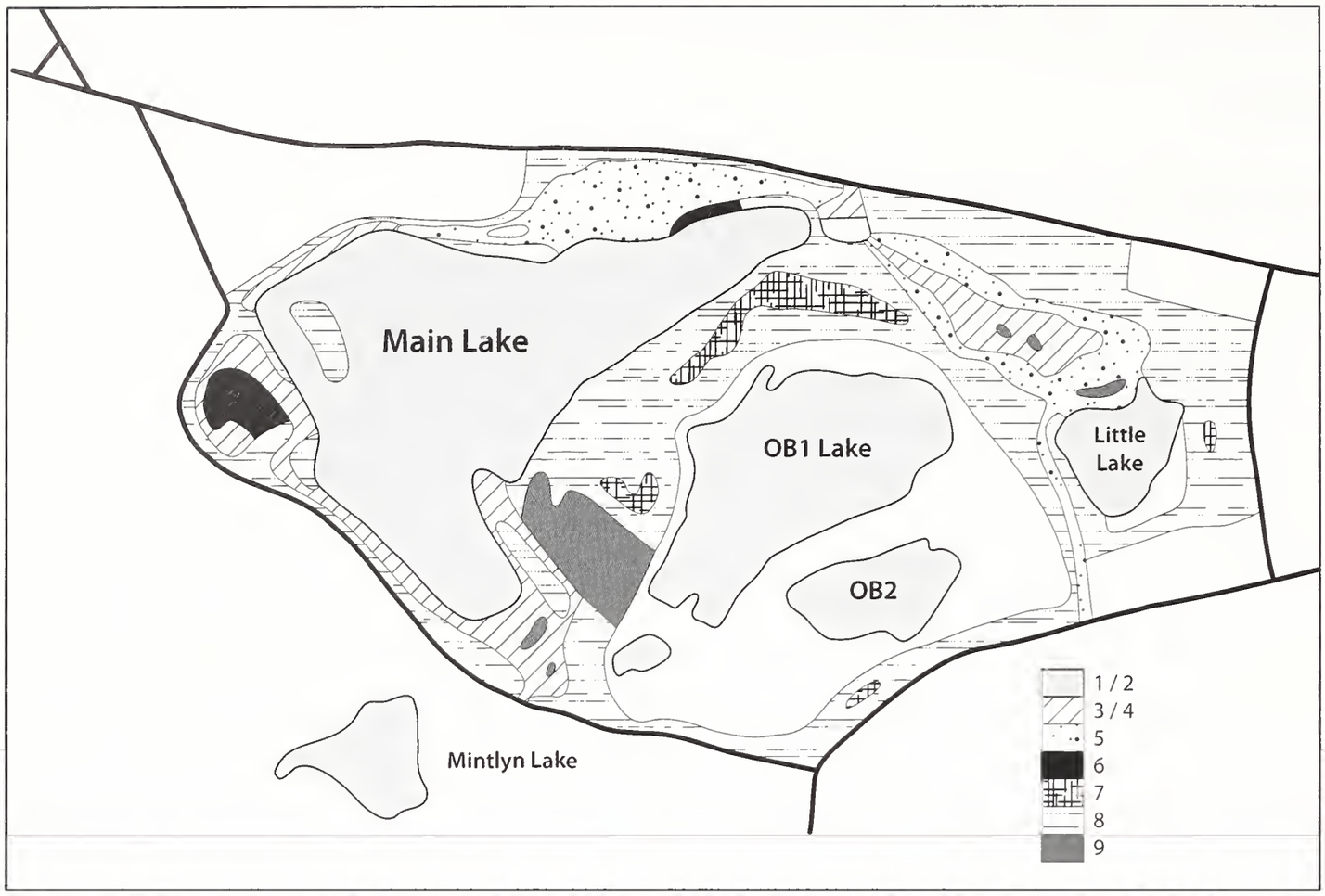

Figure 2. The main vegetation units and their distribution within the Country Park. Boundaries have been traced from aerial photographs and are therefore only approximate. 1/2: Lake and lake margins, 3 / 4: Bare sand (and bryophyte dominated communities), 5: Short herbaceous vegetation, including Sand Sedge, 6: *Calluna* heath, 7: Open calcareous grassland 8: Mixed woodland – planted and regenerated, 9: Conifer plantation.

directly on pure sands, whilst soils forming on overburden and spoil may – if founded on glauconite rich sands – be rather clayey. However, where the overburden is rich in iron pyrite (FeS_2) this breaks down to provide rather toxic substrates. The Anglian tills, of course, tend to be calcium rich, incorporating, as they do, substantial amounts of glacially eroded chalk.

Within the Country Park there is a variety of habitats present (Figure 2). These are partly controlled by topography, and partly by the type of substrate:

1. Lakes (flooded pits)
2. Damp ground associated with lake margins; these are, in part, wooded.
3. Areas of open un-colonised sand.
4. Bryophyte dominated communities.
5. Areas of sand colonised by short herbaceous vegetation, including Sand Sedge *Carex arenaria*.
6. Areas of heath, dominated by Heather *Calluna vulgaris*.
7. Open calcareous grassland.
8. Areas of mixed woodland.
9. Conifer plantations.

The Country Park is mainly contained within National Grid square TF6719, with parts in TF6619 and TF6819 and, as can be seen (Figure. 1), a considerable part of the area within the Park boundary either consists of open water or is out of bounds.

Appendix 1 lists the species recorded from the Country Park: 88 species is a very respectable total for such a comparatively small land area. Nomenclature for bryophytes follows Hill, Blackstock, Long & Rothero (2008), and Stace (2010) for vascu-

lar plants. English names have been given for vascular plants; those of the bryophytes have not been used in the text although they are provided in the appendix.

The bryophytes of the Bawsey Country Park are of interest from several different points of view:

- The more obviously pioneer communities are of educational interest since they offer opportunities for simple ecological fieldwork.
- The Park hosts significant populations of some nationally and regionally rare species of conservation interest.
- Significant populations of pollution sensitive species may be useful in monitoring air quality, should the proposed waste incinerator be built in King's Lynn.
- The presence, in abundance, of two invasive alien species is clearly producing new, recombinant, bryophyte communities. These communities are potentially capable of having an adverse effect on other organisms. The Park offers excellent opportunities for long term studies of these interactions.

1 Lakes

Only two of the lakes within the Country Park are accessible to the public: Main Lake, and Little Lake (Figure 1). The three OB (Out of Bounds) lakes are fenced off, for reasons of public safety.

Access to the Main and Little lakes is only possible at a few places. A few vascular plants are to be found growing in the water, notably Bulbous Rush *Juncus bulbosus* in Main Lake and Spiked Water-milfoil *Myriophyllum spicatum* and Rigid Hornwort *Ceratophyllum demersum* in Little Lake. However, at Mintlyn Lake (which is outside the boundaries of the Country Park), the moss *Warnstorfia fluitans* has been found growing under water; within the Park it has been found growing in damp hollows near the margin of Main Lake.

2 Damp ground associated with lake margins

The bryophytes associated with the lake margins in the Country Park depend on factors such as whether erosion or deposition dominates. This seems to be controlled by the orientation of the lake shores relative to the prevailing local winds. Where onshore winds are frequent, erosion is a constant factor, resulting in bare, un-colonised sand.

Main Lake

In more sheltered positions, such as the head of Sandy Bay, bryophytes have established themselves. The most important species to do so is the Red List (Vulnerable) liverwort *Lophozia capitata*. This is a pioneer species found most frequently in old pits. It has, in the past, been found at several sites in west Norfolk (Stevenson 1993) but is very vulnerable to seral changes, so the colonies at Bawsey are the only ones known to occur regionally at present. On the shores of Main Lake, *L. capitata* occurs in fairly small quantities, and is associated with another liverwort, *Gymnocolea inflata*. *Lophozia capitata* is also found alongside the sandy track that runs along the north-west portion of Main Lake. This colony is severely at risk from encroaching trees; from a conservation viewpoint it would be highly desirable if the trees were to be removed. (In nearby lakes outside the Country Park, which are also very sheltered, the lake shores (which have very gentle gradients) host extensive moss carpets, the dominant species being *Warnstorfia fluitans*, *Dicranella cerviculata* and the liverwort *Gymnocolea inflata*. Rarer species associated with lake shores elsewhere include members of the liverwort genera *Fossombronia* and *Riccardia*.)

Much of the southern shore of Main Lake appears to be relatively protected. A variety of trees, some of which have been planted - including Birch *Betula* spp., Alder *Alnus*

glutinosa and Willow *Salix* spp. - grow down to water level. Associated with these is a dark, humus-rich, peaty material on which bryophytes can grow. The dominant species is the liverwort *Lophocolea semiteres*, which can be associated with mats of two other liverworts, *Cephalozia bicuspidata* and *C. connivens*. Moss species found include *Dicranella cerviculata* and *Pohlia nutans*. *L. semiteres*, however, occupies the greatest areas.

Bog-moss (*Sphagnum*) is a genus that typically grows in damp acid conditions. There are, however, only a few places where Sphagna occur at Bawsey: *Sphagnum fimbriatum* and *S. squarrosum* occur in damp woodland on the western side of Main Lake, as well as amongst the rushy vegetation fringing Sandy Bay. Back in the early 1980s, before Main Lake took its present form, there were several very low-lying damp areas on which Sphagna grew; these had the potential to be developed into new mires but unfortunately they were either flooded or allowed to dry out.

Little Lake

Little Lake is somewhat different in character from the Main Lake. Most of the northern shore is open, sandy, and bryophyte free whilst the southern shore is precipitous and inaccessible. The south-western shore is wooded, mainly with willows, and the combination of a moist microclimate and a basic bark has facilitated colonisation by an interesting range of 'clean air' epiphytes. Most of the non-epiphytic bryophyte interest is centred on the north-eastern part of the lake, near a small re-entrant bay, and the area to the east of that, which is low lying and damp. *Lophozia capitata* occurs, at very low density, in this area too. Part of this area has been invaded by Alders and, again, removal of those would substantially increase the amount of suitable habitat available.

3 Areas of open un-colonised sand

The progress of invasion and stabilisation, by both vascular plants and bryophytes, can be observed on the edges of these areas.

4 Bryophyte dominated sand communities

Such communities exist in several places. An area of open ground at the western end of Main Lake is, in places, dominated totally by the moss *Campylopus introflexus*, with only minor contributions by two other moss species, *Polytrichum juniperinum* and *P. piliferum*. In one corner a slightly richer community exists in which *C. introflexus*, *P. piliferum*, *Racomitrium canescens* and *Polytrichum juniperinum* are all present. The first three of these all have hyaline (glassy) hair points. This is an adaptation which, it has been demonstrated, allows the plants to retain moisture. When they dry out the silvery hair points reflect sunlight, thus helping to maintain lower temperatures, whilst the hair points also help to trap a layer of stagnant air between the leaves and the airstream, thus reducing rates of water loss (Proctor 2009). These are clearly adaptations of value to plants colonising open dry habitats. In areas that appear to have been heavily contaminated by pyrite the only moss present is *Polytrichum piliferum*, and much of the sand surface is covered in an algal mat.

Racomitrium canescens is by far the most significant species found in this habitat. All the members of this genus are now rare in Norfolk, although *R. canescens* was obviously widespread in the past (Petch & Swann 1968; Swann 1975), but it went into a major decline in the early 1980s, disappearing from many of its known sites. Its rediscovery here in 2010 was very welcome. Where it occurs it is mainly associated with the mosses *C. introflexus*, *P. juniperinum*, *Ceratodon purpureus*, *Brachythecium albicans* and the *Peltigera* and *Cladonia* lichens. Another rare species, which probably occurs in this habitat, is the moss *Bryum knowltonii* a Red Data (Vulnerable) species (Hodgetts 2011) recorded in 1985 by the late Richard

Libbey. Unfortunately, the precise location where it was found is unknown, and it has not been seen since. Published accounts of its habitat, however, suggest that this is the sort of habitat that would be most suitable.

5 Areas of sand colonised by short herbaceous vegetation

There are extensive areas at this stage of development, which clearly follows on from the communities dominated by moss. Bryophytes tend to be dominant until Sand Sedge *Carex arenaria* manages to establish itself. Such vascular plants as are present tend to be small, and exhibit growth forms resistant to trampling and grazing. Parsley-piert *Aphanes arvensis*, Common Stork's-bill *Erodium cicutarium*, Buck's-horn Plantain *Plantago coronopus*, Mossy Stonecrop *Crassula tillaea*, Common Whitlowgrass *Erophila verna* and several grasses are generally obvious.

Although some species exhibit clear dominance in places there does not appear to be any fixed sequence in which events occur. In areas the moss *Hypnum cupressiforme var. lacunosum* is dominant, whilst elsewhere *Dicranum scoparium*, *Ceratodon purpureus*, or *Polytrichum juniperinum* can dominate, as can a variety of species of the lichen *Cladonia*. The nearest equivalents to these communities are described in volume 5 of the National Vegetation Classification system (Rodwell 2000); however, there are no exact matches. *Campylopus introflexus*, *Rhytidiadelphus squarrosus*, *Lophocolea semiteres* and a number of *Cladonia* spp. can occupy (and dominate) in patches, but are generally of lesser account. Both *L. semiteres* and *C. introflexus*, however, seem able to exist as very small forms which are not at all obvious unless the vegetation is examined closely. Their contribution can therefore be easily underestimated.

Areas dominated by Sand Sedge *Carex arenaria*

C. arenaria dominated areas occur in two places: 1) on some of the steeper northern slopes leading down to Main Lake, and 2) on the more northerly areas of flat ground between the lake and the B1145. There is a subtle change in the mosses present from those predominating in the Heather communities described below. *Hypnum cupressiforme* var *lacunosum* is most abundant, followed by *Pseudoscleropodium purum*; species such as *Dicranum scoparium*, *Hypnum jutlandicum* and *Polytrichum juniperinum* are less common. Where *C. arenaria* is less abundant there are more open areas present within which the mosses *Polytrichum juniperinum*, *Ceratodon purpureus*, *Hypnum cupressiforme*, *Polytrichum piliferum*, *Campylopus introflexus* and even *Lophocolea semiteres* vie for importance.

6 Areas of heath, dominated by Heather *Calluna vulgaris*

There are two main heather-dominated areas on the site. One is on the steep northern slopes of Main Lake. The other lies at the western end of the site, between Main Lake and the track defining the edge of the Park. The first of these is dominated by mature leggy heather which is accompanied by typical mosses such as *Hypnum jutlandicum*, *Pseudoscleropodium purum*, *Dicranum scoparium*, *Polytrichum juniperinum* and a variety of lichens. This community sporadically passes laterally into one dominated by Sand Sedge. The more westerly area, by contrast, is much younger, with shorter, fiercely rabbit-grazed, heather. Here almost the only bryophyte species present is the alien moss *Campylopus introflexus*, accompanied, in places, by subordinate quantities of *Polytrichum juniperinum* and *P. piliferum*. The only one of the pleurocarps normally associated with Heather to appear is *Pseudoscleropodium purum*, and that is only found associated with a few of the taller patches of Heather.

7 Open calcareous grassland

Small patches of open calcareous grassland are associated with the Anglian till. A var-

ied field layer is present, Hard Rush *Juncus inflexus* being very prominent. A few scattered willows also occur. In places moss dominated communities exist; the commonest species is generally *Calliergonella cuspidata*, but *Brachythecium mildeanum* and *Cratoneuron filicinum* can also be prominent; all three of these are damp loving species – a reflection of the poor drainage provided by the underlying clays. A mosaic exists between bryophyte- and vascular plant-dominated patches. Again, single species of bryophytes tend to dominate in some areas. In general there are few small acrocarps associated with this type of vegetation. *Bryum rubens, Bryum capillare* and *Barbula unguiculata* and *B. convoluta* have all been found on anthills, whilst *Aloina aloides, Didymodon fallax* and *Dicranella varia* have been found on steeper slopes.

8 Areas of mixed woodland

This is a vegetation type that is widespread across large areas of the site. The dominant trees are naturally regenerated Birches and Pedunculate Oak *Quercus robur*, along with Rowan *Sorbus aucuparia*, Holly *Ilex aquifolium*, willows, and Rhododendron *Rhododendron ponticum*. Occasional planted conifers are present, as are areas of deliberate planting, such as on the south-eastern shore of Main Lake. Regeneration, judging by the size of the trees (which is very variable), has taken place sporadically. It is also affected by the nature of the underlying soils, as is the ground flora. Where the soil is acid, Bracken *Pteridium aquilinum* is often dominant. This, plus leaf litter, means that very few bryophytes are present, except along the sides of paths, and also on steeper slopes associated with earlier phases of sand extraction, where leaf litter cannot lie. *Kindbergia praelonga, Pseudoscleropodium purum* and *Brachythecium rutabulum* tend to be the commonest mosses but – particularly on areas of clay soils – other species such as *Oxyrhynchium hians, Eurhynchium striatum, Fissidens taxifolius* and *Plagiomnium affine* can appear, though usually only occasionally. Rarities include *Rhytidiadelphus triquetrus* and *Hylocomium splendens*.

Epiphyte communities

Epiphytic bryophytes fall into two groups. There are a number of non-specialist epiphytes that can grow on a variety of substrates, and there are specialist epiphytes that are (more-or-less) confined to growing attached to trees.

Non-specialist epiphytes, over most of the site, generally consist of a few common species. *Brachythecium rutabulum, Kindbergia praelonga, Hypnum cupressiforme*, and its var. *resupinatum* are very common, *Rhynchostegium confertum* less so. The richest epifloras are found on willows, and are largely confined to younger, smooth-barked trees. The commoner specialist epiphyte species include the liverworts *Metzgeria furcata* (sometimes in abundance) and *Frullania dilatata*, and mosses such as *Orthotrichum affine* and *Ulota bruchii*.

The specialist epiphytes are of the greatest interest since many of them are very pollution sensitive. They are highly concentrated on the willows on the western side of Little Lake. This area is particularly rich, presumably because the proximity to the lake helps to ensure high humidity levels, which facilitate bryophyte growth. The specialists are species, which, 20 years ago, were simply not found in Norfolk (or were extremely rare) because of the legacy of air pollution. Over the last few years some of them have been re-appearing, indicating substantial improvements in air quality (Adams & Preston 1992). *Orthotrichum lyellii, Orthotrichum pulchellum, Orthotrichum stramineum* and *Orthotrichum striatum* are important examples, as are *Ulota crispa, Ulota bruchii* and *Ulota phyllantha*. Epiphytic hepatics include *Cololejeunea minutissima* (which was first recorded for Norfolk from this site (Stevenson & Ghullam 2009)), *Metzgeria furcata, M. violacea* and *Frullania dilatata*. *Zygodon conoideus* is a specialist epiphyte found on some of the willows

adjacent to the main car park, though not elsewhere.

Elsewhere in west Norfolk young oaks have, of recent years, proved to be good hosts for epiphytic bryophytes but this is not the case in the Country Park where epiphytes are almost all, apart from the very commonest non-preferential species, associated with willows.

Whilst it is tempting to ascribe dramatic changes in abundance of species to climate change, Bates & Preston (2011) have been at pains to point out that there are a number of possible causes which need to be carefully distinguished: these include more intensive recording effort and, as noted, improvements in air quality. The general consensus favours the latter explanation.

Clearly micro-climate, and the nature of the substrate, plays an important role in controlling colonization by epiphytes, as well as the wider importance of improved air quality, which is why these plants could play an important role in monitoring air quality in the area, should the proposed waste incinerator be built in King's Lynn.

9 Conifer plantations

Mature conifer plantations are confined to an area in the south-western corner. Here the ground flora is dominated by Bracken and very few bryophytes at all are present, apart from a few mosses such as *Pseudoscleropodium purum* and *Kindbergia praelonga* by the sides of paths.

Alien species, recombinant communities, and conservation

Unlike alien vascular plants, which tend to be most important in urban areas, alien bryophytes seem to occur more frequently in the countryside at large. As yet the number of species involved in fairly small (Söderström 1992), but this is no ground for complacency.

Three alien species occur within the Country Park: the mosses *Campylopus introflexus*, *Orthodontium lineare* and the liverwort *Lophocolea semiteres*. All three of these are from the southern hemisphere, and all are very effective colonisers which compete with native species. (Curiously, none of these three features on any British legislation regarding undesirable alien plants, although they are mentioned in Hill *et al.* (2009).)

Orthodontium lineare is most restricted by habitat, being confined to tree bases and vertical, acid, earthy banks. It is therefore the least common of the three in the Park, despite producing abundant capsules.

Campylopus introflexus is registered on both the Daisie (Delivering Alien Invasive Species Inventories for Europe 2006, 2009) consortium and Nobanis partnership (Klink 2010) websites of invasive aliens. It can spread over open sand and seems to be able to cope with fairly extreme conditions, even being found where there is clear evidence of contamination by decomposing pyrite. *C. introflexus* fruits abundantly, but also produces deciduous tips to the shoots; these detach and can be spread on feet, or simply blown about, meaning it produces substantial numbers of potential propagules. It can be a major invader of heathland habitat, the presence of adjacent woodlands apparently promoting invasion (Piessens, Stieperaere, Honnay & Hermy 2008).

Lophocolea semiteres is not only a colonist of open sandy ground, but can also thrive in rather damper conditions than either of the other two; it is, for instance, the dominant coloniser of damp peaty soils round suitably sheltered parts of Main Lake, where it can be accompanied by species such as *Cephalozia bicuspidata, Gymnocolea inflata, Dicranella cerviculata* and *Pohlia nutans*. In fact *L. semiteres* seems to be absent from the very driest sites, which are only colonised by *C. introflexus* and *P. piliferum*. Interestingly, in the woodland that extends up the south-eastern side of Main Lake, although

L. semiteres does occur on the ground, it is also relatively frequent as an epiphyte around the base of the trunk of young birch trees. Presumably in this position it benefits from the extra moisture associated with stem flow. *L. semiteres* appears to be tolerant of pollution too as it is quite frequent on the slopes around Pyrite Point, along with other toxi-tolerant species such as *Gymnocolea inflata* and *Pohlia nutans*. When it forms large patches *L. semiteres* is very obvious, it can also, however, occur as very small, thin, more-or-less upright strands which are far from obvious unless the community is being examined very closely; this growth form can mask just how pervasive it can be as a species. In Belgium *Lophocolea semiteres* is regarded as a 'plague' species (Stieperaere 1994) which, under certain conditions (Stieperaere, Heylen & Podoor 1997) has a negative influence on native liverwort floras.

Clearly the competitive ability of aliens such as *Lophocolea semiteres* and *Campylopus introflexus* has implications for the conservation of more desirable species such as *Bryum knowltonii, Racomitrium canescens* and *Lophozia capitata*. Of the two, *C. introflexus* would appear to pose the greater threat since it fruits freely, as well as being spread by leaf fragments. It presumably poses the greatest risks to *Bryum knowltonii* and *Racomitrium canescens*, both of which are plants of dry habitats. There is also evidence that it has a negative impact on insect faunas (Schirmel, Timler & Buchholz 2010; Vogels *et al* 2005) and lichen communities (Biermann & Daniëls 1997; Ketner-Oostra & Sýkora 2004, 2008) and the re-establishment of vascular plants (Equihua & Usher 1993). However, within the Country Park, neither lichens nor vascular communities appear to have been much affected; they have presumably evolved from scratch, in tandem with those of the bryophytes. *L. semiteres*, on the other hand, is likely to pose a much greater threat to *Lophozia capitata*, given that it is a very effective coloniser of moist situations. However, it does not appear to reproduce sexually (all the local material is female) so it is dependent on fragments being transported about, probably mainly by humans and dogs. On a well-used site such as the Country Park it would be virtually impossible to stop this happening. It would seem highly likely that *L. semiteres* will have the same sort of influences on the establishment of vascular plant seedlings, and on lichens and insects, as *C. introflexus*. Monitoring the competitive interactions between *L. semiteres* and *C. introflexus* could form an interesting long-term study, indeed this site could be ideal for the sort of monitoring and surveillance suggested by Genovesi, Scalera, Brunel, Roy & Solarz (2010).

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C.R. Stevenson 111 Wootton Road, King's Lynn, Norfolk PE30 4DJ

crs111@talktalk.net

Appendix. The mosses and liverworts recorded on the site. RDB species are indicated in **bold**; regionally or locally rare species are underlined. Not all of the species listed are referred to directly in the text since many are, although not necessarily common in the Country Park, common in the wider world.

Scientific name	English name
Mosses	
Aloina aloides	Common Aloe-moss
Amblystegium serpens	Creeping Feather-moss
Atrichum undulatum	Common Smoothcap
Aulacomnium androgynum	Bud-headed Groove-moss
Barbula convoluta	Lesser Bird's-claw Beard-moss
Brachythecium albicans	Whitish Feather-moss
Brachythecium mildeanum	Sand Feather-moss
Brachythecium rutabulum	Rough-stalked Feather-moss
Brachythecium velutinum	Velvet Feather-moss
Bryum bicolor	Bicoloured Bryum
Bryum caespiticium	Tufted Thread-moss
Bryum capillare	Capillary Thread-moss
Bryum gemmiferum	Small-bud Bryum
Bryum knowltonii	**Knowlton's Thread-moss**
Bryum rubens	Crimson-tuber Thread-moss
Calliergonella cuspidata	Pointed Spear-moss
Campylopus introflexus	Heath Star Moss
Ceratodon purpureus	Redshank
Cratoneuron filicinum	Fern-leaved Hook-moss
Dicranella cerviculata	Red-neck Forklet-moss
Dicranella heteromalla	Silky Forklet-moss
Dicranella varia	Variable Forklet-moss
Dicranoweisia cirrata	Common Pincushion
Dicranum scoparium	Broom Fork-moss
Didymodon fallax	False Beard-moss
Didymodon insulanus	Cylindric Fork-moss
Isothecium myosuroides	Slender Mouse-tail Moss
Kindbergia praelonga	Common Feather-moss
Eurhynchium striatum	Lesser Striated Feather-moss
Fissidens taxifolius	Common Pocket-moss
Funaria hygrometrica	Common Cord-moss
Grimmia pulvinata	Grey-cushioned Grimmia
Hypnum cupressiforme	Cypress-leaved Plait-moss
Hypnum cupressiforme var. *lacunosum*	Great Plait-moss
Hypnum cupressiforme var. *resupinatum*	Supine Plait-moss
Hypnum jutlandicum	Heath Plait-moss
Hylocomium splendens	Glittering Wood-moss
Mnium hornum	Swan's-neck Thyme-moss
Orthodontium lineare	Cape Thread-moss
Orthotrichum affine	Wood Bristle-moss
Orthotrichum diaphanum	White-tipped Bristle-moss
Orthotrichum lyellii	Lyell's Bristle-moss
Orthotrichum pulchellum	Elegant Bristle-moss

Orthotrichum stramineum	Straw Bristle-moss
Orthotrichum striatum	Smooth Bristle-moss
Oxyrhynchium hians	Swartz's Feather-moss
Plagiomnium affine	Many-fruited Thyme-moss
Plagiomnium rostratum	Long-beaked Thyme-moss
Plagiothecium curvifolium	Curved Silk-moss
Plagiothecium undulatum	Waved Silk-moss
Pleurozium schreberi	Red-stemmed Feather-moss
Pohlia melanodon	Pink-fruited Thread-moss
Pohlia nutans	Nodding Thread-moss
Polytrichum commune	Common Haircap
Polytrichastrum formosum	Bank Haircap
Polytrichum juniperinum	Juniper Haircap
Polytrichum piliferum	Bristly Haircap
Pseudocrossidium hornschuchianum	Hornschuch's Beard-moss
Racomitrium canescens	Hoary Fringe-moss
Rhynchostegium confertum	Clustered Feather-moss
Rhytidiadelphus squarrosus	Springy Turf-moss
Rhytidiadelphus triquetrus	Big Shaggy-moss.
Pseudoscleropodium purum *	Neat Feather-moss.
Sphagnum fimbriatum	Fringed Bog-moss
Sphagnum squarrosum	Spiky Bog-moss
Syntrichia ruralis var. ruraliformis	Sandhill Screw-moss
Syntrichia ruralis	Great Hairy Screw-moss
Tortula muralis	Wall Screw-moss
Ulota crispa	Crisped Pincushion
Ulota bruchii	Bruch's Pincushion
Ulota phyllantha	Frizzled Pincushion
Warnstorfia fluitans	Floating Hook-moss
Zygodon conoideus	Lesser Yoke-moss

Liverworts

Aneura pinguis	Greasewort
Cephalozia bicuspidata	Two-horned Pincerwort
Cephalozia connivens	Forcipated Pincherwort
Cephaloziella divaricata	Common Threadwort
Cololejeunea minutissima	Minute Pouncewort
Frullania dilatata	Dilated Scalewort
Gymnocolea inflata	Inflated Notchwort
Lophocolea bidentata	Bifid Crestwort
Lophocolea heterophylla	Variable-leaved Crestwort
Lophocolea semiteres	Southern Crestwort
Lophozia capitata	**Large-celled Flapwort**
Metzgeria furcata	Forked Veilwort
Metzgeria violacea	Blueish Veilwort
Riccardia chamedryfolia	Jagged Germanderwort
Riccardia multifida	Delicate Germanderwort

* Found in fruit at two separate locations within the park, in 2009. This plant is very rarely found in fruit.

Discovery of the Stripe-winged Grasshopper *Stenobothrus lineatus* in east Norfolk

Tim Gardiner

The Stripe-winged Grasshopper *Stenobothrus lineatus* is a widespread but distinctly localised insect in Norfolk. Its twentieth century stronghold in the county was the chalk grassland of Breckland (Richmond 2001) but in the early years of the twenty-first century it was discovered over a wide area of north-west Norfolk (Richmond 2006). In 2008 it was reported from Mousehold Heath in Norwich and two years later it was discovered on recently restored heathland at Cawston, along with the Bog Bush-cricket *Metrioptera brachyptera* (Richmond 2010; 2011). There have, hitherto, been no confirmed reports from the extreme east of the county, so it was something of a surprise when a stridulating male was heard on 30 July 2011 in Waveney Forest, in a small area of acid grassland and heathland (TG 460005). The author had searched the Forest many times before (each summer since 2008) and thought there were no new species to be discovered. The addition of the Stripe-winged Grasshopper brings the total number of Orthoptera species recorded in the Forest to 13, which includes the localised Mottled Grasshopper *Myrmeleotettix maculatus* (Gardiner 2008; 2010). Upon hearing the distinctive metallic sounding stridulation, the author searched the area for grasshoppers, but could only find four females and two males; the open heathy vegetation underneath the pylons was heavily scrubbed over due to a lack of cutting or grazing. This scrub encroachment could be a serious threat to the survival of the grasshopper in the Forest.

An interesting question arises from the discovery of Stripe-winged Grasshopper in Waveney Forest: was the grasshopper overlooked or has it colonised the Forest during a range expansion? Addressing this question, there are interesting parallels from survey work in Essex. The Grey Bush-cricket *Platycleis albopunctata* was presumed extinct in Essex, with an absence of records for several decades (all sightings were pre-1961). Orthopterists (including the author) had searched suitable habitat at Colne Point for many years without success; however, in 2004 two individuals were located in pitfall traps (Harvey & Gardiner 2006) in habitat that had been searched visually for several years by countless surveyors. How they missed this large bush-cricket for so long is unclear, but is probably a combination of the cryptic colouration of adults, giving them good camouflage in sand dune vegetation, the low population density, and the lack of a suitable survey technique. Latterly a bat detector has been used to record Grey Bush-cricket with some success; without it, it is difficult to detect the species by eye or with a sweep net (Gardiner *et al.* 2010). Therefore it is possible that Stripe-winged Grasshopper had been overlooked for many years in Waveney Forest, even the author may have missed it despite visiting the site at least five times in each of the last four years.

The issue of whether Stripe-winged Grasshopper has colonised rather than been overlooked in Waveney Forest is an interesting one. Assuming that there must be a driver for a range expansion then it will in all likelihood be climate change (warmer springs and summers in recent years). However, the nearest known populations of Stripe-winged Grasshopper are 40-50 km distant in the Brecks, and 20-30 km away in Norwich (Mousehold Heath) and Walberswick in East Suffolk. This appears

quite a distance for the grasshopper to travel, to do so it would have to traverse many unfavourable habitats such as arable fields and improved pastures. It may be using roadside verges to disperse although no evidence of this has yet been collected. On verges there is an abundance of exposed soil (which the species seems to require) due to vehicles parking on them, general ground disturbance during mowing, and perhaps even from de-icing salt applied in winter (Thompson *et al.* 1979). Verges of trunk roads such as the A12 (one potential path of colonisation from the Walberswick populations) may also have grass with high nitrogen content due to exhaust emissions, suitable for the growth and development of herbivorous insects such as grasshoppers (Port & Thompson 1980). It is possible that grasshoppers may hitch a lift on cars; species such as the Lesser Marsh Grasshopper *Chorthippus albomarginatus* have been found to do so. The author once unwittingly carried Lesser Marsh Grasshopper in his car for a distance of 50 km.

In some cases, Stripe-winged Grasshopper appears to be specific to a certain type of habitat which usually has patches of exposed soil, presumably for basking nymphs and adults. It seems that acid grassland with ant-hills is the preferred habitat for the colonising Stripe-winged Grasshoppers in Epping Forest in Essex (Wilde 2009; Gardiner 2011). Searching around the occupied habitat at Waveney Forest on the day of discovery, two well developed ant hills were found with plenty of Sheep's Sorrel *Rumex acetosella* and small patches of Heather *Calluna vulgaris*/Bell Heather *Erica cinerea*. Therefore, to some extent the habitat at Waveney Forest bears a resemblance to that of the Epping Forest populations. Could the presence of ant-hills be crucial to its survival and if so, why? Within Waveney Forest, Stripe-winged Grasshopper has been found to be widespread since the initial sighting, inhabiting *Sphagnum* bogs with fringing Purple Moor-grass *Molinia caerulea* tussocks, commonly with the Common Green Grasshopper *Omocestus viridulus*. Stripe-winged Grasshopper has also been recorded within a clear felled area along with Common Green Grasshopper and Mottled Grasshopper. Several females were also observed in the Forest on dry heathland dominated by Heather and Bell Heather. Perhaps they only favour areas with ant hills because in some situations they provide the broken ground which the grasshopper seems to require. Afforested heathland also provides plenty of exposed soil, particularly when subjected to intensive tree felling, due to the damage to the ground caused by the heavy machinery. Open ground established during felling of conifers in forestry plantations situated on heathland could be close to the ideal habitat.

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T. Gardiner Environment Agency, Iceni House, Cobham Road, Ipswich, Suffolk, IP3 9JD

tim.gardiner@environment-agency.gov.uk

Weather Report 2010

Norman Brooks

Observations made with approved Meteorological Office instrumentation, and in accordance with standard Metereological Office practice, at Old Costessey, Norfolk. Monthly figures are presented in Table 1.

Monthly accounts

January 2010 With a mean temperature of 1.4°C it was the coldest January locally since the much colder January of 1989. Snow was much in evidence, being observed to fall on 14 days, with a snow cover persisting for 17 days. The mildest day, 17 January, had a maximum of a mere 7.6°C, and the lowest minimum was -6.4°C on 6 January.

Jan. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	5	2	4	0	1	0	7	11

February 2010 Another cold month with, locally, the coldest Decmber-February period since the severe winter of 1978/79. Snow fell on 14 days and lay on five, but never to any great depth. Unusually for a cold winter month it was significantly wetter than normal with only two dry days. On 27 February the temperature just reached 10°C for the first time since 10 December. A period of seventy-nine days devoid of even a brief mild period is very unusual in our maritime climate.

Feb. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	5	4	2	2	0	3	3	8

March 2010 Spring arrived mid-month. with the soil temperature exceeding 6°C (the temperature needed for plant growth to resume) on 17 March after a period of ninety-seven days continuously below this figure. From 1 March to 13 March maxima were below 10°C but from March 14 to March 31 every day exceeded the March average.

Mar. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	0	7	1	0	3	3	7	6	4

Table 1 Monthly summaries for 2010

Month	Total rainfall (mm)	Percentage of mean rainfall	Days air frost	Days ground frost	Monthly mean temperature (°C)	Deviation from mean (°C)
January	61.7	106%	16	22	1.4	-2.6
February	88.6	206%	19	21	2.5	-1.3
March	40.3	84%	9	14	6.9	+1.0
April	18.0	37%	3	19	9.0	+1.4
May	33.5	63%	3	12	10.8	-0.5
June	37.5	70%	0	0	15.4	+1.1
July	51.3	91%	0	0	19.1	+2.6
August	105.8	207%	0	0	16.4	0
September	94.0	173%	0	0	14.1	-0.2
October	80.6	139%	0	0	10.9	0
November	102.8	147%	10	13	5.7	-1.0
December	27.1	44%	24	27	0.0	-4.8

April 2010 A sunny and very dry month with warm days and cold nights. Dry ground and clear nights allowed ground frosts to form with exceptional frequency, retarding spring growth. This was exemplified by Bluebells only coming into bloom during the closing days of the month. Over the United Kingdom as a whole spring, as indicated by plant growth, was twenty-five days later than in 2009.

April wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	2	5	1	0	2	6	8	4	2

May 2010 The coldest May since 1996 and the driest since 2001. As in April, the frequency of clear nights allowed ground frosts to be unusually frequent. The combination of frosts and the deficiency of rainfall inhibited spring growth with signs of wilting on even established plants by the end of the month.

May wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	6	8	0	1	3	2	8	3	0

June 2010 A dry and sunny month with alternating periods of cool conditions with an occasional warm day, culminating in a true heatwave from 22 June to 30 June. The maximum of 30.0°C on 27 June was notable.

June wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	3	3	0	1	3	6	4	9	1

July 2010 Warm and dry with less sunshine than usual and a preponderance of south-westerly winds. The maximum of 31.7°C on 10 July was the hottest day locally since 26 July 2006. The countryside showed signs of distress due to deficient rainfall.

July wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	0	1	0	0	2	16	6	4	2

August 2010 As so often, nature restores the balance; the monthly rainfall total was in excess of double the average. There was a total absence of any settled weather and the highest temperature for the month in the United Kingdom was 26.7°C at Weybourne on 21 August. The night of 20 August was exceptional; the minimum of 19.5°C was very close to the record of 20.6°C on 9 August 2004.

Aug. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	3	1	2	0	3	6	8	8	0

September 2010 The wettest September locally since 2001, with near-normal temperatures. Variable cloud during the coldest nights saved most of the county from the first frost of autumn.

Sept. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	6	2	1	2	4	8	3	4	0

October 2010 With rain recorded on nineteen days it was the wettest October locally since 2004. Otherwise it was a benign month, devoid of fog, air frost or a single gale, with a bonus of glorious autumn colours.

Oct. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	3	2	3	2	7	2	7	4

November 2010 Initially mild but with the sudden onset of wintry conditions on 24 November. Generally wet, the coldest November locally since 1993. The first week was so mild that lawns were still being mowed and the maximum of 17.3°C on 4 November was appropriate for early June. Snow fell daily from 24 November to 30 November and covered the ground from 25 November with a maximum depth of 7 cm.

Nov. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	4	3	2	2	0	4	2	5	8

December 2010 Locally it was the coldest December since 1981 with the temperature remaining below freezing for 130 hours betwen 16 and 22 December. Snow, mainly slight, fell on twelve days and covered the ground for eighteen. With the ground frozen to a depth of 10 cm it was obviously a difficult period for many species of birds. As is usually the case in cold winter months it was dry and there was an absence of wind. The lowest screen minimum, on 18 December, was -17.0°C at Buxton

Dec. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	3	5	1	1	1	1	2	5	12

Annual summary 2010

Total rainfall	741.2 mm
	114% of mean
Wettest day	25 Aug, 20.9 mm
Days with rain recorded	200
Days with sleet or snow	48
Days with snow lying	46
Highest maximum temperature	31.7°C
	10 July
Lowest maximum temperature	-3.2°C
	20 December
Highest minimum temperature	19.5°C
	21 August
Lowest minimum temperature	-11.6°C
	18 December
Lowest grass min. temperaure	- 12.4°C
	18 December
Air frosts	84
Ground frosts	131
Days with hail	8
Days with thunder	8
Days with gales	1
	11 November
Longest period with no measurable rain	
	14 days (12-25 May inclusive)
Days with fog (09.00 hrs)	16
Mean cloud cover at 09.00 hrs	69%
Wind direction at 09.00 hrs (days):	
North	30
North-east	48
East	16
South-east	16
South	25
South-west	60
West	53
North-west	65
Calm	52
Annual mean maximum temp.	13.3°C
Annual mean minimum temp.	5.4°C
Annual mean temperature	9.3°C
	coldest since 1987

N. Brooks *Fellow Royal Meteorological Society* 1 The Croft, Old Costessey, Norwich NR8 5DT.

Wildlife Report 2010

Butterflies

Andy Brazil

If the headline event of 2010 was the sudden arrival of Silver-washed Fritillaries in some numbers, the most significant non-event was the virtual absence of Peacocks from many sites. In fact many of the nymphalids suffered declines this year. By contrast, many of the lycaenids (blues and hairstreaks) did well, particularly Green Hairstreak and Holly Blue.

Atlas surveys diverted some recorders into new and previously unrecorded areas; for most it was soon obvious why they were rarely visited. Like many others, I had the dispiriting experience of trudging through a 2 km x 2 km square only to report a Meadow Brown and perhaps a white. It is sobering to report how few butterflies exist in the agricultural heart of the county. Often it was only in and around gardens that other species appeared, although horse paddocks and organic farmland proved that butterflies could survive in the wider countryside, once removed from pesticides and intensive farming.

This diversion of recorder effort away from the coasts and into the centre of the county is perhaps behind some declines in the number of tetrads reported for some species such as Wall Brown and Grayling. However, our solid background of regulars who report from their garden and 'local patches' ensured the broad comparability of reports year on year. Over half of tetrads were visited in both years and many squares newly visited were close to others visited last year and should not affect comparisons. The Brecks were, however, not covered as intensively this year as last, with concomitant effect on reported figures for some of their speciality species. As always, where I give a figure or date in the species accounts, the corresponding 2009 data is given in brackets. I have been able this year to use the provisional figures from the national transect population study, which show the population increase or decrease from 2009. These show that 2010 was a good year for many rarer species, but poorer for more common ones – just as seen in the Norfolk data.

Finally, I should mention some of the more unusual reports. A single Marbled White from Dersingham Bog reported by a visitor to the warden on 19 July is not that unusual – the species exists in Cambridgeshire and I suspect many wind-blown visitors go unnoticed and unreported. The report of a Monarch, however, from Matlaske on 1 July came as something of a surprise, as did the second received a few days later (complete with photograph!), an insect seen on 26 June in Mannington Hall. This later report included, however, the identity of the breeder who had released them. Another release kindly reported to us was of Marsh Fritillary – a total of 27 adults were released on a site in north-east Norfolk between the 24 May and the 2 June. One at least survived there until the 6 June, when it produced a dramatic sighting for one recorder, unaware of its provenance. A Black Hairstreak reported from Kings Lynn Golf Course on the 17 July and a Purple Emperor from just north of California were not accepted into the database. In the first case the possibility of confusion with White-letter was felt to be too great for what would be only the second ever Norfolk record (the first being at Shropham on 16 July 1974), and in the second even the observer was only inclined to assess the sighting as 'probable'. In both cases, however, the possibility of dispersal from existing sites is not too improbable – but it would probably require a photo or a long-staying individual to confirm such a claim.

No major migration was reported in 2010, although there was a slow drift of Large Whites in across the east coast through July and early August. These probably represented quite large numbers in total, but on any particular day no more than a few thousand came in – some 2-3 an hour across each kilometre of coastline. Clouded Yellow was very rare, with reports from only 8 tetrads (39). These were on 30 July (2 reports), 31 July (2), 23 August (3) and 7 October (1). Nationally, transect reports were down by 90% (and Painted Lady was down by 99% - unsurprising given the large migration in the previous year). Camberwell Beauty were also rare: only four reports (3) 17 April Strumpshaw village, 28 June Titchwell RSPB reserve - viewed by many folk in the car park - it stayed until at least the 2 July. On 11 July one was at West Acre and one on the Pedders Way near Holme.

Species Accounts

Dingy Skipper

Recorded from 12 (17) tetrads. The apparent fall is illusionary, it merely reflects tetrads along the cut-off channel surveyed in 2009 and not visited in 2010. In fact one new tetrad was added this year, suggesting colony spread. The largest number seen was 40 (SH) (20); earliest 10 May (SH) (29 April), latest 3 June (i) (29 May). These dates reflect a late spring this year, with many species playing catch-up through the season.

Grizzled Skipper

Recorded from 11 (14) tetrads. A report from Kelling Heath (PGl) is extremely odd. It seems inconceivable that a colony could have been overlooked for so long on such a well visited site, and this suggests a possible release - particularly since we know of a breeder in the area. It has therefore not been included in the tetrad total above. The largest number seen was 30 (PGl) (20) ; earliest 23 April (TC) (29 April), latest 3 June (i) (29 May).

Small/Essex/Large Skippers

Nationally these did extremely badly, recording some of their worst numbers since 1976. It was the second worst year for Essex Skipper (-33% on 2009) and third worst year for Small Skipper. Casual records do not permit such detail, but the largest numbers reported fell for all three species. Perhaps one positive outcome of the current economic situation might be a decline in local council's manic desperation to cut grass verges to billiard table height, as these are all species that need long grass.

Swallowtail

Reported from 21 tetrads (22). It is almost impossible to distinguish broods in the data. From the first record on the 14 May (TN) (15 May), insects were seen almost every day until 31 August (EG) (16 August). The longest gap was between 15 July and 29 July, when only four individuals were seen. A single caterpillar sitting on a single Milk Parsley plant in the middle of Winterton Dunes in August was much photographed – it must have been the driest spot with a caterpillar in Norfolk. The largest count was 15 (RS).

Orange-tip

An exceptional year. Nationally it produced its third best count ever, while in Norfolk it was so common that even the general public noticed the females; resulting in my receiving calls to report 'Bath White' and 'Dappled White'. This indicates two things: first, that a book featuring British and European butterflies is not a good choice for the beginner; secondly, the importance of not organising guide books alphabetically. First seen 20 March (MC) (5 April), last 24 June (SR) (25 June), with an exceptional records on 31 August (TN), indicating a rare second brood. The largest count was 20 plus (75).

Green Hairstreak

Reported from 39 tetrads (43). In Norwich it took advantage of habitat restoration work done by the Mousehold Defenders to colonise the slope in front of the prison, and several reports were received from Marriot's Way near Costessey and from the bottom of Sloughbottom Park in Norwich. The largest count was 14 (14). The main flight period was 20 April (NL) (19 April) to 15 June (PGl) (12 June), with just two records after that, on 28 June (JW) and 9 July (TN).

Purple Hairstreak

Reported from 41 (57) tetrads. A slight decline after last year's bumper crop might have been expected, yet 32 of those tetrads were new to the *Atlas* period. I was fortunate enough to discover one feeding at knee height in a garden centre on a potted plant – it is not often you get to look down on a Purple Hairstreak. The largest count was 40 (30+); earliest 25 June (MC) (24 June), latest 12 August (AW) (22 August).

White-Letter Hairstreak

Reported from 29 tetrads (43). Again, 20 were new squares, reflecting continued work by the White-letter Hairstreak survey team. The earliest on the 30 June (MGr) (26 June) was an outlier, the main season started on 10 July (PGl, DB), with the latest 7 August (ABa) (25 July) ; highest count 17 (AT).

Small Copper

An astonishingly early report of 2 seen 25 March (CJ) (21 April) from Waveney Forest was an outlier, the main season was 18

April (MC) to 2 October (30 October) (ABr, AM). A single of the form *caeruleopunctata* was reported from Horsey Mill. Seen in 167 tetrads (186), the decline possibly due to recorder effort being redirected. Largest count 13 (MGl) (33).

Brown Argus

Nationally it recorded its third best year ever – with an 85% increase on the previous year, and continued to spread from its historic distribution. Recent research suggests this is due to climatic conditions allowing it to switch from using predominantly Rock Rose *Helianthemum nummularium* to geraniums such as Dove's-foot Cranesbill *Geranium molle*. The first on 28 April (MC) was an outlier; the main flight period was 9 May (10 May) to 22 September (MGr) (14 September); highest count 13 (MGw) (12). Only one marked individual was reported (other than by the researchers) from the study mentioned in last year's report, and that was in Suffolk.

Common Blue

A very good year, with two counts of over a hundred (JD, JL). Nationally it showed an increase of 146% over 2009 to produce the second best year recorded. Reported from 263 tetrads (258). First 9 May, (i) (29 April), last 4 September (MR) (8 October).

Holly Blue

Recorded from 216 squares (140). The most likely butterfly to be reported from tetrad surveying after browns and whites, it is recorded from a third of all tetrads. Nationally showed a 156% increase on 2009. First seen 18 March (MC) (20 March), that brood ended by 2 July (JL). The second brood started around 13 July and was last seen 15 September (MGr) (7 September).

Chalkhill Blue

Nationally up 74%, our colony outstripped that with a highest count of 240 (MGl) (25). First seen on 24 July (MGo) (28 July), last seen on 22 August (BC survey) (25 August). Such an increase is probably not sustainable on such a small site and I would expect a dramatically smaller count next year, as competition for food among the large number of larvae produced will be intense.

Dark-green Fritillary

Nationally recorded a 38% increase, but not in Norfolk, where it again had a poor year at its main site at Horsey. First seen 25 June (MR) (21 June) then daily until 8 August (PT) (9 August). Then two separate sightings on 4 September (MR, DW) (1 September). Highest count 200 (225), again from the north coast, with Horsey only managing a high of 42. Something is clearly amiss here, just a few years ago counts of 300-400 were common.

Silver-washed Fritillary

There were 33 reports, covering 16 tetrads, between 16 July and 9 August. More than one individual was seen at Beccles, Cley, Sheringham, Foxley, Holkham, Bodham Wood, Swangey Fen, West Runton and Holt Country Park, but any wood in the east or near the Suffolk border with abundant violets could be the site of a new colony.

White Admiral

Nationally up 90%. Recorded from 57 (67) squares this year, but many were new squares. It continues its march westward on the North Norfolk coast and also appeared for the first time in two new 10km squares (TF70 and TL79). This is now a butterfly that should be present in any wood with Honeysuckle north of a line from Hunstanton to Beccles, and at present rates will cover all suitable habitat by 2020. First seen 28 June (PGl) (24 June), last 6 August (FF, AMo) (8 August), with two outliers: 20 August (BA) and 30 August (FF). Again, no extra brood from Holkham this year. Highest count 20 (PT).

Red Admiral

This had a poor year, a combination of poor immigration and low survival over winter. Nationally it fell by 5%, but it seemed scarcer in Norfolk. First seen 14 March (i)

(5 February), last 15 November (PGl) (1 December), illustrating how the cold cut short the season at both ends of the year.

Small Tortoiseshell

Reported from 40% of tetrads surveyed (60% in 2009). Such a fall is not just redirection of recorders, as most species showed comparable rates for both years, but indicates a genuine decline. First seen 16 March (many recorders) (17 January), last 30 October (Dlo) (10 December). The highest count of 30 from Yarmouth Cemetery (ABr) was the only indication of immigration (211).

Peacock

A major decline in the east coast counties from Essex to Northumberland was reported, but completely normal results from the west of the UK. Since the cold weather was actually worse in the west this is puzzling. There were 680 reported sightings (1573) representing 33% of tetrads surveyed (58%). Transect data shows a virtual disappearance after the second week in May (Figure 1).

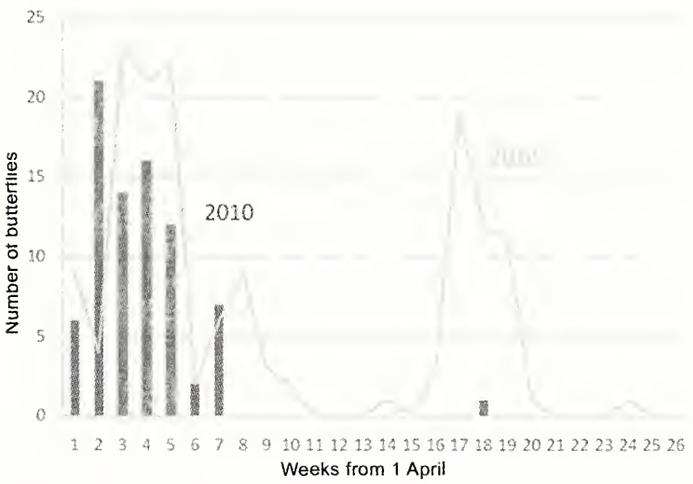


Figure 1. Peacock numbers. Marston Marsh transect; 2009 and 2010.

There was also a near-complete absence of caterpillars: no larval webs at all were reported after the first flight period. Clearly some caterpillars must have survived, or there would have been no second brood Peacocks, and these were seen, but the webs were certainly not observed.

There are three possibilities for this crash: (a) so few peacocks survived the winter that they did not meet and breed and thus few eggs were laid; (b) something affected the larval food plant (nettles); (c) parasites attacked the eggs or young larvae, meaning they never spun webs.

The first possibility seems unlikely, as most counts were normal for emerging insects in the first few weeks of the season. It is true that nearly all the nettle-feeding species of butterfly declined, but I observed sites that historically have supported high numbers of Peacock larvae and the nettles were there, in usual numbers and not obviously diseased. However, all the nettle feeders had a bad year, so there may have been a problem we were not seeing.

When coupled with the fact that the crash was only observed in the east coast counties, however, there is the possibility that we may have a new parasite/predator coming over from the continent. I would ask recorders, therefore, to pay particular attention to any Peacock larvae found in May/June and to collect any which appear diseased or parasitized. Please either post them to me (place each caterpillar in a twist of tissue paper and wedge it in a circular section of an empty toilet roll before placing in an envelope marked fragile), or rear them yourself and capture any parasites that emerge, then forward those to me (after putting them in the freezer for a day).

Comma

Nationally declined by 31%, but appears to have held up better than the other nymphalids in Norfolk. First seen 13 January (MH) but the main season was 16 March (i) (11 March) to 19 October (EG) (25 October), just one sighting after that, on 3 November (i). Reported from 39% of tetrads surveyed (41%).

Speckled Wood

Appears to have been badly hit by the cold winter, certainly not as commonly seen as in previous years. Nationally declined by

34%. The first sighting on 24 March (MC) was exceptional, the next was 6 April (MC) (5 April), the last 16 October (PT) (28 October); highest count 20 (77).

Wall Brown

Nationally its third worse year, declining 21% from 2009. An early sighting on 22 March (JC) was exceptional, the main flight period was 11 May (PGl) (6 May) to 18 June (RD) (16 June), then 30 June (MW) (19 July) to 12 September (RH) (31 August), and then 21 September (MR) and 30 September (MR, RH) suggesting a third brood. A paper in preparation suggests that this species has now adopted a double brooded strategy inland, and maintains a three-brooded lifestyle only on the coast. It argues that this shift explains the decline in non-coastal areas seen in the data.

Grayling

Far fewer records this year: 53 (190), and fewer high counts, suggest a poor year. The first sighting on 4 June (MR) was exceptional, it was not seen again till 7 July (AMo) (14 June), then till 4 September (many) (1 September). Just one sighting after this, on 30 September (MR). Highest count 100 plus (BCo) (147).

Small Heath

Main flight period 9 May (PGl) (9 May) until 22 September (MGr, PT) (24 September). Surveying unvisited tetrads has shown that this species occurs more widely than the data had previously shown, with 23 new tetrads found. There remain, however, 12 10km squares where it was not recorded during the Atlas period, whereas it was absent from only two such squares in the 82-89 *Atlas*.

Records were received from the following individuals – my thanks to them all:

Agent76, A Abercrombie, J Alloway, B & Y Anderson (BA), D Appleton, L Bacon, D Balmer (DB), A Banwell (ABa), P Barkham, P Bedford, P Benson, P Benson, H Beynon, J Bingham, I Boston, P & C Boyes, A Brazil (ABr), K Brett, M Brewster, R Briscombe, C Brooker, A Brown, M Burge, A Burkin, A & B Carpenter, M Casey (MC), P Cawley, D Cheyne, P Childs, P Clarke, J Clifton (JC), B Cobbold (BCo), F Cooke, T Court (TC), S Crafer (SC), N Davies, C & A Dawson, B & V Dawsons, A Dixon, A Dodgson, L Dorward, J Dossetor, R Driscoll (RD), J & G Dunmore (JD), R Edmunds, A Edwards, J Emerson, Mrs Emery, D Fairhead, E Fairweather, F Farrow (FF), P Feakes, G Fletcher, K Flowerday, L Freelfree, M Gasson, J & J Geeson, E George (EG), M Ghullam, M Glyn, M Gluth (MGl), P Gluth (PGl), M Golley (MGo), M Green, M Greenland (MGr), H Greenland, E Goodyear, P Goodyear, M Gwilliam (MGw), R Hadman (RH), J Halls, M Harcup, J Harling, S Harrap, D Hatton, S Hearle, P J Heath, J Hemmings, D Hipperson, R Hoe, Holman, G Hooton, M How (MH), P Howling, J Hulbert, K Husband, P Ingham, T Irwin, C Jacobs (CJ), J Jarvis, F Jolliffe, D Jones, E Kallioniemi, D Kennett, A Kerr, P Kitchener, D Knight, M Lane, J Lawson, N Lawton (NL), V Lea, R Lee, D Leech, J Levien (JL), D Longden,, D Longe (DLo), P Lorber, R Lucking, A Maguire, J Manners, A Mason, R Mason, A Maxwell, D Mee, J Metcalf, P Millard, G and S Miller, A Monteath (AMo), D & K Moss, S Moss, T Moverley, A Musgrove (AM), T Needham (TN), D Newland, D Nice, D Nobbs, N Owens, B Palmer, P Parker, R Parker, J & C Parr, S Paston, S Pennell, S Perry, E Phipps, S Plant, T Prichard, S Prowse, B & B Pummell, M Riches (MR), D & R Richmond, A Riley, S Rix (SR), R Rogers, T Rollins, M Rooney, C Ross, J Rowe, M Rowe, M Rowe, A Russell, D Ruthven, K Saul, T Shingler, T & T Stevens, C R Stevenson, R Stewart (RS), W Stewart, M Stolworthy, E Stubbings, M Sweeney, Dr P Taylor, P Taylor (PT), S Thane, B Thompsett, A Thompson (AT), E Tickle, J Tinker, C Tyler-Smith, J Wagstaff, C Ward, J Warham, C Watkinson, BR Watts, J West (JW), D Whitehouse, C Whiting, R Williamson, J Wilson, D Withrington (DW), A Woodrow (AW), P Woolnough, M Wright (MW), S Wright, E Yeomans, K Zealand,

Records were also received via Rare Bird Alert, NWT and NBIS. Others were taken from postings on various internet forums and photo-sites. These are shown as 'i' in the accounts above.

A. Brazil 68 Albany Road, Great Yarmouth, NR31 0EE

recorder@norfolkbutterflies.co.uk

Dragonflies

Pam Taylor

2010 was a relatively uneventful year for most of our resident dragonflies. As in many previous years, the flying season started towards the end of April and numbers of most species were as expected throughout the summer. Migrants were few and far between, but there were a few arrivals from the continent, plus some wandering individuals within the county.

Banded Demoiselle ***Calopteryx splendens*** Recorded in good numbers from a wide range of sites, this species appears to be spreading within the county. Most recently it appears to have moved into many areas of north-west Norfolk, as well sites in the Attleborough to Diss region.

Scarce Emerald Damselfly ***Lestes dryas*** Away from its usual strongholds in Breckland, this species was also recorded from two sites north-east of Holt and from Swanton Novers.

Small Red-eyed Damselfly ***Erythromma viridulum*** This recent colonist is now established throughout the county with many of its main sites being in east Norfolk. It seems to be equally happy inhabiting small ponds or larger waterbodies.

Norfolk Hawker ***Aeshna isosceles*** Despite reasonable weather in June, its main flying month, numbers reported from many sites in 2010 were lower than usual. Only at Strumpshaw Fen, How Hill, Upton Fen and Catfield Fen were numbers as expected. Within the Norwich area, there were records from Marston Marsh and the River Wensum at Hellesdon. One wandering individual was noted at Felbrigg Lake in early June.

Downy Emerald ***Cordulia aenea*** This species has only one major breeding site within Norfolk, but for the third year running, individuals were recorded at Sutton Fen RSPB reserve. A few were also recorded at Swanton Abbott where it was first found in 2006.

Migrants

Winterton Dunes provided many of the migrant records for this year, with August being a particularly good month at the site.

Southern Emerald Damselfly ***Lestes barbarus*** A single male was seen at Winterton Dunes on 7/8 August and a female on 22 August.

Willow Emerald ***Lestes viridis*** Recorded from Strumpshaw Fen in August and early September. Up to three pairs were noted and ovipositing into overhanging willows was observed.

Southern Migrant Hawker ***Aeshna affinis*** Male recorded at Winterton Dunes on 22 August.

Yellow-winged Darter ***Sympetrum flaveolum*** One male reported from Winterton Dunes on 6 August.

Red-veined Darter ***Sympetrum fonscolombii*** A single male was observed at Walsey Hills near Cley on 3 June and one seen at Felbrigg Lake in mid-July.

Recording continues for both a new national atlas, due for publication in 2013, and for a revised Norfolk atlas, so if you have any dragonfly records please send them to me as County Recorder. We are currently targeting under-recorded areas and I can supply details of these on request.

Dr P. Taylor Decoy Farm, Decoy Road, Potter Heigham, Norfolk NR29 5LX

pamtaylor@british-dragonflies.org.uk

Orthoptera

David Richmond

It is now ten years since the publication of the millennium distribution maps in the *Grasshoppers and Allied Insects of Norfolk* (N&NNS Occasional Publication No. 7). In that book, the author wrote of the sedentary nature of the orthoptera, often tied to the history of the landscape.

We now know that this is not always the case, and over the last ten years two species in particular, Roesel's Bush-cricket and Long-winged Conehead, have demonstrated the ability of the fully-winged orthopterans to colonise an entire county within a decade.

Short-winged Conehead, Stripe-winged Grasshopper and Lesser Marsh Grasshopper have also shown dispersal tendencies. For the other species, there has been a lot of tetrad infilling through recorder effort, and a full set of updated distribution maps is given at the end of this report. In these maps, solid squares show the core distribution as recorded over the last twenty years of the 20th Century, while open squares and crosses show range expansion / new records in the periods 2001-5 and 2006-10 respectively.

There were very few observations of particular note during 2010, but the discovery of Bog Bush-cricket and Stripe-winged Grasshopper on restored heathland at Cawston is worthy of mention. The former species is present in the adjacent mature heathland to the north, but there is no obvious source of colonisation for Stripe-winged Grasshopper other than the 21st Century dispersal tendencies noted above.

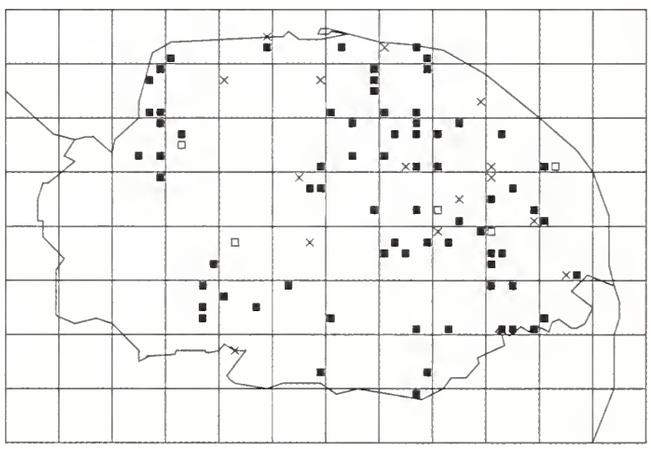
Jeremy Halls had an interesting record of Short-winged Conehead at Cow Tower pond in Norwich, and also found three new tetrads for Dark Bush-cricket at Oby, Stokesby and Filby (all in TG41). This is an under-worked square probably deserving more attention.

Late dates

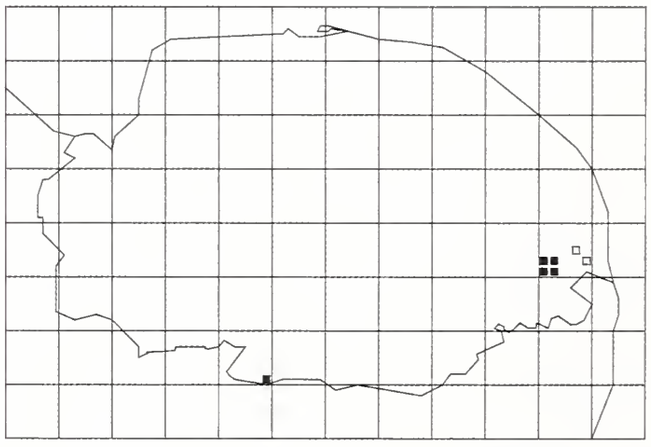
Long-winged Conehead was recorded until 2 November in Reepham, where Field Grasshopper survived until 5 November. There was then a period of cold temperatures with strong winds and rain. The last Dark Bush-cricket was heard on 12 November. There were frosts on the 15 and 16 of November but Speckled Bush-cricket managed to survive until 21 November before cold wet weather set in again, followed by long-lasting snow on 24 November.

Distribution maps

OAK BUSH-CRICKET *Meconema thalassinum*

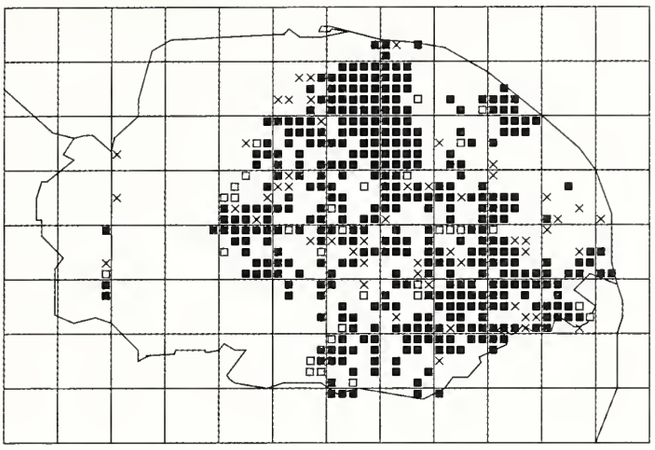


GREAT GREEN BUSH-CRICKET *Tettigonia viridissima*

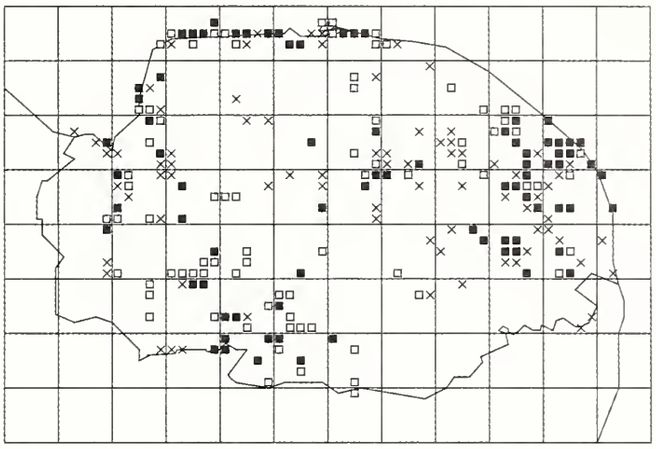


Key: (earliest record in review period)
■1981-2000 ❑ 2001-2005 X 2006-2010

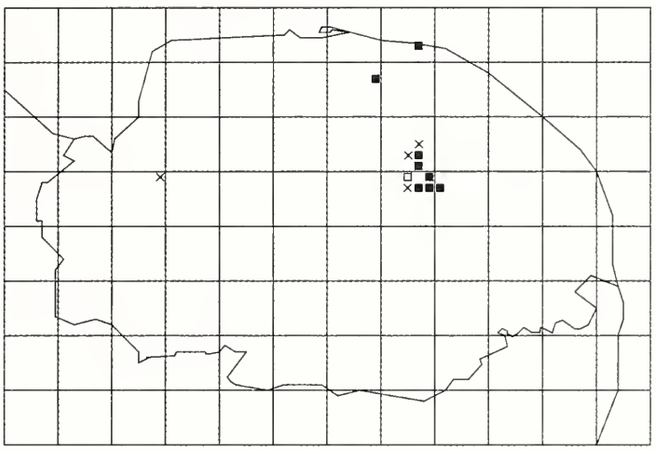
DARK BUSH-CRICKET *Pholidoptera griseoaptera*



SHORT-WINGED CONEHEAD *Conocephalus dorsalis*

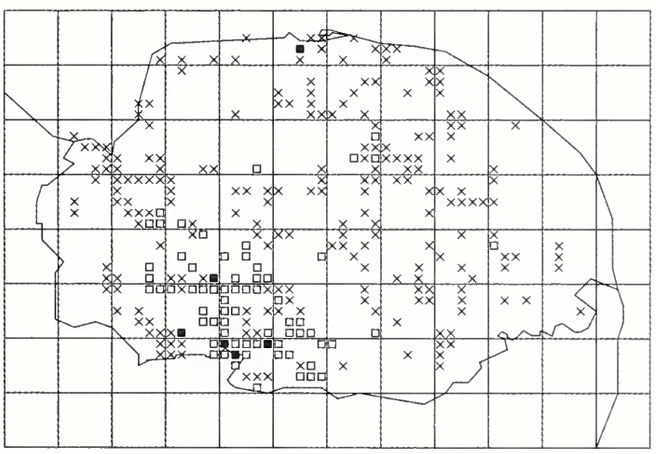


BOG BUSH-CRICKET *Metrioptera brachyptera*



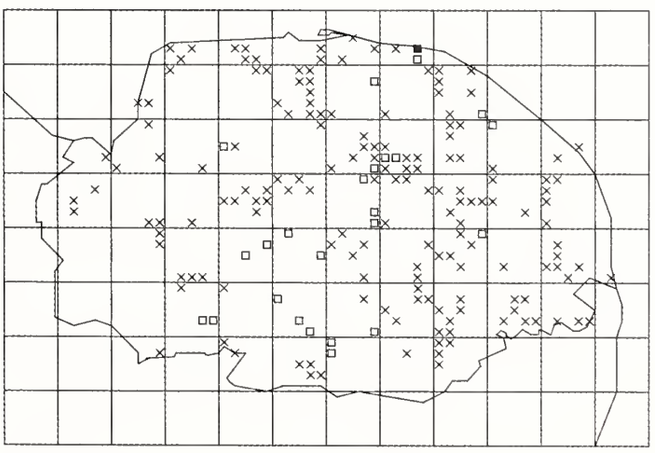
SPECKLED BUSH-CRICKET *Leptophyes punctatissima*

ROESEL'S BUSH-CRICKET *Metrioptera roeselii*

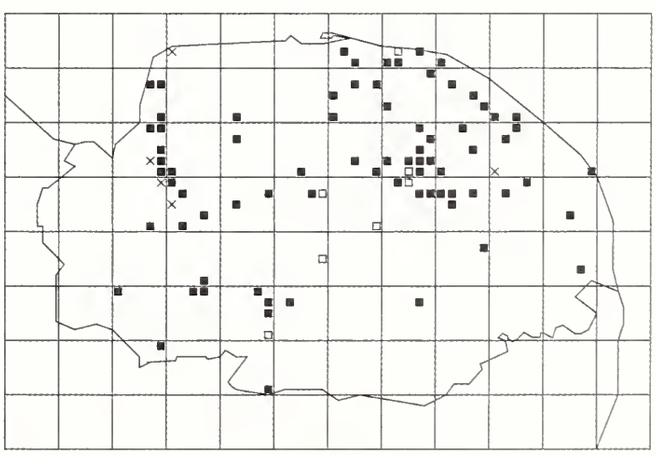


SLENDER GROUNDHOPPER *Tetrix subulata*

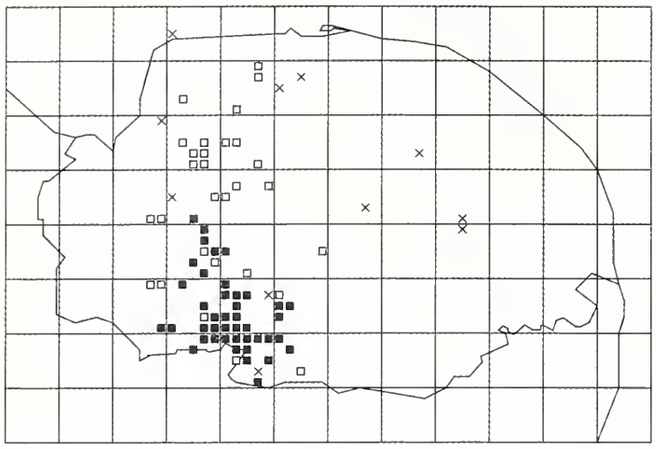
LONG-WINGED CONEHEAD *Conocephalus discolor*



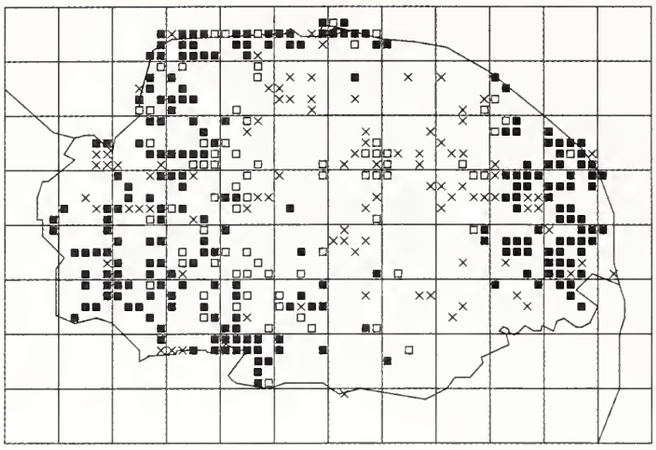
COMMON GROUNDHOPPER *Tetrix undulata*



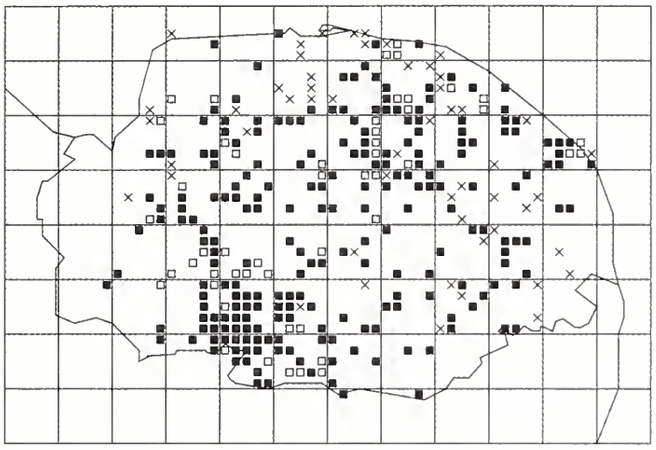
STRIPE-WINGED GRASSHOPPER *Stenobothrus lineatus*



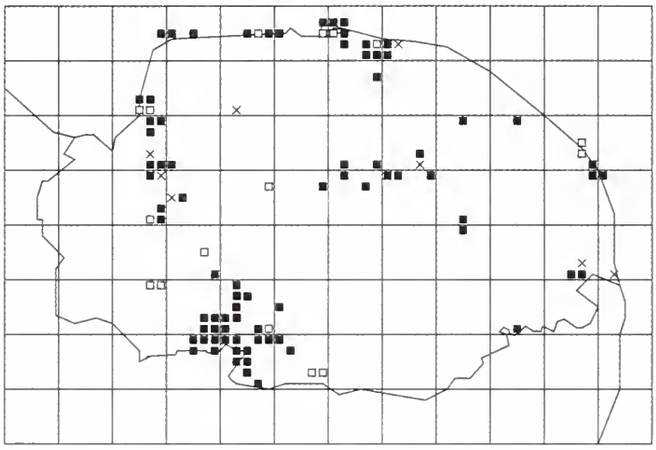
LESSER MARSH GRASSHOPPER *Chorthippus albomarginatus*



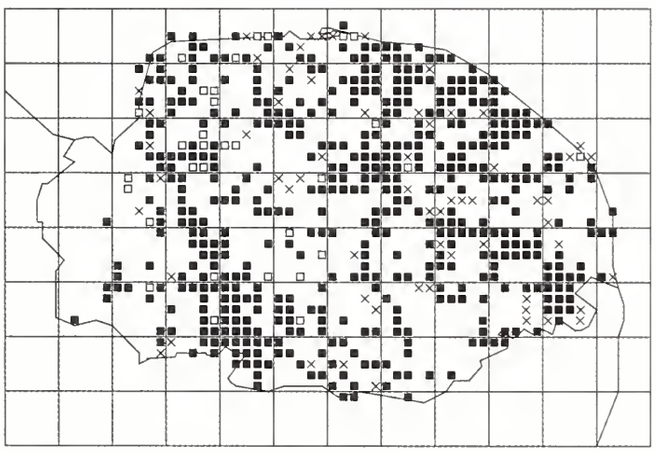
COMMON GREEN GRASSHOPPER *Omocestus viridulus*



MOTTLED GRASSHOPPER *Myrmeleotettix maculatus*



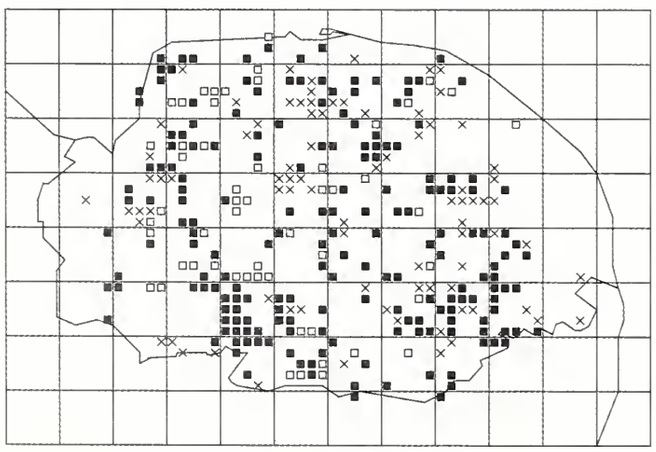
FIELD GRASSHOPPER *Chorthippus brunneus*



Key: (earliest record in review period)
■1981-2000 ❑ 2001-2005 X 2006-2010

D.I. Richmond 42 Richmond Rise, Reepham, Norfolk, NR10 4LS

MEADOW GRASSHOPPER *Chorthippus parallelus*



Wildlife Report 2010

Bumblebees

David Richmond

Despite the popularity of the group most species remain under-recorded. This is particularly the case for the difficult-to-identify cuckoo bees. I am grateful to Nick Owens for his continuing work in north Norfolk and in the Stanford Training Area, and to all other recorders who have submitted records. Details are given below of all 2010 records of the less common bumblebees and cuckoo bees. An up-to-date account of all species is given in the 'species guides' section of the Society's website (www.nnns.org.uk)

Bombus jonellus Nick Owens reported an active nest of this heathland specialist in a bird box on Kelling Heath on the late date of 15 October.

Bombus hypnorum This species is a recent colonist of Great Britain and is uniquely identified by its ginger thorax and prominent white tip to the abdomen. It was reported from thirteen widely scattered localities in east Norfolk during 2010.

Bombus muscorum This species is being increasingly reported along the north Norfolk coast. In August 2010 Nick Owens discovered a colony at the western end of Weybourne Camp.

Bombus bohemicus (cuckoo of *B.lucorum*) Reported from East Ruston and the Stanford Training Area (Owens).

Bombus rupestris (cuckoo of *B.lapidarius*) There were five records during July and August from Mulbarton (Harvey), Buxton Great Wood (Richmond) and Holt, Kelling Heath and Kelling Hard (Owens). These provide continuing evidence of the recovery of this species, which suffered a significant decline over the last third of the 20th century.

Bombus barbutellus (cuckoo of *B.hortorum*) Despite the ubiquity of its host, this species is rarely reported. Nick Owens found two males on knapweed and scabious at Weybourne in August.

D.I. Richmond 42 Richmond Rise, Reepham, Norfolk, NR10 4LS

Wildlife Report 2010

Vascular plants

Bob Ellis

There were three major discoveries during 2010 in Norfolk. One of these has already been reported elsewhere: **Wood Club-rush** *Scirpus sylvaticus* was seen for the first time in Norfolk since the 19th century at Derby Fen, Grimston (Beckett 2010).

The second exciting find is the occurrence of **Holly-leaved Naiad** *Najas marina* outside its Broadland strongholds; it was discovered in a lake on an east Norfolk estate by Carl Sayer. The precise location remains confidential.

The third, **Marsh Clubmoss** *Lycopodiella inundata*, was found at two sites, one in the

west of the county at Bawsey by Robin Stevenson (see photo on inside back cover), the first sighting since 1942 for vice-county 28, and one in the east at Buxton Heath. About ten years ago an attempt was made to re-introduce Marsh Clubmoss at Buxton Heath, but it disappeared soon afterwards and the re-introduction site was some two to three hundred metres to the east of where Rachel Richmond found it early in 2010. Whether this small colony is a survival of that re-introduction or a result natural resurgence or dispersal is a matter of conjecture. Prior to this, the most recent record that I am aware of for East Norfolk was made in 1971. Incidentally, whilst visiting Buxton Heath to look at the Marsh Clubmoss, Martin Rand spotted a hybrid thistle *Cirsium ×forsteri* (*C. dissectum* × *C. palustre*), the first record for Norfolk since 1975, when it was recorded by Francis Rose and Peter Lambley at Southrepps Common.

Marsh Clubmoss is classified as Endangered on the Red Data List and Holly-leaved Naiad as Vulnerable. Other 2010 records in 'new' tetrads since *A Flora of Norfolk* (Beckett *et al.* 2001), for species classified as Endangered or Vulnerable on the Red Data List, are as follows.

Critically endangered

Crested Buckler Fern *Dryopteris cristata*
Barton Broad, TG32K (British Pteridological Society excursion).

Shepherd's-needle *Scandix pecten-veneris*
Tibenham, TM18J (Hatty Aldridge and Bob Ellis). Margins of a wheat field.

Endangered

Annual Knawel *Scleranthus annuus*
Pensthorpe Reserve, TL92P (Flora Group). In some quantity.

Greater Water-parsnip *Sium latifolium*
West Harling, TL98S (Flora Group). First recorded here in 2002, it was much reduced in 2010 since low water levels had allowed cattle to graze and trample it.

Narrow-fruited Cornsalad *Valerianella dentata*
Briston, TG03Q (Emily Swan). In an arable margin. The first East Norfolk record since Petch & Swann's *Flora* was published in 1968.

Vulnerable

Stinking Chamomile *Anthemis cotula*
Apparently 2010 was a good year for this species but it may just be a case of visiting the right area at the right time.

Bunwell Bottom, TM19C. Margins of a wheat field.

Burston and Shimpling, TM18L (Flora Group). In field beans.

Alburgh and Denton, TM28T. Widespread in oil-seed rape, wheat, field beans, sugar beet and fallow.

Rye Brome *Bromus secalinus*
Apparently continuing to spread.

Saxlingham Nethergate, TM29I. In field beans.

Denton, TM28Z. Edge of a track.

Acle Marshes, TG40T (Bob Ellis and Bob Leaney). Edge of a grazing marsh.

Slender Hare's-ear *Bupleurum tenuissimum*
Berney Marshes, TG40T (Bob Ellis and Bob Leaney). It was first reported from this area in 2001 by Craig Robson and was also recorded here in 2005 (Flora Group) as well as in the adjacent tetrad TG40S. This is the only site in Norfolk where Slender Hare's-ear has been recorded since 2000 and it is quite frequent in parts of a long, narrow strip of well cattle-trampled grazing marsh just to the landward side of the Breydon wall.

Frogbit *Hydrocharis morsus-ranae*
Sutton Fen, TG32R (Flora Group). Widespread – it is possible that these particular ditches were not recorded for *A Flora of Norfolk* (Beckett *et al.* 2001).

Henbane *Hyoscyamus niger*
Wiveton, TG04H. Reported by Simon Harrap and also by Thomas Wood.

Smooth Cat's-ear *Hypochaeris glabra*
Pensthorpe Reserve, TL92P (Flora Group).

Booton, TG12B (Bob Ellis and Mary Ghullam). Sandy edge of a roadside passing place with Mossy Stonecrop *Crassula tillaea*, Common Cudweed *Filago vulgaris*, Bird's-foot *Ornithopus perpusillus* and Hoary Cinquefoil *Potentilla argentea* in the immediate vicinity.

Weasel's-snout *Misopates orontium*
Cawston, TG12R (Flora Group). Edge of a potato field.

Marsham, TG12W. In sugar beet.

Prickly Poppy *Papaver argemone*
Flitcham with Appleton, TF72J (Simon Harrap).

South Lopham, TM08K (Bob Ellis and Mary Ghullam). On a roadside verge.

Briston, TG03Q. A cultivated uncropped margin beside barley.

Borrer's Saltmarsh-grass *Puccinellia fasciculata*
Salthouse Marshes, TG04R, S & W (Bob Ellis & Emma Harris). Cattle-trampled areas of grazing marshes.

Prickly Saltwort *Salsola kali* subsp. *kali*
Sidestrand, TG24Q (Flora Group).

Mundesley, TG33D (Bob Ellis and Mary Ghullam).

Walcott, TG33R (Flora Group).

Night-flowering Catchfly *Silene noctiflora*
This is another plant that seems to have done well in 2010 (but the same caveat given for Stinking Chamomile applies).

Castle Acre, TF81C (Robin Stevenson and Frances Schumann).

North Creake, TF83I (Gillian and Ken Beckett). In the corner of a beet field.

Warham, TF94L (Flora Group). In wheat stubble.

Binham, TF94V (Bob Ellis and Hatty Aldridge). In a 'conservation mix' including Fodder Radish, Gold-of-pleasure, White Mustard, Phacelia and Millet.

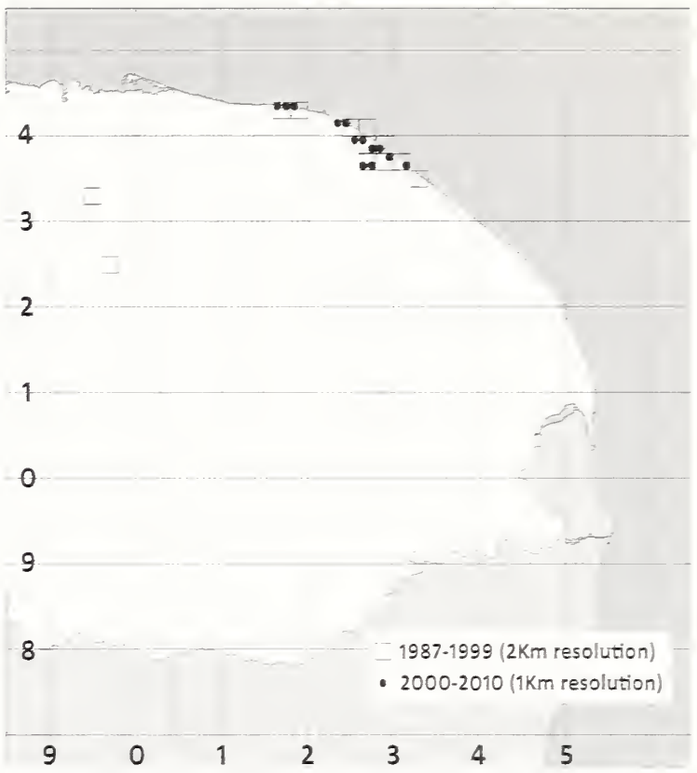


Figure 1. Yarrow Broomrape records in Norfolk since 1987.

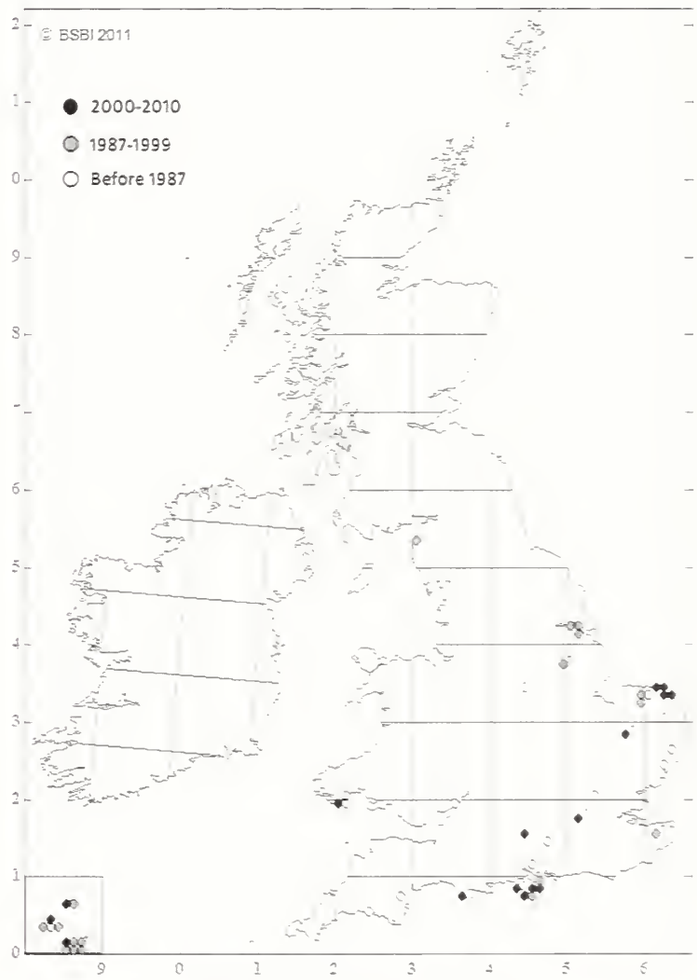


Figure 2. Distribution of Yarrow Broomrape in the British Isles (based on the BSBI Maps Scheme:www.bsbimaps.org.uk/atlas). Where post-1987 records are known to be just from a single site they are marked 1.

Forncett, TM19H. In sugar beet.

Woodbastwick, TG31G (Bob Leaney). In sugar beet.

Corn Spurrey *Spergula arvensis*
Pensthorpe Reserve, TL92P (Flora Group). In an area sown with a 'wild flower' mixture, but presumably this was from the seed bank.

Caistor St Edmund , TG20M. In sugar beet.

Wortwell, TM28S. In maize. A new 10 km square record.

Marsh Stitchwort *Stellaria palustris*
St Benet's Abbey, TG31X (Flora Group).

Yarrow Broomrape *Orobanche purpurea*
Although it was not recorded in any 'new' tetrads, Yarrow Broomrape seems to have had a good year in the Trimmingham area (see photo on inside back cover). It was reported from three new locations, including the slumped cliffs (Flora Group), a broad grass roadside verge just into Mundesley parish (Paul Houghton), and it flowered in great abundance (hundreds of spikes) in a small horse-grazed field, an event that was reported independently by a number of people.

Yarrow Broomrape, often called 'Purple Broomrape', is listed as Vulnerable on the current Red Data List but is not treated as a priority species in the UK Biodiversity Action Plan. The coastal band of northeast Norfolk from Sheringham to Mundesley, inland as far as Southrepps, is a particular stronghold for Yarrow Broomrape and the only records for the county since 2000 have come from this area (Figure 1). Indeed, a glance at Kirby Trimmer's 1866 *Flora* shows that this was the case in the nineteenth century (when it was known as *Orobanche caerulea*). He lists Weybourne, near Mundelsey and Trimingham, Beeston, Northrepps, and Sheringham. Furthermore, the first known British record (1779) is listed in Sowerby's *English Botany*: a single specimen near Northrepps reported by a Mr Scarles (quoted in Nicholson 1914). Modern outliers at Ryburgh and Little Snoring were last seen in 1988 and 1998 respectively.

In the British Isles Yarrow Broomrape has a very clustered, widely separated, distribution with centres in northeast Norfolk, on the Isle of Wight and in the Channel Isles, but with a number of isolated populations elsewhere (Figure 2); most populations are small (Wiggington 1999). This suggests that dispersal may be very local in the main, but perhaps with occasional long-distance events. It also may mean that there is some degree of genetic isolation, especially as it has been suggested that the flowers may normally be self-pollinated (Wiggington 1999). It is a plant that appears to live 'life on the edge', favouring vulnerable habitats like roadside verges and crumbling cliffs and it is often difficult to envisage what conservation measures might be taken to assist its survival. Even in churchyards it is at risk from unfavourable mowing regimes. On the positive side, it is a parasite of a very common host, Yarrow *Achillea millefolium*; it produces prolific seed that is thought to remain viable for long periods and it is found in a range of grasslands, from tall and rank to much shorter swards.

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Note. The Red Data List has been revised several times and the most recent revision is available at www.bsbi.org.uk/resources.html

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R.W. Ellis 11 Havelock Road, Norwich NR2 3HQ

bob@elymus.demon.co.uk

Lichens

Peter Lambley

In October 2009 Ashley Murray found a single well-developed thallus of *Cetraria islandica* at Sugar Fen near Leziate, amongst Heather *Calluna vulgaris*. This species was known until the mid-1990s from Ling Heath near King's Lynn but was not found when searched for in 1995. The habitat at Ling Heath, bryophytes under birch and pine, had not changed. Its disappearance might have been put down to climate change, as it is normally a montane species in Britain, but it had survived for over a hundred years at Ling since its discovery there by Plowright. Perhaps more significant were the deer droppings in the vicinity and it may be more likely that its disappearance was due to the burgeoning deer population in the area. This second site, with one thallus, was therefore a complete surprise. Despite an intensive search of the area no more could be found. There remains the feeling that in the King's Lynn area there is another population lurking somewhere.

Searches have also been undertaken for another disappearing species, *Anaptychia ciliaris*, a lichen that grows on Ash *Fraxinus excelsior* and elm *Ulmus* spp. It was last seen in 1992, at Hilborough Park and Fritton Common, but recent searches of these and other former sites have failed to find it. It is a species that is declining everywhere, although the causes are not understood. A species with a similar ecology, *Pleurosticta acetabulum*, is also declining and has gone from all of its Norfolk sites except Guist, where there is still a strong colony high on a Sycamore *Acer pseudoplatanus*.

On a more positive note a number of species have been recorded for the first time on trees in Norfolk, including the very attractive *Candelaria concolor*, which is turning up in scattered localities in both West and East Norfolk, with a particularly strong colony on willows *Salix* spp. at Sparham. It appears to be responding to changing air quality and possibly to climate change. An interesting find in 2011 was *Mycoglaena myricae*, which grows on the stems of Bog-myrtle *Myrica gale*. It is known from the north and west of Britain, with another population in the New Forest. Its discovery at Woodbastwick Fen and then Roydon Common was not really a surprise, as Bog-myrtle has long been known there: it was, however, new to East Anglia.

Surveys of churchyards have yielded a number of new species for the county, including *Lecanora pruinosa*, found by Chris Hitch at Blakeney Church. This is a species that was thought to be extinct in the British Isles until its rediscovery in southern England in 1993; it is now known from quite a few sites in central-southern England and in a narrow band extending north-eastwards into Lincolnshire. The genus *Lecania* is a difficult one and *Lecania inundata* and *Lecania suavis* are both now known from Norfolk churches. In 1989 *Lecania coerulescens* was found on Foulsham Church. This species was previously known and described by a lichenologist called Mudd from North Yorkshire in the nineteenth century. It appears that the Foulsham site is currently the only known site for this species, which is only recorded from the British Isles. Whilst it may be found elsewhere in due course, the entire known world population currently occurs on two window ledges. A recent exciting find was made during a visit by the British Lichen Society churchyard group to south Norfolk, when *Miriquidica pycnocarpa* was found on a sandstone tomb in Saxlingham Nethergate churchyard. This is an upland and montane species not pre-

viously recorded from the lowlands. The group also recorded 106 species on Ashwellthorpe church and churchyard making it the richest so far recorded in Norfolk.

P.W.Lambley The Cottage, Elsing Road, Lyng, Norfolk NR9 5RR

Plambley@aol.com

Wildlife Report 2010

Fungi

Tony Leech

Despite the fact that over 3200 species of fungi have now been recorded from Norfolk, new county records continue to be made. Some of these species are genuine newcomers, but others are added as a result of more intensive searching, the better availability of good identification literature and a greater number of interested naturalists. As an example of the last, Anne Crotty has contributed no fewer than four new county fungus records this year. Her main expertise lies in fungi on treesb, especially brackets, so it was appropriate that she noticed *Inonotus cuticularis* in 2009 growing in a hollow dead Beech tree at Holt Hall (TG0739) and confirmed it in 2010. Jonathan Revett found the same species in West Norfolk in 2010 (St Helens TL8287). *I. cuticularis* is not a particularly rare fungus nationally, with the majority of records coming from the London area, Sussex and Hampshire, but it had hitherto escaped the eyes of Norfolk mycologists.

A second bracket found by Anne, on worked wood on a bench at Whitlingham Country Park (TG2607), looked at first to be Conifer Mazegill *Gloeophyllum sepiarum*, which is common in Scotland but for which there are only two Norfolk records. However, the Whitlingham specimen possessed sinuous and convoluted pores rather than the slit-like pores of *G. sepiarum*. This raised the possibility that the bracket was actually the much rarer *G. trabeum*, for which there have been very few British records and which has Red Data List 2 Endangered status (see photograph on inside back cover). Martyn Ainsworth (RBG Kew) has kindly confirmed that it is indeed the latter species. As often seems to happen, a second specimen of this species was found a few weeks later, on a boardwalk at Sculthorpe Moor (TF9030).

Anne Crotty's contributions have also included two species from her greenhouse at Whitlingham (TG2707); *Conocybe vexans*, a small brown agaric with a ring (see photograph on inside back cover), and *Lepiota (=Echinoderma) carinii*. The latter resembles a tiny version of the Freckled Dapperling *Lepiota (=Echinoderma) aspera* and has been recorded from only three other sites in Britain. It is probable that neither of these new fungi would have been identified had it not been for the publication of *Funga Nordica*, a compendious set of keys to the agarics of Northern Europe.

Janet Metcalfe also has a keen eye for the unusual. In May she sent me specimens of an irregular yellow discomycete that she

had found in a bag of peat-free compost packed in County Tyrone. It turned out to be *Otidea (= Flavoscypha) phlebophora*, now flagged up as a Red Data Book species, designated Vulnerable/Rare. Most of the post-1990 records are from Perthshire and may refer to only two sites, but during the 20th century it has occurred in a few places in England. Given that it is growing in a bag of imported compost, is this a Norfolk record?

Janet's second find was on a roadside verge near her home at Barnham Broom (TG0807). She and her mother (Lil Evans) were in no doubt that it was an unusual ring-less *Amanita* (formerly *Amanitopsis*), but which one? After much deliberation with *Funga Nordica* we considered that the specimens (first found in 2009) were closest to *Amanita magnivolvata*. The volva was indeed relatively large and thick on at least some specimens (as well as being orange-spotted in some cases and deeply buried). However, none of the specimens showed stem-banding (although some showed cracking) and this species is not on the British list, so the most likely identification becomes *A. argentea*, despite the vinaceous-buff cap and slightly narrower spores of the Barnham Broom specimens. There are a number of records for the latter species throughout England and Wales. In 2008 Martyn Ainsworth commented that this group was in need of molecular investigations to resolve species limits.

An exciting development this year has been the consolidation of the Dersingham Mushroom Club, set up by Ash Murray and supported financially by Natural England. The collecting emphasis is on West Norfolk sites and expertise is growing rapidly. In September Ash found *Cordyceps longisegmentis*, a parasite on *Elaphomyces* truffles, on Dersingham Bog NNR (TF6729). This species was separated from *C. capitata*, for which there is a single Norfolk record, in 1988. In 2010 Jonathan Revett encountered *C. capitata/longisegmentis* on two forays in West Norfolk but was unable to retain specimens for critical determination.

The early autumn of 2010 was an exceptional time for the fruiting of the larger mycorrhizal fungi. A damaged specimen of *Lactarius mairei*, a shaggy species resembling a dark *L. torminosus*, was found by Tony Leech under oak in parkland at Gunton Park (TG2233). Coincidentally, at about the same time Jonathan Revett made the first Suffolk record for this species, which is designated Near Threatened on the Red Data List.

New records for some of the scarcer Norfolk fungi are shown in Table 1.

Coral Tooth *Hericium coralloides*, a second tooth fungus at Whitlingham

On 9 November 2010, Albert Ward, Information Assistant at Whitlingham Visitor Centre, noticed four whitish fungal fruiting bodies high on the trunk of a dead Beech tree in Whitlingham Country Park (TG2607). Although unable to identify the fungus, which was well out of reach, he thought it might be similar to the Bearded Tooth *Hericium erinaceus* which was seen, for the first time in Norfolk, at nearby Trowse Woods in 2006. Albert took photographs and informed others, including Martin Horlock (NBIS) who suspected that it was a second *Hericium* species, Coral Tooth *H. coralloides*. Once a specimen had been collected it was possible to confirm that it was indeed *H. coralloides* (see photograph on inside back cover).

All three British species of *Hericium* are scarce, with virtually all records being south of a line between the Severn Estuary and The Wash, with a further eastern bias (especially for *H. coralloides*), although scattered records from northern England do exist for all three. In the first Red Data List all three were assigned Vulnerable status and in the 2nd edition this has been revised to Near Threatened for *H. coralloides*.

Until *H. coralloides* was found by Jonathan Revett in King's Lynn in 2006 the only

Table 1 New records for some scarcer Norfolk fungi

Species	Place	Collector [Identifier if different*]	Previous Norfolk sites
Anthracobia macrocystis	West Rudham TF8227	Tony Leech	1
Agaricus rufotegulis	Dersingham Bog TF6729	Keith Fox	1
Anthracobia maurilabra [1]	Kelling Heath TG1042	Nick Owens [ARL]	2
Astraeus hygrometricus [2]	Saxthorpe TG1132	C Rolph [JR]	1
Coprinus heterosetulosus	Wigston Villa TL5294	Jonathan Revett	1
Cortinarius croceocaeruleus **	Two Mile Bottom TL8488	Jonathan Revett	1 (1926)
Cystolepiota pulverulenta	Cockley Cley TF7804	Jonathan Revett	2
Entoloma formosum	Holt Lowes TG0837	Tony Leech	2
Galerina atkinsoniana	Holme TF7043	Tony Leech	1
Geopora arenicola	Wigston Villa TL5294	Jonathan Revett	1
Geopora cervina [3]	Wigston Villa TL5294	Jonathan Revett	1
Hydnellum spongiosipes Velvet Tooth	Smallburgh Fen TG3224	Steward Milburn [ARL]	2
Lactarius zonarius	Foxey Wood TG0422	Jonathan Revett	2
Lepiota ochraceofulva [4]	Lynford Arboretum TL8294	[JR]	0
Leucoagaricus badhamii	Wigston Villa TL5294	Jonathan Revett	4
Mitrophora semilibera Semifree Morel [5]	Ringstead Downs TF6940	Keith Fox	5
Ramaria abietina [6]	near Hockering Wood TG0714	Anne Crotty [ARL]	1
Sarcodontia crocea Orchard Tooth [7]	Hunstanton TF6641	Ash Murray [ARL]	1
Schizophyllum amplum [8]		Anne Crotty [ARL]	1
Schizophyllum amplum [8]	Wigston Villa TL5294	Jonathan Revett	1
Suillus collinitus [9]	Wigston Villa TL5294	Jonathan Revett	1
Tephrocybe tylicolor	Holt TG0839	Tony Leech	1
Terana caerulea Cobalt Crust	Brinton Hall TG0335	Jeremy Bagnall-Oakeley [ARL]	2
Terana caerulea Cobalt Crust	Ditchingham TM3292	Dorothy Cheyne [ARL]	3
Verpa conica Thimble Morel [5]	Ringstead Downs TF6940	Keith Fox	3

* Identifiers: JR = Jonathan Revett; ARL = Tony Leech. ** Photograph on inside back cover.

Note [1] Carpeting large area of burnt heath

[2] Still hanging on at the only Norfolk site despite vehicular erosion

[3] Nationally rare species, previously confirmed by Brian Spooner from same site

[4] Found in previous years on public forays but material not recovered. Also known from Brandon Country Park.

[5] *Mitrophora semilibera* and *Verpa conica* occur together as they do at both Lynford and Hoe Rough

[6] Almost certainly this species but on rotten lime.

[7] On old apple tree; Red Data List Vulnerable B.

[8] Nationally rare species.

[9] With pine and showing strong pink mycelium in the stem base. Previously only found (by JR) at Holkham, in sandy soil.

Norfolk record for this species (on the national fungus database, FRDBI) was from West Norfolk dated 18xx (sic) but probably before 1833. It has been recorded from Cambridgeshire in 2000 and 2001 (possibly at the same site), from East Suffolk in 1985 (and earlier) and from West Suffolk sometime in the 20th century.

There was much excitement in 2006 when the Bearded Tooth *Hericium erinaceus* appeared, for the first time in Norfolk, in Trowse Woods, close to Whitlingham Woods. It is remarkable that two scarce members of the same genus have occurred so close to each other in the space of a few years. *Hericium erinaceus* was seen again at Trowse Woods in 2007 but not, apparently, subsequently. It was recorded in East Suffolk in 1990, in West Suffolk earlier in the century and appeared at Minsmere, in East Suffolk, in 2009.

An orange 'mould' on a Barn Owl pellet – an undescribed *Gymnascus* sp.?

At the 'Wild About Wymondham' event in June 2010, I noticed that one of the owl pellets that David & Chris Cannon were displaying for dissection had an orange mould on it. Relatively few fungi have been recorded from bird pellets but what made the challenge of identification more appealing was that the provenance of the pellet was known: it had been collected on 6 September 2007 by Tim & Jenny Francis in Essex, donated to the RSPB and kept for at least the past year in a sealed container in a refrigerator.

The fungus formed discrete, irregular, orange-red patches up to 2.5 mm across. The patches had a powdery appearance with a slight dusting of white particles, probably oxalate crystals. Under the microscope, the presence of spores in clusters of eight, without an ascus wall, indicated that the fungus was a 'plectomycete'. Most are known from dung and the only one I could find fitting the general description and having this colour was *Arachniotus ruber* (Ellis & Ellis 1985). *A. ruber* is a scarce (or under-recorded) fungus with only 13 records on FRDBI, the national fungus database, of which one was from a falcon pellet.

Dried material was sent to Alick Henrici at Kew. Neither he nor Brian Spooner (Head of Mycology) were able to see an equatorial groove on the spores, so *A. ruber* is excluded. As they were unable to match it to any described species, it may well be an undescribed species in this little-studied group, now included within the genus *Gymnascus*. The material has been deposited in the herbarium at the Royal Botanic Gardens, Kew.

A puzzing *Coprinopsis* spp. from a hen house at Briston

Not only have molecular studies resulted in the old inkcap genus *Coprinus* virtually disappearing (two species remain in it), but the three genera into which former *Coprinus* species have been distributed (*Coprinellus, Coprinopsis* and *Parasola*) have been transferred to the family Psathyrellacea. The latter three genera are separated by veil characteristics and by the presence or absence of cystidia (hair-like cells) on the cap. *Coprinopsis* species have a veil but lack pileocystidia.

In April I was brought a collection of inkcaps from a hen house in Briston (TG0632), where they were growing on chipboard. Since they had branched hyphae in the veil and rough spores it was relatively easy to assign them to the group containing *Coprinopsis echinospora, C. phlyctidospora* and *C. rugosobispora*. There are two Norfolk records for *C. echinospora*, none *for C. phlyctidospora*, and *C. rugosobispora* has not been recorded from Britain. Both *C. echinospora* and *C. phlyctidospora* have been recorded in association with bird droppings.

The Briston specimens were all 2-spored (rather than having the normal 4-spored basidia). From the keys available this would indicate *C. rugosobispora*, but the

spores were far too large. There is an ongoing debate as to whether 2-spored forms are separate species or merely varieties. In general, spore sizes are much greater for corresponding 2-spored forms. Derek Schafer, the UK expert on these genera, considers that the specimens could be *C. rugosobispora* with abnormally large spores or a 2-spored form of *C. phlyctidospora.* If the latter were deemed to be a distinct species it would be new to science. The only way of resolving this is to carryout DNA sequencing and Derek Schafer is hoping that Laslo Nagy, a Hungarian mycologist, will be able to do this.

Is the Hoof Fungus *Fomes fomentarius* spreading?

The Hoof Fungus *Fomes fomentarius* is common on birch in Scotland and occurs in south-east England on a variety of hosts but, at least until recently, was hardly known from the Midlands and East Anglia. Its discovery on Roydon Common in 2008 led to the revelation that it had been known from the wooded parts of Dersingham Bog NNR for some time. In 2010 the species was seen on Holt Lowes (TG0837) and at Bodham Common (TG1039). In both cases brackets were found on single trees. It has also been seen recently at St Faith's Common (TG1817).

The Hoof Fungus was one of three species included in a fungus survey organised by the Norfolk Biodiversity Information Service. There were several reports of its occurrence but these still have to be investigated.

Since this bracket is prominent and distinctive it is hard to escape the conclusion that it is indeed extending its range, but we must not ignore the fact that *F. fomentarius* may have been in the county for a long time: a fossil specimen of this species, found at Shropham and on display at the Castle Museum, Norwich, is dated 115,000-130,000 years BC!

Pepperpot *Myriostoma coliforme* - not quite in Norfolk

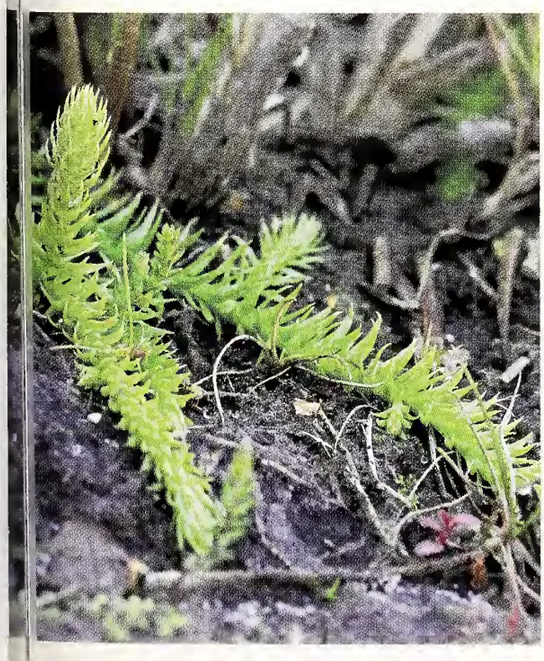
The Pepperpot *Myriostoma coliforme* is something of a holy grail for mycologists. It is a striking and distinctive earthstar, being the only British species in which the spore-sac has multiple stalks and multiple perforations. Until recently the last record of its occurrence in mainland Britain was Charles Plowright's record at Hillington, West Norfolk (TF7125), in 1880. It was found in Jersey in the 1990s and in Suffolk, at a site that has not been disclosed, in 2006.

On his way home from a foray in Norfolk this autumn, Neil Mahler (Suffolk County Fungus Recorder) stopped his motorcycle just 230 metres over the border into Suffolk to examine a bank which looked 'promising for earthstars'. To his great excitement what he found was a large colony of *Myriostoma coliforme.* An extensive search by Neil elsewhere in Suffolk, especially around places where the fungus was known in the eighteenth century, has failed to reveal any further sites. Over to Norfolk's mycologists!

Dr A.R. Leech 3 Eccles Road, Holt, Norfolk NR25 6HJ

leech@dialstart.net

Top left: ***Gloeophyllum trabaeum*** (upper- and underside) (Anne Crotty); top right: ***Cortinarius croceocaeruleus*** (Jonathan Revett); above ***Hericium coralloides*** (Anne Crotty). Left: **Marsh Clubmoss *Lycopodiella inundata***, Bawsey (Robin Stevenson); below left: Buxton Heath (Simon Harrap); below: **Yarrow Broomrape *Orobanche purpurea***, Trimmingham (Simon Harrap); below right: ***Conocybe vexans*** (Anne Crotty). See Wildife Reports.



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Cover: **Dick Hamond (on the right) and Ray Williams surveying Half-Moon Pond at Cley-next-the-Sea:** photo by Sue E. Williams.

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